

الجامعة
البريطانية في
دبي



The
British University
in Dubai

**Investigating the Role of Students' Attainment,
Aptitude and Attitude Assessments in Predicting
SAT Achievement:
The Case of US-Curriculum Schools
in the UAE**

بحث في دور تقييمات مستوى تحصيل الطلاب وقدراتهم الإدراكية وسلوكهم
في توقع نتائجهم في اختبار السات:
دراسة في المدارس التي تتبع المنهاج الأمريكي في الإمارات

by

LAMES ABDUL HADI

**A thesis submitted in fulfilment
of the requirements for the degree of
DOCTOR OF PHILOSOPHY IN EDUCATION**

at

The British University in Dubai

November 2021

الجامعة
البريطانية في
دبي



The
British University
in Dubai

**Investigating the Role of Students' Attainment,
Aptitude and Attitude Assessments in Predicting SAT Achievement:
The Case of US-Curriculum Schools in the UAE**

بحث في دور تقييمات مستوى تحصيل الطلاب وقدراتهم الإدراكية وسلوكهم
في توقع نتائجهم في اختبار السات:
دراسة في المدارس التي تتبع المنهاج الأمريكي في الإمارات

by

LAMES ABDUL HADI

**A thesis submitted to the Faculty of Education
in fulfilment of the requirements for the degree of
DOCTOR OF PHILOSOPHY IN EDUCATION**

at

The British University in Dubai

November 2021

Thesis Supervisor

Professor Christopher Hill

Approved for award:

Name

Designation

Name

Designation

Date:_____

Name

Designation

Name

Designation

DECLARATION

I warrant that the content of this research is the direct result of my own work and that any use made in it of published or unpublished copyright material falls within the limits permitted by international copyright conventions.

I understand that a copy of my research will be deposited in the University Library for permanent retention.

I hereby agree that the material mentioned above for which I am author and copyright holder may be copied and distributed by The British University in Dubai for the purposes of research, private study or education and that The British University in Dubai may recover from purchasers the costs incurred in such copying and distribution, where appropriate.

I understand that The British University in Dubai may make a digital copy available in the institutional repository.

I understand that I may apply to the University to retain the right to withhold or to restrict access to my thesis for a period which shall not normally exceed four calendar years from the congregation at which the degree is conferred, the length of the period to be specified in the application, together with the precise reasons for making that application.

Lames Abdul Hadi

Signature

COPYRIGHT AND INFORMATION TO USERS

The author whose copyright is declared on the title page of the work has granted to the British University in Dubai the right to lend his/her research work to users of its library and to make partial or single copies for educational and research use.

The author has also granted permission to the University to keep or make a digital copy for similar use and for the purpose of preservation of the work digitally.

Multiple copying of this work for scholarly purposes may be granted by either the author, the Registrar or the Dean of Education only.

Copying for financial gain shall only be allowed with the author's express permission.

Any use of this work in whole or in part shall respect the moral rights of the author to be acknowledged and to reflect in good faith and without detriment the meaning of the content, and the original authorship.

ABSTRACT

The focus on the role of assessments in predicting students' performance is rapidly increasing. The literature highlights the need to investigate students' achievement predictors in exit assessments. Some studies have focused on investigating the relationship and/or predictability between one or two types of assessment within the academic, cognitive, or affective domains (Chen et al., 2012; Donati, Meaburn & Dumontheil, 2019; Gonzalez, 2015; Hong, 2018). In US-curriculum schools in the United Arab Emirates (UAE), three types of assessment are implemented that measure students' attainment, aptitude, and attitudes toward learning, namely the Measures of Academic Progress (MAP), Cognitive Ability Test (CAT4), and the Pupil Attitudes toward Self and School (PASS). The current study utilised those assessments to investigate the role of students' attainment in MAP, aptitude level in CAT4, and attitude towards learning in PASS assessments in Scholastic Assessment Test (SAT) achievement. This study used an explanatory sequential mixed-method design, and data was collected in two phases. Assessment data of students in Grades 9-12 from five US-curriculum schools in the UAE conducting the MAP, CAT4, PASS, and SAT was analysed to find the relationship between those assessments and to investigate the predictability of SAT using MAP, CAT4, and PASS scores. As a result, in phase one of the study, 603 SAT-Math scores and 169 SAT-English scores for the same students were analysed, and stakeholders' perceptions were collected from 84 leaders' and teachers' and 797 students' questionnaires dedicated to each participant group. In phase two, 13 leaders, 15 teachers, 32 students, and eight parents were part of focus group interviews.

The results highlighted a positive relationship between SAT-Math and SAT-English scores and attainment, aptitude, and the majority of attitudes toward learning factors. Specifically, the strongest positive relationship is between students' MAP and SAT scores and between CAT4 and SAT-Math. Two prediction equations were developed, concluding that MAP, CAT4, and PASS variables explained 44.7% of the variance in SAT-Math scores with an effect size of 0.808, and 42.9% of the variance in SAT-English scores with an effect size of 0.751. Stakeholders' perceptions revealed an overall high agreement on the role of students' academic attainment in English and math, aptitude level, and attitudes toward learning in predicting SAT achievement. Learner self-regard and confidence in learning are the only attitude factors that all stakeholders agreed on in relation to their role in SAT achievement, confirmed by assessment data analysis. Stakeholders' perceptions highlighted the use of MAP, CAT4, and PASS assessments to support teaching and learning processes and pointed to the lack of a systematic process using assessment data to predict students' SAT scores. The study contributes to the field by guiding researchers and educators in their pursuit of identifying factors within academic, cognitive, and affective domains that predict students' academic achievement. Accordingly, the findings can guide educators and schools in supporting students' academic and social development by finding a systematic process of utilising assessment information, tracking students' progress, providing feedback about curriculum development, assessment policies, teaching and learning processes, and finally identifying stakeholders' need for support in the role and use of assessments.

Keywords: Attainment, Achievement, Academic Achievement, Aptitude, Attitude, Attitude towards Learning, Cognitive Ability.

مستخلص

يتزايد التركيز على دور التقييمات في توقع أداء الطلاب بشكل سريع. تسلط الأدبيات الضوء على الحاجة إلى التحقيق في تنبؤات إنجاز الطلاب في تقييمات الخروج. ركزت بعض الدراسات على التحقيق في العلاقة و / أو القدرة على التنبؤ بين نوع أو نوعين من التقييم ضمن المجالات الأكاديمية أو المعرفية أو العاطفية (Chen et al., 2012; Donati, Meaburn & Dumontheil, 2019; Gonzalez, 2015; Hong, 2018). في مدارس المناهج الأمريكية في دولة الإمارات العربية المتحدة ، يتم تنفيذ ثلاثة أنواع من التقييم تقيس تحصيل الطلاب واستعدادهم ومواقفهم تجاه التعلم ، وهي مقاييس التقدم الأكاديمي (MAP) ، واختبار القدرة المعرفية (CAT4) ، واتجاهات التلميذ تجاه الذات والمدرسة (PASS). استخدمت الدراسة الحالية تلك التقييمات للتحقيق في دور تحصيل الطلاب في MAP ، ومستوى الكفاءة في CAT4 ، والموقف تجاه التعلم في تقييمات PASS في إنجاز اختبار التقييم الدراسي (SAT) باستخدام درجات التقييم وتصورات أصحاب المصلحة. استخدمت هذه الدراسة تصميمًا توضيحيًا متسلسلاً للطريقة المختلطة ، وتم جمع البيانات على مرحلتين. تم تحليل بيانات تقييم الطلاب في الصفوف 9-12 من خمس مدارس مناهج أمريكية في الإمارات العربية المتحدة والتي تجري MAP و CAT4 و PASS و SAT لإيجاد العلاقة بين هذه التقييمات والتحقيق في إمكانية التنبؤ بـ SAT باستخدام MAP و CAT4 و عشرات PASS. نتيجة لذلك ، في المرحلة الأولى من الدراسة ، تم تحليل 603 درجة من درجات SAT-Math و 169 درجة SAT-English لنفس الطلاب ، وتم جمع تصورات أصحاب المصلحة من 84 استبيانًا من القادة والمدرسين و 797 استبيانًا للطلاب مخصصة لكل منهم مجموعة المشاركين. في المرحلة الثانية ، شارك 13 قائدًا و 15 معلمًا و 32 طالبًا وثمانية أولياء أمور في المقابلات الجماعية المركزة.

أبرزت النتائج علاقة إيجابية بين درجات SAT-Math و SAT-English والتحصيل والاستعداد وأغلبية المواقف تجاه عوامل التعلم. على وجه التحديد ، تكون أقوى علاقة إيجابية بين درجات الطلاب في MAP و SAT وبين CAT4 و SAT-Math. تم تطوير معادلتين للتنبؤ ، وخلصت إلى أن متغيرات MAP و CAT4 و PASS أوضحت 44.7 ٪ من التباين في درجات SAT-Math بحجم تأثير يبلغ 0.808 و 42.9 ٪ من التباين في درجات SAT-English بحجم تأثير 0.751. كشفت تصورات أصحاب المصلحة عن اتفاق كبير بشكل عام على دور التحصيل الأكاديمي للطلاب في اللغة الإنجليزية والرياضيات ، ومستوى الكفاءة ، والمواقف تجاه التعلم في التنبؤ بإنجاز SAT. يعتبر احترام المتعلم الذاتي والثقة في التعلم من العوامل الوحيدة التي اتفق عليها جميع أصحاب المصلحة حول دورهم في تحقيق اختبار SAT ، والتي أكدها تحليل بيانات التقييم. سلطت تصورات أصحاب المصلحة الضوء على استخدام تقييمات MAP و CAT4 و PASS لدعم عمليات التدريس والتعلم وأشارت إلى عدم وجود عملية منهجية باستخدام بيانات التقييم للتنبؤ بنتائج SAT للطلاب. تساهم الدراسة في المجال من خلال توجيه الباحثين والمعلمين في سعيهم لتحديد العوامل داخل المجالات الأكاديمية والمعرفية والعاطفية التي تتنبأ بالإنجاز الأكاديمي للطلاب. وفقًا لذلك ، يمكن للنتائج أن توجه المعلمين والمدارس في دعم التطور الأكاديمي والاجتماعي للطلاب من خلال إيجاد عملية منهجية لاستخدام معلومات التقييم ، وتتبع تقدم الطلاب ، وتقديم ملاحظات حول تطوير المناهج ، وسياسات التقييم ، وعمليات التدريس والتعلم ، وأخيرًا تحديد أصحاب المصلحة الحاجة إلى الدعم في دور التقييمات واستخدامها.

كلمات مفتاحية: تحصيل، إنجاز، إنجاز أكاديمي، قابلية، سلوك، السلوك تجاه التعلم، القدرة على الاستيعاب.

DEDICATION

The completion of my dissertation is one of the most challenging journeys that I've had to complete without losing my positivity. This accomplishment was possible with the support of my lovely kids, parents, and friends. I dedicate my dissertation work to my family and friends. My mother's and friends' words of encouragement gave me the push and courage to reach the goal.

A special feeling of gratitude is to my kids Rayan, Faris, Adam, and Jana. Their positive motivating words and understanding gave me the power to overcome the challenges. Rayan, thank you for reminding me with my deadline. Faris, you were my consistent reminder of how to be determined and a hard worker. Adam, thank you for understanding and missing a lot of matches to let me study. Jana, thank you for helping in creating list of tables and figures. I know it was not part of grade 5 classes. I also dedicate this work to my best friends, who supported me during the journey of my study.

ACKNOWLEDGEMENT

Foremost, I would like to acknowledge and thank Professor Christopher Hill, for his support, encouragement, and patience throughout the thesis process. He has been supportive since the day I joined the PhD. Program.

Second, I would like to express my deep appreciation to the committee members who were generous with their expertise and precious time. The support and encouragement offered by the British University in Dubai professors are highly appreciated. I take this time to extend my thanks to the university staff.

I am really blessed with supporting friends and colleagues who surrounded me with their love, care and support. Without their support and motivation completing this study would not be possible.

I owe a lot to my parents, who encouraged and helped me at every stage of my personal and academic life. I am very much indebted to my family, my kids, Rayan, Faris, Adam and Jana, who supported me in every possible way to see the completion of this work.

Table of Contents

Chapter One: Introduction	1
1.1 Introduction	1
1.2 Background of the Research	6
1.3 Statement of the Problem	13
1.4 Study Purpose and Questions	17
1.5 Significance of the Study	18
1.6 Scope of Work	22
1.7 Thesis Structure	23
Chapter Two: Conceptual Framework, Theoretical Framework and Literature Review	25
2.1 Conceptual Framework	25
2.1.1 Academic Attainment and Achievement	26
2.1.2 Aptitude	30
2.1.3 Attitude Towards Learning	31
2.2 Theoretical Framework	34
2.2.1 Goal Setting Theory	34
2.2.2 Information Processing Theories	37
2.2.3 Social Cognitive Learning Theory	40
2.2.4 Metacognitive Learning Theory	42
2.3 Literature Review	48
2.3.1 High Stake Assessments	48
2.3.2 Assessments Role in US-Curriculum Schools	53
2.3.3 Assessments Role in the UAE Educational Reform	56
2.3.4 Attainment and Students' Academic Achievement	62
2.3.5 Aptitude and Students' Academic Achievement	66
2.3.6 Attitudes toward Learning and Students' Academic Achievement	77
2.3.7 Combined Factors Contributing to Academic Achievement	92
2.3.8 Multiple Data Sources in Predicting Academic Achievement	102
Chapter Three: Methodology	110
3.1 Research Approach	110
3.2 Research Design	113
3.3 Research Methods	115
3.4 Study Context, Population and Sites	117
3.5 Sampling and Participants	120
3.6 Data Collection and Instrumentations	125
3.6.1 Document Analysis	127
3.6.1.1 Measures of Academic Progress (MAP) - NWEA Reports	128
3.6.1.2 Cognitive Ability Test (CAT4) Reports	131
3.6.1.3 Pupil Attitudes to Self and School (PASS) Reports	133
3.6.1.4 Scholastic Aptitude Test (SAT) Reports	135

	3.6.2 Stakeholders' Questionnaires	135
	3.6.2.1 Leadership Questionnaire	136
	3.6.2.2 Teacher Questionnaire	139
	3.6.2.3 Student Questionnaire	140
	3.6.3 Focus Group Interviews	142
3.7	Procedures and Data Analysis	144
3.8	Pilot Study	147
	3.8.1 Reliability	148
	3.8.2 Validity	150
3.9	Ethical Considerations	154
Chapter Four: Data Analysis and Results of Phase One		156
4.1	Introduction	156
4.2	Results of Document Analysis of Students' Assessment Data	157
	4.2.1 Descriptive Summary of Assessment Scores	158
	4.2.2 The Relationship between the Students' Attainment, Aptitude, Attitude, and SAT Achievement	162
	4.2.3 Predictability of Students' Achievement in SAT by Attainment, Aptitude and Attitude towards Learning Scores	166
4.3	Stakeholders' Questionnaire Results	175
	4.3.1 Leaders' and Teachers' Questionnaire Results	176
	4.3.1.1 Demographic Information	176
	4.3.1.2 Leaders' and Teachers' Perceptions about Students' Attainment, Aptitude, Attitude, and SAT Scores	179
	4.3.1.3 Leaders' and Teachers' Perceptions about the Predictability of Students' SAT Scores by Attainment, Aptitude, and Attitude	200
	4.3.1.4 Factor Analysis for Leaders and Teachers Questionnaire	210
	4.3.2 Students' Questionnaire Results	219
	4.3.2.1 Demographic Information	219
	4.3.2.2 Students' Perceptions about their Attainment, Aptitude, Attitude, and SAT Scores	220
	4.3.2.3 Students' Perceptions about the Predictability of their SAT Scores by Attainment, Aptitude, and Attitude	232
	4.3.2.4 Factor Analysis for Students' Questionnaire	239
4.4	Summary of Phase One Results	248
	4.4.1 The Relationship between the Attainment, Aptitude, Attitude towards Learning, and SAT Achievement	248
	4.4.2 The Predictability of SAT Achievement by Students' Attainment, Aptitude, and Attitude towards Learning	249
	4.4.3 Stakeholders' Perceptions about the Role of Attainment, Aptitude, and Attitude towards Learning in Predicting SAT Achievement	251

Chapter Five: Data Analysis and Results of Phase Two	253
5.1	Focus Groups Interview Results 253
5.1.1	Thematic Analysis Results 256
5.1.1.1	Stakeholders' Perceptions about Attainment, Aptitude, Attitude towards Learning and SAT Achievement 256
5.1.1.2	Stakeholders' Perceptions about the Role of Attainment, Aptitude, and Attitude towards Learning in Predicting SAT Achievement 271
5.1.1.3	Stakeholders' Perceptions about Factors Affecting SAT Achievement 278
5.2	Summary of Phase Two Results 282
5.2.1	Leaders' Perceptions about the Role of the Attainment, Aptitude, and Attitude towards Learning in SAT Achievement 282
5.2.2	Teachers' Perceptions about the Role of the Attainment, Aptitude, and Attitude towards Learning in SAT Achievement 283
5.2.3	Students' Perceptions about the Role of the Attainment, Aptitude, and Attitude towards Learning in SAT Achievement 285
5.2.4	Parents' Perceptions about the Role of the Attainment, Aptitude, and Attitude towards Learning in SAT Achievement 287
Chapter Six: Discussion of Findings	288
6.1	Discussion 288
6.1.1	The Relationship between Students' Attainment in MAP, Aptitude Level in CAT4, Attitude towards Learning in PASS, and SAT Achievement 288
6.1.2	The Predictability of Students' Achievement in SAT using their Attainment in MAP, Aptitude Level in CAT4 and Attitude towards Learning in PASS 298
6.1.3	The Stakeholders' Perceptions about the Role of Attainment, Aptitude and Attitude towards Learning in Students' SAT Achievement 303
6.1.3.1	Leaders' and Teachers' Perceptions about the Role of Attainment in MAP, Aptitude and Attitude towards Learning in Students' SAT Achievement 304
6.1.3.2	Students' Perceptions about the Role of Attainment in MAP, Aptitude and Attitude towards Learning in Students' SAT Achievement 308
6.1.3.3	Parents' Perceptions about the Role of Attainment in MAP, Aptitude and Attitude towards Learning in Students' SAT Achievement 310
6.2	Summary 312
Chapter Seven: Conclusion and Recommendations	315
7.1	Conclusion 315
7.1.1	Attainment, Aptitude and Attitude Factors within Academic, Cognitive, and Affective Domains 317

7.2	Implications and Contribution	323
7.3	Limitations	326
7.4	Recommendations for Future Research	328
References		331
Appendices		375
	Appendix A: National Agenda Parameters	375
	Appendix B: Study Permission Letter by the British University in Dubai	379
	Appendix C: Research Consent Form for Participation in the Study	380
	Appendix D: Leadership's Questionnaire	382
	Appendix E: Teachers' Questionnaire	387
	Appendix F: Students' Questionnaire	392
	Appendix G: Interview (1) Leadership Team Focus Group	396
	Appendix H: Interview (2) Teachers Focus Group	397
	Appendix I: Interview (3) Students Focus Group	398
	Appendix J: Interview (4) Parents Focus Group	399
	Appendix K: Pilot Study – Pearson Correlation Coefficients	400
	Appendix L: Correlational Analysis Results for all the Variables	401
	Appendix M: Partial Regression Plots for Model 1	405
	Appendix N: Partial Regression Plots for Model 2	410
	Appendix O: Regression Analysis Output (SAT-Math)	416
	Appendix P: Regression Analysis Output (SAT-English)	417
	Appendix Q: Homoscedasticity Plots, Residuals Plot and Histograms	418
	Appendix R: Correlation Matrix of Leaders and Teachers Questionnaire Items	434
	Appendix S: Convergent Validity Estimates from CFA on Leaders' and Teachers' Questionnaires	435
	Appendix T: Correlation Matrix of Students Questionnaire Items	437
	Appendix U: Convergent Validity Estimates from CFA on Students' Questionnaire	438

List of Tables

Table (3. 1): Alignment between Research Questions and the Methods.....	117
Table (3. 2): The Population and Categorisation in the Participating Schools.....	124
Table (3. 3): The Participants' Distribution.....	126
Table (3. 4): Study Variables.....	128
Table (3. 5): Distribution of Overall Scores into Percentile Rankings (NWEA, 2020)	131
Table (3. 6): CAT4 Batteries and Items Included.....	132
Table (3. 7): Relationship between CAT4 Scores (GL-Assessment, 2019, p.5)	133
Table (3. 8): PASS Factors (GL-Assessment, 2017)	134
Table (3. 9): Leaderships' Questionnaire Items.....	139
Table (3. 10): Teachers' Questionnaire Items.....	141
Table (3. 11): Students' Questionnaire Items	143
Table (3. 12): Assessment Alignment and Types of Scores	146
Table (3. 13): Reliability Test of Leaders & Teachers' Questionnaire.....	151
Table (3. 14): Reliability Test of Students' Questionnaire	151
Table (3. 15): Convergent and Discriminant Validity –	153
Table (4. 1): Students' Demographic Summary	158
Table (4. 2): Descriptive Summary of Assessment Scores for	160
Table (4. 3): Pearson's r Correlation Coefficients	164
Table (4. 4): The Correlation between SAT and each Assessment	166
Table (4. 5): Model-1 Multiple Regression Results for Predicting SAT-Math	171
Table (4. 6): Multiple Regression Results for Model-2.....	174
Table (4. 7): Demographic Information (gender and nationalities) of.....	178
Table (4. 8): Demographic Information (roles and specialisations)	179
Table (4. 9): Demographic Information (qualifications and years of experience)	180
Table (4. 10): Descriptive Summary of Leaders and Teachers' Perceptions about.....	186
Table (4. 11): Comparison between Leaders and Teachers' Responses on Academic Factors	187
Table (4. 12): Descriptive Summary of Leaders and Teachers' Perceptions about.....	193
Table (4. 13): Comparison between Leaders' and Teachers' Responses on Cognitive Factors	194
Table (4. 14): Descriptive Summary of Leaders and Teachers' Perceptions about.....	200
Table (4. 15): Comparison between Leaders' and Teachers' Responses on Affective Factors	201
Table (4. 16): Reasons why Leaders and Teachers think that MAP can help in Predicting Students' SAT Scores: "Knowledge/Progress Measure" Theme	203
Table (4. 17): Reasons Why Leaders and Teachers think that MAP can help in Predicting Students' SAT Scores: "Common Questions" Theme.....	204
Table (4. 18): Reasons Why Leaders and Teachers think that MAP can help in Predicting Students' SAT Scores: "MAP has Different Types of Questions" Theme.....	205
Table (4. 19): Reasons Why Leaders and Teachers think that CAT4 can help in Predicting Students' SAT Scores: "Assess Student's Potential" Theme	207
Table (4. 20): Reasons Why Leaders and Teachers think that CAT4 can help in Predicting Students' SAT Scores: "Learning Style" Theme.....	207
Table (4. 21): Reasons Why Leaders and Teachers think that PASS can help in Predicting Students' SAT Scores: "Positive Attitude" Theme	209
Table (4. 22): Reasons Why Leaders and Teachers think that PASS can help in Predicting Students' SAT Scores: "Aspiration & Willingness to Learn" Theme.....	209

Table (4. 23): Reasons Why Leaders and Teachers think that PASS can help in Predicting Students' SAT Scores: "Self-confidence" Theme	210
Table (4. 24): Reasons Why Leaders and Teachers think that PASS can help in Predicting Students' SAT Scores: "Motivation" Theme.....	210
Table (4. 25): KMO and Bartlett's Test for Leaders and Teachers' Questionnaire	211
Table (4. 26): MSA and Communalities for the Teachers' and Leaders'	213
Table (4. 27): Pattern Matrix ^a Factor Loadings from PCA with Promax Rotation for a Three-Factor Solution for Leaders and Teachers' Questionnaire (N = 84).....	215
Table (4. 28): Fit Indices for Measurement Model of Leaders and	218
Table (4. 29): Convergent Validity Estimates from CFA on Leaders' and Teachers' Questionnaire-Standardized Factor Loadings.....	219
Table (4. 30): Discriminant Validity for Leaders' and Teachers' Perceptions Model	219
Table (4. 31): Demographic Information of Students (N=797).....	221
Table (4. 32): Descriptive Summary of Students' Perceptions about Academic Factors.....	224
Table (4. 33): Descriptive Summary of Students' Perceptions about Cognitive Factors	228
Table (4. 34): Descriptive Summary of Students' Perceptions about Affective Factors.....	231
Table (4. 35): KMO and Bartlett's Test for Students Questionnaire (30 items).....	241
Table (4. 36): MSA and Communalities for the Students Questionnaire (30 items).....	242
Table (4. 37): Pattern Matrix ^a Factor Loadings from PCA with Promax Rotation for a Three-Factor Solution for Students' Questionnaire (N = 797).....	244
Table (4. 38): Fit Indices for Measurement Model of Students' Questionnaire	247
Table (4. 39): Convergent Validity Estimates from CFA on Students' Questionnaire-Standardised Factor Loadings.....	248
Table (4. 40): Discriminant Validity for Students' Perceptions Model.....	249

List of Figures

Figure (2. 1): The Conceptual Framework of the Study	33
Figure (2. 2): Information Processing Model of Learning and Memory	38
Figure (2. 3): The Study's Theoretical Framework	47
Figure (2. 4): The Interrelation between the Theoretical and Conceptual Framework	48
Figure (2. 5): Cognitive Ability Test Batteries	69
Figure (2. 6): Relationship between CAT4 Batteries and Learning/Encoding Process.....	71
Figure (2. 7): The Hypothesised Structural Model of Achievement.....	98
Figure (2. 8): The Final Structural Model of Achievement in Statistics	99
Figure (3. 1): Overview of the Research Approach.....	114
Figure (3. 2): Research Design	115
Figure (3. 3): Number of Private Schools in the UAE.....	119
Figure (3. 4): Distribution of Private Schools per Curriculum	119
Figure (3. 5): Focus Groups Data Analysis Process	148
Figure (4. 1): Normal Q-Q Plot of SAT-Math.....	161
Figure (4. 2): Normal Q-Q Plot of SAT-English	161
Figure (4. 3): Normal Q-Q Plot of MAP-Math.....	161
Figure (4. 4): Normal Q-Q Plot of MAP-Reading.....	161
Figure (4. 5): Normal Q-Q Plot of MAP-Language	161
Figure (4. 6): Normal Q-Q Plot of CAT4	161
Figure (4. 7): Normal Q-Q Plot of PASS-1 Feelings about School.....	162
Figure (4. 8): Normal Q-Q Plot of PASS-2 Perceived Learning Capability	162
Figure (4. 9): Normal Q-Q Plot of PASS-3 Learner Self-regard.....	162
Figure (4. 10): Normal Q-Q Plot of PASS-4 Preparedness for Learning	162
Figure (4. 11): Normal Q-Q Plot of PASS-5 Attitudes to Teachers	162
Figure (4. 12): Normal Q-Q Plot of PASS-6 General Work Ethic	162
Figure (4. 13): Normal Q-Q Plot of PASS-7 Confidence in Learning	163
Figure (4. 14): Normal Q-Q Plot of PASS-8 Attitudes to Attendance	163
Figure (4. 15): Normal Q-Q Plot of PASS-9 Response to Curriculum Demands	163
Figure (4. 16): Regression Model-1.....	170
Figure (4. 17): Regression Model-2.....	173
Figure (4. 18): No. of Years Leaders and Teachers Used the MAP Test	181
Figure (4. 19): Leaders' Perceptions about Academic Factors (%).....	182
Figure (4. 20): Teachers' Perceptions about Academic Factors (%)	183
Figure (4. 21): No. of Years Leaders and Teachers Used the CAT4 Test	188
Figure (4. 22): Leaders' Perceptions about Cognitive Factors (%)	189
Figure (4. 23): Teachers' Perceptions about Cognitive Factors (%)	190
Figure (4. 24): No. of Years Leaders and Teachers Used the PASS Test	195
Figure (4. 25): Leaders' Perceptions about Affective Factors (%).....	196
Figure (4. 26): Teachers' Perceptions about Affective Factors (%)	198
Figure (4. 27): Do you Think that MAP can help in Predicting Students' SAT Scores?	202
Figure (4. 28): Reasons why Leaders and Teachers think that MAP can help in Predicting Students' SAT Scores.	202
Figure (4. 29): Do you Think that CAT4 can help in Predicting Students' SAT Scores?	206
Figure (4. 30): Reasons Why Leaders and Teachers think that CAT4 can help in Predicting Students' SAT Scores	206

Figure (4. 31): Do you Think that Students' Attitude towards Learning can help in Predicting Students' SAT Scores?	208
Figure (4. 32): Reasons why Participants think that Students' Attitude towards Learning can help in Predicting Students' SAT Scores.....	208
Figure (4. 33): Scree Plot EFA (Principal Component Analysis with Promax Rotation) for Leaders' and Teachers' Questionnaire.....	216
Figure (4. 34): CFA Measurement Model of Leaders and Teachers' Questionnaire	217
Figure (4. 35): No. of Years Students Participated in the MAP Test	222
Figure (4. 36): Students' Perceptions about Academic Factors – Attainment (%).....	225
Figure (4. 37): No. of Years Students Participated in the CAT4 Test	226
Figure (4. 38): Students' Perceptions about Cognitive Factors – Aptitude (%)	229
Figure (4. 39): No. of Years Students Participated in the PASS Test	230
Figure (4. 40): Students' Perceptions about Affective Factors-Attitude towards Learning (%)	232
Figure (4. 41): Do you Think that MAP can help you in Predicting your Results in SAT?..	234
Figure (4. 42): Reasons that 76% of Students Think that MAP can help them in Predicting their Results in SAT.....	234
Figure (4. 43): Do you Think that CAT4 can help you in Predicting your SAT Scores?.....	236
Figure (4. 44): Reasons that 51.6% of Students Think that CAT4 can help them in Predicting their Results in SAT.....	236
Figure (4. 45): Reasons that 48.4% of Students do not Think that CAT4 can help them in Predicting their Results in SAT	237
Figure (4. 46): Do you Think that your Attitude towards Learning can help you in Predicting your SAT-Math Scores?	239
Figure (4. 47): Reasons that 73.9% of Students Think that their Attitude towards Learning can help them in Predicting their Results in SAT.....	239
Figure (4. 48): Scree Plot EFA (Principal Component Analysis with Promax Rotation) for Students Questionnaire	245
Figure (4. 49): CFA Measurement Model of Students Questionnaire.....	246

Chapter One: Introduction

1.1 Introduction

Educational institutes face challenges of implementing different types of assessments to enhance the quality of education and improve learners' performance. Different levels of assessments have been utilised to track trends and evaluate the effectiveness of programmes and curricula (Shepard & Penuel, 2017). Assessments have also been used to enable valid comparisons within institutions in the United Arab Emirate (UAE) and those overseas (Matsumoto, 2019). The primary focus of high-stake assessments is the desire by the educational institutions and the supervising authorities to assess systems and schools' accountability and credibility. These assessments are also supposed to be a way of monitoring large-scale trends to guide future policies and developments. At the same time, the different types of assessment are intended to check on the comparability of claims about the level of students' performance and proficiency. Due to the transformation of the global economy and global job markets, the UAE has witnessed an increase in the demand for graduates majoring in Science, Technology, Engineering, Arts, and Mathematics (STEAM) subjects. This has placed further pressure on institutions to assess their output in order to meet the requirements of the knowledge-based economy and the needs of the workforce (Byat & Sultan, 2014; Cooper et al., 2015; Sebesta, 2019).

Therefore, schools and universities have changed their focus by enriching the offered programmes and benchmarking students' achievement using external and high-stake assessments to ensure the quality of those programmes and students' readiness for the next step (Matsumoto, 2019; Pennington, 2017). The practice of triangulating data from a three-dimensional view of internal and external assessments is well known to measure and improve

educational quality (Kelly et al., 2020). Like other education authorities around the world, the UAE education governance demanded assessments and inspections of schools. Additionally, US-based accreditation boards also put pressure on local institutions to provide assessment data that captures a holistic picture of the quality of education and students' performance in schools and universities (Kelly et al., 2020; KHDA, 2020).

The change in the role and types of assessment implemented in schools have guided the schools' improvement plans to support students, enhance their learning, and track their progress and attainment. Accordingly, governance of schools is based on decisions and developments driven by data. The different types of assessment are supposed to reveal the quality of education, students' academic performance, growth, and readiness to study at university. Students' readiness for university is tested through high-stake assessments and university acceptance assessments like the Scholastic Aptitude Test (SAT). Students' performance in the SAT needs to meet college expectations and requirements include students' preparedness, prior knowledge, and self-efficacy. According to Credé, Tynan and Harms (2017), Perry et al. (2005) and Vandeveld et al. (2013), each college uses an assessment tool that satisfies its needs. Institutions' expectations are that these assessment tools reveal the best prepared students, not only cognitively but also in relation to positive attitudes and self-efficacy.

Research on assessment of students' academic achievement explores the role of using different types of assessment in assessing students' attainment, aptitude, and attitude and providing feedback useful in recalibrating the teaching and learning methods (Kelly et al., 2020; Shepard & Penuel, 2017). Studies on students' academic achievement have mainly focussed on academic, cognitive, affective, psychological, and sociocultural factors (Gonzales, 2015; Sebesta, 2019) and their role in predicting students' academic achievement (Bassey, Umoren

& Udida, 2013; Musa & Samuel, 2019). Interestingly, it was found that relying only on academic achievement scores to identify a student's mastery of standards do not provide teachers with clear insight about the student's thinking nor can this predict academic performance (Shepard & Penuel, 2017). Moreover, the field of educational research and policy has given a great deal of attention to curriculum, teachers, and schools, but not that much attention has been paid to students' characteristics (Chingos, Whitehurst & Lindquist, 2014; Detterman, 2016).

One of these considered characteristics is aptitude, also known as cognitive ability. Findings from studies (Gonzalez, 2015; Wai, Brown & Chabris, 2018) highlighted the importance of cognitive ability and the significant overlap between learners' aptitude and their academic achievement. Learners' aptitudes contribute heavily to the variance that students bring to the classroom, which is particularly important when studying the impact of teachers or school type on students' performance (Finn et al., 2014; Gonzalez, 2015; Reggianini, 2017). Other researchers (Momsen et al., 2013; Sebesta, 2019; Styers et al., 2018) have studied the impact of instructional practices and different types of assessments including summative and formative ones on enhancing learners' use of higher order cognitive skills and developing deep meaningful learning. For example, Sebesta (2019) examined students' perceptions to find which student characteristics affect academic achievement. The study focused on self-regulated learning strategies, assessment performance, and attitudes toward learning. The findings highlighted the role of using cognitive and metacognitive strategies in enhancing academic achievement, and current academic attainment predicted students' achievement at the end of the course. Finally, self-regulation skills and attitudes toward learning predicted academic achievement (Sebesta, 2019). This finding is supported by a large body of research about the relationship between positive attitudes towards learning, higher-order cognitive

skills, and academic achievement (Lipnevich et al., 2011; Sebesta, 2019; Shepard & Penuel, 2017; Volpe, 2016).

Predicting students' academic achievement based on a combination of different factors (academic achievement, cognitive abilities, and attitudes towards learning) is evident in research (CTB/McGraw-Hill, 2014; Finn et al., 2014; Gonzalez, 2015; Lipnevich et al., 2011; Lipnevich, Preckel & Krumm, 2016; Reggianini, 2017; Volpe, 2016). However, these studies have only investigated two factors at a time. For example, Gonzalez (2015) examined the predictive relationship of students' achievement in the New York Math state exam with the initial math scores and aptitude test scores; while Lipnevich, Preckel and Krumm (2016) demonstrated that students' attitude towards mathematics contributed to their academic achievement in the subject more than the contribution of their aptitude level or personality. Gonzalez (2015) found that students' current academic attainment in mathematics and aptitude level predicted their achievement in mathematics. On the other hand, Lipnevich, Preckel and Krumm (2016) found that attitudes toward mathematics in general and achievement in specific incrementally explained around 25% of variance in mathematics grades over and above students' cognitive ability. Therefore, investigating more factors could increase the percentage of the explained variance in students' academic achievement.

Curriculum-based assessments, cognitive ability or aptitude, attitude towards learning assessments, and wellbeing census are all different types of assessment that provide schools with the opportunity to triangulate data to improve the quality of education. The literature highlights the gap in studies that have used three types of assessment that cover academic, cognitive, and affective domains to predict students' academic achievement (Lipnevich, Preckel & Krumm, 2016). At the same time, investigating the factors simultaneously is crucial in order to formulate students' learning profiles. These individualised learning profiles can

provide information about students' current academic attainment, aptitude, and attitude towards learning and guide how to tailor the most effective teaching (Chen et al., 2012; Detterman, 2016). For example, students' participation in curriculum-based assessments that include reflection and setting goals as part of learning process has been proven to act as a metacognitive tool that develops students' self-regulation (Azevedo, 2005a), self-efficacy (Schraw & Moshman, 1995), attitude towards learning, self-capabilities (Dabbagh & Kitsantas, 2013; Dinsmore, Alexander & Loughlin, 2008), cognitive ability, and therefore achievement (Schunk, 2012).

Most recently, educational systems/institutions around the world have been working hard to implement methods and procedures of assessment that balance between the required ethical and legal standards of assessments and the staff and students' health and safety needs during the COVID-19 pandemic 2020 (NASP, 2020c; Stifel et al., 2020). As a result of the pandemic, education has been significantly affected in a negative way because of either interruption or closure of schools since 2020. Many schools around the world have been unable to resume schooling or full face-to-face instruction (Unicef, 2021). The interruption to school and university courses has proved to increase the educational inequalities, widen the educational gaps, and slow down or even stop the progress in students' achievement (Van Lancker & Parolin, 2020; Viner et al., 2020).

While the mode of learning changed to accommodate the students' needs during the COVID-19 pandemic 2020, such as with remote learning or blended/hybrid learning models, assessing students and providing reliable evidence of students' achievement remained challenging. Many assessments were administered remotely or online using computer-based assessments instead of classic paper and pen assessments (NASP, 2020a; Stifel et al., 2020). Researchers and policymakers have questioned the equivalency of grades obtained from online and in-person

cognitive and achievement assessments (Daniel & Wahlstrom, 2019). The COVID-19 pandemic has significantly delayed academic and psychoeducational assessments (Stifel et al., 2020) and this has increased concerns about students' readiness to attend universities. The Quality Assurance Agency (QAA) (2020a) highlighted the need to find alternative approaches to assess students while maintaining the academic standards in a response to the COVID-19 pandemic. As a result, the need to identify learning gaps and to utilise the implemented types of assessments in schools effectively is crucial. Investigating the predictability of students' academic achievement using academic, cognitive, and affective predictors can provide a rich source of data to identify students who are more likely to be underachieving and give direction to best support them. Additionally, actions can be taken accordingly to improve learning outcomes and to provide feedback on the curriculum review process.

1.2 Background of the Research

The notion of assessment for validity, accountability and comparability purposes has increased (Smith, 2014). Many educational systems use assessment as a tool for different purposes. First, assessments could be used to predict students' scores and to identify the achievement gap (Plucker, Burroughs & Song, 2010). Second, they can be utilised by policymakers to change/update educational policies where measures such as Qualification Mismatch Measures (QMM) can be used to increase the school and university graduates' qualifications and to provide feedback to the policymakers (OECD, 2015b). That focus increased the pressure on schools by ensuring that assessments play a leading role in guiding the cycle of educational improvement plans.

Third, assessments could be utilised to benchmark the quality of education (Darling-Hammond, 2011). Griffin, Care and McGaw (2011) have argued that the power of assessment is not limited to the evaluation purpose or one perspective. A powerful assessment, as described

by Wiggins and McTighe (2005), looks like a ‘photo album’ that brings together multiple sources of evidence collected over time rather than a single ‘snapshot’. The utilisation of assessment information can formulate a rich resource that directs the teaching and learning process if data was used effectively (Griffin, Care & McGaw, 2011). Nonetheless, such effective use is challenging especially when schools deal with different types of assessment, either formative or summative, and there is a mismatch between the purposes of these assessments.

For example, the Measures of Academic Progress (MAP) is a curriculum-based assessment in reading, language usage, mathematics and science which is utilised to benchmark the students against the standards as well as track their progress in literacy across subjects (Barber, 2017; Beesley et al., 2018; Cordray et al., 2013; Marshall, Smart & Alston, 2017). MAP is known as a personalised test because it is an adaptive test and provides reports that require students to set goals and then monitor their own progress and attainment (Cordray et al., 2013). The adaptive test means that the level of difficulty and depth of knowledge per question is adjusted based on each student’s level and response to previous questions (NWEA, 2012).

In the education system, there are multiple stakeholders who may use assessment information for different purposes. While government and policymakers use the assessment information to evaluate the quality of education in the country (Darling-Hammond, 2011), teachers and students employ the information to reflect on the current practices and to set improvement plans (Gilchrist, 2017; Johnson, 2016; Zimmerman, 2008). On other hand, parents need both the evaluative and feedback information to support their children. Consequently, understanding stakeholders’ perceptions about assessment data helps in improving the students’ learning skills, tracking their progress and feeding back to the curriculum, and in the teaching and

learning processes (Beesley et al., 2018; Leithwood, Mascall & Strauss, 2008; Marshall, Smart & Alston, 2017; Rudloff, 2009).

The UAE pursues an effective international approach and has prioritised educational development to achieve a ‘First Rate Education’ (UAE Vision 2021, 2018). This was evident in the UAE federal budget for education which exceeded 20% of the overall government budget in 2017 and 2018 (Byat & Sultan, 2014). In 2019 and 2020, the budget varied between 14.8% and 16.8% which continue to reflect the focus on improving the quality of education (Gallagher, 2019; UAE Government, 2021).

The UAE has witnessed a significant increase in the educated population over the past 48 years (Government.ae, 2018a). There has been a remarkable increase in the number of international schools in the UAE since 2006. Currently the UAE has the second highest number of international schools after China (Kamal & Trines, 2018). US- and British- curriculum schools are the dominant types of international schools. In 2018, the UAE had more than 600 international schools serving more than 620,000 students (Dubai Statistics Centre, 2019).

These schools are mostly located in big emirates, especially Dubai and Abu Dhabi. More than 90% of the students who graduated from high school intend to study abroad and this percentage is consistently increasing. At the same time, the UAE witnessed more than 132% increase in the demand for enrolment in universities abroad (Abu Dhabi Statistics Centre, 2019; Dubai Statistics Centre, 2019).

Establishing a first-rate education system and a competitive knowledge-based economy are international demands (Bouyamourn & Malek, 2016) echoed in the UAE’s Vision 2021 (UAE Government, 2019; UAE Vision 2021). Therefore, the UAE initiated the National Agenda

Parameters (NAP) as part of the UAE's Vision 2021 that unified the used indicators to evaluate the quality of education in schools offering different curricula in the country (Matsumoto, 2019; UAE Government, 2019; UAE Vision 2021). The parameters were created to focus on Trends in International Mathematics and Science Study (TIMSS), Programme for International Student Assessment (PISA), curriculum-based assessments, aptitude assessments, high school qualifications, and the qualifications of teachers and leaders in schools (Matsumoto, 2019; UAE Government, 2019).

To monitor the quality of education in the UAE, NAP requires each school to conduct three different types of assessment. First, the schools were required to conduct aptitude and curriculum-based assessments as part of the quality indicator of students' attainment and progress. Since 2016, US-curriculum schools were requested to run the MAP test (NWEA, 2014) as a curriculum-based assessment in core subjects: mathematics, science, and English, along with the Cognitive Ability Test (CAT4). CAT4 is an aptitude test that assesses the students' cognitive abilities in verbal reasoning, number sense, spatial ability, and logical thinking (GL-Assessment, 2017). Secondly, the schools were required to conduct a test called the 'Dubai Student Wellbeing Census' (KHDA, 2017) to measure students' social and emotional development, physical health, and attitude towards learning. Another attitude test was required which is the Pupil Attitudes to Self and School (PASS) Test. It is conducted to understand the root causes of students' disengagement, their self-regard, and attitudes toward learning and school (GL-Assessment, 2017). Thirdly, in 2017, the Ministry of Education (MOE) reviewed the high school equivalency policy to enhance the rigour of the graduation requirements (MOE, 2019; UAE Government, 2018). Accordingly, the high school equivalency requirements in US-curriculum schools were updated by increasing the required scores of the SAT and by adding the Advanced Placement tests as a requirement to get an 'Advanced' or 'Elite' path of equivalency (MOE, 2019). Moreover, MOE developed the

Emirates-SAT (EmSAT) test across subjects to benchmark students' performance against international standards (Pennington, 2017).

As a result of the NAP's requirements, the role of assessment in the UAE has been significantly increasing over the past five years to ensure continuous monitoring and improvement in the educational system (Matsumoto, 2019). The ultimate goal is to develop the UAE into one of the best places offering high quality education in the world (Bouyamourn & Malek, 2016; UAE Vision 2021). Accordingly, later in 2021, the UAE government updated the national agenda priorities and announced the new 'UAE Centennial 2071 Plan' reflecting the country's new updated national agenda (UAE Centennial 2071, 2021). The UAE Centennial Plan 2071 is based on four pillars: future-focused government, excellent education, knowledge-based economy, and finally, developing a happy and cohesive society. The pillars highlight the importance of education, knowledge, a positive environment, and society's wellbeing in the UAE. More focus has been given to raising the productivity of the national economy and increasing the investment in education to achieve high standards and to enhance the use of technology.

The UAE has participated in high stake assessments like TIMSS, PISA, and the Progress in International Reading Literacy Study (PIRLS) to track large-scale trends in education, even during the COVID-19 pandemic (Kelly, 2020; KHDA, 2020). Quality assuring, inspection, and graded assessments continued during the pandemic to maintain curriculum alignment, quality of teaching and learning, and to provide the required support to students (Alshamsi, Zahavich & El-Farra, 2021). As a lesson learned from the pandemic and lockdown, assessment methods were revisited to provide customised authorship evidence, to improve the cognitive complexity of assessment, and to ensure the validity and reliability of on-site and remote testing.

The UAE prioritised reaching an excellent quality in advanced health science, technology, engineering, space science and innovation in education (UAE Government, 2019), especially after the UAE report that was interpreted in the local context by shedding light on the decrease in students' enrolment in STEAM studies and the increase in the business field (KHDA, 2015; Moonesar et al., 2015). The issue was traced back to the high school level, which confirmed the gap between the high school graduation level and university readiness level (ADEC, 2012). In 2018, 44.8% of the students in Dubai were enrolled in foundation year (UAE Vision 2021, 2018) while the number in Abu Dhabi reached 95% due to their lack of university readiness (ADEC, 2012; Matsumoto, 2019). Accordingly, more focus has been given to mathematics and physics by adding two mandatory assessments to the high school equivalency policy and university placement requirements (MOE, 2019). In relation to this, tracking students' performance in English, mathematics, and science using international and curriculum-based assessments became more crucial.

Since assessment plays the main role in benchmarking students' levels in high school exit exams and university admission tests based on evaluating assessment results, the used assessment tool should be valid and reliable to reflect accurate evaluation (Gonzalez, 2015). SAT is one of the high-stake assessments used around the world mainly in US-curriculum schools. The findings from high-stake assessment results have been impacting educational systems across the world, where factors like students' readiness, teacher accountability, and curriculum alignment are investigated (Fremer & Wall, 2004; Shepard & Penuel, 2017). For example, SAT scores have been proven to be one of the significant factors that predicted students' college readiness and achievement (Dale & Krueger, 2011; Wai, Brown & Chabris, 2018). Consequently, using students' SAT scores and including their aptitude level and attitude towards learning are crucial to develop the students' learning profiles in order to meet their learning' needs (Detterman, 2016).

Students' achievement in mathematics has been affected by other factors like attitude towards learning mathematics (Lipnevich et al., 2011), cognitive ability (Deary et al., 2007), and the character of personality (Heaven & Ciarrochi, 2012). Few studies have investigated the relationship between students' performance in mathematics, their cognitive ability, and attitude towards learning (Lipnevich, Preckel & Krumm, 2016). Similarly, few studies have investigated the validity of the MAP assessment to predict the American College Testing (ACT) and SAT scores (Brown, 2014). Those studies recommended investigating the predictability of standardised assessments by other types of assessments.

Students' attitude toward self and school has proven to have a main contribution to their engagement and achievement (Lipnevich et al., 2011; Lipnevich, Preckel & Krumm, 2016). Studying students' attitudes and aptitude level and how they can predict students' performance is crucial to identify variables that affect achievement in high-stake assessments like SAT (Wai, Brown & Chabris, 2018). Studying the relationship among students' attitudes toward learning, aptitude, and attainment has provided empirical evidence on factors which played a main role in predicting students' achievement (Gonzalez, 2015; Hong, 2018; Lipnevich et al., 2011) and helped in designing models and frameworks to predict achievement based on general and specific academic level, cognitive ability, and self-concept (Brunner, Ludtke & Trautwein, 2008; Chen et al., 2012). Having a systematic process of assessment that includes a well-balanced and rigorous assessment is crucial.

The researcher's professional background and area of interest have been directed toward assessment. Using assessment data comprehensively to improve teaching and learning will drive quality of education and through this, create a culture of a positive attitude toward assessments which is a need in education. This is important specially that since the COVID-19

pandemic crisis and the subsequent changes in the offered education, where the new normal has affected students' achievement and progress negatively in MAP- Reading and MAP-Math (Lewis & Kuhfeld, 2021). This situation has increased the need to monitor students' academic, cognitive, and behavioural performance to identify learners' needs, support them and facilitate their learning. The findings from the study will help to predict students' performance, feedback curriculum development, and teaching and learning processes. Moreover, the results will support the development of school improvement plans based on data-driven decisions.

1.3 Statement of the Problem

There is a great focus on assessment in the UAE, where high-stake assessments are conducted for accountability and comparability. Curriculum-based assessments and Aptitude/Cognitive Ability Tests (GL-Assessment, 2017) along with attitude towards learning assessments are triangulated to create learners' profiles and to measure their attainment and progress (KHDA, 2017). The data from the above assessments were compared to the students' performance in international assessment results in SAT, A-Level in UK-curriculum, International Baccalaureate (IB), TIMSS and PISA then used to judge the quality of education in schools (KHDA, 2019). The UAE's NAP and educational targets are communicated yearly to schools by providing a list of mandatory assessments based on the school curriculum. One of the US high school diploma graduation requirements in the UAE is to achieve a SAT mathematics score of 511, which is the California average, and which is a challenging score to attain (KHDA, 2017). Moreover, the UAE's High School Equivalency policy (HSE) (MOE, 2019) requires the US-curriculum schools to enrol all the students in the EmSAT in English, Arabic, mathematics, and physics, SAT mathematics, and one English proficiency test. Simultaneously, the inspection framework sets the student's achievement in SAT as a quality indicator to judge the quality of attainment in English and mathematics (KHDA, 2017).

The CAT4 and the UK-Progress Tests in English, mathematics and science have been utilised in IB- and UK-curriculum schools to predict students' curriculum-based exam scores (GCSE/A-level and IB). The GL-assessment company provides the IB- and UK-curriculum schools with predicted grades based on students' scores in CAT4 and UK progress tests (GL-Assessment, 2017). However, US-curriculum schools do not benefit from the CAT4 and MAP tests when it comes to predicting students' performance in PSAT and SAT exams. Accordingly, the UAE's NAP prioritised the use of CAT4 and MAP to enhance students' achievement (KHDA, 2017). Hence a student's performance in SAT serves as an indicator of the quality of high school achievements and assesses the student's readiness for university (Wai, Brown & Chabris, 2018). Therefore, investigating the predictability of the student's performance in SAT using their aptitude, attainment and attitude data is a demanding need.

Several studies have aimed to utilise the currently used standardised/benchmark assessments (Gonzalez, 2015), cognitive ability tests (Chen et al., 2012; Finn et al., 2014), and attitude towards learning tests (Shepard & Penuel, 2017; Volpe, 2016) to predict students' achievement in the summative assessments. However, the literature review has shown that only a limited numbers of studies investigated the role of attainment, aptitude and attitude factors together in predicting students' SAT scores using quantitative and qualitative data. The limitations of those studies are either in relying on quantitative data using mathematical and statistical models generated by software without considering substantive explanation (Nasser, 2004; Quinn-Nilas, Kennett & Maki, 2019; Vizoso, Arias & Rodriguez Perez, 2019) or relying on quantitative approach using assessment scores and questionnaires without using qualitative approach to provide insights of possible factors playing main role in students' academic achievement to explain the findings (Chen et al., 2012).

On the other hand, previous studies about academic, cognitive and affective factors and the relationships between them concluded that including qualitative approaches is most appropriate to investigate the topic (Cunha, Heckman & Schennach, 2010; Detterman, 2016; Duckworth & Yeager, 2015; Lee & Shute, 2010; Richardson, Abraham & Bond, 2012; Stankov, 2013; Whitham et al., 2013). Moreover, relying only on tools such as self-reporting tools which was the case in Lee and Stankov's (2016) study, affects the reliability of the results because of the possible discrepancy between participants' perception and their actual behaviour. Moreover, investigating the effect size of the predictors complied and explaining the findings are effective in shedding more light on the role of the predictors (Lee & Stankov, 2016).

The literature indicates that previous studies confirmed that investigating students' academic achievement using two or more different types of factors as predictors increase the percentage of predictability of the dependent variable (Beesley et al., 2018; Chen et al., 2012; Detterman, 2016; Marshall, Smart & Alston, 2017) and the in-depth information of the findings (Gonzalez, 2015; Thum, 2011). Therefore, due to the interrelationship between the different academic, cognitive and affective factors which makes studying them challenging, considering different factors and methodological approach is crucial.

The more accurate model for predicting students' performance is the better early intervention which can be provided to support students to enhance their performance at the end of year summative assessments, and to enable developing a model or framework for prediction. Preparing high school students to take high-stake assessments like SAT and predicting their achievements have been a focus and a demand for further investigation in the literature (Gonzalez, 2015; Shepard & Penuel, 2017; Thum, 2011; Thum & Matta, 2015). The findings recommended including larger sampling, using different types of aptitude tests to predict

students' performance, and investigating students' performance in more than one subject (Gonzalez, 2015). The findings also highlighted the importance of early intervention for all levels of students' achievement, especially where mistakenly identifying a student to be on track would lead to missing out or being late in preparing that student as early as possible to be back on track for college readiness (Thum & Matta, 2015).

Due to the special combination of the implemented assessments in the UAE, there is gap in the literature of studies that utilised the MAP, CAT4, and PASS in predicting SAT assessments in one study. For schools to implement all the required assessments and fulfil the policies mandated by the UAE educational authorities it is crucial to communicate explicitly with stakeholders the rationale of choosing specific types of assessments and how can they be used effectively to support students' performance. This is especially important since assessments such as CAT4 do not provide dedicated reports to US-curriculum schools compared to what is provided to UK- and IB-curriculum schools (GL-Assessment, 2017). This need for clear, explicit communication was reflected in the UAE literature review about the educational reform which indicated a critical need for improving the way of communicating policies and collaborating with schools and teachers as the primary implementers of those policies (Matsumoto, 2019).

In conclusion, the literature has shown limited numbers of studies have been conducted to investigate the predictability of students' SAT scores using their CAT4, MAP, and PASS scores. Therefore, the current study is needed due to the lack of utilisation of different types of assessment data. Moreover, this study will develop an equation to predict students' SAT scores based on MAP, CAT4, and PASS scores. At the same time, most of the studies either used quantitative or qualitative data only. As discussed earlier, there is a need to investigate the role

of the assessments in students' academic achievement from data perspective and stakeholders' perceptions to add more depth and shed more light on factors that affect the study findings.

1.4 Study Purpose and Questions

The main purpose of the current study is to investigate the role of the different types of assessments implemented in US-curriculum schools in the UAE in students' achievement in SAT-English and SAT-Math. To achieve that goal the study first investigated the relationship and predictability of students' academic achievement in SAT using their current attainment, aptitude level, and attitude towards learning. This took place through utilising the data from three types of assessment, the MAP test, the CAT4, and the PASS. The study also explored the stakeholders' perceptions about the role of the MAP, CAT4, and PASS assessments in predicting students' academic achievement in SAT to add-more depth to the study in explaining the proposed prediction model.

To achieve the study's objectives, the following main question was created:

What is the role of students' attainment, aptitude, and attitude assessments in predicting SAT achievement in US-curriculum schools in the UAE?

Three sub-questions were formulated to guide the study and to fulfil the study's main question and purpose:

RQ1: What is the relationship between students' attainment in MAP, aptitude level in CAT4, attitude towards learning in PASS, and SAT achievement?

RQ2: How can the attainment in MAP, aptitude level in CAT4, and attitude towards learning in PASS predict students' achievement in SAT?

RQ3: What are the stakeholders' perceptions about the role of attainment in MAP, aptitude level in CAT4, and attitude towards learning in predicting students' SAT achievement?

Accordingly, the first two research questions (RQ1 & RQ2) were formulated to investigate the relationship between the variables and the predictability of students' SAT achievement based on the other predictors (MAP, CAT4, PASS). The hypotheses described below were created to be tested during the quantitative phase of the study.

Hypothesis-1: There is a positive correlation between students' attainment in MAP and their SAT achievement.

Hypothesis-2: There is a positive correlation between students' aptitude level in CAT4 and their SAT achievement.

Hypothesis-3: There is a positive correlation between students' attitude towards learning in PASS and their SAT achievement.

Hypothesis-4: The students' attainment in MAP, aptitude level in CAT4, and attitude towards learning in PASS combined could statistically predict students' SAT achievement.

1.5 Significance of the Study

The use of assessment data in predicting students' performance is rapidly increasing. Specifically, the literature highlighted studies that investigated the relationship and predictability of students' academic achievement using other types of assessments. Some studies have focused on investigating the relationship or the predictability between one or two types of assessments within the academic, cognitive or affective domains (Chen et al., 2012; Donati, Meaburn & Dumontheil, 2019; Gonzalez, 2015; Hong, 2018). For example, several studies have proposed that currently used standardised and benchmark assessments (Gonzalez, 2015), the cognitive ability test (Finn et al., 2014), and attitude towards self and school (Shepard & Penuel, 2017; Volpe, 2016) can be utilised to predict students' achievement in the summative assessments and exit exams (CTB/McGraw-Hill, 2009; Gonzalez, 2015; NWEA, 2013; Reggianini, 2017). However, the conclusion from the literature points to a great gap in

using a routinely collected range of assessment data to predict students' academic performance in US-curriculum schools (Wai, Brown & Chabris, 2018).

The SAT is one of the high-stake assessments investigated in US-curriculum schools, especially since SAT has been used as a requirement for pursuing a US high-school diploma and used as a college readiness test. The literature on SAT highlights the effort to predict students' achievement in SAT using the MAP test and to bridge the gap in SAT achievement as early as middle school age (Thum, 2011; Thum, 2017; Thum & Matta, 2015; Wai, Brown & Chabris, 2018). Therefore, the current study aimed to develop equations that predict students' SAT achievement in English and mathematics using the different types of assessment implemented in US-curriculum schools. These routinely undertaken assessments measure students' current academic attainment, aptitude, and attitude towards learning but are not currently used in a comprehensive way to create full learning profiles and guide more effective teaching and learning processes. Therefore, the significance of the current study is in using the three assessments compiled to create the prediction equation and through this improve the quality of education in these schools.

Academic, cognitive, and affective factors have been proven to be strong predictors of students' achievement (Lipnevich et al., 2011; Sebesta, 2019; Shepard & Penuel, 2017; Volpe, 2016). Students' cognitive ability tests are well known for predicting academic achievement and progress in general (Finn et al., 2014) and their proficiency levels in mathematics and science (Berkowitz & Stern, 2018; Reggianini, 2017). Students' academic attainment in specific subjects as measured by MAP tests is also proven to be predicted by other curriculum-based assessments (Merino & Beckman, 2010) or are used to predict students' performance in mathematics and science in general (Beesley et al., 2018; Marshall, Smart & Alston, 2017). Students' characteristics and attitude toward learning are other main contributors to students'

academic performance (Lipnevich, Preckel & Krumm, 2016; Nasser, 2004). It is important however to understand not only each of these factors individually but investigate the interrelationship between them. Therefore, the current study aimed to build on those studies by utilising current students' academic attainment in MAP, aptitude using CAT4, and attitude towards learning assessments in US-curriculum schools to predict students' academic achievement. Moreover, the study utilised aimed to provide deeper understanding about the relationship among factors within academic, cognitive, and affective domains from the assessment data perspective and stakeholders' perceptions.

One of the aims of the current study is investigating the under-researched issue of using specifically MAP, CAT4, and PASS scores in predicting students' SAT achievement, especially since using MAP and CAT4 along with students' attitude to predict achievement is still uncommon. This is because MAP is widely used in US-curriculum schools (NWEA, 2013) while CAT4 and PASS (GL-Assessment, 2017) are used in UK-curriculum schools. They are however implemented in US-curriculum schools in the UAE as part of the country's national requirements (KHDA, 2020).

Being able to predict students' performance in exit exams will help in accelerating students' progress by considering early intervention plans to narrow the gap in achievement and to support the students in improving their performance. The prediction will help in providing rich data to identify students' readiness, to provide feedback on curriculum review, and in teaching and learning processes. Further, by appraising the study findings in light of theory, stakeholders can take action to develop students' learning outcomes by adjusting the design of curriculum alignment, teaching, and learning plans to consider the cognitive and affective factors along with the academic factors using data triangulation (Hong, 2018; Kelly et al., 2020).

Studying students' attitude toward learning, self and schools is crucial to address contextual variables that might hinder students' performance and affect the learning environment negatively. The literature highlights the influence of students' characteristics, learning environment, and attitude on performance (Detterman, 2016; Lee & Stankov, 2016; Sebesta, 2019; Williams, Whittome & Watts, 2005). Therefore, the current study aimed to build on those studies by contributing to the theoretical knowledge about individual and contextual variables related to students' academic achievement.

Additionally, exploring stakeholders' perceptions sheds light on and adds depth to the study findings to better utilise assessment data, maximise students' achievement, and identify the need for professional development programmes and training for stakeholders. Leaders' and teachers' clear understanding of information gathered from different types of assessments can help them in providing students with positive constructive feedback and in creating differentiated learning activities (Prashanti & Ramnarayan, 2019). Further, by understanding stakeholders' perceptions about the role of each assessment, this can help in developing more effective approaches to optimise the use of assessments in schools as tools in designing professional development programmes for teachers and to enhance students' learning.

Exploring parents' and students' perceptions about the contribution of each assessment to academic achievement can raise awareness and shift parents' and students' attention from focusing solely on the outcome of assessments to using assessment as a learning tool. Accordingly, having the discussion about students' cognitive abilities and attitudes toward self, school, and learning can help students to enhance their metacognitive awareness about their own learning and therefore understand how to learn better (Christian, 2017; Hong, 2018; Stankov, 2013; Stankov et al., 2012). Moreover, exploring students' perceptions will help educators to effectively communicate with parents and students the purpose of assessments, to find methods to train students on how to integrate assessments into the learning process, to

monitor their own progress, and to enhance their self-regulation skills (Banks, 2020; Richardson, Abraham & Bond, 2012; Stupnisky et al., 2012).

Accordingly, the study contributes to the body of knowledge about data-driven decisions based on assessment data and stakeholders' perceptions of these assessments, since the common methods in previous similar studies either used assessment data solely or stakeholders' perceptions rather than both. The created equations and questionnaires in the current study will help in developing a systematic process using valid and reliable tools and using both quantitative and qualitative data to provide feedback for school improvement plans and policy review.

1.6 Scope of Work

This study aims to investigate the relationship between students' academic attainment using the MAP test, aptitude level using the CAT4, attitude towards learning using PASS test, and SAT achievement in US-curriculum schools in the UAE that implement the four assessments. Therefore, the sequential explanatory mixed-method approach was adopted to explain the research problem that aims to create a prediction equation for students' academic achievements, together with a more in-depth investigation supported by stakeholders' perceptions about the findings (Johnson & Christensen, 2020; Tashakkori & Teddlie, 2010). Academic attainment, aptitude, and attitude towards learning formulated the independent variables in the first phase of the study as factors falling under academic, cognitive, and affective/psychological domains. The relationship between those independent variables was also investigated in the first phase, as factors that might contribute to students' overall academic achievement. Therefore, the predictive relationship among the attainment in the MAP test, aptitude level, and attitude towards learning on students' SAT achievement was also

studied. The second phase of the study explored and explained the stakeholders' perceptions about the role of the implemented assessments in predicting students' academic achievement.

The adopted sequential mixed-method design guided the framework and flow of the study, which is a characteristic of the mixed-method research approach that directs the timeline of collecting and analysing the quantitative and qualitative data either sequentially or concurrently (Onwuegbuzie & Collins, 2007). In phase one a dominant quantitative approach was adopted by collecting quantitative data to answer the first and second research questions. The data was collected concurrently in the first phase using two main tools that involved document analysis of students' assessment data and participants' responses to questionnaires. The participants in phase one were leaders, teachers, and students from grades 9-12. Phase two started after analysing phase one's results and developing tools for the qualitative phase of the study. The qualitative phase consisted of semi-structured interviews with focus groups. The focus groups comprised a leadership team, teachers, students, and parents.

1.7 Thesis Structure

The purpose of this study is to investigate the predictability of students' achievement in SAT using their scores in attainment, aptitude, and attitude towards learning assessments in private US-curriculum schools in the UAE. Furthermore, the study explored the stakeholders' perceptions about the role of three types of assessments, namely MAP, CAT4, and PASS, in predicting students' academic achievement in SAT. The study is made up of seven main chapters.

Chapter one introduces the background, rationale, significance of the research, problem statement, purpose, and research questions, along with the scope of the work. This chapter

demonstrates the main factors that contribute to students' academic achievement, prioritised by the education system in the UAE, and how they are connected to the current study.

Chapter two covers the conceptual framework, theoretical framework and literature review. The chapter illustrates how the main theories are utilised in the current research and how they are connected to the main concepts in order to guide the study. The rest of chapter two reviews the literature related to high-stake assessments and their role in US-curriculum schools, assessment in the UAE educational reform, and factors that contribute to students' academic achievements such as academic attainment, cognitive, affective, and behavioural factors. The literature review discusses the relationship between these factors and the role of multiple data sources from assessment in predicting academic achievement. The findings from previous studies in related topics are highlighted.

Chapter three outlines the research approach, design, and methods adopted in the study. The chapter also explains the study's context, site, population, and sampling. Moreover, the instrumentation is discussed in detail as well as how the pilot study was conducted. Procedures and data analysis are outlined along with the validity and reliability of the used tools, and ethical considerations are presented.

Chapter four and five present the data analysis and findings of phase one and phase two of the study respectively. The data analysis of quantitative and qualitative data is presented in tables, diagrams, and quotations from the interviews to add depth and clarification for the understanding of the readers.

Chapter six summarises the findings of each phase of the study and discusses the integration of the findings, connecting them to the literature review and theoretical framework.

Chapter seven covers the conclusion, recommendations, challenges, the limitations of the study, and finally the suggestions for future research.

Chapter Two: Conceptual Framework, Theoretical Framework and Literature Review

The main purpose of this study is to investigate the role of students' attainment in MAP, aptitude level, and attitude towards learning in predicting SAT achievements. The study utilised students' assessment data and stakeholders' perceptions. Chapter two involves an extensive literature review covering the dimensions of the topic. The current study investigates three different types of assessments, their relationship, and use in predicting SAT scores, therefore separate sections will cover the concepts of each type of assessment, the conceptual framework, and theoretical framework underpinning the study. The review will also scrutinise studies that aimed to utilise standardised/benchmark assessments, cognitive ability tests, and attitude towards learning tests to predict students' achievement in high-stake assessments. Studies about stakeholders' perceptions and contributions towards students' achievement will also be reviewed.

2.1 Conceptual Framework

Several factors/constructs contribute to students' academic achievement within different dimensions of cognitive, non-cognitive, and sociocultural contexts. These factors are categorised under major domains: cognitive, non-cognitive/psychological/affective, academic, biological, and sociocultural context (Cunha, Heckman & Schennach, 2010; Duckworth & Yeager, 2015; Lee & Shute, 2010; Richardson, Abraham & Bond, 2012; Stankov, 2013; Whitham et al., 2013). Several types of assessment are used to measure academic gaps in learning. These academic gaps are identified using standardised assessments (Anderson, Medrich & Fowler, 2007). However, these academic gaps reflect the achievement gap but might not be reflective of a learner's aptitude or attitude. Accordingly, a student's learning

profile and performance are based on a mix between content knowledge, skills, cognitive abilities, and attitude towards learning. Such a mix would provide rich data about students' attainment, aptitude, and attitude towards learning to understand the learners' needs, to provide feedback regarding the curriculum and instruction for differentiation. Students' attainment, aptitude, and attitude towards learning are considered main factors that predict students' performance (Detterman, 2016; Lipnevich, Preckel & Krumm, 2016). The literature concludes a positive relationship between academic achievement, in general and in specific domains, and cognitive ability (Deary et al., 2007; Salimabarkat & Anjum, 2017; Watkins, Lei & Canivez, 2007). The literature, as argued in Schunk and Pajares (2009), has also reported that there is a positive relationship between academic achievement and the student's attitude towards learning, self, and school.

The following sections include the operational definition of the study's key concepts and the relationship between them.

2.1.1 Academic Attainment and Achievement

The terms 'academic attainment' and 'achievement' have been used mutually in studies investigating students' educational outcomes in different types of assessment, either curriculum-based or skill-based (Donati, Meaburn & Dumontheil, 2019; Kao & Thompson, 2003; Wai, Brown & Chabris, 2018). '**Attainment**' in curriculum-based assessments refers to the level a student has reached in specific curriculum standards (KHDA, 2017). Attainment is also defined as benchmarking students' levels against knowledge and a set of skills where the degree of proficiency to be attained is organised by levels (UNESCO-IBE, 2013). Students' '**Achievement**' refers to outcome and performance in general; more specifically, students' academic achievement refers to their learning outcome which can be measured by scores or grades (Kao & Thompson, 2003; UNESCO-IBE, 2013), standardised achievement scores in

specific assessments, and teachers' rating (Chen et al., 2012). Achievement tests are mainly summative in nature. In general, the term '**Academic Achievement**' refers to the student's level of success as calculated by the end of the course, semester, or degree. Individuals' achievement targets define the goals, as stated by Tolman (1926). Later on, Murray (1938) described achievement as the need to accomplish hard tasks and to attain a high standard. This need is affected by an individual's character and attitude. Consequently, the literature related to achievement orientation has a great educational psychology background. Murray (1938) added that performance and mastery are components of achievement's factors.

The term '**Academic Achievement**' has been used as the result of evaluation of learning outcomes and performance in schools (Olivier et al., 2019). Accordingly, when judging students' overall performance in summative or exit assessments, the term academic achievement is used. For example, academic achievement is used to describe students' performance in high-stake assessments such as PISA (OECD, 2016) and SAT or ACT (Wai, Brown & Chabris, 2018). While in assessing the student's current level in certain content standards and comparing it to curriculum standards the terminology, '**Attainment**' is commonly used to describe the student's performance (Hyman, 2017; Wai, Brown & Chabris, 2018; Williams, Whittome & Watts, 2005). The quality of students' academic attainment is also evaluated as guided by school inspection frameworks and through comparing the students' current attainment to the curriculum standards they have reached which is described by a letter, number, or adjective (KHDA, 2017).

While in school, accreditation frameworks such as the New England Association of Schools and Colleges (NEASC) (2017) accreditation framework, the term *achievement* is used instead of attainment when describing learners' academic achievement related to learning outcomes, gained skills and knowledge. The term *attainment* is used only combined with learners'

progress toward learning goals when students achieve the next attainment level. On the contrary, in the Council of International Schools (CIS), the term attainment is used instead of achievement. It is associated with the description of students' learning based on clear criteria representing attainment of knowledge, understanding, and skills (CIS, 2017). On the other hand, the term achievement is only associated with overall assessment results represented by numbers and grades (CIS, 2017).

The literature indicated that the terms academic achievement and attainment are used interchangeably. Some studies (Althoff, 2016; Shepard & Penuel, 2017; Volpe, 2016) used academic achievement to indicate the learners' overall performance represented by grades or scores while other studies (Donati, Meaburn & Dumontheil, 2019) used the term attainment for the same purpose. Academic achievement is also used in some studies to refer to a student's achievement levels, gains, and growth over a period of time within the academic year (Gonzales, 2015).

Based on the assessment rationale, both terminologies (attainment and achievement) are used for the same assessment but for different purposes. For example, the MAP is a computer based adaptive test developed by the Northwest Evaluation Association (NWEA, 2013). MAP is used to benchmark students' levels against the Common Core State Standards (CCSS) in English and math and Next Generation Standards in Science (NGSS), i.e., it measures students' progress toward specific projected goals. Hence MAP is a curriculum-based assessment which covers reading, language usage, mathematics, and science. Thus, it is used in these subjects as a tool to measure students' attainment every semester, progress during the academic year, and achievement by the end of the year (Brown, 2014). MAP has been used as a measure of attainment and achievement within the school year and by the end of year (NWEA, 2004; Thum & Kuhfeld, 2020; Volpe, 2016) where students' MAP scores are considered as attainment level

when compared to the curriculum standards or compared to other students. MAP scores are also considered as an achievement when referred to the individual overall performance in the MAP test by end of the year (Thum & Matta, 2015; Volpe, 2016).

Simultaneously, the literature pointed to studies that used both terminologies when investigating the relationship between students' performance in high-stake college admissions test like the SAT and other assessments (Hyman, 2017; Wai, Brown & Chabris, 2018). These studies used achievement when referring to students' achievement in SAT or ACT and attainment when referring to students' postsecondary attainment level.

In conclusion, academic achievement and attainment are closely linked and interpreted in literature based on the context and scope of the study. Moreover, the studies which used both terminologies have distinguished between educational attainment and academic performance (Kao & Thompson, 2033). Achievement referred to overall scores and goals while attainment referred to scores and levels related to benchmarks and standards (Donati, Meaburn & Dumontheil, 2019; Wai, Brown & Chabris, 2018). Academic achievement can also be seen as an evaluation of overall learning outcome which is closely linked to students' self-regard and perceived learning capability in specific domains (O'Neal, 2019; Olivier et al., 2019), and academic and professional success (Shogren et al., 2017). On the other hand, attainment is mainly used to describe specific curriculum academic attainment (Donati, Meaburn & Dumontheil, 2019) or academic degree or level (Kao & Thompson, 2003).

As stated in Chapter 1, the current study aims to investigate the relationship between students' academic attainment in MAP and achievement in SAT. In line with NWEA (2013) and based on the type and use of MAP test, as discussed above, the term '*attainment*' is used in the current study to refer to the MAP scores, specifically that MAP scores in the study context are used to

refer to the students' current academic attainment in reading, language usage, and math. The SAT test is conducted in Grade 12 with the aim of measuring the overall performance test that identifies students' overall achievement and college readiness. Therefore, the term '*achievement*' is used to refer to SAT scores.

2.1.2 Aptitude

Academic achievement does not explain the full story; students' aptitude, which is known as cognitive ability level, plays a crucial role in students' achievement (Finn et al., 2014) and predicts their proficiency level (Reggianini, 2017). '**Aptitude**' is defined as the student's potential or capability rather than previously learned knowledge or skills. '**Potential**' is another common synonym for aptitude. '**Aptitude**' or '**Cognitive Ability**' is conceptualised as an intrinsic capability or capacity (Deary et al., 2007). Several researchers consider cognitive ability a primary predictor of academic achievement (Deary et al., 2007; Rohde & Thompson, 2007). They added that achievement is connected to cognitive ability because achievement represents students' outcome performance obtained through learning and is built on a foundation of cognitive ability (Chen et al., 2012).

Student proficiency in mathematics, science, reading, and language usage acquires several cognitive processes (Veenman, 2012). Therefore, assessing students' cognitive ability levels reveals their areas of strength, interest, and concern that affect their performance (Cunha & Heckman, 2007; Reggianini, 2017). High-stake assessments like PISA confirm that learners' proficiency levels in contextual questions are affected by knowledge, skills, competencies, and cognitive abilities (OECD, 2018a). Students' verbal, quantitative, non-verbal, and spatial reasoning skills formulate their aptitude profile (Riley & Ahlberg, 2004; Veenman, Van Hout-Wolters & Afflerbach, 2006). Many tools were developed and used to measure students' cognitive ability, like the CAT4 (GL-Assessment, 2017) and CogAT (Gonzalez, 2015; Lohman

& Hagen, 2001). Several studies used the tools that measure learners' cognitive abilities and attitudes to investigate their role in the variation in students' academic achievement (Best, Miller & Naglieri, 2011; Cragg & Gilmore, 2014). The literature highlighted the relationship between students' academic achievement and aptitude level when academic achievement reflected as an overall outcome performance based on accumulated learning and built on the innate capacity (Chen et al., 2012; Deary et al., 2007). However, the literature indicated a limitation in the number of studies that investigated the relationship between students' aptitude level and students' achievement in standardised assessments such as SAT (Althoff, 2016).

2.1.3 Attitude towards Learning

'Attitude' in general is defined as the internal beliefs that reflect the characteristics and influence actions (Schunk, 2012). A student's **'attitude towards learning'** determines the student's ability and willingness to learn, which is affected by factors like attitude towards self, subject, school, teacher, self-concept, and self-efficacy (Sawalha, 2018; Seligman, 2012). In general, the attitude has been conceptualised as the individual's positive or negative response to a situation, concept or person based on learned predispositions (Aiken, 1980). It has been said that attitude acquires the involvement of beliefs or knowledge, emotions, motivations, action tendencies, or behaviour. Attitude also involves cognitive, affective, and performance dimensions (Aiken, 1980). Therefore, attitude is defined as a multidimensional concept (Olson & Zanna, 1993) that affects academic achievement (Grootenboer & Hemmings, 2007; Leder & Forgasz, 2006; Zan et al., 2006).

'Attitude' toward a specific subject like mathematics refers to the learner's positive or negative degree of effect on that subject (McLeod, 1992). Researchers have proven that students' attitude towards mathematics affects learning and performance in the subject, where negative beliefs and perceptions toward mathematics limit students' ability to perform and learn

(Grootenboer & Hemmings, 2007; Leder & Forgasz, 2006; Zan et al., 2006). On the other hand, the studies highlight the significant positive correlation between attitude toward learning mathematics and mathematical achievement (Ai, 2002; Singh, Granville & Dika, 2002). Other factors that affect the student's attitude toward learning mathematics are their beliefs about their mathematics capability, confidence about their mathematical knowledge, and interest in learning the subject (Uerz, Dekers & Beguin, 2004; Wells, Sanchez & Attridge, 2009).

Students' attitudes toward learning, school, and self have been highlighted as factors playing a main role in students' engagement and therefore academic achievement (Lipnevich et al., 2011; Lipnevich, Preckel & Krumm, 2016). This is especially relevant since a student's engagement in the learning processes by following instructions, observations, and performance exemplifies the interaction between several factors within academic, cognitive, affective, and biological domains (Whitham et al., 2013). Students' engagement in the formative assessment as a process that involves studying, receiving feedback and reflection has shown impacts on developing students' levels of performance in formative assessment practices and final exams (Horn, Jansen & Yu, 2011; Nowicki et al., 2012; Radhwan, 2019).

Previous studies confirmed the positive relationship between students' attitude towards learning and assessment demands and requirements (Radhwan, 2019; Ramsden, 2003; Struyven, Dochy & Janssens, 2005). The positive relationship between the factors helped design models and frameworks to predict achievement (Brunner, Ludtke & Trautwein, 2008; Chen et al., 2012). For example, the findings recommended considering other methods when investigating the relationship among students' attitude toward self, aptitude, and academic achievement (Chen et al., 2012). Moreover, Chen et al. (2012) highlighted that examining the relationship between the cognitive and affective factors should take place in different types of schools, in different contexts, and at different grade levels. Including the qualitative approach

2.2 Theoretical Framework

Recent decades have seen psychological theories progress by transforming the focus from behaviourism to cognitivism, then post-cognitivism (Potter, 2000). However, cognitive theories focus on learning as a process of making sense of how people learn, construct knowledge, and develop new knowledge (Shepard & Penuel, 2017). Furthermore, cognitive theories defined learning contexts as a social interaction rather than a reason for helping students construct knowledge and application. Teaching general reasoning skills failed, which led the field to focus on developing cognitive processes in specific subject-based knowledge (Glaser, 1963). Accordingly, the Cognitivism Theory is used as the backbone of the current study. It includes Goal Setting Theory, Information Processing Theory, and Social-Cognitive Learning Theory that leads to the Metacognitive Learning Theory. The theoretical framework is based on the cognitive constructivist perspectives emphasised by Schunk (2020, p. iv) that “learners are not passive recipients of information but rather actively seek, construct, and adapt their knowledge, skills, strategies, and beliefs.”

2.2.1 Goal Setting Theory

The following section provides a brief explanation of goals and goal setting in educational psychology and the establishment of the standards of performance and learning functions as the purpose of an individual’s behaviour (Schunk, 2001; Zimmerman, 2001). Goal setting can occur for different reasons, such as achieving a specific target or avoiding failure. The process of goal setting involves planning for a future target and comparing it to the current reality (Oettingen & Gollwitzer, 2009). During goal setting, learners reflect on previous learning experiences and attainment levels to set new goals that can be ordered based on priority (Carver & Scheier, 2009). However, theorists emphasise that attaining those goals relies on the goals’ specificity and priority (Gollwitzer, 1999).

Setting goals or targets focuses the individual's attention on strategies and processes that improve their skills and develops aptitudes; this experience is affected by individual self-efficacy, self-concept, motivation, and self-regulation, then ends with the progression towards the goal (Wentzel, 1992). The progression towards achieving learning goals affects the cognitive processes and the students' beliefs and attitude towards learning (Pintrich, 2000a). Students experience the goal setting process during MAP because taking an adaptive assessment like MAP (NWEA, 2004) provides each student with a score per subject and domain, scaled score compared to the Norm, and target goal to achieve. Such assessment experience leads to students' involvement in a cycle of goal setting and monitoring their own attainment and progress. This process is defined by the Goal Setting theory (Locke & Latham, 2002), where detailed assessable objectives inspire individuals. The concept is the creation of challenging and specific detailed targets that lead to improving performance and keeping the learners on task (Zimmerman, 2008). This process also targets students' metacognitive awareness because it encompasses their reflection on their goals to self-evaluate performance then set new goals. As a result, the process enhances students' academic self-regulation where learners demonstrate metacognitively and behaviourally active engagement and regulation of learning processes (Banks, 2020).

Goal setting process and the related literature distinguish between two types of goals: achievement goals and mastery goals. Students' engagement in learning and dealing with competence defines achievement goals, while mastery goals include developing competence and mastering the learning contents (Agus et al., 2016; Polychroni, Hatzichristou & Sideridis, 2012). In the Self-Regulate Learning models it was concluded that learners could construct goals, control, monitor, then regulate their learning (Pintrich, 2000b). These models illustrate the relationship between the cognitive and academic domains, where students' aptitude and attainment factors play a crucial role in affecting academic achievement.

Several studies have discovered that performance goals are a better predictor of academic achievement than mastery goals (Senko & Harackiewicz, 2005). Moreover, the researchers concluded that students with high self-efficacy are more determined, interested, and focused on achieving performance goals (Schunk, 1991). Goal-setting and self-monitoring involved in the self-regulation processes have a cyclical relationship with self-efficacy (Winne & Hadwin, 1988; Zimmerman, 2000a). Simultaneously, the learner's level of challenge is influenced by their self-efficacy and persistence (Pastorelli, 2001), which influence goal achievement (Zimmerman et al., 1992). Conversely, low level or negative self-efficacy hinders learners' resilience and engagement in goal setting (Salimirad & Srimathi, 2016). That has been said to highlight the connection between academic, cognitive, and affective factors that contribute to students' academic achievement (Detterman, 2016; Gonzales, 2015).

In conclusion, Goal Setting Theory is discussed in the current study based on learners' achievement motivation rather than just setting the goal as a process without the aim to achieve that goal. It is important to highlight that considering the Goal setting theory in the current research cannot be isolated from other moderator factors that affect achieving goals (Locke & Latham, 2019). The moderators' factors were defined by the theory including feedback, goals commitment, learners' ability, and environmental factors (Locke & Latham, 2019). However, the limitations of the application of Goal setting theory are in ensuring that all the moderators' factors are satisfied to achieve the goals.

Accordingly, students' experience in taking the MAP test which requires their engagement in a process of setting and tracking goals then committing to these goals to achieve the required score in next MAP test can be explained by the Goal Setting theory. At the same time, the SAT required score for a US diploma can be challenging for underachieving students. Therefore,

setting a challenging goal might cause negative impact where students develop negative attitude towards self or learning. This is considered one of the disadvantages of the implementation of the Goal Setting theory. However, this cannot be explained fully in isolation without exploring the effect of students' attitude, ability to use their knowledge and skills, students' clarity about their goals, and learning environment that can hinder or facilitate students' academic achievement.

2.2.2 Information Processing Theories

Dealing with students' cognitive abilities and how they process information and relate it to prior knowledge in memory, then retrieve that knowledge as needed, is precisely the focus of information processing theories (Schunk, 2012). Mayer (1996, p.154) identified the principles of information processing theories and stated: "Humans are processors of information. The mind is an information-processing system. Cognition is a series of mental processes. Learning is the acquisition of mental representations." Therefore, information processing theories have different models and mainly focus on the intervention between response and stimuli involved in the mental processes (Schunk, 2012).

The Two-Store (Dual) Memory Model of information processing is adopted in the current study and explains how information processing happens in stages (Atkinson & Shiffrin, 1971). The information processing starts when a visual, auditory, or stimulus input imposes on the senses, then connecting the meaning and known information to the stimulus input happens. Schunk (2012, p.166) illustrated that the flow of information throughout the Information Processing Model of Learning and Memory is regulated by the control/executive processes, as shown in Figure (2.2) below. The control processes include visually representing information, putting information into context, and monitoring knowledge. In conclusion, the control processes include imaging, coding, and utilising motivational, self-regulation strategies and

metacognitive activities. Figure (2.2) also illustrates the learning or encoding process. First, the information enters the Information Processing System through a sensory register then enters the Short-Term Working Memory (STM/WM) after comparing the new information with the previous information stored in the Long-Term Memory (LTM). Therefore, learning occurs when information is stored in the LTM.

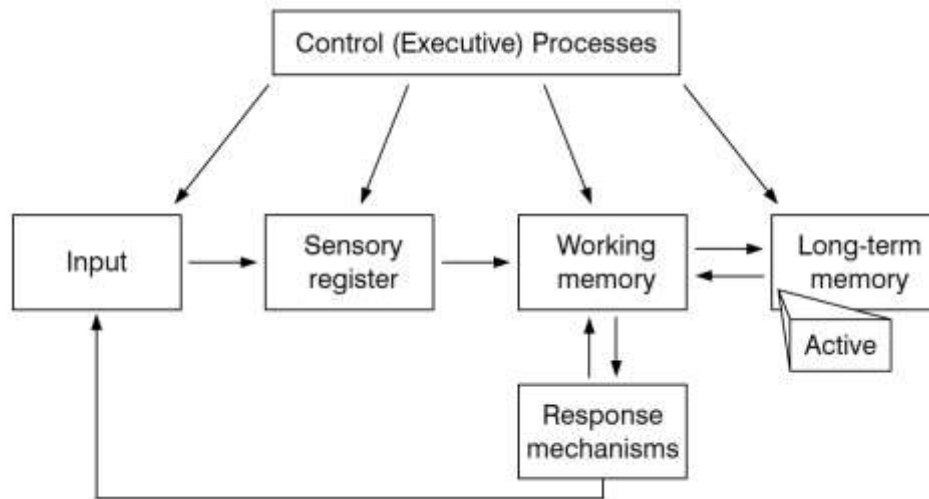


Figure (2. 2): Information Processing Model of Learning and Memory
(Schunk, 2012, p.166)

Hence mathematics, reading, and language usage in assessments encompass several cognitive activities to rehearse, think, reason, model, and solve problems; trying to interpret and understand these activities related to the memory and information-processing theory are highlighted in the literature (Chen et al., 2012; Detterman, 2016). Problem-solving skills like those involved in mathematics questions consist of steps to have initial understanding, set target and sub-targets, and perform operations to achieve the targets (Schunk, 2012). This process includes brainstorming, mental modelling, analogical reasoning of the problem, and how it can be applied to solve it (Burton et al., 2009).

During cognitive ability tests, the student is exposed to different stimuli that trigger their memory, mental activities, and reasoning skills (Gonzalez, 2015; Mayes et al., 2014; Moore,

Carlson & Oehrtman, 2009). By referring to the model in Figure (2.2), both WM and LTM are involved in information processing during cognitive ability tests, where WM is active in acquiring knowledge and relating the information to the related knowledge in LTM (Schunk, 2012). The control processes are responsible for directing information processing into and out of WM, like metacognitive activities and checking, predicting, and explaining. Cognitive ability tests consist of questions that rely on the learner's ability to think with words (Verbal Reasoning), number sense (Quantitative Reasoning), shapes (Non-Verbal Reasoning), and shapes and space (Spatial Ability). Information processing underpins all the previous abilities and how they are related to Short-term Working-, Long-term-, Semantic-, Verbal-, and Visual/Iconic Memory (Schunk, 2012).

Hence, the information processing theories explain the transformation of information through the learners' cognitive system (Schunk, 2020), and the theories can explain the role of learners' aptitude level and current academic attainment when studying learners' responses to different types of questions in assessment. This is specifically when students are exposed to assessment questions, and they can relate the questions to recall prior knowledge and skills. The literature on information processing theories recommended investigating the theories' practice in learning specific academic content and in practical situations, considering the conditions of learning and the types of information (Schunk, 2020).

However, information processing theories have been critiqued for their unclear influence on the educational decisions about practices (Shepard & Penuel, 2017). While cognitive theories place emphasis more on how information is presented to learners and how learners interact with this information, information processing theories emphasise the way information is stored and retrieved from the memory. Therefore, Information Processing theories focuses on the capacity of the brain and are limited to covering the role of the memory as a computational

process without considering other factors within a contextual situation. Accordingly, when investigating the role of different academic, cognitive, and affective factors in learners' academic achievement, learners' information processing is not enough to explain the factors. Considering learners' aptitude level along with academic attainment and attitudes toward learning can explain the differences when students are exposed to the same information.

2.2.3 Social Cognitive Learning Theory

Over the years, different theories and frameworks have proposed and argued the relationship between students' academic achievement and affective factors. Social Cognitive Learning Theory (SCLT) covers an extensive range of theoretical models that combine social and behavioural sciences theories (Whitham et al., 2013). SCLT argues that learning happens through social environments (Schunk, 2012) where learners have an active role in their development and learning processes (Whitham et al., 2013). SCLT theory is based on the expansion of the Social Learning Theory by Bandura (1986; 1999), which points to the combined influence of external and internal factors to regulate behaviours. One of the main limitations of the Social Learning theory is that it does not cover a cohesive explanation of learners' behaviour and it has a challenge in observing the social learning. The theory puts more emphasis on the situation rather than the learners' characteristics.

The SCLT model seeks to explain the dynamic interrelationship among learners' intrapersonal factors, behaviours, and the environment that are considered components of the attitude towards self and school (Zimmerman & Schunk, 2003). Zimmerman (1989; 1990a) highlighted the interaction between three factors within three dimensions that represent the social cognitive perspective on learning: 1) Personal characteristics of learners include prior subject knowledge, self-regulated learning skills, attitude towards learning, self, and school; 2) Learners' adopted behaviours to academic achievement; and 3) Context where learning occurs. Hence learning

occurs through following instructions, observing models, and actual performances; the SCLT addresses the interaction between cognitive, affective, and biological factors (Whitham et al., 2013).

SCLT also emphasises self-efficacy, goals, and outcomes, explaining the connection between self-concepts and learning (Schunk & Pajares, 2009). The theory posits that learners are active in their development through self-regulation and self-reflection while adapting to environmental stimuli to control the environment surrounding them. The SCLT provides a framework to predict, understand, and change behaviour (Green & Peil, 2009). Therefore, SCLT emphasises several factors related to students' attitude towards self; others thus affect expectations and achievements (Mark & Campbell, 2011). Given one of the SCLT implications regarding learning, students with an aptitude for high academic achievement can learn to succeed if placed in a rigorous programme.

The literature about learning theories highlighted the crucial role of learners' perceptions about themselves and learning environment to enhance learning outcomes (Schunk, 2020). Particularly that student's attitude towards learning is proven to be affected by factors like self-awareness, motivation, attitude towards the subject, feelings about school and the learning community, relationship with teachers and classmates (Sadler et al., 2012; Sawalha, 2018; Seligman, 2012). Self-efficacy is one factor that lies at the centre of SCLT and affects learners' self-regard, perceived capabilities, and behaviour. Self-efficacy is defined as the individual's judge of potential and capability to successfully achieve designated academic goals (Bandura, 1986; Schunk, 1989). In general, learners' self-beliefs about perceived learning capability plays a vital role in developing a positive attitude towards learning (Zimmerman, 2000a) which makes learners think more positively and improves their achievement (Bernacki, Byrnes & Cromley, 2012; Bernacki, Nokes-Malach & Aleven, 2015; Schunk & DiBenedetto, 2014).

In summary, the literature showed examples of SCLT applications in academic research in education about e-learning (Zhang et al., 2012), student engagement and self-efficacy (Schunk & Mullen, 2012), and alignment of SCLT with educational learning models (Burney, 2008). However, the SCLT differentiates between new learning and performance of prior learned behaviour (Schunk, 2012, p.122). Hence students' attitude and learning environment influence each other; the current study investigated the role of students' attitude towards learning, self, and school in their academic achievement using stakeholders' perceptions and students' attitude towards self and school assessment scores. Moreover, the process of taking academic assessments frequently that include learners' self-assessment, setting goals, and tracking progress involves learning through performance, interactions, observing, and engagement in learning activities and environment. The process is supported by SCLT but cannot be fully interpreted without considering the students' self-regulation and goal setting processes and skills which are explained by the metacognitive learning theory.

2.2.4 Metacognitive Learning Theory

The "metacognitive theory" is defined by Schraw and Moshman (1995, p.356) as a "relatively systematic structure of knowledge that can be used to explain and predict a broad range of cognitive and metacognitive phenomena." Metacognition, which is known as 'thinking about thinking', is defined as the thoughtful, conscious control of cognitive processes (Brown, 1980) and considered a part of the cognitive system that controls it (Veenman, Van Hout-Wolters & Afflerbach, 2006). Metacognition is also explained as the individual's knowledge of their own learning processes, including awareness of their own knowledge and skills, monitoring of their own learning, self-assessment against success criteria, strengths and areas of concern, self and peer-directed learning, self-reflection on learning and performance, and adjusting goals accordingly.

Metacognitive skills are crucial for learners to be aware of their own learning strategies, knowledge, skills, and self-regulated learning processes to achieve their goals (Flavell, 1979; Schraw, 1998; Schraw et al., 2006). When pursuing learning goals, metacognition plays the main role in optimising learners' cognitive actions (Griffin, Wiley & Salas, 2013). On the other hand, learners' low metacognitive awareness of their learning processes leads to low performance and learning deficiency (Zimmerman, 2002). In particular, metacognitive processes support the integration of information processing (Schunk, 2012). Metacognition involves two interrelated groups of skills. The first group of skills is having an understanding of the task and skills required, and strategies to perform that task, including all information-processing items. The second group of skills is utilising the skills in the first group, such as predicting outcomes and evaluating the target's taken actions (Schraw & Moshman, 1995). Students' metacognitive knowledge is not enough to predict success in specific factors, where other influential factors such as students' capability, attitude, and self-efficacy should be considered (Veenman & Spaans, 2005).

The research supports the claim that certain learning activities enhance students' metacognitive skills when the emphasis is on the learning processes rather than the learning products (Schraw & Moshman, 1995). Metacognitive learning processes are considered important components of self-regulation where both metacognitive monitoring and control form the main components of self-regulated learning processes (Butler & Cartier, 2018; Winne, 2011; Zimmerman, 2008). Winne and Hadwin (1998) developed the Self-Regulated Learning (SRL) framework from the perspective of a sequence of metacognitive monitoring and control processes within the SRL framework. They considered metacognitive skills as the procedural knowledge that regulates learning processes. Learners' awareness of their learning defines metacognitive monitoring

(Pieschl, 2009). The process of adjusting the learning processes in response to metacognitive monitoring defines metacognitive control (Nelson, 1996).

Learners vary in the extent to which they utilise learning strategies to plan effectively, monitor, and evaluate, which impact reaching goals and consequently their level of academic achievement (Dang et al., 2018; Dye & Stanton, 2017; Stanton et al., 2015). Students with the propensity for high academic achievement tend to utilise self-regulation learning strategies more effectively and regularly than low-achieving students (Kritzinger et al., 2018; Mega et al., 2014; Richardson, Abraham & Bond, 2012). Self-regulated learners can monitor learning strategies, starting with defining the task, setting goals, planning study strategies, and reflecting on adapting strategies for future tasks (Winne, 2010, 2018; Winne & Hadwin, 1998). The whole process represents metacognitive control and monitoring.

Metacognitive learning theory is considered the dominant theory that underpins the integration of the concepts in the study. Integrating the concepts will lead to understanding the students' full learning profile, including aptitude, social and behavioural factors, goal setting, and content knowledge and skills that affect students' overall achievement and performance. The students' learning profiles are considered to be an opportunity for learning and growth. Although the important role of metacognition is in studying learners' metacognitive skills and cognitive behavior (Schraw & Moshman, 1995), the literature points to a debate about the interpretation of metacognitive theories in light of the nature, scope, and interrelations among the different types of metacognitive processes and knowledge (Schraw & Moshman, 1995). The gap in the metacognitive learning theory is in covering the influence of personal and contextual factors. In general, cognitive theory's limitation is in focusing only on what happens inside the learner's brain and considering the social interactions as context for learning without considering the influential role of social interactions to constitute what the learner is able to do and know

(Shepard & Penuel, 2017). Accordingly in the current study, the cognitive and affective factors are explained considering the social cognitive and information processing learning theories connected by the metacognitive learning theory. In light of the fact that metacognitive theory is not limited to cognition theories and is considered a subset of other theories related to mind, personality and emotion (Flavell, 1992), in the current study the metacognitive learning theory is utilised to explain the learner's personal experience and self-reflection as a result of participation in different types of assessment.

Students either consider assessment as a measure of performance that is subject to judgement or consider assessment as an opportunity for learning and growth. Assessment scores are interpreted to reflect on future abilities in that academic subject and to set performance goals. In general, students' metacognitive capabilities can be employed in assessment. Students skilfully apply the strategies that align with the cognitive processes, effort, and time needed for the task to reach high academic achievement (Broekkamp & Van Hout-Wolters, 2007; Hora & Oleson, 2017). Setting goals, exam preps, and tracking their own progress are all captured and involved in computer-based adaptive assessments and technology-based Learning Management Systems (LMS). Moreover, the metacognitive theories have been studied in practice using different approaches such as learners' verbal reporting which was criticised because it involves unobservable processes.

As a conclusion, the literature about metacognitive theories supports investigating the processes because they enhance students' metacognition such as collaboration and self-reporting rather than the focus on product of learning. Thus, in the current study students' learning experience through assessment using assessment scores and stakeholders' perceptions is investigated and explained in light of metacognitive learning theory supported by other social cognitive and behavioural learning theories. The current study utilised stakeholders'

perceptions using self-reporting statements in the questionnaires followed by semi-structured interview questions to be able to capture the unobservable processes and thoughts that cannot be concluded by analysing assessment scores solely.

In conclusion, since Flavell (1976) explained the process of thinking and connected the way learners think and recall information using the term ‘metamemory’, it is crucial to investigate students’ experience in assessment and tracking targets considering the information processing and goal setting theories. Specifically, the four types of metacognitions proposed by Flavell (1976), and which represent the framework of thinking about the theory, namely metacognitive knowledge, experience, strategies, and goals, are interrelated with cognitive and affective factors that influence students’ learning.

Figure (2.3) below illustrates the theoretical framework underpinning the study. Researchers have increasingly focused on the social and cognitive processes based on the SCLT and information processing theories that students utilise to manage and plan learning and academic achievement (Schunk, 2012). For example, if the tools that monitor learning and performance are used as pre- and post-assessments, then based on the metacognition theory (Winne & Hadwin, 1998), the tools can accurately capture their learning behaviours.

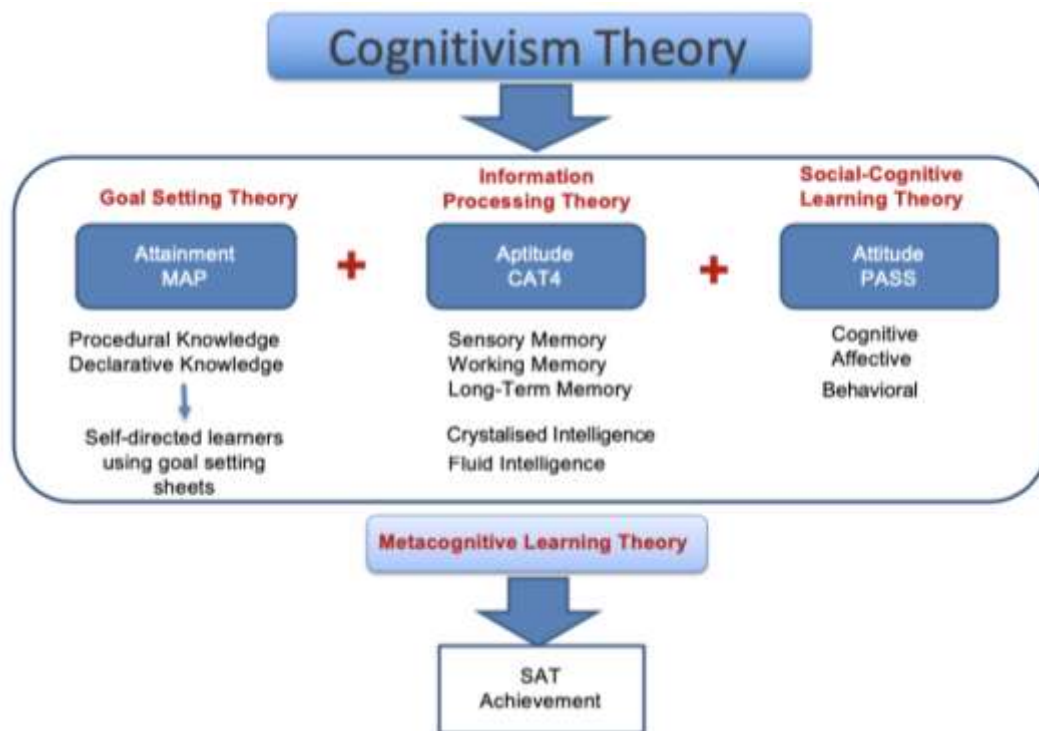


Figure (2. 3): The Study's Theoretical Framework
(Source: Author)

The literature highlights the connections between the different factors that contribute to students' academic achievement and has investigated them from different dimensions. For example, several studies have investigated the predictability of students' achievement based on the combination of two types of assessment: academic attainment (CTB/McGraw-Hill, 2014; Reggianini, 2017) and cognitive ability (Gonzalez, 2015), attitude and cognitive ability (Finn et al., 2014), or academic achievement and attitude towards learning (Lipnevich et al., 2011; Shepard & Penuel, 2017; Volpe, 2016). Yet, few studies have covered all of them simultaneously (Lipnevich, Preckel & Krumm, 2016). Hence the relationship between each two of the factors individually was concluded. Figure (2.4) represents the researcher's proposed conceptualisation of the study's perspectives, underpinned by related theories. The figure represents how the theoretical and conceptual frameworks are interrelated. Combining these different theoretical aspects and perspectives into one study could provide a deeper understanding of the factors that impact academic performance. The aim is to contribute to the

theoretical knowledge about individual and contextual variables on students' academic achievement.

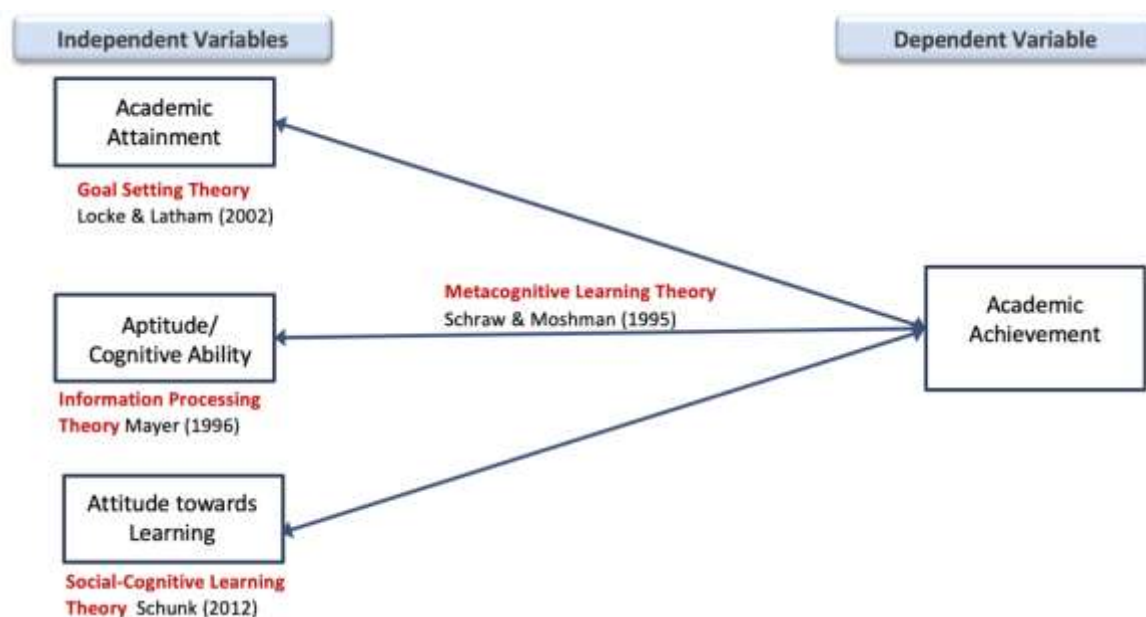


Figure (2. 4): The Interrelation between the Theoretical and Conceptual Framework
(Source: Author)

2.3 Literature Review

2.3.1 High-stake Assessments

Assessments have different types and purposes based on the need and ultimate goal. High-stake assessments are mainly used to evaluate students' overall learning quality (Gardner et al., 2010). High-stake assessments are also used to assess the learner's qualifications for awards, placements, and career guidance (Harlen et al., 2010). 'Assessment of Learning' is a summative assessment that captures students' learning outcomes, the quality of learning, and overall student achievement against a set of standards and skills (National Research Council, 2001, p.25). To measure and track large-scale trends and to perform research, high-stake national and international assessments are conducted such as PISA and TIMSS, which are administered by the International Association for the Evaluation of Educational Achievement (IEA).

Assessment is not limited to evaluative purposes; assessment can also serve for identification purposes of students' learning needs and adjusting teaching and learning strategies accordingly. 'Assessment for Learning' or 'Formative Assessment' is another type of assessment that involves ongoing and interactive assessments of students' progress (OECD, 2018c). 'Assessment as Learning' is also one of the types of formative assessment where students are involved in assessing their own learning processes and product and monitoring of their own progress (Liem, 2019). This involvement in the assessment processes helps in promoting learners' metacognitive skills, which was emphasised by the PISA report on assessment for learning research (OECD, 2018c). The following section elaborates on the connection between PISA as an international summative high-stake assessment that evaluates students' overall performance and development.

PISA is one of the high-stake international assessments administered by the Organization for Economic Co-operation and Development (OECD). The PISA framework emphasises the student's capacity to utilise cognitive processes, collaborative skills in problem-solving, attitude towards learning, and engagement (OECD, 2015; OECD, 2018a). The PISA-2015 Collaboration Problem-Solving Competencies' (CPS) framework pointed to the importance of integration between students' cognitive abilities, 21st century skills, and problem-solving (National Research Council, 2011b; OECD, 2017a). PISA has been used to measure the quality of education and students' level of academic performance (Hanushek & Woessmann, 2010). PISA uses six levels of proficiencies to evaluate students' performance. Level two is considered the baseline proficiency level, where one is the lowest and six-point is the highest level of proficiency.

In the PISA test, 'Reading Literacy' is defined as understanding, employing, engaging with text, and reflecting on goals to achieve targets and develop learners' knowledge, potential, and

contribution to society (OECD, 2017b, p.27). PISA indicated that Reading Literacy involves a wide range of cognitive competencies, while 'Mathematics Literacy' is defined as 'formulating, employing, and interpreting math in various contexts' (OECD, 2017a; p.1). The student's use of mathematical reasoning, strategies, and interpretation and explanation of facts reflects the students' 'Mathematics Literacy', a term used by OECD to also represent mathematics achievement.

The PISA report about assessment for learning (OECD, 2018c) highlighted the important role of students' active involvement in their learning processes which is one of the main goals of assessments for learning to enhance students' metacognition and metacognitive awareness. The report pointed to learners' self-efficacy, metacognitive skills, and self-regard where they found that students who had those skills tend to perform better on the PISA reading literacy scale than those who do not. The report also concluded that assessment for learning has raised students' overall level of academic achievement. The report supported that conclusion with previous studies which indicated that the effect size of formative assessments reached up to 0.7 (OECD, 2018c). Accordingly, investigating the role of different assessments and their utilisation in intervention to raise students' academic achievements is crucial.

Several disciplines in social sciences like psychology (Richardson, Abraham & Bond, 2012; Stankov, 2013) and education (Duckworth & Yeager, 2015; Lee & Shute, 2010) have dedicated a considerable number of studies towards investigating and exploring affective factors related to academic achievement (Cunha, Heckman & Schennach, 2010). Similar factors were emphasised by large-scale studies and high-stake assessments such as OECD reports that highlighted the strong correlation between self-efficacy and academic achievement (OECD, 2011, 2015). Related large-scale studies also concluded that self-efficacy is considered one of the significant predictors of academic achievement (Lee, 2019; Lee & Stankov, 2013; Lee &

Stankov, 2016). Some of the studies utilised students' scores in high-stake assessments to examine the predictability of students' academic achievement based on cognitive and affective factors. For example, Lee and Stankov (2016) investigated the predictability of students' academic achievement using their 65 different affective attributes. The study used large-scale data from two high-stake international assessments: PISA and TIMSS. The study used five sets of data and analysed them individually to maintain the consistency of each dataset's different assessment settings. The results concluded that eight out of 43 non-cognitive variables in PISA and three out of 43 non-cognitive variables in TIMSS have a moderate, strong, direct correlation with mathematics achievement. The findings highlighted the best predictors of students' mathematics achievement, namely educational aspiration in PISA and TIMSS, confidence in TIMSS, and self-efficacy in PISA (Lee & Stankov, 2016). Self-belief showed high predictability of students' mathematics achievement and had the highest effect size (0.3) among all the predictors.

The review of Lee and Stankov's (2016) study methodology points to the need to investigate the effect size of the predictors/variables compiled rather than the bi-directional cyclical relationships. Lee and Stankov (2016) indicated the limitations of their study due to the use of only a self-reporting tool which affects the reliability of the findings because of the possible discrepancy between students' perception and actual practice and behaviour. Another limitation was the lack of exploration and investigation of the reasons behind the resulted effect size or the negative results. According to the previous limitations, another main limitation addressed the need to review the used instrumentations where investigating the predictability of students' academic achievement by cognitive or affective factors should not be limited to using a self-reporting tool. Self-reporting data should be supported by analysing assessment scores of the different variables within the investigated factors. Using both tools could increase

the reliability and validity of the study findings and shed more light on possible reasons behind the concluded results.

A meta-analysis that involved university students and 50 different psychological factors was investigated (Richardson, Abraham & Bond, 2012). The correlational analysis of the 50 factors consisted of 1105 independent variables drawn from empirical studies published between 1997 and 2010 and highlighted students' perception about their academic performance capability as the largest correlation ($r=0.59$) with students' academic achievement. While general academic self-efficacy of students' perceptions about their control over academic performance showed lower correlation ($r=0.31$) with students' academic performance (GPA), the results also found that there was a small to medium correlation between the students' cognitive ability and their academic achievement where aptitude explained 4% to 5% of the variance in the students' academic achievement. The study also concluded that cognitive ability and self-control are the most important factors contributing to university students' academic achievement. Richardson, Abraham and Bond's (2012) study findings showed limitation due to the small variance of students' aptitude levels within the same study field in the university. Therefore, replicating the study with other sampling that varies in academic and aptitude level is beneficial. The findings indicated the need to investigate the relationship between academic achievement and both cognitive and affective factors.

In conclusion, reports about different types of assessment highlighted their important role because they could be customised to suit different purposes and at the same time could be realistic to a shared model of learning (National Research Council, 2003; OECD, 2018c). Hence the summative assessment is the most visible one in schools to measure students' overall learning outcomes, therefore, if large-scale assessments are standardised in covering learning goals and administration procedure, they could be reliable indicators for effective program and

overall learners' academic achievement (Shepard & Penuel, 2017). Accordingly, using students' scores from high-stake and standardised assessments enhances the quality of the educational research due to the high validity and reliability of those assessment tools.

2.3.2 Assessments Role in US-Curriculum Schools

In US-curriculum schools, assessment is mainly the internal school assessment and/or external benchmark like MAP, PSAT in grades 9 or 10, and SAT or ACT in grades 11 or 12. SAT and ACT measure the students' knowledge, skills, and college readiness. Some colleges ask for specific SAT-II tests that focus on a specific subject (ACT 2016; The College Board, 2017). Another optional assessment like the Advanced Placement (AP) is recommended for high-achieving students. To understand the role of assessments in US-curriculum high schools, it is important to understand the US curriculum structure which is explained in the following section.

High schools implementing the US-curriculum consist of four years from grades 9-12 (CDE, 2022). Studying a high school course for one academic year is equivalent to one credit and is counted as 120 hours of instruction. A half-credit course is a course that can be covered in one semester and is equivalent to 60 hours of instruction. To gain a high school diploma, students must fulfil the following graduation requirements: A minimum of three years of English, two years of math (including Algebra-I course), two years of science (including physical science and biology), three years of social science (including US and world history, culture, geography, one semester of economics and one semester of the American government), two years of physical education, and one year of visual or performing arts, foreign language, or a career technical education course.

The US curricula of English and math are the CCSS (CCSS K-12, 2010). Each state follows the CCSS and implements them based on the scope and sequence. Since 2015, forty-five US states have been implementing their curricula based on the CCSS Initiative (2017). In addition, some states use the Partnership for Assessment of Readiness for College and Careers (PARCC) as a national test to benchmark the students' levels in English and math and to track students' progress in mastering the CCSS. The math standards are divided into content knowledge and Math Practices (MP) and are offered either as Grades 9-12 regular path or Grades 9-12 integrated path (Downey, 2011). The standards cover five math domains: Algebra-I, Algebra-II, Geometry, Trigonometry, Probability and Statistics, and Calculus. In PISA-2015, US schools' mean score was below the OECD mean score, which placed the US below 36 other school systems and better than 28 others. Moreover, the gap between the students' scores in the 90th percentile and the 10th percentile in the US is more significant than in 15 other school systems.

SAT is one of the international assessments that has been used as an exit exam in the US high school diploma or as an entrance exam to a university. SAT is well-known as an accurate indicator of academic success at the university level when looking at the first year in university Grade Point Average (GPA) (Sackett et al., 2009). Students' readiness for university is reflected by the score the students achieve in SAT-Mathematics and SAT-Reading (Wai, Brown & Chabris, 2018). As part of students' preparation for university, early indicators of students' readiness play a significant role. Therefore, several studies have aimed at finding college readiness benchmarks to track the students through their education journey in schools (Sackett et al., 2009; Thum & Matta, 2015).

Hence assessment has different purposes and is interpreted to serve different objectives; US districts level assessments have also utilised assessments to compare schools, evaluate the

effectiveness of implemented programmes, and track students' achievements (Shepard & Penuel, 2017). A quasi-experimental study targeting high school students in US-curriculum schools found that increasing students' involvement in contrasting case-based instructional supports in physics by providing them with content knowledge, comparing good and poor solutions, and grading rubrics improved students' accuracy and self-assessment strategies, and therefore their academic achievement in physics (Jax, Ahn & Lin-Siegler, 2019).

Other types of benchmark assessments in US-curriculum schools were utilised to serve that need, such as the NWEA-MAP growth test in reading and mathematics (Thum & Matta, 2015). Hence the MAP test is conducted up to three times per year for each grade; MAP is used as an assessment as, for, and of learning. Taking the MAP test involves students in the reflection and goal setting process. A longitudinal study that included MAP growth scores of all grades 5-9 in several districts in the US concluded that the students who performed between the 40th-50th percentiles, or above, in reading and 60th-70th percentiles, or above, in mathematics are likely to be on track in their college readiness SAT scores (Thum, 2011). The study showed that about 60%-75% of students who met or exceeded the MAP growth preparedness benchmarks were classified correctly to track college readiness (Thum, 2011).

Besides academic factors that might affect students' performance in high-stake assessments, many factors have been investigated in the literature, such as students' attitudes, personal characteristics, and cognitive ability used to predict and improve students' scores (Detterman, 2016). Few studies have been conducted to test the correlation between aptitude tests and standardised assessments such as SAT (Althoff, 2016). A study by Althoff (2016) investigated the predictability of students' academic achievement using their non-verbal aptitude level. Although the findings confirmed that students' non-verbal aptitude predicted students' academic achievement and could explain 15.5% of the variance in their academic achievement

scores, the study findings could not be generalised due to sampling limitations. The sample was convenience sampling and does not represent the different demographic traits of the population. Moreover, the used aptitude test measured the learners' non-verbal ability rather than overall aptitude level. Another limitation was the inflation in students' academic achievement because the scores were collected from students' end of year GPA where some students mainly selected easier courses to gain high scores. It is recommended to measure academic achievement using common or standardised assessment.

2.3.3 Assessments Role in the UAE Educational Reform

The educational system in the UAE is dynamic, rapidly growing, and involves a diverse educational environment from kindergarten to higher education. The UAE's MOE regulates and evaluates public schools and the UAE national curriculum (MOE, 2019), while private schools are regulated and evaluated by either the Abu Dhabi Department of Education and Knowledge (ADEK) (ADEK, 2020) or the Knowledge and Human Development Authority (KHDA) (KHDA, 2021), based on the school's demographic location. Schools are inspected by the authority yearly or every two years using a unified inspection framework across the UAE (MOE, 2014). The inspection framework aims to assure education in schools regardless of their curriculum and is updated whenever the need arises (KHDA, 2017). The majority of Emirati students attend private education institutions; around 58% of Emirati students and 88% of expatriates attend private schools, which offer around 17 different curricula. Abu Dhabi has 198 private schools, with around 64% of the student population attending these (Abu Dhabi Statistics Centre, 2019). There are 209 private schools in Dubai, with around 90% of the student population attending private schools (Dubai Statistics Centre, 2019). Between 2009 and 2019, the number of students in Dubai's private schools increased by around 64% (176,473 to 289,195) (KHDA, 2019).

The UAE allocates a high budget for education annually (Byat & Sultan, 2014). The UAE's Vision 2021 was launched in 2014 in order to reach excellence in education, especially in the STEAM field (UAE Government, 2019). The pillars of the UAE Vision 2021 have been mapped into key focus actions prioritised by the government to achieve 'First Rate Education' (UAE Vision 2021, 2018). To achieve the target, eight education-related priorities were identified as indicators and targets. Those eight indicators are called the UAE's NAP. The regulatory authority oversees schools' operations to ensure the high quality of education that promotes academic achievement and wellbeing at the same time. Therefore, the authority holds schools accountable for the students' outcomes and quality of education through the school inspection process (Kelly et al., 2020). The inspections are driven by evaluating the quality of students' attainment and progress, students' social, emotional, and behavioural development, the high quality of learning and education, the school's level of inclusivity, and their alignment with the UAE National Agenda requirements (KHDA, 2017; 2019).

Gaining a US high school diploma in the UAE requires fulfilling specific graduation requirements including covering at least 22 credits and achieving a minimum of 60% in the final assessments (MOE, 2019; UAE Government, 2018). A minimum of 22 credit hours is equivalent to four credits for English, three credits for math (including Algebra-I course), three credits for sciences (including physical science and biology), two credits for a world language, two credits for social studies, two credits for physical education, plus a half credit for visual or performing arts, and five and a half credits for elective courses (MOE, 2019; UAE Government, 2018).

The notion of assessment in the UAE is for accountability, validity, and comparability purposes to ensure continuous development in the educational system (Smith, 2014), which is highlighted in the UAE's NAP (Matsumoto, 2019). The UAE's participation in international

assessments pointed to the need for all schools to conduct regular international or external national assessments to benchmark students' achievement, evaluate the level of progress over time, and compare their progress in schools' curriculum against international benchmarks. TIMSS-2019 (Kelly et al., 2020; KHDA, 2020) and PISA-2018 (OECD, 2018b) both pointed to students' low performance in US-curriculum schools compared to the UK and IB-curriculum schools in the UAE. In US-curriculum schools it is a common practice that high school students participate in international assessments relevant to college and university placement requirements. Therefore, the UAE's MOE reviewed the High School Equivalency policy and updated the requirements and university acceptance by increasing the required scores of SAT-mathematics in US-curriculum schools and adding the national benchmark assessment EmSAT (Pennington, 2017) and international assessments in US-curriculum schools like the AP (MOE, 2019).

The UAE's NAP identifies certain assessments in schools based on the school curricula (KHDA, 2020). Attached is Appendix A which lists all the required assessments based on the school curriculum (KHDA, 2020). To improve the quality of education in the UAE, NAP required each school to conduct aptitude and achievement tests as part of the quality indicator of students' attainment and progress. Since 2016, US-curriculum schools were requested to run the MAP test (NWEA, 2014) as a curriculum-based assessment in core subjects: mathematics, science, and English, along with the CAT4. CAT4 is an aptitude test that assesses the students' cognitive abilities in verbal, quantitative, non-verbal reasoning, and spatial ability (GL-Assessment, 2017). Starting from 2017, the MOE increased the rigour of high school equivalency requirements in US-curriculum schools by increasing the required scores of the international assessments such as SAT and by adding the AP tests as a requirement to get an 'Advanced' or 'Elite' path of equivalency (MOE, 2019).

Hence students' attitude towards learning is considered one of the crucial factors that affect their wellbeing and achievement. Large-scale assessments like the Students Wellbeing Census (KHDA, 2017) and PASS (GL-Assessment, 2017) are conducted internationally and in the UAE to measure students' emotional, physical, social development, and attitude towards self and school. Another attitude test is the PASS which was developed to investigate the reasons behind students' disengagement, attitude, their self-regard, and attitude toward learning and school (GL-Assessment, 2017). Students' attitude toward learning involves feelings about school and teachers, perceived learning capability, preparedness for learning, general work ethic, self-regard, and self-efficacy. All these factors are getting increased attention in literature, especially regarding how they can impact students' achievement.

Starting from the academic year 2020-2021 and after the COVID-19 global pandemic that caused disruption and required modifications in the learning models offered in schools, the PASS test was added to the UAE's NAP 2021 (KHDA, 2020). The PASS test has been recommended to be taken as an attitude test in all school curricula for grades 5, 7, 9, and 11. Accordingly, the three types of assessment: MAP, CAT4, and PASS, cover three factors related to academic, cognitive, and psychological domains. The practice of triangulating data from a three-dimensional view of internal and external assessments is utilised when the need arises to measure and improve educational quality (Kelly et al., 2020).

In March 2020, all UAE students went on to the online learning model instead of physically attending classes due to the COVID-19 pandemic. All external assessments were cancelled, except AP, and exams were conducted online. Starting from September 2020, all schools under the supervision of the authority were requested to submit a School Readiness Plan document addressing health and safety and modifications to learning models offered in schools. The need for assessments to ensure the continuation of learning, students' progression, and their

wellbeing increased. Data analysis of students' MAP scores at the start of the academic year 2020 compared to the year 2019 concluded a similar average in students' reading level, but lower average in math (Kuhfeld et al., 2020). This indicates that after school closures due to the pandemic, there was a decrease in students' math level. This drop was around 5 to 10 percentile points in the subject.

The UAE participated in the TIMSS for the first time in 2007 and considers TIMSS-2007 as the benchmark. Since TIMSS-2007, the UAE has participated in TIMSS every four years, publishes results, and shares them with schools. In 2019, 64 countries and eight regional entities participated in the TIMSS-2019 cycle, including the UAE. The participating countries were given the option to conduct the digital version of TIMSS, the eTIMSS-2019. One of the school inspection process's quality indicators is to monitor schools' progress in international assessments like TIMSS and PISA towards achieving their individual National Agenda targets assigned by the authority in the UAE. The UAE eTIMSS results concluded that US-curriculum schools performed significantly lower than the TIMSS centre-point average compared to other curricula schools (KHDA, 2020).

The OECD (2015a) report highlights the low level of students' proficiency in PISA reading, mathematics, and science in the UAE compared to the advanced economy countries. That report was one reason that led to the country initiating the UAE's NAP and Emirati projects (UAE Vision 2021, 2018). Even though the OECD (2018b) report indicates that the overall results improved, a concern was raised about PISA performance, especially that Emirati students' proficiency level is still below the non-Emirati students. This concern is confirmed by the overall decrease in number of students enrolled in STEAM studies in the UAE (Moonesar et al., 2015; OECD, 2018b). Consequently, the educational system in the UAE

started implementing other national, international, and curriculum-based standardised assessments to track students' performance in English, mathematics, and science.

Rindermann, Baumeister and Groper (2014) conducted a study in the UAE that compared the TIMSS, PISA, and cognitive abilities level of 30 German and 30 Emirati students in engineering (Rindermann, Baumeister & Groper, 2014). The study used the quantitative, non-verbal, and general mean scores collected from the CogAT test that measures students' cognitive ability (Lohman & Hagen, 2001). Rindermann, Baumeister and Groper's (2014) study concluded a positive correlation between students' cognitive ability and performance in PISA and TIMSS. The study recommended to include cognitive ability tests in universities and to enhance the teaching by implementing explicit cognitive learning activities. The study also recommended that the educational reform in the UAE should include tracking students based on their ability and conducting international assessment studies. The review of the used methodology indicates the limitation in the study due to the low number of participants in the study which affects the accuracy and generalisability of the findings. Moreover, the collected CogAT scores in the study do not reflect the overall students' aptitude level because verbal reasoning and spatial ability were not considered (Rindermann, Baumeister & Groper, 2014).

The UAE literature indicates a gap in covering the contribution of students' aptitude, attitude, and achievement toward their performance, especially in high-stake assessments like TIMSS, PISA, and SAT (Radhwan, 2019). It is challenging to find any study in the UAE that investigates the role of different types of assessment simultaneously in students' academic achievement.

The literature review in the area of factors affecting academic achievement has contributed to understanding the role of cognitive, affective, and contextual factors. The next part of the literature will highlight the literature about each factor individually, then combine them.

2.3.4 Attainment and Students' Academic Achievement

Students' *attainment* related to certain benchmarks or standards is affected by cognitive, affective, psychological, and contextual factors along with sociodemographic and sociocultural backgrounds (Liem, 2019). Therefore, overall *academic achievement* is considered the net result of students' cognitive and affective characteristics (Lee & Shute, 2010; Lee & Stankov, 2016), alongside the sociocultural context where the learning process happens (Liem & McInerney, 2018; Liem & Tan, 2019).

It is important to discuss how academic achievement is measured. One of the ways is using cumulative grade point average (CGPA), or grade point average (GPA), and the assessment scores (Cassidy, 2012; Mushtaq, 2012). GPA is commonly used as an indicator for academic achievement (Richardson, Abraham & Bond, 2012) because it is a reliable measure and represents the student's overall attainment in the course (Bacon & Bean, 2006). Since GPA might be inflated due to the variation in grading between institutions (Didier et al., 2006; Johnson, 2003), external measures seem to be more reliable than internal ones. SAT is one of the external measures where SAT scores were found to predict 18% of the variance in students' GPA in the first year of university (Anastasi, 1988). Simultaneously, high school attainment accounts for 19% of the variance in students' GPA in the first year of university (Wolfe & Johnson, 1995), which means that both predictors can predict 25% of college variance GPA.

The literature highlights major studies about curriculum-based assessments' effectiveness in predicting students' performance and attainment (Crawford, Tindal & Stieber, 2001; Fuchs et

al., 2001; Merino & Beckman, 2010). The following sections cover the literature about curriculum-based assessments such as the MAP (NWEA, 2004), STAR, AIMSWEB, and Acuity (CTB/McGraw-Hill, 2014).

The NWEA developed the MAP, a K-12 computer-based adaptive test aligned with the US curriculum CCSS (NWEA, 2004). MAP is administered three times per year each fall, winter, and spring to track students' attainment and progress/growth against the CCSS. MAP scores are normed on all the data from the 50 states and compared to all MAP participants in the states and internationally (NWEA, 2004; NWEA, 2014). Rasch Unit is known as the RIT, which is an equal-interval unit (NWEA, 2007b), named after the statistician Georg Rasch who discovered the theory. Every question in the MAP test is assigned a RIT level according to the difficulty level.

MAP has been utilised with other types of assessments like STAR, AIMSWEB, and Acuity (CTB/McGraw-Hill, 2014) as a local formative assessment to measure students' achievement and growth in CCSS in mathematics and English (Gonzalez, 2015). MAP has been utilised to assess the quality of teaching and learning practices in reading (Cordray, 2013), science (Marshall, Smart & Alston, 2017), and mathematics (Beesley et al., 2018). In a study that aimed to measure the effectiveness of elementary curriculum-based assessment to predict 376 elementary students' achievement in MAP, the findings indicated that the reading fluency test significantly ($P < 0.5$) predicted the MAP-Reading scores (Merino & Beckman, 2010). In general, using assessment data as a predictor for the score of other assessment types has shown accuracy in the literature (Lipnevich, Preckel & Krumm, 2016; Shepard & Penuel, 2017).

Among the predictors of statistical achievement, the research highlighted factors such as mathematical abilities and students' aptitude level (Galagedera, Woodward & Degamboda,

2000; Gonzalez, 2015), attitudes towards mathematics, effort, and level of anxiety (Gardner, Lalonde & Pierson, 1983); other factors were added, such as motivation (Tremblay, Gardner & Heipel, 2000), the impact of curricula and attitudes towards the subject on achievement were also investigated (Sorge & Schau, 2002). The literature points to a significant positive correlation between high school attainment, aptitude, and standards-based assessments and academic achievement in college (Al-Alwan, 2009; Olani, 2009; Newton et al., 2007). Predicting students' achievement based on a combination of factors within different academic, cognitive, and affective domains such as academic assessment results (CTB/McGraw-Hill, 2014; Reggianini, 2017) and students' aptitude level (Gonzalez, 2015), or both attitude and cognitive ability (Finn et al., 2014) or academic achievement and attitude towards learning (Lipnevich et al., 2011; Shepard & Penuel, 2017; Volpe, 2016), have been extensively investigated in the literature. However, few studies triangulated the three types of assessment to predict students' academic achievement (Lipnevich, Preckel & Krumm, 2016). Studies that join the MAP and cognitive abilities along with students' attitudes are still absent in the literature. At the same time, it is necessary to formulate students' learning profiles to be able to predict achievement accurately.

Some studies investigated students' academic achievement considering other affective factors. One of the studies tested a hypothesis about the relationship between academic failure and grades using academic resourcefulness as a mediator (Quinn-Nilas, Kennett & Maki, 2019). The study population was Canadian undergraduate students. There were around 1114 participating students with a mean age of 21.85 years. The results concluded that task difficulty and lack of effort negatively predict academic resourcefulness while personal ability positively predicts academic resourcefulness. The analysis of indirect effects concluded the indirect prediction of students' academic achievement through students' academic resourcefulness. The study used the students' end of year grades as their academic achievement. A study on Spanish

undergraduates investigated the relationship between coping strategies and optimism effects on academic achievement (Vizoso, Arias & Rodriguez Perez, 2019). The study recommended the focus on training programmes targeting the development of students' adaptive coping skills like cognitive restructuring, emotional and social support, and academic stress management, which have been proven to enhance students' attainment. The previous two studies (Quinn-Nilas, Kennett & Maki, 2019; Vizoso, Arias & Rodriguez Perez, 2019) used Structural Equation Modeling (SEM) which relies on equations created by statistical and mathematical properties concluded by models representing the relationship between the different variables/factors. These kinds of studies showed limitations due to accepting the models without establishing the external validity or including substantive explanation (Tarka, 2017). Moreover, SEM analysis involves numerous decisions that can increase the possibility of errors (Guo, Perron & Gillespie, 2009).

High-stake assessments that measure the quality of students' overall performance in literacy, numeracy, and science such as PISA shed more light on the relationship between students' metacognitive skills and involvement in assessment and learning processes to enhance academic achievement (OECD, 2018c). The literature has also proved that learners' metacognitive skills developed with experience and time (Vandeveldt et al., 2013; Veenman, Van Hout-Wolters & Afflerbach, 2006). When studying metacognitive monitoring, several empirical studies used self-reporting tools (Griffin et al., 2013; Pintrich, Wolters & Baxter, 2000). The advantage of self-reporting tools is that students express how they utilise metacognitive skills and strategies. However, one limitation of self-reporting data collection is reliability, due to the variance in a learner's self-assessment of their own learning processes (Winne, 2005; 2018). Another reason that affects being reliant on self-reporting data collection is the participants' bias (Cromley & Azevedo, 2006; Winne, 2005); especially since completely understanding students' utilisation of metacognitive skills and strategies during learning and

assessment processes is complicated. Considering other variables like context, time, and granularity is crucial to study the cognitive and metacognitive processes and how they can impact students' learning processes (Bernacki, 2018). Along with self-reporting tools, other types of data and data collection tools should be considered to support and validate the findings from the self-reporting tools.

2.3.5 Aptitude and Students' Academic Achievement

A student's intrinsic potential or capability to learn defines the individual's ***aptitude*** or ***cognitive ability*** (Deary et al., 2007). That potential is considered a main predictor of academic achievement (Chen et al., 2012; Deary et al., 2007; Rohde & Thompson, 2007). How people utilise their mental abilities to learn, apply knowledge and skills to reason, and solve problems defines cognitive psychology (Hunt & Ellis, 2004). The development of cognitive and metacognitive abilities is crucial to enhance students' achievement in general and in problem-solving (Kuo et al., 2013; Veenman, 2012). Since Binet and Simon (1916) attempted to measure cognitive ability, it has been identified as one of the primary factors for predicting academic achievement. Veenman (2012, p.27) identified that "the metacognitive self-instructions and the cognitive processes involved in the execution of those instructions" define the cognitive system. The literature highlights the involvement of cognitive processes in reading, language usage, problem-solving, and reasoning skills, especially in mathematics and science education (Veenman, 2012). The highest involvement is between students' ability to reason quantitatively and reasoning skills in mathematics classes (Moore, 2010; Thompson, 2011). The reasoning process involves question formulation, data collection, analysis, and the interpretation of results (Frosch & Johnson-Laird, 2011).

There is a difference between a general aptitude test and SAT. The concept of scholastic aptitude involves cognitive abilities and achievements that are related specifically to academic

achievement. For example, the ACT is linked to a particular curriculum's achievement. Simultaneously, the SAT is a reasoning test related to the overall learning experience in high school (Zwick, 2007). Although intelligence has been majorly investigated in the literature as a strong predictor of academic achievement (Jensen, 1998; Roth et al., 2015), scholastic aptitude's theoretical conceptualisation remains quite vague (Schult & Sparfeldt, 2016). Scholastic aptitude tests have been used as college readiness tests and general intelligence indicators (Jackson & Rushton, 2006). The correlational range of 0.5-0.8 is proven between intelligence and college placement/admission tests (Frey & Detterman, 2008). Adding to that, intelligence and college placement tests are strong predictors of academic achievement (Richardson, Abraham & Bond, 2012). The literature points to studies that focused on studying the relationship between specific aptitude factors (rather than general overall aptitude factors) related to general and specific academic achievements (Brunner, 2008; Schult & Sparfeldt, 2016; Valerius & Sparfeldt, 2014). For example, focusing on content areas such as science, maths, and language when studying specific cognitive abilities can link the abilities conceptually to a specific subject area in the school.

Researchers have defined the different abilities supported by both cognitive and educational psychology. Burton et al. (2009) defined Verbal Reasoning (VR) as the learner's involvement in reading, listening, and writing activities that require the application of reasoning, text analysis, and verbal skills. VR goes beyond a learner's language skills to evaluation, interpretation, and synthesis skills crucial in problem-solving (Burton et al., 2009; Gonzalez, 2015). Quantitative Reasoning (QR) was defined by Thompson (1994d) as the procedure of connecting quantitative values to qualities that involve the application of number sense, quantitative literacy, modelling, interpreting, and deductive reasoning skills in a contextual situation (Mayes et al., 2014). The literature about cognitive abilities highlights the importance

of conceptualising the QR to visualise a mental image in problem-solving (Moore, Carlson & Oehrtman, 2009) and reason information (Carlson et al., 2002).

Non-Verbal Reasoning (NVR), or what is known as non-verbal aptitude testing, differs from achievement tests because it identifies the learner's potential without the use of language and does not require any prior mastery of skills or specific curriculum. However, the quantitative and reasoning items require students' skills in words and number sense which revealed that students with high potential or cognitive ability could achieve high educational standards (Gonzalez, 2015). The debate about the cognitive abilities tests that include word recognition, VR, and QR items indicates that students with high academic achievement would do better on these tests (Lohman, 2005).

Several inventories have been developed to assess and evaluate how learners' cognitive abilities support them academically (Schraw, Crippen & Hartley, 2006). The CAT4 test is a cognitive ability test developed mainly as a non-curriculum-based tool to assess the aptitude level and was tested for reliability (GL Assessment, 2012; 2017). CAT4 assesses the reasoning abilities through four batteries: VR that involves verbal classifications and verbal analogies questions, QR that includes number series and number analogies questions, NVR that includes questions about figure classifications and figure matrices, and finally Spatial Ability (SA) which consists of figure analysis and figure recognition questions. Figure (2.5) shows the different batteries in the CAT4. An individual's score in each battery places the student's score on a scale from one to nine compared to the Norm and Standardised Age Score (SAS). That score is called the Stanine score (ST).

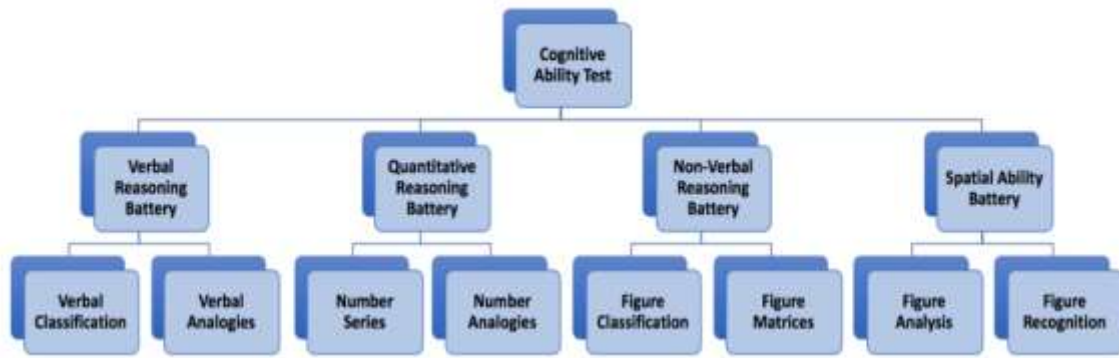


Figure (2. 5): Cognitive Ability Test Batteries
(Source: Author)

Cognitive ability batteries have been investigated and correlated to academic achievement (Chen & Whitehead, 2009; Rhodes et al., 2014; Rhodes et al., 2016). Spatial working memory, along with planning, has been shown to predict attainment in biology (Rhodes et al., 2014), while visual-spatial working memory has also been proven to predict physics (Chen & Whitehead, 2009) and chemistry (Rhodes et al., 2016). This process has been explained by information processing theories (Mayer, 1996) and the Information Processing Model of Learning and Memory (Schunk, 2012). At elementary, middle, and high school levels, working memory and general IQ are strong predictors of attainment in mathematics (Dumontheil & Klingberg, 2012), literacy (Alloway & Alloway, 2010), and reading (Lan et al., 2011). Although many studies confirmed that cognitive abilities are strong predictors of academic attainment, few of them have targeted adolescents (Stipek & Valentino, 2015), especially investigating that early prediction can help develop intervention plans and pedagogical approaches (Heckman, 2006).

Cognitive abilities have impacted attainment during adolescence and influenced the change in academic achievement, but this change is inconsistent across subjects (Donati, Meaburn & Dumontheil, 2019). Although there was no significant difference between studying the overall cognitive abilities or individual abilities related to specific subject attainments such as reading

and math (Best, Miller & Jones, 2009; Best, Miller & Naglieri, 2011), in contrast, other studies (Donati, Meaburn & Dumontheil, 2019; Latzman et al., 2010) highlighted a difference in impacts of cognitive abilities on subject-specific academic attainment. Therefore, investigating cognitive abilities and academic attainment in each subject as separate variables or factors is recommended. Interestingly, those kinds of studies confirmed that as grades increase, general cognitive ability and learning skills have a higher impact than discrete subject knowledge or skill. The previous findings are aligned with the literature about the strong correlation between a student's academic attainment in science, reading, and math due to the involvement of spatial abilities and reading skills in science learning (Donati, Meaburn & Dumontheil, 2019; Mayer et al., 2014).

Donati, Meaburn and Dumontheil (2019) aimed to examine the relationships between students' cognitive abilities and Executive Functions (EFs) (specifically processing speed, working memory, and inhibitory control while performing cognitive tasks) using the structural equation models and measures of IQ including vocabulary and matrix reasoning. Academic attainments in adolescents concluded that cognitive abilities and students' socioeconomic background affected their academic achievement in English, mathematics, and science (Donati, Meaburn & Dumontheil, 2019), especially since EFs were proven to develop and change during adolescence, which impacts cognitive abilities and academic achievement (Lee, Bull & Ho, 2013; Luna et al., 2015). The study confirmed previous findings that cognitive abilities impact attainment, and this impact varies based on the academic subject (Donati, Meaburn & Dumontheil, 2019). Moreover, the findings confirmed the need to be specific about the type of cognitive predictors used in predicting academic achievement. As explained earlier, these kinds of studies that rely on structural equation models showed limitations due to the lack of enough substantive explanation to accept the models (Tarka, 2017).

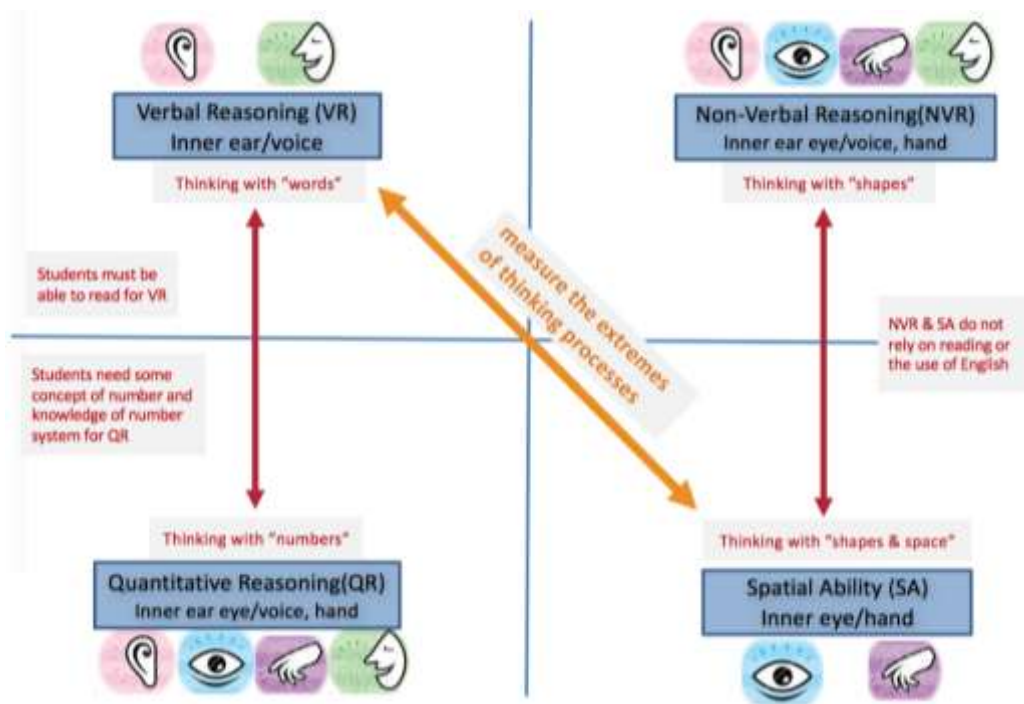


Figure (2. 6): Relationship between CAT4 Batteries and Learning/Encoding Process

(Source: Author)

The researcher developed Figure (2.6) above to summarise the literature about each cognitive ability's characteristics and how these can be related to the other abilities and learning needs. So, Figure (2.6) represents how the learning or encoding process starts during cognitive ability tests, as discussed earlier in the section on information processing theory, when the student is exposed to different words, numbers, shapes, and spatial activities and stimuli that trigger their memory, mental activities, and reasoning skills.

The following section will focus on the relationship between students' aptitude and academic achievement. One of the important indicators to test the cognitive ability test's validity is to predict academic achievement (Brody, 1992). Schult and Sparfeldt's (2016) correlational study investigated the relationship between the cognitive ability test factors (intelligence and scholastic aptitude) and high school GPAs. The results concluded a high correlation, however, there was a convergent validity for mathematics achievement and numeric abilities (Schult &

Sparfeldt, 2016). Other studies focused on the relationship between verbal content and math or science individually (Calvin et al., 2010) or as group factors together called nested or bifactor (Valerius & Sparfeldt, 2014). The studies were not limited to teenage years and beyond but also included early ages.

A correlational study was conducted in Italy to find the relationship between two non-verbal aptitude tests (CPM and NNAT) and the academic achievement in reading and math standardised assessments of 269 students (Balboni, Naglieri & Cubelli, 2010). The finding concluded 0.32 and 0.52 predictability of the academic achievement based on the two aptitude tests. Accordingly, both CPM and NNAT are recommended to predict academic achievement, and they did not present bias for students with the language issue. Another longitudinal study targeted kindergarten to Grade two students and found that working memory predicted academic performance whilst the verbal aspect was a higher predictor than SA (Kyttala et al., 2019). The study recommended early interventions to enhance students' working memory skills.

A study by Kaufman et al. (2012) targeting children aged 5-19 found that general aptitude tests and general factors of academic achievement tests are correlated ($0.77 \leq r \leq 0.94$). However, recent literature concluded that investigating the relationship between the subfactors should be considered for more accurate results (Beaujean et al., 2014; Coyle et al., 2014; Valerius & Sparfeldt, 2014). This was evident in a study that targeted around 13 000 students whose aptitude test results at the age of 11 were used after five years to predict their academic achievements (Deary et al., 2007). The study findings highlighted that the general intelligence predicted the English exam scores ($\beta=0.48$) while the verbal abilities by themselves indicated an incremental validity ($\beta=0.07$). Similar results were concluded using the French exam scores, where the correlation with general aptitude indicated the validity of ($\beta=0.45$) and verbal

indicator ($\beta=0.05$). Similar findings are concluded from a study by Calvin et al. (2010) where 178599 mathematics national curriculum test scores and general intelligence were significantly correlated ($r=0.80$). However, when the quantitative ability alone was considered, the validity decreased ($r=0.13$) (Calvin et al., 2010). Unpredictably, Calvin et al. (2010) found that the correlation between quantitative and English scores was negative ($r= -0.08$).

Another recent study investigating the correlation between 160 670 students' SAT-Mathematics scores and STEM GPA scores in college found a small positive correlation (Coyle et al., 2015). However, the correlation between STEM GPAs and SAT-Verbal scores were negative. Valerius and Spiseldt (2014) undertook a similar correlational study of 562 ninth-grade students' language, mathematics, and physics scores as academic achievement and their aptitude test scores but added to the verbal and quantitative aptitudes they used SA scores. The general factors of intelligence and school scores had a moderate positive correlation ($r=0.44$). The group factors included convergent correlation ($r=0.51$) between quantitative and both mathematics and physics, and similar between verbal and language scores ($r=0.49$). On the other side, divergent group factor correlations ($r=0.04$) were found between quantitative and language scores, and ($r= -0.18$) between verbal and mathematics or science scores (Valerius & Sparfeldt, 2014).

Stanford Achievement Test 9 (SAT-9) is commonly used as a standardised test in K-12 schools in the US. It has been found to predict 23%-47% of a student's GPA (McDonald et al., 2001; Sackett et al., 2009) which is considered a medium to large effect size (Cohen, 1988; Cohen, Manion & Morrison, 2018). Naglieri and Ronning (2000) studied 22 600 Grade K-12 students who were given the NNAT aptitude test and SAT-9 Reading components. They identified an overall average correlation of 0.56 with a positive correlation between 0.49 in Grade 2 up to 0.61 in Grade 11. Moreover, it was concluded that non-verbal aptitude tests alone could

accurately predict academic achievement in a specific subject area. Naglieri and Ronning (2000) argued that it is not a must to include verbal and quantitative components to predict academic achievement accurately. They proved their point when their study results indicated a degree of correlation similar to other studies that used other cognitive ability tests that included non-verbal, verbal, and quantitative batteries such as Woodcock-Johnson, the Wechsler Intelligence Scale, the K-ABC, and the Differential Ability Scale. However, none of these studies was compared regarding the main dependent variable, the type of academic achievement indicator. Accordingly, to support Naglieri and Ronning's (2000) argument, their study results should be compared to the results of other studies that used the SAT-9 scores to measure academic achievement as the main dependent variables to be able to judge if similar results are concluded.

Based on previous findings, Schult and Sparfeldt (2016) examined the pattern of convergent relationships between scholastic aptitudes, general intelligence, and academic achievement using English and mathematics (Algebra I and II and Pre-Calculus) GPAs of grade 11 and 12 students. The SAT and ACT scores included SAT/ACT-Reading, SAT/ACT-Mathematics, and SAT-Verbal. Item response theory was followed to get the individual ability estimates on each subscale of the aptitude test. The Armed Service Vocational Aptitude Battery (ASVAB) was used and contains 12 sub-items which cover VR, NVR, QR, SA, general science, mathematics knowledge, auto, mechanical, shop, and electronics information. The study also investigated the (pattern of convergent and divergent) relationships between the quantitative and VR as factors of cognitive abilities and the related specific subject's academic achievement. The study confirmed the convergent correlations between academic achievement (general factor) and mathematics factors. However, a small divergent correlation was found between incongruent group factors (Schult & Sparfeldt, 2016). The findings are aligned with previous studies (Brunner, 2008; Calvin et al., 2010). Surprisingly, the correlation between English and verbal

aptitude was small ($r=0.11$), whereas the correlation between quantitative reasoning and mathematics scores was large/strong ($r=0.75$). Conceptually, the study findings concluded a pattern that confirms the agreement between cognitive ability and academic achievement in the specific strengths and weaknesses in both (Brunner et al., 2013; Schult & Sparfeldt, 2016; Valerius & Sparfeldt, 2014).

Cognitive ability has attracted researchers' interest as a strong predictor for academic achievement (Hell, Trapmann & Schuler, 2008; Richardson, Abraham & Bond, 2012) but with little divergence in effect sizes (Formazin et al., 2015). Richardson, Abraham and Bond (2012) conducted a review of thirteen years of research of university-level students' GPAs. The review concluded that cognitive ability had shown a small to medium-sized correlation with academic achievement (Richardson, Abraham & Bond, 2012). Due to the lower variation between students' cognitive ability levels in university, cognitive ability accounts for around 5% of academic achievement (Formazin et al., 2015). Additionally, cognitive ability does not appear to be enough for high achievement, especially at university level (Richardson, Abraham & Bond, 2012). The data included in the literature is mixed related to the size and direction of correlations between academic achievement and cognitive ability. The convergent patterns in correlations are dominant in most of the studies that included the sub-factors (Gustafsson & Balke, 1993). However, when non-matching subject areas were studied, the results sometimes showed divergent validities (Valerius & Sparfeldt, 2014).

Investigating learners' aptitude in the specific subject area has been a focus for researchers (Coyle et al., 2015; Schult & Sparfeldt, 2016; Valerius & Sparfeldt, 2014). For example, when studying academic achievement in mathematics, frequently studies have investigated the learners' mathematical aptitude and prior knowledge. There are different theoretical perspectives for the problem-solving process related to the role played by graphics, such as the

graphic representation of the problem (Johnson-Laird, Khemlani & Goodwin, 2015). Solving problems and reasoning require the involvement of working memory and normative responses correlated with general and specific abilities (Evans & Stanovich, 2013; Klaczynski, 2014). This model of thinking implies the utilisation of the algorithmic mind and the reflective mind, as defined by Evans and Stanovich (2013) as follows: Algorithmic mind refers to educational factors related to learners' differences in fluid intelligence, whereas reflective mind refers to the rational thinking dispositions involved in the metacognitive processes. Students' mathematical ability is found to have a consistent significant positive relationship with their academic performance (Galagedera, 1998; Nasser, 1999; Woodward & Degamboda, 2000; Wooten, 1998). Certain studies referred the positive attitudes toward mathematics to the prior level of knowledge and skills in the subject (Galagedera, 1998) or to the mathematical ability, which impacts the acquisition of mathematical skills where abilities are found to have a negative relationship with mathematics anxiety (Wisenbaker, Scott & Nasser, 2000).

The above literature addressed the important role of aptitudes in academic achievement and the need to further investigate the predictability of academic attainment based on cognitive abilities during adolescence specifically, rather than using broad or general measures (Donati, Meaburn & Dumontheil, 2019; Lee, Bull & Ho, 2013; Luna et al., 2015). Additionally, the literature also showed a gap in investigating specific factors that do not match the subject, like VR and mathematics. Therefore, in the current study, the overall aptitude level, which includes all the factors, namely learner's VR, NVR, QR, and SA level, has been considered rather than individual ability to enhance the validity. In conclusion, the literature suggests that the investigation should be done beyond the general factors of aptitude and academic achievement (Brunner, 2008; Coyle et al., 2015; Deary et al., 2007; Schult & Sparfeldt, 2016; Valerius & Sparfeldt, 2014). The literature also recommends more investigation into the relationship between academic achievement, aptitude, and affective factors like self-control, which is

known as self-regulation and involves effortful control and self-regard (Duckworth & Kern, 2011; Stadler et al., 2016) which enhance the learners' positive attitude (De Ridder et al., 2012).

2.3.6 Attitudes toward Learning and Students' Academic Achievement

Affective attributes have been studied to identify which attributes are relevant to students' academic achievement (Cunha, Heckman & Schennach, 2010). Affective attributes refer to the different personal attributes, characteristics, and skills representing an individual's emotional, attitudinal, motivational, behavioural, and other psychological dispositions (Lee & Stankov, 2016). The variables that are related to a student's academic achievement but cannot be measured by cognitive or achievement tests are called 'non-cognitive' by sociologists (Bowles & Gintis, 1976; Farkas, 2003) and conceptually are independent of cognitive ability (Lee & Stankov, 2016). Despite the criticisms of using the term 'non-cognitive', there is still debate on the suitability of using other terminology (Duckworth & Yeager, 2015).

So far, literature has not concluded exactly which affective variables are likely to be the most impactful and direct factors to academic achievement. Educational systems have planned to improve attainment by creating a positive attitude towards self and school (Aeby et al., 1999; Midgley et al., 1998). Other factors affect students' academic achievement like characteristics, attitudes, motivations, and perceptions about the subject or learning in general. All the above factors are expected to explain success beyond aptitude and current academic attainment. These factors were proven to explain student's higher academic performance at university level, outside of intelligence level (Credé, Tynan & Harms, 2017; Duckworth & Quinn, 2009; Richardson, Abraham & Bond, 2012; Wolters & Hussain, 2015).

Identifying students' achievement is not enough to give teachers access to understand students' thinking (Shepard & Penuel, 2017). Although those students are the main users of assessment,

exploring their perceptions about the role of assessment in achieving their goals is still underdeveloped (Barker, Pistrang & Elliott, 2002; Christian, 2017; Vaessen et al., 2017). Students differ in their willingness to undertake greater responsibility for their own learning. Consequently, attitudes and perceptions towards learning can foster students' engagement in learning and support higher academic achievement (Linnenbrink-Garcia & Patall, 2015). A great focus on literature highlights the importance of psychological variables as factors that predict academic achievement (Rickinson & Rutherford, 1996; Wince & Borden, 1995). Psychological variables have been highlighted as indicators of college retention and academic performance (Krumrei-Mancuso et al., 2013). More personalised student conversations would shed more light on other factors that might affect students' achievement, which is impossible due to many limitations and time constraints (Heaven & Ciarrochi, 2012). This was the rationale behind the study by Sadler et al. (2012) that formative assessments should enhance students' experience in internalising good work quality. Furthermore, the literature highlights the influential role of students' attitudes on performance assessments like MAP (Volpe, 2016). The following section explains each affective factor in detail.

A ***student's attitude towards learning*** reflects the learner's willingness to learn, which is affected by several factors such as attitude towards self, the subject, school, teachers, self-concept, and self-efficacy (Sawalha, 2018; Seligman, 2012). Learners' attitude towards learning can vary based on the subject. For example, the learner's attitude towards mathematics refers to the learner's positive or negative degree of effect toward mathematics (McLeod, 1992). The literature indicates that students are the most important factor in the attainment of educational outcomes. Underachieving students at the start of university have poor metacognitive skills and undeveloped attributional beliefs (Ley & Young, 1998).

Attitude towards learning is one of the variables that fall under the affective domain. Due to the growing appreciation of the benefits of non-traditional factors affecting academic achievement such as mindfulness practice, the literature showed an increase in interest in investigating psychological affective predictors of academic attainment (Bender et al., 2018; Liem, 2019). A recent study that targeted factors affecting Australian undergraduates' academic achievement concluded that mindfulness practices increased students' adaptability and resilience to enhance their engagement to lead to improvement in their grades (Elphinstone et al., 2019). The mindfulness practices contributed to students improved academic performance, especially when students have positive attitudes and are trained to utilise their behavioural, cognitive, and affective resources in their learning process (Elphinstone et al., 2019).

With the start of positive psychology, the focus increased on the effects of ***students' attitude toward self, subject, learning*** and the impact on academic achievement (O'Neal, 2019). Students' attitude toward a subject such as mathematics means to what extent the students have a positive or negative feeling toward the subject (Haladyna, Shaughnessy & Shaughnessy, 1983; McLeod, 1992). Mathematics requires much use of reasoning skills, which can increase students' anxiety and negative attitudes towards mathematics, impacting academic achievement (Chiesi & Primi, 2009a). Learning complex subjects like mathematics involves the interchange between cognitive, affective, and metacognitive factors (Agus et al., 2016; Nasser, 2004; Stankov et al., 2012). The research confirmed that certain taught strategies such as solving mathematics problems in class and teaching students problem-solving strategies helped improve students' content knowledge and attitude toward the subject (Sawalha, 2018; Seligman, 2012).

For example, in a study in the USA, Canada, and Norway, students' attitude toward mathematics was the strongest predictor of attitude and interest in the subject, while in Canada and Norway, students' confidence was the strongest predictor of mathematics success (Ercikan, McCreith & Lapointe, 2005). The academic attainment and positive attitude of high school students aged 15 towards mathematics were found to affect their academic achievement and math course choices in high school and university (Guo et al., 2015). Prior mathematics knowledge also affected middle school students' mathematics self-concept and their attitude towards mathematics, leading to improvement in students' attitude towards mathematics in high school and college (Guo et al., 2015).

Hattie (2009) conducted a meta-analysis to find the highest affective factors concerning academic achievement. The findings pointed to the highest four factors: motivation and engagement, self-concept, anxiety, and attitude towards mathematics, with effect size in terms of Cohen's value of $d=.48$, $.43$, $.40$, $.36$ respectively. It is important to note that the study did not include self-efficacy, and the value of Cohen's $d=.40$ is equivalent to Pearson product-moment correlations of around $r=.20$. The common finding between the previous studies is that the self-belief factor was significantly correlated with students' academic achievement (Hattie, 2009; Lee & Shute, 2010; Richardson, Abraham & Bond, 2012; Stankov, 2013). Hattie's study addressed the limitation of using only the self-reporting tool to measure students' self-beliefs in mathematics. Self-reporting tools might lead to inconsistency between what students report and their actual attitude and behaviour. So, the study recommended adapting the validation method on self-reporting (Hattie, 2009). Accordingly, including other instruments to collect information and data about students' attitude towards learning and academic achievement would be beneficial to enhance the validity and reliability of the findings.

A great number of studies have attempted to explore various affective factors that might affect students' achievement in mathematics, such as attitude, anxiety, fear of low achievement, self-confidence (Bandura, 1997; Bowd & Brady, 2003; Ercikan et al., 2005; Grootenboer & Hemmings, 2007; Leder & Forgasz, 2006; Lent & Hackett, 1987; Pajares, 1996, pp. 543, 570; Usher & Pajares, 2008, p. 751; Zan et al., 2006). Those studies investigated learners' attitudes towards mathematics, proving that these predict academic achievement (Garden, 1997; Grootenboer & Hemmings, 2007; Leder & Forgasz, 2006; McLeod, 1992; Zan et al., 2006). Unfortunately, a negative attitude towards mathematics was common and negatively affected learning (Garden, 1997; McLeod, 1992). Math anxiety was also correlated to low achievement (Sherman & Wither, 2003).

Although several researchers have argued the positive correlation between negative attitude towards mathematics and low achievement in mathematics, there is not enough evidence to confirm if negative attitude has caused the low achievement, or the opposite (Furinghetti & Morselli, 2009). For example, in studies examining the relationship between attitudes toward mathematics and statistics, the findings indicated conflicting results. A group of studies confirmed no significant relationship between attitudes toward mathematics and mathematics achievement (Adams & Holcomb, 1986), while other studies concluded the opposite (Feinberg & Halprin, 1978). Therefore, the literature points to the importance of studying this relationship to improve the learning of mathematics (Gresalfi & Cobb, 2006; Grootenboer & Hemmings, 2007).

Students' positive attitude towards teachers was confirmed as a strong influencer on academic success and achievement, as identified by a study that examined students' perceptions about the positive relationship between teachers and students (Calero et al., 2014). Students' positive attitude towards their teachers and the feedback provided by teachers have been proven to

affect students' academic achievement and develop students' self-concept (Prince & Nurius, 2014), develop positive relationships with peers and positive attitudes toward learning in general (Calero et al., 2014; O'Neal, 2019).

Certain factors related to students' general attitudes toward teachers, attendance, and schools gained attention in the literature. SCLT (Schunk, 2012) highlights how the critical student-teacher relationships affect students' feelings about school and sense of belonging at school (Finn, 1989; Voelkl, 1997), and students' attitudes toward teachers and school (Elliot & Dweck, 2005; Radel et al., 2010). Although these factors have been extensively investigated within theoretical approaches, many empirical studies recommend studying the relationship between the factors and understanding the broader structural framework.

Students' attitude towards school is affected by school environments, which form another important factor in influencing academic achievement. Several studies highlighted the school environment's vital role in developing students' academic self-concept, which affects academic performance (Becker et al., 2014; Hu et al., 2015). Peer relationships and attitude towards school were found to affect academic performance (Hu et al., 2015; Becker et al., 2014). The analysis of PISA (OECD, 2004a) indicated a substantial correlation between students' attitudes toward school and academic achievement. Furthermore, the student's sense of belonging to school contributed to improving academic achievement (OECD, 2004b). The correlational level between students' sense of belonging and subject achievement in PISA 2000 was significant in mathematics ($r=.48$), reading ($r=.51$), and science ($r=.50$) (OECD, 2003).

Academic self-concept is defined as an individual's belief in their academic ability (Lone & Lone, 2016). A substantial number of studies have shown that academic self-concept is a strong predictor of future academic achievement at high school and university levels (Arens et al.,

2017; Fives et al., 2014; Lone & Lone, 2016; Marsh et al., 2016; O’Neal, 2019; Pinxten et al., 2013; Prince & Nurius, 2014). Simultaneously, it has been proven that academic achievement affects students’ academic perception (Yang-Wallentin, 2013). Wouters et al. (2011) aimed to investigate if academic self-concept can predict high school students’ future academic achievement in the first year of college. The findings concluded that academic self-concept predicted academic performance. Similar results elsewhere confirmed the predictability of academic achievement by academic self-concept and vice versa (Fives et al., 2014; Pinxten et al., 2013), known as the reciprocal effect model (McInerney et al., 2012). Moreover, the models in a study by McInerney et al. (2012) indicated that self-concept in English predicted both English and math achievement.

Academic self-concept as a predictor of academic achievement has been the focus of many researchers, especially when investigated in relation to a specific subject (Katsperski, Shany & Katzir, 2016; Liou, 2014; Marsh et al., 2016). Reading and students’ achievement in reading have a positive relationship, while a perceived competence in reading and students’ achievement in reading have a negative relationship (Fives et al., 2014). The study confirmed that self-concept positively affects high school students’ achievement in reading. Students’ verbal self-concept was also confirmed to positively correlate with students’ reading scores (Arens & Jansen, 2016). There is a strong positive correlation between mathematics academic self-concept, academic achievement, and effort (Marsh et al., 2016); the findings concluded a significant positive correlation among the variables. The studies highlight that academic self-concept differs based on the subject investigated. For example, it was proven that academic self-concept in math was different from that in reading and writing (Schmidt et al., 2017). This positive relationship has been proven to have a reciprocal effect, specifically in the mathematics domain (Arens et al., 2017).

A great number of studies have attempted to explore various psychological factors that might affect students' achievement in mathematics, such as attitude, anxiety, fear of low achievement, and self-confidence (Bandura, 1997; Bowd & Brady, 2003; Ercikan et al., 2005; Grootenboer & Hemmings, 2007; Leder & Forgasz, 2006; Lent & Hackett, 1987; Pajares, 1996, pp. 543, 570; Usher & Pajares, 2008, p. 751; Zan et al., 2006). Those studies investigated learners' attitudes towards mathematics, proving that attitudes toward mathematics predict academic achievement (Garden, 1997; Grootenboer & Hemmings, 2007; Leder & Forgasz, 2006; McLeod, 1992; Zan et al., 2006). Challenging subjects such as mathematics had shown usual negative attitudes toward it from learners and accordingly negatively affected learning (Garden, 1997; McLeod, 1992). In addition, mathematics anxiety was also correlated to low achievement (Sherman & Wither, 2003).

Both self-efficacy (Bandura, 1986, 1997; Pajares, 1996; Schunk, 1991) and self-concept (Harter 1985 a, 1985 b; Marsh, 2007) belong to the self-belief factors that are debatable and highlighted in literature because of their impact on academic achievement (Christian, 2017). Moreover, learning strategies within the self-regulation framework (Mayer, 1998; Pintrich, 2000; Zimmerman, 2001) emphasise metacognitive skills (Banks, 2020) and represent factors that can be grouped as approaches to learning.

Self-regard is another used terminology and stems from the individual's attitude towards self, influenced by the individual's view of their abilities, attitude, and emotional wellbeing (Joshi & Srivastava, 2014; Pan et al., 2016). Self-regard, which is also known as self-esteem or self-worth, indicates to what extent individuals value themselves (Rosenberg, 2015) and indicates the positive or negative dispositions about the self and learning experience (Hamaideh & Hamdan-Mansour, 2014). It is considered an essential factor that affects academic achievement (Saadat, Ghasemzadeh & Soleimani, 2012) because of its positive relationship with academic

achievement (Saadat et al., 2012), with a positive correlation ranging between $r=.10$ to $.30$ (Stupnisky et al., 2007). Only a few studies concluded either a weak or lack of relationship between self-regard and academic achievement (Demo & Parker, 1988; Stupnisky et al., 2007; Wintre et al., 2011). The positive relationship between self-regard and academic achievement is that students with high self-regard do not give up when they are challenged or fail, but keep trying (Baumeister et al., 2003).

Although the factors that play a main role in academic performance and how education systems can improve students' attainment and overall achievement have been a focus in research (Miller, 2014), social-emotional factors such as academic self-regard have not been deeply investigated (Marsh & Martin, 2011). The studies that examined factors affecting academic achievements like self-regard started simultaneously with the increased focus on positive psychology and specifically, positive education (Marsh & Martin, 2011; O'Neal, 2019; Seligman, 2012). Marsh and Martin's (2011) study that targeted high school and college students concluded the reciprocal relationship between academic self-regard and academic achievement. The same findings were highlighted later by other studies (DeFreitas & Rinn, 2013; Fives et al., 2014; Pinxten et al., 2013). The literature points to the importance of investigating the relationship between those variables as early as with Grades 1 to 5 students (Arens et al., 2017). On the other hand, O'Neal's (2019) correlational study targeted 143 fourth to sixth graders and concluded a positive correlation between academic self-concept and math scores ($r(82) = 0.552$) and reading scores ($r(82) = 0.333$), with $R^2 = 0.111$.

Self-efficacy refers to the learner's self-perceptions of their ability to perform well in a specific area and accomplish tasks (Bandura, 1997; 2001). Self-efficacy has attracted much attention in educational research due to its impact on students' achievement in different subjects. Concepts like self-concept are further investigated and distinguished from self-efficacy (Schunk &

Pajares, 2005). Bandura (1997) clarified that the expectation of successfully meeting the goals is what mastery means, whereas the feelings of self-worth and accepting self are known as self-esteem. Students' **self-confidence** in abilities allows them to utilise skills, knowledge, and work time more efficiently. The studies about self-confidence conclude that self-efficacy is positively correlated with statistical achievement (Agus et al., 2016; Nasser, 2004), and interest in careers related to science and math subjects (Lent & Hackett, 1987), achievement, and aspects of success in school (Pajares, 1996, p. 570). In contrast, low mathematics achievement was related to low self-confidence (Onwuegbuzie, 1998; 2000).

Hence self-efficacy, self-regulation, and self-perception are interrelated. They can impact motivation, thus attainment and academic achievement (Bandura, 1997; Pintrich & De Groot, 1990; Richardson, Abraham & Bond, 2012; Wäschle et al., 2014; Zimmerman, 2000). Self-confidence/esteem and achievement reinforce each other. For instance, research indicates that a higher level of fear of failure negatively affects students' self-confidence and achievement (Zakaria et al., 2012). Simultaneously, low self-efficacy and perceived learning capability lead the student to believe that they lack the ability to perform and are worthless and incompetent. Therefore, learners will have performance-approach goals in the subject they excel at. Although during adolescence the capacity for regularity control improves (Luna, Padmanabham & O'Hearn, 2010), studies prove that self-regulation and self-efficacy decline in early adolescence (Caprara et al., 2008; Eccles & Roeser, 2011).

A negative relationship has been found between self-efficacy and anxiety, whereas a positive one has been shown between self-efficacy and statistical achievement (Onwuegbuzie, 2003). From other perspectives, academic self-concept acts as a mediator in selecting a learning approach and correlates positively with academic achievement (Chen, Chui & Wang, 2015). Therefore, academic self-concept strongly predicts academic performance (O'Neal, 2019;

Stajkovic et al., 2018). Liem, McInerney and Yeung (2015) took further steps in investigating the influence of academic self-concept on academic achievement in English, maths, and science concerning students' ability grouping. They found that students with high academic self-concept have a high academic achievement in mathematics, but this finding cannot be generalised to other subjects (Liem, McInerney & Yeung, 2015). In general, other studies found a positive relationship between English and mathematics self-concepts, and both declined at the end of high school (Martin et al., 2015).

Perceived learning capability and ***perceived academic control*** are defined as the degree of learners' view of themselves as owning and affecting their learning processes and outcomes (Perry et al., 2001; 2005). Perceived learning capability entails the combined effects of maintaining academic control and effort over time to achieve targets (Duckworth et al., 2007). In general, learners' self-perceived capability is also explained by the students' perception of their abilities. Perceived academic control differs from self-efficacy. The first addresses the learner's beliefs that they have control over outcomes, while self-efficacy means the learner's belief about the ability to perform the task (Bandura, 1997; Zimmerman, 2000). Learners who perceive learning capability and academic control believe that they have control over the outcomes. They have the necessary skills to achieve goals to push themselves to accept challenges, thus they perform well.

Self-control also explained the variance in high school students' attendance and responses to curriculum demands (Duckworth & Seligman, 2005). Duckworth and Seligman's (2005) longitudinal study targeted 140 eighth-grade students and found that academic control explained around 30%-45% of the high school GPA variance. They argued the validity of measuring students' academic achievement using the GPA than the standardised assessments that evaluate students' knowledge and skills over a few hours. They based their arguments on

the assumption that the GPA reflects students' achievements using multiple types of internal assessments and evaluated by many teachers over the school academic year. However, their argument does not consider the validity and rigour of the school's assessments or the grading of those assessments that affects the GPA. Moreover, self-control was found to have a strong effect on university students' academic achievement (De Ridder et al., 2012). Students' overall self-awareness of their academic performance was examined regarding academic performance in college (Phan, 2014). The common practice in studies about self-control is the use of self-reporting questionnaires, stakeholder ratings, behavioural and attitude assessment (Duckworth & Seligman, 2005; Stadler et al., 2016). Every tool has its advantage and disadvantage according to the type of data and the context.

On the other hand, students' perceived learning capability in math and science has a positive correlation with academic achievement (Arens et al., 2017; Marsh et al., 2016; O'Neal, 2019). It can be concluded that the student's ability to see themselves achieving a goal and mastering a task can play a role in their ability to achieve. Covington (2000) described mastery orientations as the deep-level use of strategies, competence, and understanding of the content. In contrast, performance orientations refer to the demonstration of competence, outperforming others, and the superficial level of information processing. The literature points to the difference between mastery-oriented learners and performance-oriented learners. Mastery-oriented learners have positive attitudes toward learning because they relate achieving goals to the effort and strategy (Muis & Edwards, 2009; Pintrich & Schunk, 1996). Performance-oriented learners might have negative attitudes towards learning because they believe that ability controls achieving the goals, rather than the effort (Hidi & Harackiewicz, 2000). Moreover, performance-orientated learners have null or negative relations with peers and teachers, while mastery-orientated learners have positive relations with peers and teachers (Polychroni, Hatzichristou & Sideridis, 2012).

Factors like self-efficacy and reflective thinking were examined in Phan's (2014) longitudinal study. The findings indicated that self-efficacy impacts academic achievement; prior academic attainment affects self-efficacy and self-regard (Phan, 2014). Phan's (2014) study pointed to students' engagement in reflective thinking and their self-efficacy on their academic performance. This finding aligns with previous studies, that students' awareness of their own abilities enhances their self-concept and effort to achieve their goals (Rosman, Mayer & Krampen, 2015; Stajkovic et al., 2018). They added that the self-concept level helps students recognise their ability level and improve learning skills and academic performance. A study by Stajkovic et al. (2018) concluded a positive correlation between self-efficacy and academic performance, where students' attitude and emotional stability predicted academic self-efficacy and achievement.

In conclusion, the ***interaction between factors*** like students' characteristics, context, and previous learning experiences influences students' attitude towards learning, behaviour, and learning strategies the students adopt to succeed academically. Several factors have been examined in the research, highlighting the important role of combined affective factors such as school environment, curriculum, teachers, parents, students' attitudes toward mathematics, and self-regard on academic achievement (Bandura, 1997; Jacobs & Bleeker, 2004; Grootenboer & Hemmings, 2007; Leder & Forgasz, 2006; O'Neal, 2019; Soni & Kumari, 2017) where students' attitudes towards self, school, and learning are

general predictors of academic achievement in mathematics (Grootenboer & Hemmings, 2007; O'Neal, 2019; Viljaranta et al., 2014; Zan et al., 2006), and English and mathematics (Liem, McNerny & Yeung, 2015; Martin et al., 2015).

However, certain factors are more situated in the learning context, such as students' attitudes toward learning (Sebesta, 2019). For example, students' goal orientation, persistence, perceived learning capabilities, and self-efficacy may explain the variation in students' academic achievement (Credé, Tynan & Harms, 2017; Linnenbrink-Garcia & Patall, 2015; Richardson, Abraham & Bond, 2012). Students utilise learning strategies based on their knowledge, previous experience, and belief in their ability to utilise these strategies. The literature highlights that the learner's ability to monitor their learning skills and responsiveness to contextual cues such as assessment demands guide their approaches to studying and performance (Dye & Stanton, 2017; Schraw, Crippen & Hartley, 2006; Stanton et al., 2015) which can impact academic achievement (Credé & Philips, 2011; Richardson, Abraham & Bond, 2012; Sitzmann & Ely, 2011). In general, students' subjective evaluation is considered an alternative reliable indicator of academic achievement (Stadler et al., 2015). Subjective evaluation refers to the learner's judgement of achievement

related to their personal goal or compared to peers (Ng et al., 2005), and related to a frame of reference that determines how learners perceive certain grades (Komarraju & Nadler, 2013).

The school environment, teacher-student and student-student relationship, and assessment system all represent the social context settings in education (Schunk, 1991; Skinner et al., 2008). Students' perception of their relationship with peers and teachers is correlated with self-beliefs (Bandura, 1986; Schunk, 1991), engagement (Skinner et al., 2008), and sense of control (Radel et al., 2010). For instance, when students have a positive attitude towards themselves and school and feel supported by teachers, they will develop self-confidence and confidence in their capabilities (Calero et al., 2014; Den Bork et al., 2004). The school environment and teachers provide students with cognitive modelling that enhances students' learning strategies (Schunk, 1991; Soric & Palecic, 2009) through discussion and reflection (Soric & Palecic, 2009).

Several empirical studies have implied the possibility of developing structure among the major domains or factors that play a main role in academic achievement (academic attainment, aptitude, and attitudes towards self and school). Marsh et al. (2006) revealed that the primary factors of academic self-beliefs, including self-concept and self-efficacy, are correlated with a range of ($r = 0.66-0.91$). This finding was confirmed by other studies (Lee, 2009). Students' self-beliefs and attitudes toward school along with motivation are significantly correlated with a range of ($r = 0.73-0.79$) (Martin, 2007), while attitude towards school is significantly correlated ($r = 0.51-0.58$) with the self-regulation learning skills (Martin, 2009). Christian (2017) and Martin (2009) recommended the use of broader factors because they resulted in shared variances among the cross-domain factors. From a theoretical perspective, items within each factor overlap and are significantly correlated (Lee, 2009; Marsh et al., 2006; Martin,

2009), concluding the overarching structure describing the relationships within and across the factors (Christian, 2017).

The validity of the tools used to measure students' attitude towards learning in general and towards the specific subject plays a substantial role in finding the relationship between the attitudes and academic achievement in that subject. For example, in studying the relationship between attitudes toward statistics/mathematics and achievement in these subjects, Wisenbaker, Nasser and Scott (1998) and Wisenbaker, Scott and Nasser (2000) concluded a small to moderate positive relationship. They added that these findings are consistent regardless of the type of the instrument used to measure attitude or achievement. Their findings confirmed earlier studies targeting the same aim (Lalonde & Gardner, 1993; Nasser, 1999; Schau et al., 1995).

2.3.7 Combined Factors Contributing to Academic Achievement

A great body of literature has examined the relationship between students' characteristics and academic achievement. Factors affecting students' academic performance are categorised under cognitive factors including students' aptitude, previous content knowledge, and cognitive dimensions of students' attitudes toward the subject or affective factors that are related to feelings, beliefs, anxiety, motivation, and affective dimensions of attitudes toward the subject (Feinberg & Halprin 1978; Nasser, 2004). Affective factors are related to the conceptualisation of the 'non-cognitive', which includes all psychological and behavioural dispositions and tendencies that are not measured by cognitive tests such as aptitudes, cognitive ability, and school performance tests (Bowles & Gintis, 2002; Farkas, 2003). Cognitive and affective factors are interrelated where cognitive skills require some level of non-cognitive

capacity (Christian, 2017). Due to the nature of interrelation between cognitive and affective factors, Farkas (2003) pointed to the different degrees of correlation between cognitive and affective variables based on the type of variable and debated that no factor could be purely cognitive or affective.

Although affective factors might have a long-term impact on academic achievement, studies have focused on cognitive factors (Gal & Ginsburg, 1994; Vaessen et al., 2017; Zieffler, Garfield & Fry, 2018). Throughout the research, students' achievement, cognitive ability, and attitude towards learning appear to be interchangeable/interrelated. Understanding the student's self-perspective must be studied as it relates to matters regarding their attitude towards learning, including self-efficacy (Midgley et al., 1998).

Coleman's surprising report, which was based on a US study in 1966 (Coleman et al., 1966), involved ability and achievement testing of 645 000 students in Grades 1, 3, 6, 9 and 12 from 4 000 schools; the data revealed that the variation in achievement was due to students' differences rather than the differences between schools' qualities. Other studies have confirmed Coleman's finding that the school's effect on variance in students' achievement is not more than 40% (Gamoran & Long, 2006). Similar findings are concluded at the university level in the US where students' SAT-Mathematics scores, major, and gender predicted 93% of the students' achievement in the Graduate Record Examinations (GRE) admission test to a postgrad degree (Angoff & Johnson, 1990). This leaves the university with an impact of 7% of the variance in students' achievement. Simultaneously, Dale and Krueger's study (2011) confirmed that SAT-Mathematics scores significantly predicted students' college readiness and achievement.

The topic of mathematics achievement and the variables affecting it, such as the impact of the curriculum, schooling, teacher's influence, parental involvement, student's attitude towards learning and mathematics, self-perception, and self-confidence, have received greater attention over the years (Arens et al., 2017; Marsh et al., 2016; Nasser 2004; O'Neal, 2019). Examining the relationship and finding the different variables that might affect students' achievement have come into focus and debate (Detterman, 2016). Although cognitive ability is proven to have a high impact on achievement, other characteristics and factors have not been thoroughly investigated, such as intelligence (Deary et al., 2007; Detterman, 2016). Previous large-scale studies have proven that intelligence significantly impacts students' achievement, but not the opposite (Crano, Kenny & Campbell, 1972; Watkins, Lei & Carnivez, 2007). Interestingly a similar finding was concluded from a study on music ability and practice (Mosing et al., 2014).

Seventy-thousand English students' scores are collected from the General Certificate of Secondary Education (GCSE) and the CAT (Deary et al., 2007). The GCSE is a subject test that measures students' achievement using a common scale as a point score. CAT is a reasoning test commonly used in England to measure students' cognitive ability. A correlational test was conducted between the GCSE subject scores of 15 to 16 years old students and the matching scores of their CAT test when they were at the age of 11. The study concluded the strong positive correlation (0.81) between academic achievement and cognitive ability scores. Moreover, students' cognitive ability predicted around 58.6% of students' achievement in mathematics which was the highest prediction among other subjects. Interestingly students' cognitive ability level predicted students' academic achievement in specific courses five years after taking the CAT.

Years later, a study by Kaufman et al. (2012) confirmed the same findings using two intelligence and achievement tests, the Kaufman and Woodcock-Johnson tests, where the

correlation between students' cognitive ability and academic achievement was 0.83, which is very similar to the findings by Deary et al. (2007). The study pointed to the increase in the correlation by age from 0.77 to 0.94. The study by Kaufman et al. (2012) also used the matching scores of individual students' academic achievement and cognitive ability scores. Other correlational studies were conducted on TIMSS scores and IQ scores to estimate students' achievement based on their intelligence and ability (Lynn & Mikk, 2007). The conclusion highlights the importance of intelligence in academic achievement. However, the researchers recommended using individual correlations rather than using mean cohort scores. This recommendation is what was implemented in studies by Deary et al. (2007) and Kaufman et al. (2012) by matching students' scores across different types of assessment to provide complete data for individual students.

The proposed models on factors predicting statistical achievement concluded a major effect of attitude (Chiesi & Primi, 2009b; Nasser, 2004), metacognitive aspects of confidence (Stankov, 2013; Stankov et al., 2012), mathematical abilities (Chiesi & Primi, 2009a), and a moderate effect of affective factors (Nasser, 2004), and feelings of rightness (Evans, Thompson & Over, 2015; Thompson & Johnson, 2014). The feeling of rightness is one of the metacognitive aspects of a learner's confidence associated with the intuitive answers that predict the likelihood that learners might change answers (Thompson et al., 2011). Using more than one factor when studying academic achievement has been more significant than using a single factor. For example, certain character attributes like grit are considered a hierarchical construct because the interaction between sub-constructs formulates it. Learners' perseverance in reaching goals and consistency in sustaining long-term interests are the two sub-constructs of grit (Duckworth & Quinn, 2009). Grit was proven to impact students' academic achievement (Sebesta, 2019; Duckworth et al., 2007). Additionally, predicting academic achievement based on the overall measure of grit is stronger than using each sub-construct individually (Duckworth et al., 2007;

Duckworth & Quinn, 2009). Students who believe in their perceived academic control tend to have a high academic achievement (Richardson, Abraham & Bond, 2012; Stupnisky et al., 2012) and to utilise metacognitive strategies (Perry et al., 2001) and self-regulated learning and goal-setting strategies (Phillips & Gully, 1997).

Johnson (2016) describes teachers as the significant variable to impact the teaching and learning processes and, consequently, the quality of education. Other researchers (Chingos, Whitehurst & Lindquist, 2014; Detterman, 2016) disagreed with Johnson's point of view which ignored students' characteristics and their contribution to academic achievement. The literature highlights the importance and influence of students' characteristics, attitudes, and cognitive ability to predict SAT achievement, more than the school they attend (Cullen, Hardison & Sackett, 2004; Detterman, 2016). They supported their findings by indicating that teachers' effect as a major contributor to impact students' achievement decreases when we include variables and factor in students' characteristics or background rather than schools (Chingos, Whitehurst & Lindquist, 2014; Detterman, 2016).

A group of researchers conducted studies to accurately predict students' academic achievement specifically in mathematics subjects based on students' mathematical aptitudes, attitudes toward mathematics, and prior attainment in mathematics (Wisenbaker & Scott, 1997; Wisenbaker, Nasser & Scott, 1998; Wisenbaker, Scott & Nasser, 2000). The studies concluded that students' attitudes toward mathematics improved over the course, where the accuracy of mathematical achievement prediction increases. Another main finding was the moderate positive correlation between mathematical aptitude and achievement. The study recommended investigating more factors that might affect students' performance.

Other studies used a socio-educational structural model (Lalonde & Gardner, 1984; 1993) to predict achievement in statistics using students' attitudes, aptitudes, and mathematics effort. The studies concluded a direct relationship between aptitude and achievement and an indirect relationship between anxiety and achievement. They highlighted the indirect effect of the relationship between the combination of attitudes towards mathematics and motivation and the level of anxiety to predict performance in mathematics.

Nasser (2004) examined the predictability of students' achievement in statistics based on attitudes towards mathematics, anxiety, motivation, and mathematical aptitude. One hundred and sixty-two preservice teachers were enrolled in introductory statistics courses to teach primary and middle school students. The study found a large effect of mathematical aptitude on achievement in statistics. Additionally, the combination of attitudes toward mathematics, anxiety, motivation, and mathematical aptitude accounted for 36% of the learners' achievement statistics variance. This means that the combination of cognitive and affective factors can explain 36% of students' mathematics achievement. In comparison, mathematical aptitude alone can explain 22% of the variance in students' achievements, while the rest of the variables can explain 14% of the achievement variance. The following model shown in Figure (2.7) was proposed as a potential structural model of achievement in statistics (dependent variable) based on the direct and indirect relationship among a combination of cognitive and affective factors (independent variables). The model is based on theoretical and empirical research in the field about the interrelation among cognitive, affective, and performance dimensions underlying academic achievement (Aiken, 1980; Duckworth & Kern, 2011; Stadler et al., 2016; Nasser, 2004; Stankov et al., 2012).

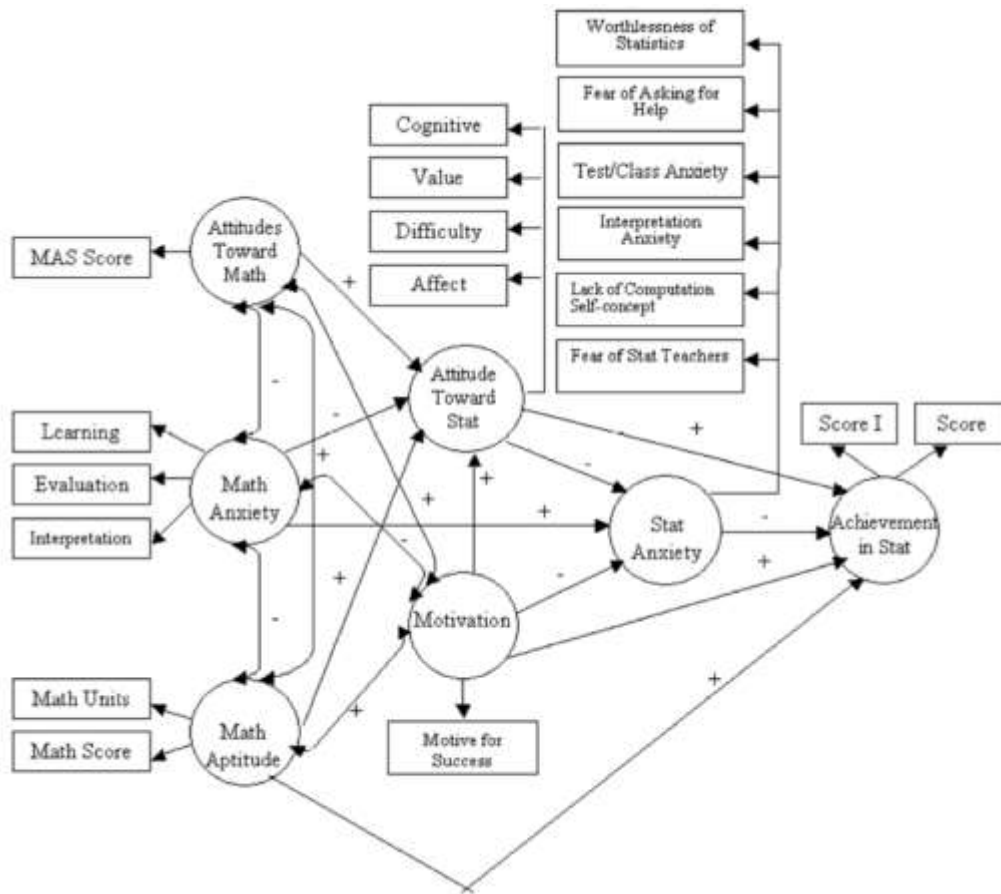


Figure (2. 7): The Hypothesised Structural Model of Achievement in Statistics (Nasser, 2004, p.5)

The SEM was employed to examine the relationship between the factors, which consist of students' cognitive, affective, and mathematics achievement. The EQS Multivariate Software was implemented with the SEM analysis to assess the hypothesised model's adequacy to the data (Bollen & Long, 1993). Estimating the parameters is another reason behind following the structural modelling approach besides assessing if the hypothesised model fits the data, which guides the research on the consistency of the empirical relationships among the model variables. Moreover, the model parameter estimates imply the level and direction of the relationships among the variables.

Findings concluded that the SEM in Figure (2.7) yielded a very poor fit and that assessing anxiety in isolation with including it in mathematics attitudes is unsuccessful. Therefore, the study found that it was better to establish the relationship between mathematics anxiety, attitudes toward mathematics, then mathematics achievement in the literature than the direct parallel relationships. To improve the model, factors from the statistics anxiety were excluded, as shown in Figure (2.8). The finding from this study was supported by other studies (Chingos, Whitehurst & Lindquist, 2014; Detterman, 2016), that investigating attitude towards learning as a multivariable that includes attitude towards teachers, schools, and learners' characteristics within the affective domain is more accurate than investigating each variable individually.

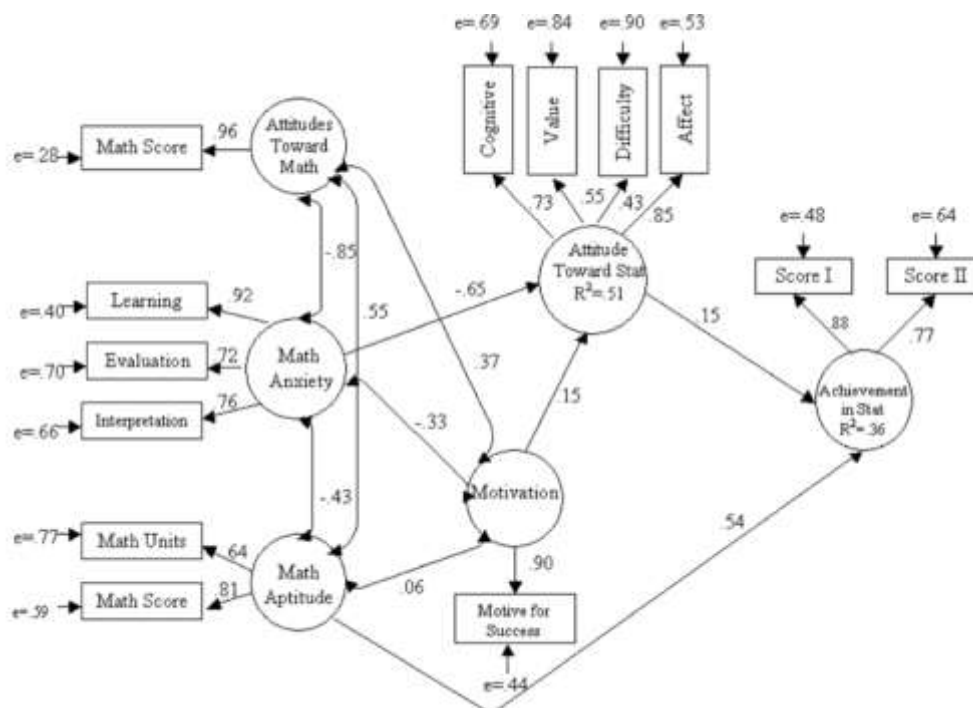


Figure (2. 8): The Final Structural Model of Achievement in Statistics

(Significant structural paths only) (Nasser, 2004, p.13)

As discussed earlier in the literature, the findings from previous studies (Quinn-Nilas, Kennett & Maki, 2019; Vizoso, Arias & Rodriguez Perez, 2019) similar to Nasser's (2004) study that are based on SEM are critiqued by other researchers (Guo, Perron & Gillespie, 2009; Tarka, 2017). As stated earlier, the argument is based on concluding relationships between variables

or factors relying on statistical and mathematical properties without supporting the findings with substantive explanation or establishing the external validity. Nasser's (2004) study showed another limitation due to the sample size especially as the produced model included highly parameterised models and low reliability of indicators. The recommendation is to conduct similar studies with a larger number of participants. Moreover, the study measured students' achievement in statistics using written assessment consisting of a limited number of open-ended questions which does not assess students' knowledge and skills adequately. The study also used five different types of surveys to measure students' attitudes toward statistics and mathematics, statistics and mathematics anxiety, and motivation. The number of surveys including the number of self-reporting statements in each survey might be overwhelming for participants which affect the accuracy of their responses. On the other hand, students' mathematical aptitude was not measured using a specific aptitude test. The study relied on the participants' high school scaled scores and the numbers of covered units in mathematics to calculate their aptitude in mathematics. Using a more valid and reliable tool that measures students' aptitude would enhance the validity and reliability of the collected scores. As will be discussed later in the literature including VR, NVR, QR and SA questions/batteries would increase the accuracy of predicting students' academic achievement (Lakin, 2012; Lohman, 2005).

Later on in the educational psychology field, focus has been given to teaching activities that promote students' cognitive and metacognitive skills (Veenman, Van Hout-Wolters & Afflerbach, 2006). A quantitative longitudinal study aimed to examine the predictability of 151 fifth-grade students' achievement in the New York State Mathematics Assessment (NYSMA) using the mathematics formative assessment Acuity Predictive Assessment (Acuity) that measured students' progress over the year and its relationship with students' cognitive ability measured by the CogAT (Gonzalez, 2015). Lohman (2005), the CogAT test developer,

advocates including quantitative and verbal components along with the non-verbal components to better predict future academic achievement. The reason behind this is the argument that academic achievement is predicted more accurately based on previous academic attainment combined with aptitude measurements. Lakin (2012) studied each battery's relationship in the CogAT test and grades 3 and 4 Arizona standardised test results. Lakin (2012) argued that including the VR components with all other components is beneficial, especially if the students are English Language Learners (ELL) because the verbal components will identify the achievement gap. Lakin (2012) added that ELLs' VR battery results are limited in the VR component's validity, reliability, and psychometric qualities. It is important to point to the challenge to generalise results from multidimensional tests because the results will differ based on the population; for example, ELL participants' results will be different from those dealing with diverse sampling.

Gonzalez's (2015) longitudinal study aimed to examine the predictability of 151 fifth-grade students' mathematics assessment scores from 2011-2013 in the NYSMA using their scores in the formative assessment in mathematics Acuity that are based on their aptitude level measured by the CogAt scores. The correlational test concluded positive moderate correlations between the two tests. Stepwise multiple regression analysis indicated that students' initial academic level in mathematics and their aptitude level predicted their current achievement in mathematics (Acuity assessment). Moreover, the aptitude level and the initial achievement test combined predicted 44% of the variance in students' mathematics achievement in the Acuity (Gonzalez, 2015, p.4). The study's significance has provided policymakers with feedback about the usefulness of choosing certain types of assessment to predict students' performance and progress (Gonzalez, 2015). The study also recommended providing teachers with proper professional development to utilise the cognitive ability test results to meet students' needs, predict their achievement and give feedback on teaching and learning processes (Gonzalez,

2015). The study limitation is in the sample size where a larger population could help in increasing the predictive validity of the district assessment. Hence the study included elementary students and mathematics scores only; it is recommended to expand the scope of the study to include English language and secondary students. The study used the NYSMA that is based on the mathematics CCSS, however including students' reading and language usage scores related to the CCSS especially at that early age would shed more light on other variables that might affect their mathematics achievement.

A similar longitudinal study investigated 17 to 23 year old students' variation in EFs (Friedman et al., 2016). EFs are the cognitive processes that do not include a learner's IQ (Friedman et al., 2006; Friedman & Miyake, 2017). Study findings by Friedman et al. (2016) concluded that the environment has a major influence on EFs' variation rather than the growing (age). Other studies (Lee et al., 2013; Lehto et al., 2003) that had targeted adolescents and adults addressed two major findings: first, the multifactor solution for EF variables fits better than individual factor solutions, indicating the preference to keep the cognitive factors as distinct components. Second, the attainment measures should be investigated in specific subjects related to the individual cognitive abilities.

The review of studies by Friedman et al. (2016). Gonzalez (2015), Lee et al. (2013) and Lehto et al. (2003) concluded that investigating the relationship and predictability of students' academic achievement based on their current attainment and aptitude should consider a large sample size and specific subject when collecting data. Moreover, considering the students' age group should be combined with other influential factors such as the environment and the different batteries/factors within the general aptitude level, specifically since previous studies indicated that aptitude level and factors such as attitude and motivation can explain the

variation in students' academic attainment and intelligence level (Best & Miller, 2010; Best, Miller & Jones, 2009; Best, Miller & Naglieri, 2011; Cragg & Gilmore, 2014).

Academic, cognitive, and affective factors significantly correlate with academic achievement, yet limited studies have investigated them together to predict academic performance. Variables like academic level, subject confidence, beliefs, and attitude towards learning have been proven to play a main role in students' achievement in English, science, and math (Donati, Meaburn & Dumontheil, 2019; Furinghetti & Morselli, 2009; Johnson-Laird, Khemlani & Goodwin, 2015; Lee, 2009; Lee & Shute, 2010; Marsh et al., 2006). The previous literature recommended investigating various variables simultaneously that might affect academic achievement from psychological, environmental, cognitive, social, and demographic aspects (Alonazi, 2018; Hamaideh & Hamdan-Mansour, 2014; Kilminster et al., 2007; Mushtaq, 2012). The following section will shed more light on those recommendations.

2.3.8 Multiple Data Sources in Predicting Academic Achievement

Several studies have attempted to develop prediction models of students' achievement utilising different data sources and variables such as demographic information (Dejaeger et al., 2012; Dennis, Phinney & Chuateco, 2005; Guruler, Istanbulu & Karahasan, 2010; Petty, 2014), motivation (Bong 2001; Hulleman et al., 2010), and behavioural data (Jayaprakash et al., 2014); few studies have investigated all these variables simultaneously in a prediction model (Hong, 2018). Specific demographic information variables are significant in predicting students' performance and choices in the STEM field (Moakler & Kim, 2014; Wang, 2013). Prediction models that combine multiple data sources and types concluded improved accuracy compared to the models with individual source types. The following sections covered the literature highlighting studies and methods about predicting academic achievement

The literature has shown a growing interest in the use of algorithms and methodologies that can predict students' performance to improve academic achievement (Baker & Yacef, 2009; Pistilli, Willis & Campbell, 2014, Pritchard & Wilson, 2003; Romero et al., 2010; Zajacova, Lynch & Espenshade, 2005). However, these studies are debatable because they focus on context, educational theories, and demographic information rather than including students' learning behavioural data and interpreting events during the learning experience (Hong, 2018; Marques-Vera et al., 2013).

Many variables could be examined when studying factors that might affect high school students' academic achievement. The literature has shown that the variables are either academic variables such as current subject attainment, GPA, national or international exams, standardised tests, and aptitude tests; demographic variables like ethnicity, age, gender, and parental engagement and education; or psychological variables such as perceived learning capability, anxiety, stress, self-regard, and attitudes toward learning or a subject. Hence, a high level of cognitive abilities predicts high academic achievement. High academic achievement in high school predicts high academic performance in college; thus, universities use high school attainment as a criterion for accepting students (Alonazi, 2018).

In conclusion, to ensure academic success in high school and high-stake assessments, it is important to investigate which variables can be utilised to predict academic achievement and significantly affect students' academic performance. Hong's (2018) study investigated the relationship and examined the role of metacognitive learning processes, students' characteristics, and motivation in their academic achievement. The findings concluded that employing multiple data sources and approaches is more accurate and adds depth and various dimensions to the study. Triangulating the methodological approach and types of data resources supported the study's empirical findings (Hong, 2018). The review of Hong's (2018)

study confirms what previous studies concluded, that there is a limited response of participants to self-reporting tools which is not sufficient to capture participants' actual learning behaviour and perceptions (Cromley & Azevedo, 2006; Winne, 2005). To understand the learning processes from different perspectives, data should be collected from multiple data sources such as questionnaires, assessment information, and follow up interviews.

Researchers have examined limited aspects of cognitive theories and their impact on students' academic achievement. Christian's (2017) study targeted 367 undergraduate students by investigating their perceptions about seven cognitive factors and how these can predict students' academic performance. The study concluded that beliefs about intelligence, goal orientation, academic self-efficacy, performance-avoidance goals, stereotype threat and vulnerability, self-handicapping, and casual uncertainty directly predicted students' GPA achievement. Theories of intelligence indirectly predicted academic achievement, with the rest of the factors acting as mediators. The findings highlighted the importance of exploring students' beliefs and perceptions about factors that might affect their performance. Such studies help bridge the potential discrepancies between learners' perceptions and implicit theories to develop proper intervention plans (Christian, 2017). The study acknowledged that one of its limitations is solely using a self-report data source because it might have a social desirability response bias. Therefore, the study recommended including in the reporting data more actual assessment-based data or direct observation (Barker, Pistrang & Elliott, 2002).

A study in Saudi Arabia confirmed that positive correlation with coefficients equals 0.93 between the Saudi National Achievement Exam and Aptitude Exam (Al-Alwan, 2009). Both exams comprise two parts: linguistics and mathematics. The study targeted first-year college students to predict their academic achievement (GPA) in the first year of college, based on high school academic achievement, demographic, and psychological factors (Alonazi, 2018). The

investigated factors comprised six variables: high school score, aptitude test, attainment test, gender, stress, and parents' education level. The findings are aligned with the literature, that previous academic attainment was the strongest predictor of academic achievement (Al-Alwan, 2009; Newton et al., 2007; Olani, 2009), followed by the rest of the factors. One of the significant findings is developing a model that can predict students' academic achievement in college. The model accounted for around 18% of the variance in students' GPA in college, where high school GPA was ($\beta=0.15$), Saudi achievement test was ($\beta=0.14$), and aptitude test was ($\beta=0.15$). The participants were 91 male students, and their mean high school score was 95.5 out of 100 while their aptitude mean score was 82.3 out of 100. This mean that all participants were high achievers with a high aptitude level which limited the study findings to a similar population.

Students with a positive attitude towards self and school tend to be self-regulated learners who have perceived learning capabilities, utilise different learning strategies, and monitor and control learning processes and their own progress (Christian, 2017; Schunk, 2001; Zimmerman, 2001). The predictive power of students' positive attitude towards learning on their academic achievement is well-supported in the literature (Lee, 2009; Lee & Shute, 2010; Marsh et al., 2018; OECD, 2018b). Marsh et al. (2006) concluded a moderate, strong correlation between both reading and mathematics achievement and self-concept ($r= 0.30-0.33$). Self-efficacy and self-concept had a range of correlation ($r= 0.27- 0.34$) with reading and math achievement. Attitude towards mathematics and mathematics academic achievement in PISA-2003 have fairly strong relationships ($r= 0.41$) between mathematics achievement and math self-efficacy, and ($r= 0.23$) between mathematics achievement and self-concept (Lee, 2009).

The inverse relationship has also been verified in the literature. When students perceive that their cognitive abilities and learning skills are effective in helping them to achieve learning goals, their attitude towards learning improves (Mayer et al., 2014; Schunk, 1991), and academic achievement is enhanced (Grootenboer & Hemmings, 2007; O’Neal, 2019; Viljaranta et al., 2014; Zan et al., 2006). Students with positive self-regard tend to have cognitively oriented learning behaviours and metacognitive learning strategies (Pintrich & De Groot, 1990; Schunk, 1991). Students’ learning skills and metacognitive awareness play the main role as a mediating variable in the effect of aptitude and attitude towards learning on students’ academic achievement (Christian, 2017; Schwinger et al., 2009).

The process of taking the assessment and receiving feedback was found to influence academic self-regard (Baadte & Schnotz, 2014; Viljarante et al., 2014) and enhance students’ learning strategies and goal setting, which impact academic achievement in general (O’Neal, 2019), as well as in reading and math (Pesu et al., 2016). This process is well explained by the Metacognitive Learning Theory (Schraw & Moshman, 1995), Information Processing Theory (Mayer, 1996; Schunk, 2012), and Goal Setting Theory (Locke & Latham, 2002). The key learning strategies that have been recognised in an international assessment like PISA (OECD, 2010) and in literature (Cardelle-Elawar, 1992) are: 1) control by identifying what they know and what they did not understand; 2) elaboration by connecting new knowledge to prior knowledge and making the real-world connection, and finally 3) memorisation. The studies about using the previous strategies and PISA test concluded a moderately strong correlation between students’ utilisation of control and elaboration strategies and students’ PISA achievement (OECD, 2010). Previous PISA reports confirmed the same findings and added that control strategies had the strongest correlation with reading and mathematics achievement (OECD, 2004a, 2010). The goal-setting process to achieve a certain learning target or grade is part of the students’ learning strategies (Haahr, 2005), where the process of goal setting

involves planning for a future target and comparing it to the current reality (Oettingen & Gollwitzer, 2009). This process is defined by the Goal Setting Theory (Locke & Latham, 2002) where detailed assessable objectives inspire individuals.

In chapter two, the literature review covered the different types of assessment that target students' academic attainment, aptitude, along with attitude towards learning and how they have been utilised to predict students' achievement in high-stake assessments, indicate a positive relationship between each type of assessment individually and the academic achievement (Berkowitz & Stern, 2018; Reggianini, 2017). Other studies confirmed the increase of the percentage of predictability of students' achievement when the predictors are two or more different types of assessment rather than only one predictor (Beesley et al., 2018; Chen et al., 2012; Detterman, 2016; Marshall, Smart & Alston, 2017). The literature concludes that the more variables and factors predicting academic achievement the research investigates, the more accurate and in-depth information the findings will conclude (Gonzalez, 2015; Thum, 2011).

There is a great focus in the literature on documenting the relationship between the cognitive, affective, academic domains, and academic achievement (Lee & Stankov, 2016). Overall, the studies investigating the relationships between cognitive and affective factors underlying academic achievement in international assessments are limited. To accurately investigate and predict academic achievement, the first step would be to identify the factors known as independent variables, then categorise and investigate their role in predicting academic achievement rather than only relying on a hypothesised structural model and equation to predict academic achievement as a dependent variable. Although recent studies point to the importance of including attitude towards self and learning in predicting academic achievement (Stankov et al., 2012; Stankov, Morony & Lee, 2014), conclusions in the literature about the

predictability of subject-specific academic achievement based on the combination of current subject attainment, aptitude, and attitude towards the subject are not fully established.

Another debate in the literature about investigating the relationship and predictability of students' academic achievement using their attainment, aptitude and attitudes toward learning is related to the methodological approach and instrumentation. Three points are summarized from that debate. First, using SEM or any other methods that rely solely on data using statistical and mathematical calculations without considering the external validity, theoretical perspective, and substantive explanation affects the reliability and validity of the findings. Second, another argued point is related to instrumentation. The assessment data should be collected from a valid and reliable tool administered under more or less similar conditions and based on clear standards and criteria in content and grading. Third, the debate related to relying on self-reporting tools only when collecting stakeholders' perceptions, especially when participants might be inconsistent between what they report and their actual attitude and behaviour. Therefore, investigating the relationship between the study's factors should be compared and explained using quantitative and qualitative data from different sources to shed more light on factors affecting students' academic achievement.

In conclusion, although there is a major focus on studies that investigated the predictability of school age students' academic achievements using their cognitive ability and attitude levels (Brock et al., 2009; Gilmore et al., 2013), few studies have investigated the variation in the effect of cognitive abilities on academic attainment in a specific subject (Donati, Meaburn & Dumontheil, 2019). Other studies put more focus on the role of students' attitudes toward the subject in their engagement and academic achievements (Lipnevich et al., 2011, while other studies debated attitude has a higher impact on achievement than cognitive ability (Lipnevich, Preckel & Krumm, 2016).

The literature points to a gap and insufficient studies that link cognitive ability level, academic attainment, attitude towards learning, and student achievement. US-curriculum schools run aptitude, attitude, and curriculum-based assessments without utilising them to predict students' academic achievement, especially given that universities require predictive assessment for placement and acceptance purposes. The literature has further shown limited numbers of conducted studies to investigate the predictability of students' SAT scores using their CAT4, MAP, and PASS scores (Cullen, Hardison & Sackett, 2004). Both empirical and theoretical perspectives support the links between the factors in the current study. The factors are related, but they also share a common group of antecedents and outcome variables. Little research has been conducted to examine the structure and impact of the factors in predicting academic achievement. The relationship between the factors as independent variables and the outcome as dependent variables may clarify the relationship between major educational cognitive, affective factors, and academic achievement.

Chapter Three: Methodology

The methodology chapter provides details on the chosen research design and chosen methods, participants, instrumentation, data collection, and pilot study. The validity and reliability of the study's instruments were examined by piloting the questionnaires. In addition, the trustworthiness of the study is discussed while identifying the procedure, ethical issues, and expected results.

3.1 Research Approach

In the current study, the researcher aimed to maximise the benefits from the qualitative and quantitative approaches by embracing the two extremes, bridging the gap between the other approaches, utilising deductive and inductive reasoning, and having a more flexible research design (Cohen, Manion & Morrison, 2018; Johnson & Christensen, 2020). Consequently, the pragmatism philosophical rationale underpins the current study's mixed research design to address the study questions and the related circumstances in a reflexive and flexible approach (Johnson & Christensen, 2020, p.445). Since the foundation of the pragmatism philosophy by Peirce (1934), James (1910), and Dewey (1998), pragmatist philosophy is well known as the philosophy that focuses on mixing research components and using what works for the specific situation, context, and research question (Johnson et al., 2017; Johnson & Christensen, 2020). Therefore, pragmatism has been chosen by researchers who based their study approach on bridging the gap between positivist and constructivist approaches to utilise the benefits of both (Shannon-Baker, 2015). While qualitative research generates theories, quantitative research tests those theories (Creswell, 2014).

Supported by Johnson et al. (2007) and Cohen, Manion and Morrison (2018), the researcher adopted the mixed-method approach because it supported the integration of numeric and narrative approaches, samplings, databases, and instrumentations which fulfilled the objectives

of the study. Moreover, the mixed-method approach provided the opportunity to test various assumptions and to investigate real-world problems that include quantitative and qualitative data (Cohen, Manion & Morrison, 2018).

As stated in Chapter 1, this study aims to investigate the predictability of SAT achievement using three different types of assessment (i.e., students' academic attainment using the MAP test, aptitude level using the CAT4 test, and attitude towards learning using the PASS test), and then explore the stakeholders' perceptions about the findings. To achieve this aim, the research approach needed to be based on evidence to assess which theoretical representation of the relationship between the different assessment data leads to interpretable and reliable measures to predict students' academic achievement. Consequently, the current study followed a sequential explanatory mixed-method research approach that includes both quantitative and qualitative methods (Johnson & Christensen, 2020; Johnson et al., 2014). Quantitative methods are needed to answer the research questions related to data analysis of assessment scores for building the prediction equations and models and to analyse the stakeholders' questionnaires (i.e., RQ1, RQ2 and part of RQ3) (Cohen, Manion & Morrison, 2018). On the other hand, qualitative methods are required to address the question related to studying the perceptions of the stakeholders about the role of the different types of assessment in predicting students' achievement in SAT (i.e., RQ3).

The mixed-method research approach brings strengths from the integration and combination of ideas from qualitative and quantitative research simultaneously (Johnson & Christensen, 2020, p.442). As argued by Creswell (2014), the characteristics of quantitative methods allow the researcher to stay neutral during the investigative process and explain the relationship between variables. However, because quantitative methods are limited in terms of providing

deep insight into participants' perspectives, qualitative methods could be used to fill this gap (as the case in the current study, i.e., understanding the stakeholders' perspectives). Qualitative information about perspectives enhances the understanding of the research problem (Johnson & Christensen, 2020, p. 443). In another words, the qualitative information can provide explanations for attitudes and behaviours while supporting researchers in understanding the meaning behind the responses (Creswell, 2014). The mixed-method research approach allows a researcher to identify and rectify the errors that might occur in a single approach (Johnson et al., 2017) and provides the researcher with the opportunity to test various assumptions, collect different types of data, and to investigate real-world problems that include quantitative and qualitative data (Cohen, Manion & Morrison, 2018; Creswell, 2014). The mixed-method research approach also enables the researcher to utilise deductive and inductive reasoning to investigate the problem from different dimensions (Cohen, Manion & Morrison, 2018, p.34). Also, Bowen, Rose and Pilkington (2017) and Creamer (2018) highlighted that collecting data sequentially through the mixed-methods approach allows more detailed explanation of the research problem. Furthermore, one of the mixed-method research's critical features is methodological pluralism, which widens the results and increases the rigour of data analysis compared to the individual method design (Johnson, Onwuegbuzie & Turner, 2007).

Typically, as shown in Figure (3.1), the sequential explanatory mixed-method research approach consists of two phases illustrating the integration of the quantitative and qualitative methods. In the first phase, quantitative data form assessment scores and questionnaires is collected and analysed (Cohen, Manion & Morrison, 2018; Fraenkel, Wallen & Hyun, 2015). In the second phase, the findings of the first phase provide feedback to guide another data collection (qualitative in this phase) and analysis of this data (Tashakkori & Teddlie, 2010).

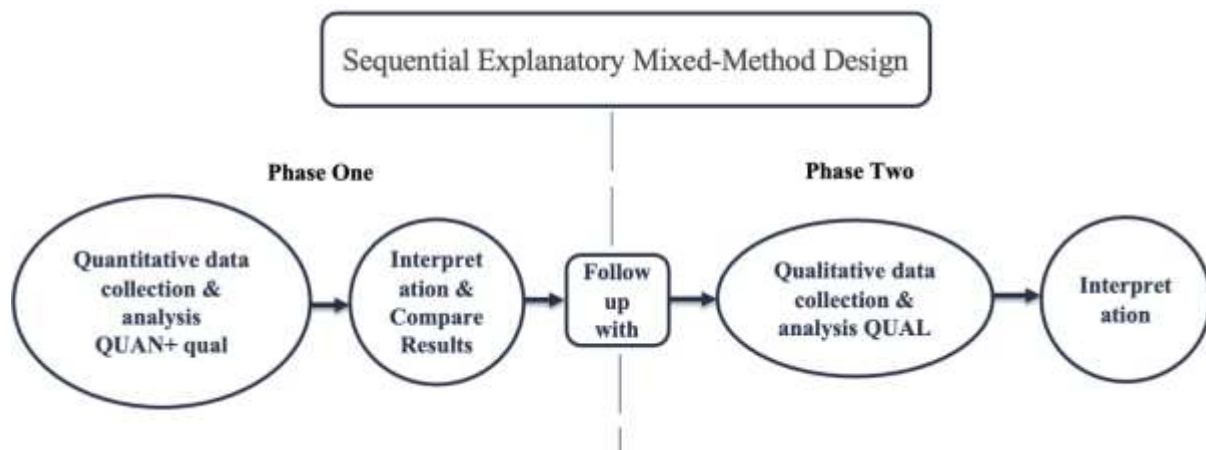


Figure (3. 1): Overview of the Research Approach

(Source: Author)

3.2 Research Design

The research problem, described in Chapter 1, aims to investigate and explain the relationship between the different types of assessment implemented in US-curriculum schools in the UAE, to come up with an equation to predict students' achievement in SAT while providing a more in-depth investigation into the stakeholders' perceptions of this phenomenon. To achieve this aim, as explained above in Section 3.1, the sequential explanatory mixed-method research design is adopted. This method consists of two phases – quantitative research (phase one) followed by qualitative research (phase two). In phase one, assessment data needs to be utilised to investigate and explain the relationship between the different variables to come up with an equation (a model) to predict students' achievement. Findings from analysing the assessment scores and questionnaires (quantitative data) in phase one were utilised to guide the development of the interview questions (qualitative data), in phase two.

The design of the study consists of two phases, as depicted in Figure (3.2) below.

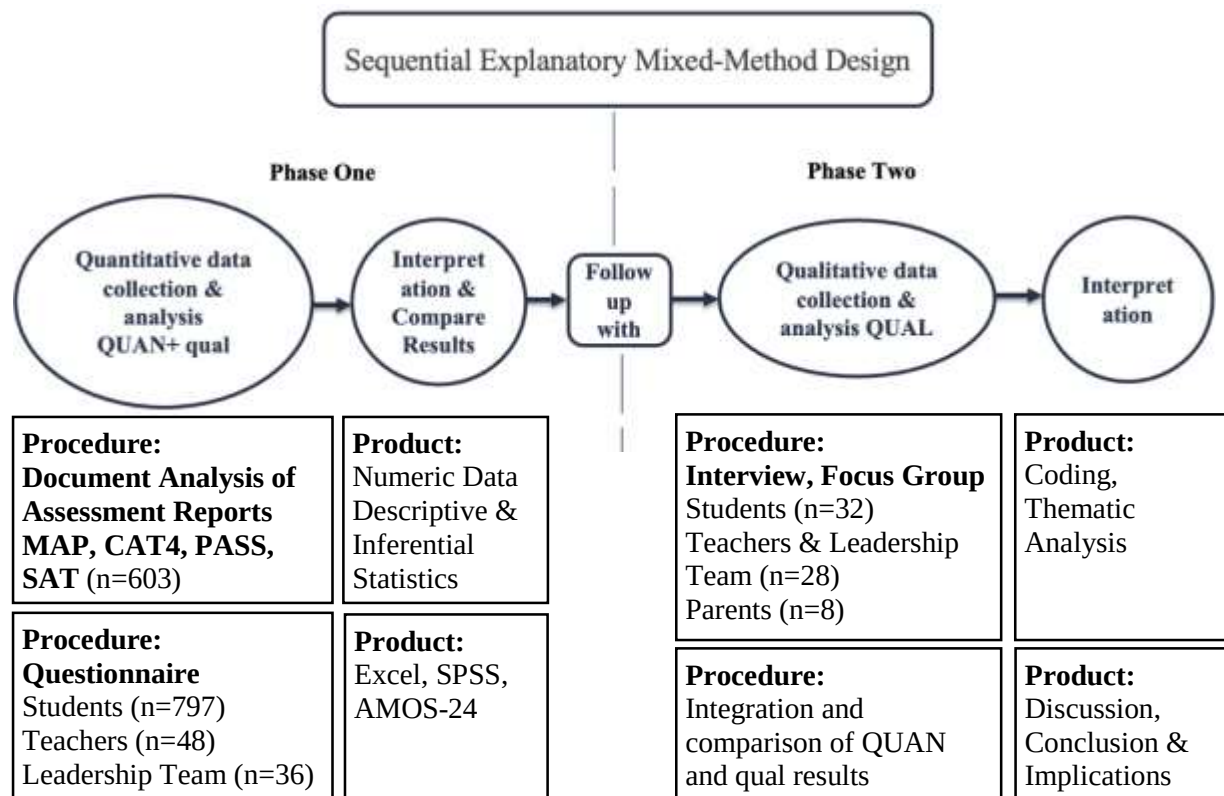


Figure (3. 2): Research Design
(Source: Author)

The first phase of the study aimed to investigate the relationship and predictability of students' academic achievement in SAT using their current attainment in MAP, aptitude level, and attitude towards learning. This took place through utilising the data from three types of assessment, namely the MAP, the CAT4, and the PASS test. The study also used stakeholders' responses to questionnaires to explore the role of the MAP, CAT4, and PASS assessments in predicting students' academic achievement in SAT. Phase one answers two questions of the study (RQ1 & RQ2). Data was collected concurrently using two main tools: document analysis of students' data from four assessments, and participants' responses to questionnaires consisting of major closed-ended questions and minor/three open-ended questions. Leadership teams, teachers, and students participated in phase one. Statistical analysis was applied to the numeric data collected from the first phase.

The second phase of the study aimed to explore qualitatively with more depth the stakeholders' perceptions about the role of MAP, CAT4, and PASS in predicting students' achievement in SAT. This phase fulfilled the second aim of the study and answered the third study question (RQ3). Findings from phase one were instrumental in developing the tools for the qualitative phase of the study (Creswell & Plano Clark, 2018; Johnson & Christensen, 2020). Semi-structured interview questions were used in focus groups with leadership teams, teachers, parents, and students.

3.3 Research Methods

This section covers the site (schools), scope of the study, population, sampling process and participants, instrumentation, and ethical consideration. Table (3.1) below illustrates the alignment between the research questions and the methods, data collection instruments, sampling method and sample size. Table (3.1) also illustrates how different approaches, participants, sampling techniques, instruments, and data analysis techniques were used to answer the research questions.

Research Question	Approach	Participants	Sampling	Instrument	Data Analysis
RQ1) What is the relationship between students' attainment in MAP, aptitude level in CAT4, attitude towards learning in	Quantitative	Grades 9-12 students who took the MAP, CAT4, and PASS in the past three years (n= 603)	Purposeful-Comprehensive	MAP, CAT4, PASS and SAT test scores collected from document analysis of reports	Correlation

PASS, and SAT achievement?					
RQ2) How can the attainment in MAP, aptitude level in CAT4, attitude towards learning in PASS predict students' achievement in SAT?	Quantitative	Grades 9-12 who took the CAT4, MAP test and PASS in the past three years (n=603)	Purposeful-Comprehensive	MAP, CAT4, PASS and SAT test scores collected from document analysis of reports	Multiple Regression
RQ3) What are the stakeholders' perceptions about the role of attainment in MAP, aptitude level in CAT4 and attitude towards learning in predicting SAT achievement?	Quantitative & Qualitative	Senior and Shared leadership team; grade 11 and 12 teachers (n=84)	Purposeful-Comprehensive	Questionnaire Open- & Closed-ended	Descriptive Statistics
		Senior and Shared leadership team; grade 11 and 12 teachers (n=28)	Purposeful	Focus group	Thematic
	Quantitative & Qualitative	Grades 9-12 students (n=797)	Comprehensive	Questionnaire Open- & Closed-ended	Descriptive Statistics
		Groups of students each includes 6-8 students (n=32)	Convenience	Focus group	Thematic
	Qualitative	Four groups of parents (n=8)	Convenience	Focus group	Thematic

Table (3. 1): Alignment between Research Questions and the Methods

(Source: Author)

To answer RQ1 and RQ2, quantitative data was collected and categorised according to the study variables. Academic attainment, aptitude, and attitude towards learning formed the independent variables in the current study as factors falling under academic, cognitive, and affective domains respectively. The relationship between those independent variables was investigated as factors that might contribute to students' overall academic achievement in SAT, which was the dependent variable. Once the relationship between variables was confirmed by applying the correlational analysis, the study investigated how the predictor (independent) variables could predict the criterion (dependent) variable using multiple regression analysis to find the correlation coefficient. Therefore, the predictive relationship between the attainment

in MAP test, aptitude level, and attitude towards learning on students' SAT achievement was also studied. Other quantitative and minor qualitative data were collected from the stakeholders' questionnaires while qualitative data was collected from the focus group interviews.

Finally, the last part was related to the RQ3 about stakeholders' perceptions where participants were identified along with the required sampling method and instruments. Quantitative and minor qualitative data were collected from the stakeholders' questionnaires while qualitative data was collected from the focus group interviews. Focus groups are designed to draw out perceptions from participants about a particular topic and to generate ideas and concepts that will help the researcher to understand the subject area under study (Johnson & Christensen, 2020). The output from the focus group study is typically used to supplement and explicate constructs from the quantitative findings obtained from answering RQ1 and RQ2.

3.4 Study Context, Population, and Sites

Based on recent statistics, there has been a consistent increase in enrolment in private education in the UAE (Dubai Statistics Center, 2019). Figure (3.3) shows the number of private schools distributed by the educational zone across the UAE, where Dubai has the greatest number of private schools, followed by Abu Dhabi (MOE.Gov, 2019).

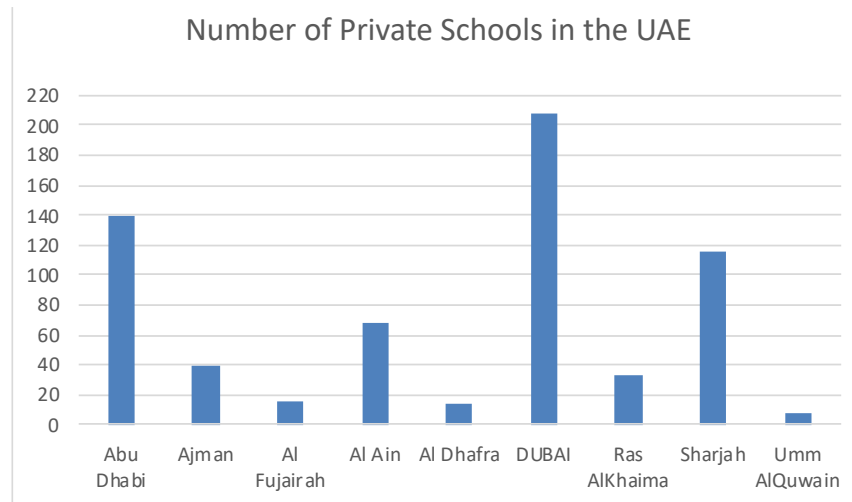


Figure (3. 3): Number of Private Schools in the UAE
(Source: Author)

The UAE has also witnessed an increase in interest in foreign education specifically, which is reflected in the increase in the number of international schools, offering around 17 different curricula. Based on recent data from the Ministry of Education in the UAE, over the past few years there was an increase in the number of international schools to 624 schools serving 627,800 students (MOE.Gov, 2019). Most of these schools are located in Abu Dhabi and Dubai. Figure (3.4) shows the distribution of private schools per curriculum in Abu Dhabi and Dubai as per 2020 statistics (KHDA, 2020; ADEK, 2020).

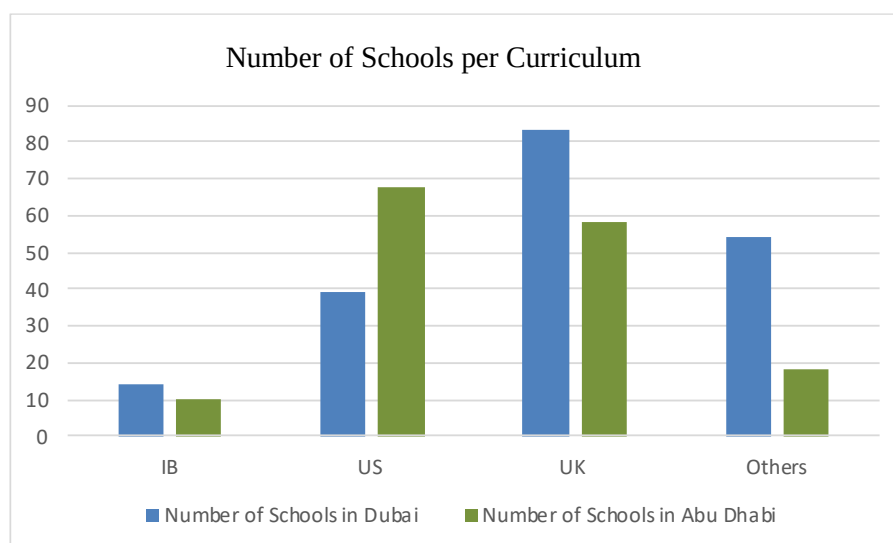


Figure (3. 4): Distribution of Private Schools per Curriculum
in Dubai and Abu Dhabi (Source: Author)

The British curriculum represents the most popular education system in the UAE, followed by the US curriculum as the second most popular. Sixty-eight schools offer a US curriculum in Abu Dhabi (ADEK, 2020). Simultaneously, in Dubai, around 90% of the students are enrolled in private schools (Dubai Statistics Center, 2019). Thirty-nine schools offer a US curriculum in Dubai, with around 43269 enrolled students (KHDA, 2020).

This study was carried out over ten months in international private US-curriculum schools in the UAE. The schools have been following the UAE's NAP since 2017, where the students must take the CAT4, MAP, and SAT. In addition, the schools also run the PASS test optionally to measure students' attitudes towards self and school to help in improving students' learning outcomes and wellbeing. The PASS test was added to the UAE's NAP guidelines in 2020 (KHDA, 2020). Accordingly, the current study's design was to collect students' intensive assessment data required to choose sites that run the above assessments. Therefore, the scope of the study was all private US-curriculum schools across the UAE that conduct those assessments.

Schools under the KHDA's supervision are requested to run the MAP, CAT4, and PASS. In contrast, schools under ADEK's supervision are requested to run only the MAP test and optional assessments. Schools in other Emirates are given a choice to run CAT4 and PASS. Based on the study objectives and the investigated assessments, the target schools are the US-curriculum ones that run MAP, CAT4, PASS, and SAT. One of the US diploma requirements is to take the SAT-Mathematics test and any English proficiency test.

Therefore, the selected sites are K-12 US-curriculum schools in the UAE. Five schools were chosen because they implement the targeted assessments. The schools also implement the

Common Core Standards in English and mathematics and the Next Generation State Standards in Science. The students take the MAP at least twice a year to measure their attainment and progress against the curriculum standards. CAT4 is conducted once every two years. Schools choose to run PASS tests to enhance students' attitudes towards self and school and to triangulate PASS results with CAT4 and MAP. Attached is Appendix A, listing the UAE's NAP, the required assessments, and their timeframe (KHDA, 2020). Due to the researcher's nature of work, preliminary approval was requested, and the study's objectives were explained. Finally, a formal letter for conducting the research was shared.

3.5 Sampling and Participants

The external and international assessments investigated in the current study were conducted in UAE schools that implement the US curriculum. The scope of the study included the high school phase where students take the MAP, CAT4, PASS, and SAT assessments. Grade 9-12 students take all the assessments except the SAT, which grades 11 and 12 students mainly participate in. However, schools start preparing the students to take the SAT from grade 9 by taking SAT mock tests or PSAT. Consequently, the study population was all grade 9 to 12 students, along with their teachers, shared and senior leadership teams in US-curriculum schools in the UAE that participate in the four assessments: MAP, CAT4, PASS, and SAT. The whole population was 797 grades 9-12 students, 48 teachers, 36 leaders and teachers, and eight parents. The participating students were only the students who took the four assessments.

Data collection took nine months to achieve the study target, and especially since collecting primary data and gaining access to the site and sampling were challenging processes. The researcher contacted the authority to collect data about the different types of assessment conducted in US-curriculum schools. The investigated topic in the current study was

considered to be confidential and sensitive topic because it is related to assessment data which affects a school's reputation and rating by the authority. The leadership's fear of sharing such information is a well-known challenge in research because findings might impact the institution or the employees negatively (Saunders, Lewis & Thornhill, 2009). Furthermore, the study took place during the Covid-19 pandemic, where the researcher and schools faced many challenges due to restrictions and social distancing rules. The authority requested all schools to run three different models, namely the Remote Learning Model where all students attend school online, the On-site Learning Model where students attend schools physically but with social distancing rules, and finally the Blended Learning Model where students attend certain days on-site and other days remotely.

All US-curriculum schools were contacted to get access. Considering all the previous factors, the researcher obtained the required permissions and consent forms earlier. Online meetings were conducted with each school individually to explain the purpose and the process of the study and to share the study permission (Appendix B) and participation consent form (Appendix C). After meeting schools and introducing the topic, some schools fulfilled the requirement of the study and accepted to participate in the study. The study's first phase took seven months, starting from the beginning of the academic year (September 2020), while the second phase took three months from April to June 2021. The researcher collected the number of students, staff, and assessment information about the schools participating in the study. The researcher faced a challenge in the number of students who took the SAT, especially because some students missed the assessment due to pandemic restrictions.

Sampling is crucial in the research process because it affects the reliability of the interpreted results (Cohen, Manion & Morrison, 2018). The sampling process depends on the study approach and study design (Johnson & Christensen, 2020). Hence the study objectives

influence the type of sampling strategy, as stated by Onwuegbuzie and Collins (2007), random sampling does not fulfil the current mixed-methods study objectives. They add that purposive sampling is the most suitable in mixed-methods research when the goal is to maximise the understanding of the research problem and obtain insight into particular events or phenomena. Therefore, in the current research, the goal was to find the predictability of high school students' SAT scores using their MAP, CAT4 and PASS scores. Moreover, no students who took the tests were excluded. Therefore, based on conditions mentioned above, the comprehensive purposeful sampling strategy was the most appropriate to address the research problem (Cohen, Manion & Morrison, 2018). The same was the case for other participants who were selected purposefully because they dealt directly with the students.

Johnson and Christensen (2020, p.261) recommended using Onwuegbuzie and Collins' (2007) mixed sampling framework that classifies the sampling designs into two criteria: 1) the first criterion is based on time, where the quantitative and qualitative phases take place sequentially or concurrently; and 2) the second criterion is based on the sample relationship, whether they are either identical, nested, multilevel, parallel, nonparallel, or collected in combination. The sequential time orientation criterion refers to the data collected from the sample in the first phase of the study to shape the sample selection in the second phase (Johnson & Christensen, 2020). In phase one, students' samples were considered identical concurrent sample relations because they simultaneously answered quantitative and qualitative components in the questionnaire, and their assessment data was collected. While in phase two, a nested sequential sample relation was considered because the students chosen to participate in the focus group in phase two were a subset group of the students who had participated in phase one, and they were chosen based on the outcomes of the first phase (Johnson & Christensen, 2020, p.261). School leadership and teacher participants were identical sequential sampling designs where the same participants answered the questionnaire in phase one then participated in the focus

group interviews in phase two. This kind of selection provides an in-depth understanding of the study problem and exposes other possible issues (Cohen, Manion & Morrison, 2018). The participation of parents was based on their availability and if they were willing to participate, so the sampling, in this case, was convenience sampling. The participation of students was also convenience sampling too based on the school selection of available students. This also allowed to eliminate pressure on stakeholders and efficiently recruited participants who were willing to take part in the interview.

In conclusion, the researcher targeted all the US-curriculum schools that participate in the four assessments: MAP, CAT4, PASS, and SAT. The population was high school students, their teachers, and the leadership team. The study participants were divided into five groups: 1) The senior leadership team that includes principals and directors; 2) The shared leadership team that includes curriculum/assessment coordinators, heads of departments, coordinators, and career/university counsellors; 3) high school English and mathematics teachers; 4) Grades 9 to 12 students; and 5) parents of high school students. Table (3.2) below shows the population in the participating schools and their categorisation.

Population Category	Senior Leadership Staff	Shared Leadership Staff	Teaching Staff	Students	Parents
Role	• Director-General • Deputy Director • Head of Section • Director of Assessment • Director of Curriculum	• Head of Math Department • Head of English Department • Head of Inclusion • Math Coordinator • English Coordinator • Career/University Counsellor	• High School Math Teachers • High School English Teachers • Teachers with Coaching Role	• Grade 9 Students • Grade 10 Students • Grade 11 Students • Grade 12 Students	• Grade 9 Parents • Grade 10 Parents • Grade 11 Parents • Grade 12 Parents
Number	19	17	48	797	8

Table (3. 2): The Population and Categorisation in the Participating Schools
(Source: Author)

In the first phase of the study, the participants were: 1) A purposeful comprehensive sampling of 797 grade 9 to 12 students who took the CAT4 at least once in the past three years, MAP, PASS, and SAT. No participants were excluded unless one of the previous assessments was missing, to ensure that the relationship between variables was examined in a natural setting without influencing any variable (Cohen, Manion & Morrison, 2018; Johnson & Christensen, 2020). 2) A purposeful comprehensive sampling of 84 leadership team members and teachers. The purposeful comprehensive sampling was chosen to get adequate participation and cover all stakeholders' possible points of view to answer the study questions fully. The integration through connecting occurred in the current study in two points: when the questionnaires and assessment data were collected from the same participants and when the analysis of the assessment data and the questionnaires guided the sampling of the focus groups interviews.

In the second phase of the study, focus groups were based on the analysis of assessment data and questionnaires. Three focus groups were formulated in each school: 1) purposeful sampling of 28 leaders and teachers that involved grade 11 and 12 teachers, senior and shared leadership members in charge of the assessment. The participants in the focus groups of leaders and teachers were selected purposefully to ensure that each focus group included mathematics teachers, English teachers, school career/university counsellors, subject leads, curriculum and assessment coordinators, and at least one principal. 2) convenience sampling that involved eight parents, and 3) convenience sampling of 32 students. The parents' and students' samplings were also supposed to be purposeful, but due to the Covid-19 Pandemic, access to participants was limited so the school and the researcher had to select the parents and students based on their availability.

Table (3.3) below exhibits the participants from the five participating schools. Using comprehensive purposeful sampling, the researcher approached all the staff and students from the targeted schools that represented the study population and shared electronic questionnaires with them.

Participants Category		Total Number of Participants in Questionnaire			Total Number of Participants in Focus Group		
		Female	Male	Total	Female	Male	Total
Senior Leadership	Director General	1	1	19	1	1	7
	Principals	2	3		2	1	
	Directors of Assessment/ Curriculum/Academics	7	5		1	1	
Shared Leadership	Subject Head of Department/ Coordinator	12	1	17	3	1	6
	Career/University Counsellor	3	1		2		
Teachers	English Teachers	13	2	48	6	1	15
	Mathematics Teachers	21	12		3	5	
Students	Grade 9	88	99	797	3		32
	Grade 10	104	57		5	2	
	Grade 11	87	96		8	3	
	Grade 12	147	119		6	5	
Parents					8		8

Table (3. 3): The Participants' Distribution
(Source: Author)

3.6 Data Collection and Instrumentations

Quantitative and qualitative data types were collected to achieve the aim of the study. As the study followed a sequential explanatory design using a mixed-method approach, each phase had its characteristic and nature that required specific data collection methods to answer the

study questions. Different data collection instruments were employed using several sampling methods and targeting various participants.

The emphasis of the first phase of the study was the quantitative data collection. Quantitative data included students' assessment data collected from document analysis of their reports and different stakeholders' questionnaires. Three different questionnaires were administered, consisting of closed-ended and open-ended questions to collect phase one data. The questionnaires focused on leaders', teachers', and students' perceptions and involved minor qualitative data. Accordingly, both types were collected in phase one, however, the majority of the data was quantitative data. Therefore, the assessment data from the document analysis of the assessment reports was pure quantitative data consisting of MAP, CAT4, PASS, and SAT scores.

In phase two, which aimed to explore and explain the stakeholders' perceptions about the role of the implemented assessments in predicting students' academic achievement, qualitative data was collected to help in answering the last research question. This was supported by semi-structured interviews to explore and explain the stakeholders' perceptions. The integration through the building approach occurred when the findings from the participants' perception questionnaires were compared with the results of the statistical analysis of assessment data, and then interpreted to guide the development of the interview questions with focus groups, which represented the qualitative data in the second phase of the study.

Table (3.4) below includes the operational definitions of the study variables: Attainment, Aptitude, Attitude towards learning, and SAT Achievement.

Variable Name	Variable Type	Definition
Attainment – MAP	Independent/ Predictor	Student’s RIT and Percentile (%ile) scores in the MAP test. Six MAP scores are recorded for each student: MAP-Mathematics RIT score, and MAP-Mathematics %ile, MAP- Reading RIT score, and MAP- Reading %ile, MAP- Language Usage RIT score, and MAP- Language Usage %ile.
Aptitude – CAT4	Independent/ Predictor	Student’s Stanine (ST) score in the CAT4. Five CAT4 scores are recorded for each student: Overall Mean, Verbal Reasoning, Quantitative Reasoning, Non-verbal Reasoning and Spatial Ability. All scores are in Stanine. Stanine is a scale from 1 to 9.
Attitude towards learning – PASS	Independent/ Predictor	Student’s percentile (%ile) in the PASS test. PASS consists of nine factors. Nine %ile are collected for each student representing the nine factors.
Achievement- SAT	Dependent/ Criterion	This is the student’s score for SAT test. Two scores are recorded for individual, SAT- English and Math.

Table (3. 4): Study Variables
(Source: Author)

The following sections provide detailed description of each instrument, and its validity and reliability.

3.6.1 Document Analysis

Collecting assessment data is crucial in the current study; students’ scores were collected from the document analysis of assessment reports, and stakeholders’ responses from questionnaires were the main tools in the first phase of the study. Collecting students’ scores from administered assessment tools in schools is a well-known practice in educational research because it provides the researcher with data from different sources leading to robust data

analysis (Cohen, Manion & Morrison, 2018). ‘Document analysis’ is defined by Corbin and Strauss (2008) as an effective technique to gain a deep understanding and develop empirical knowledge. The source of data in the current research is considered ‘primary’ and not ‘secondary’ data because it involved analysing and interpreting raw data rather than analysing already interpreted analysed data (Cohen, Manion & Morrison, 2018, p.325).

Fraenkel, Wallen and Hyun (2015) identified different ways of analysing collected data using descriptive statistics or narrative descriptions. However, in the current study, document analysis was used to collect students’ assessment scores from different assessment tools, then they were analysed quantitatively. One of the challenges in collecting such data is the time spent cleaning, filtering, and reformatting the collected scores (Yorke, 2011). In addition, each assessment tool has different documents and reports. The document analysis was mainly comprised of comprehensive data files, Excel sheets, and PDF reports. Accordingly, the researcher used several criteria to evaluate the collected documents and ensure the data’s suitability, as recommended by Cohen, Manion and Morrison (2018). Hence all the used assessment tools were known and published; the validity and reliability are explained below. The following sections explain detailed steps, each assessment tool, the type of documents used, and the validity and reliability of each assessment.

3.6.1.1 Measures of Academic Progress (MAP) – NWEA Reports

The MAP test, also known as MAP Growth, is a computer-based adaptive test published by the Northwest Evaluation Association (Cordray et al., 2012; NWEA, 2004). MAP is a K-12 curriculum-based assessment aligned with the CCSS in English and mathematics and NGSS in Science. The MAP test benchmarks students’ attainment level against the standards and measures their progress toward customised ‘projection growth’ for the individual. It aims to evaluate students’ overall understanding and achievement in reading, language usage,

mathematics, and science (Medford, 2014). The test is commonly conducted in schools following the US curriculum for grades K-12 two to three times per year each fall, winter, and spring to track individual students' growth and proficiency in curriculum standards over a specific period (Jones, 2015; NWEA, 2014). The test is normed on students' scores across all the 50 states in the US and internationally to identify each score related to its deviation from other scores in the overall scores' distribution (Thum & Kuhfeld, 2020). Therefore, NWEA provides a set of the US and international 'MAP Growth Norms', and the new norms were updated in 2020, considering longitudinal data including the drops in scores during the Covid-19 pandemic (Thum & Kuhfeld, 2020). The MAP scale is stable, and to ensure the validity and reliability of the tool, a continuous series of norming studies have been taking place, and scores with high standard errors have been excluded (Thum & Hauser, 2015; Thum & Kuhfeld, 2020).

MAP consists of multiple-choice questions and hence the test is adaptive, so the level of difficulty and depth of knowledge per question is adjusted based on each student's level and response to previous answers (Cizek & Gierl, 2016; NWEA, 2012; Paul, 2015). The MAP scores are in the form of a Rasch Unit. A Rasch Unit is known as the RIT, an equal-interval unit (NWEA, 2007b), named after the statistician Georg Rasch who discovered the theory following the Item Response Theory (Jones, 2015; NWEA, 2007b). Every question in the MAP test is assigned a RIT level according to the difficulty level of the question. Each student gets a RIT score, percentile, projected growth as a target/goal to achieve the following MAP Growth assessment, and standard error per subject. After each MAP growth assessment window, different types of reports are generated. One of the commonly used reports is the 'Goal Setting' report that includes RIT scores per subject, Lexile range for reading, and the next goal expected for the student to achieve, based on their current level. MAP categorised students' overall performance into different percentile rankings: Low, Low Average, Average, High Average, and High, based on the NWEA norms study as shown in the Table (3.5) below.

Overall Performance	Lo %ile < 21		LoAvg %ile 21-40		Avg %ile 41-60		HiAvg %ile 61-80		Hi %ile > 80	
	count	%	count	%	count	%	count	%	count	%

Lo %ile: Low (Below 21 Percentile); LoAvg: Low Average (21-40 Percentile)
Avg: Average (41-60 Percentile); HiAvg: High Average (61-80 Percentile)
Hi: High (Above 80 Percentile)

Table (3. 5): Distribution of Overall Scores into Percentile Rankings (NWEA, 2020)

MAP was tested for reliability and validity where coefficient-Alpha is around 0.9 (Brown, 2014; NWEA, 2011; NWEA, 2019). Several previous studies highlight the validity and reliability of the MAP test (Crawford, Tidal & Stieber, 2001; Fuchs et al., 2001). MAP was also tested for its accuracy in predicting students' achievement (Cronin et al., 2007; Fuchs et al., 2001; Merino & Beckman, 2010; NWEA, 2005) and for providing detailed data about students' current academic level in the tested subjects and their progress over time towards achieving their individual MAP growth projection (Cordray et al., 2013). Validity studies that compare MAP assessment to state tests indicate high validity of around 0.8 for reading, mathematics, and science (NWEA, 2019). One factor that threatens the validity of any assessment, including MAP assessment, is the student's disengagement during the test (Wise & Kingsbury, 2016). Rapid guessing and rushing answers are examples of this disengagement where MAP considers any student who rapidly guesses more than 10% of the questions to be disengaged with the test (Wise, 2017; Wise & Ma, 2012). Therefore, MAP has an indicator to rapid guessing, then students with high standard errors will have invalid tests and will be excluded, to enhance the validity of the MAP norms (Thum & Kuhfeld, 2020). Each student can take the MAP up to three times a year in the fall, winter, and spring; exposure of the same questions to the same student more than once during consecutive tests is controlled by a lockout period of three months for K-2 MAP growth and 14 months for 2-5 and 6+ MAP growth (Thum & Kuhfeld, 2020, p.12). All the previous findings support the validity of using MAP growth

results to indicate students' academic achievement across grade levels (Thum & Kuhfeld, 2020).

3.6.1.2 Cognitive Ability Test (CAT4) Reports

CAT4 (GL-Assessment, 2017) is a non-curriculum assessment that assesses the developed cognitive abilities in four areas that make a difference in students' learning and achievement. The number 4 in the name of CAT4 refers to the fourth edition of the test. The four areas are assessed individually and called batteries: verbal, non-verbal, quantitative reasoning, and spatial ability, where each battery assesses the students in items related to that ability and skill, which provides an accurate analysis of potential student achievement (GL-Assessment, 2019). CAT4 results are considered a baseline that helps in assessing the value added by the school. CAT4 assessment can be administered to students aged 6 to 17, where each age is allocated a specific assessment level. The assessment duration is two hours and fifteen minutes. Table (3.6) below explains each battery and the different items in each battery.

CAT4 Batteries	Meaning
Verbal Reasoning Battery	Represents thinking with words. Focuses on learners' ability to express ideas and reasons through words. This battery is essential for studying a subject with high language content. In addition, this battery includes items about verbal classification and verbal analogies.
Non-verbal Reasoning Battery	Represents thinking with shapes. Identifies learners' ability to solve problems using diagrams and shapes. This ability is important in studying subjects like mathematics and science. This battery includes items about figure classification and figure matrices.
Quantitative or Numerical Reasoning Battery	Represents thinking with numbers. Explores students' ability to think with numbers and use numerical skills to solve problems. This battery includes items about number analogies and number series.
Spatial Ability Battery	Represents thinking with shape and space. Concentrates on learners' capacity to draw conclusions and to get the big idea in three dimensions. This ability is important for STEM subjects. This battery includes items about figure analysis and figure recognition.

Table (3. 6): CAT4 Batteries and Items Included

CAT4 was standardised on 25,000 students, and the reliability is tested and verified annually based on around 250,000 students (GL-Assessment, 2020). CAT4 includes three types of individual reports per student, for students, parents and teachers. CAT4 also provides group reports for teachers and the leadership team. In addition, CAT4 provides scores for each student per battery (verbal, non-verbal, spatial, and quantitative reasoning). CAT4 provides Raw Score (RS), Standard Age Score (SAS), Stanine (ST), National Percentile Rank (NPR), and Group Rank (GR) scores across the four batteries, along with overall mean Stanine. CAT4 RS represents the total number of questions answered correctly by the student. The SAS is calculated based on the student's RS adjusted for age and scaled to be compared with representative samples of students. SAS average is 100, and it is used to track individual student performance and compare it to others within the same grade level. The ST score is on a scale from one (low) to nine (high), and each student is placed on that scale. The NPR is related to the SAS, indicating the percentage of students achieving any particular score. The last score is called the GR that indicates the student's performance compared to others within the same group/grade level. The relationship between the scores is represented in Table (3.7).

Description	Very Low		Below Average		Average			Above Average		Very High			
Stanine (ST)	1	2	3	4	5	6	7	8	9				
Standard Age Score (SAS)	70	80	90	100	110	120	130						
National Percentile Rank (NPR)	1	5	10	20	30	40	50	60	70	80	90	95	99

Table (3. 7): Relationship between CAT4 Scores (GL-Assessment, 2019, p.5)

Hence, SAT assessment involves applying reading and mathematical knowledge and skills; students' verbal, non-verbal, quantitative reasoning, and spatial ability are utilised in SAT. Therefore, the mean CAT4 Stanine scores were collected for all secondary students who had taken the CAT4 recently.

3.6.1.3 Pupil Attitudes to Self and School (PASS) Reports

GL-Assessment developed PASS in 1999 to investigate the reasons behind students' attitudes towards learning, disengagement and self-regard (GL-Assessment, 2017). PASS consists of 50 items categorised into one or more of nine factors. So, PASS is considered a multi-factorial diagnostic measure of students' attitudes towards self, school, learning, and success. The PASS factors cover students' feelings about school, perceived learning capabilities, self-regard, preparedness for learning, attitude to teachers and attendance, general work ethic, confidence in learning, and response to curriculum demands. Table (3.8) below summarises the nine factors covered by PASS.

PASS Factors	Meaning
Self-regard/Self-worth	Focuses on a learner's self-awareness, levels of motivation and determination.
Confidence in learning	Identifies a learner's ability to think independently and to persevere when challenged. This factor includes elements related to the learner's feelings such as anxiety.
Perceived learning capability	Explores a student's level of self-respect, determination and openness to learning.
Response to curriculum demands	Concentrates on school-based motivation to undertake and complete curriculum-based tasks, emphasising the student's approach to communication and collaboration.
Preparedness for learning	Investigates study skills, concentration, and looking at the student's determination and openness to learning.
General work ethic	Highlights the student's aspirations and motivation to succeed in life. Focuses on purpose and direction at school and elsewhere.
Feeling about school	Explores whether the student feels confident, secure, and involved in their learning community.
Attitude to teachers	Explores the student's perceptions of the relationships they have with the adults in school.
Attitude to attendance	Reflects the correlation with the student's actual attendance.

Table (3. 8): PASS Factors (GL-Assessment, 2017)

Each student's responses are summed up by factor and grade level then given a %ile score per factor. For example, 0-5%ile is considered a low satisfaction level with school experience, 6-20%ile is low moderate satisfaction, 21-30%ile is moderate satisfaction, while 31%ile to 99%ile is high satisfaction level with school experience. PASS provides three levels of analysis: whole cohort analysis; analysis by gender, grade level, and ethnicity; and individual item level analysis and profiles (GL-Assessment, 2017).

PASS has been tested for validity and reliability and has been standardised four times, where around 788,467 students aged 8-16 years took part in the process (Williams, Whittome & Watts, 2005). The standardisation process considered gender, age group, grade level, and ethnicity. The sample included students with different abilities and students with special educational needs receiving special educational provisions. The PASS's norms were recalculated through stratified sampling processes, and factor analysis has been conducted on all the 50 items of PASS (Williams, Whittome & Watts, 2005). The overall factor scores were compared to each grade level group. It was concluded that the student's age impacts attitudes towards school. The reliability of PASS was tested, and Cronbach's Alpha for the factors varied within the range of 0.8-0.9 excepting the work ethics factor that had a value of 0.6. (Williams, Whittome & Watts, 2005).

To test the validity of PASS, a correlation between PASS total scores and individual item ratings were tested. The results indicated a negative correlation between 1444 students' actual attendance and the total PASS scores. The construct validity of PASS was tested too. The results indicated that the factors are highly correlated to the total score (Williams, Whittome & Watts, 2005).

3.6.1.4 Scholastic Aptitude Test (SAT) Reports

The SAT is a standardised test used to measure students' readiness for university admission (Thum & Matta, 2015; Wai, Brown & Chabris, 2018). Each student receives a total score which is a sum of the English section and math section scores. The English section is called Evidence-based Reading and Writing. SAT-Mathematics and SAT-English scores range from 200-800 for each section, so the total score range is 400-1600. There is a correlation between MAP and SAT scores, where students who performed at least 40th-50th %ile in mathematics are likely to be college-ready (Thum, 2011). The College and Career Readiness Benchmarks set 530 in mathematics and 480 in Evidence-based Reading and Writing as the 75% predicted level of students' readiness to achieve at least a C in first-semester college courses (College Board, 2018). In the current study, the SAT-English and SAT-Maths scores were collected for each student who took the test in high school.

3.6.2 Stakeholders' Questionnaires

Since the study aimed to capture the stakeholders' perceptions, three types of questionnaires were administered: Leadership (Appendix D), teacher (Appendix E), and student (Appendix F) questionnaires. Questionnaires are considered as self-report tools that collect written responses from the individual participant in the study (Fraenkel & Wallen, 2012; Johnson & Christensen, 2020). The questionnaires were divided into two parts, and part two was divided into three sections aligned to the current study's fundamental elements. Part two of the questionnaires consisted of five-points Likert scale responses (Strongly Agree=5, Agree=4, Neutral=3, Disagree=2, and Strongly Disagree=1) as closed-ended items, and three open-ended questions that focused on different objectives related to stakeholders' perceptions about the four types of assessments implemented in the school and how they felt these assessments might affect or predict students' academic achievement in SAT. The Likert scale is also well known as a rating scale used for ranking order related to the level of agreement and disagreement on

each item (Johnson & Christensen, 2020). The open-ended questions are included to seek more elaboration, depth, and validation. The anonymity, uniform process, and self-report statements that can be easily scored are all advantages of using questionnaires as part of collecting quantitative data (McMillan & Schumacher, 2010). The following section explains the three questionnaires used in the study.

In phase one of the study, the quantitative phase, the questionnaires were shared with the participants in the five participating schools in the UAE in October. The questionnaires were distributed in the form of an electronic link using an online forms tool called JotForm. All completed forms were automatically emailed to the researcher, which provided an accurate way to follow up with the participating schools in the study. In addition, JotForm provided an easy way for participants to sign the consent form to participate electronically.

3.6.2.1 Leadership Questionnaire

The leadership questionnaire (Appendix D) was used to collect data about leadership teams' perceptions of the relationship between each type of assessment and students' academic achievement. The questionnaire was designed for grades 9-12 senior and shared leadership teams that included the Director Generals, Principals, Directors of Curriculum and Assessment, Heads of Departments and Coordinators, and Career and University Counsellors. The questionnaire was divided into two parts: Part A covered the demographic information about participants: current role, specialisation, academic and professional qualifications, gender, nationality, and spoken languages, including first and second languages. Part B (see Table (3.9) below) consisted of three sections covering the participants' perceptions about students' attainment, aptitude, and attitude towards learning. Each section included ten closed-ended self-report statements/items in the form of five-points Likert scales followed by an open-ended question. The ten statements were categorised under two objectives: six statements targeted the

participants' perceptions, beliefs, and practices about the targeted assessment, followed by four statements about the relationship between that assessment and academic achievement in SAT.

Each open-ended question was related to a specific type of assessment that requests the participants to elaborate on the relationship between that assessment and SAT, along with the predictability of students' academic achievement in SAT using each type of assessment. Section I covered the *Academic Factor (attainment-MAP)* by investigating the leadership team's perceptions about MAP in general and the relationship between MAP and students' academic achievement in SAT; Section II covered the *Cognitive Factor (aptitude-CAT4)* by investigating the leadership team's perceptions of the relationship between students' cognitive abilities measured by the CAT4 and students' academic achievement in SAT. Finally, section III covered the *Affective Factor (attitude towards learning-PASS)* by investigating the leadership team's perceptions about the relationship between students' attitude towards learning, self, and school, and their academic achievement in SAT. Thirty-six leaders from the participating schools answered the leadership questionnaire.

Section (I) Academic Factor (Attainment in MAP)	
1	I am aware of the strengths and weaknesses in the students' academic level based on MAP reports.
2	I believe that training students in using the MAP test report helps them improve their learning.
3	I encourage students to use the information in the MAP report to improve their academic knowledge and skills.
4	I advise students to adjust their plans for learning based on the results they get from the MAP test or MAP "Student Goal Setting Worksheet".
5	I think that monitoring students' academic progress should be based on their progress in the MAP test.
6	I recommend using the MAP Goals or MAP "Student Goal Setting Worksheet" frequently to reflect with students on their achievement.
Measures of Academic Progress (MAP) and SAT Achievement:	
7	I think MAP scores are important in predicting students' SAT scores.
8	I think MAP tests are helpful in improving students' scores in SAT.
9	I believe that students should connect what they learn from MAP to their SAT target.
10	I think that setting students' SAT goals should be based on the current MAP-RIT score or percentile.
Do you think that MAP can help in predicting students' SAT scores? Explain why	

Section (II) Cognitive Factor (Aptitude)	
1	I am aware of the strengths and weaknesses in the students' cognitive ability level based on CAT4 reports.
2	I believe that training students on using the CAT4 report should help them improve their learning.
3	I encourage students to use the information in the CAT4 report to improve their academic knowledge and skills.
4	I advise students to adjust their plans for learning based on the recommendation they get from the CAT4 test results and report.
5	I think monitoring students' progress during a learning task should be done using the advice they got from their CAT4 reports.
6	I recommend using the CAT4 report and recommendation frequently to improve students' learning strategies and skills.
Cognitive Ability Test (CAT4) and SAT Achievement	
7	I think cognitive ability level is important in predicting students' SAT scores.
8	I think students' cognitive abilities (verbal, quantitative, non-verbal reasoning, and spatial ability) are helpful in improving their scores in SAT.
9	I believe that students should connect what they learn about their cognitive abilities from CAT4 report to achieve their SAT target.
10	I think that setting students' SAT goals should be based on their current cognitive ability- CAT4 level.
Do you think that CAT4 can help in predicting students' SAT scores? Explain why	
Section (III) Affective Factor (Attitude towards Learning)	
1	I am aware that students' attitude towards school affects their performance in assessments.
2	I am satisfied with students' performance.
3	I think that students' attitude towards their teacher is important in affecting their academic achievement.
4	Our students have a clear vision and goals to achieve in their learning.
5	I think that our students believe in their capability of thinking independently and dealing with challenges to achieve their goals.
6	I believe that students' communication and collaboration in learning will improve their performance.
Attitude towards Learning (PASS) and SAT Achievement:	
7	I understand that students improve their attitude towards preparing for SAT tests in order to achieve their goals.
8	I think students' attitudes towards learning are important in affecting their SAT scores.
9	I think that students' attitude towards the subject affects their performance in SAT tests.
10	I think students' self-confidence in the subject is important in predicting their SAT scores.
Do you think that attitude towards learning (PASS) can help in predicting students' SAT scores? Explain why	

Table (3. 9): Leaderships' Questionnaire Items
(Source: Author)

3.6.2.2 Teacher Questionnaire

The teachers' questionnaire (Appendix E) was used to collect data about teachers' perceptions of the relationship between each type of assessment and students' academic achievement. The questionnaire was designed for grade 9-12 teachers teaching English and mathematics. The questionnaire was divided into two parts, like the leadership questionnaire. The difference is in the self-reporting statements in Part B (see Table (3.10) below), where the focus is on teachers' perceptions and practices related to the impact of students' attainment in MAP, aptitude level in CAT4, and attitude towards learning using PASS to predict students' academic achievement in SAT. Forty-eight grade 9-12 English and mathematics teachers answered the teachers' questionnaire.

Section (I) Academic Factor (Attainment in MAP)	
1	I am aware of the strengths and weaknesses in the student's academic level based on MAP reports.
2	I train my students on using the MAP test report to help them improve their learning.
3	I encourage my students to use the information in the MAP report to improve their academic knowledge and skills.
4	I help my students to adjust their plans for learning based on the results they get from the MAP test or MAP "Student Goal Setting Worksheet".
5	I monitor students' academic progress based on their progress in the MAP test.
6	I use MAP Goals or the "Student Goal Setting Worksheet" frequently to reflect with students on their achievement
Measures of Academic Progress (MAP) and SAT Achievement:	
7	I think MAP scores are important in predicting students' SAT scores
8	I think MAP tests are helpful to improve students' scores in SAT.
9	I help students to connect what they learn from MAP to their SAT target.
10	I try to set students' SAT goals based on the current MAP-RIT score or percentile.
Do you think that MAP can help in predicting students' SAT scores? Explain why	
Section (II) Cognitive Factor (Aptitude)	
1	I am aware of the strengths and weaknesses in the students' cognitive ability level based on CAT4 reports.
2	I train my students on using the CAT4 report to help them improve their learning.
3	I encourage my students to use the information in the CAT4 report to improve their academic knowledge and skills.
4	I help my students to adjust their plans for learning based on the recommendation they get from the CAT4 test results and report.

5	I monitor students' progress during a learning task using the advice I got from their CAT4 reports.
6	I use the CAT4 report and recommendation frequently to improve my students' learning strategies and skills.
Cognitive Ability Test (CAT4) and SAT Achievement	
7	I think cognitive ability level is important in predicting students' SAT scores.
8	I think students' cognitive abilities (verbal, quantitative, non-verbal reasoning, and spatial ability) are helpful in improving their scores in SAT.
9	I believe that students should connect what they learn about their cognitive abilities from the CAT4 report to achieve their SAT target.
10	I think that setting students' SAT goals should be based on their current cognitive ability- CAT4 level.
Do you think that CAT4 can help in predicting students' SAT scores? Explain why	
Section (III) Affective Factor (Attitude towards Learning)	
1	I understand that my students' attitude towards school affects their performance in assessments.
2	I am satisfied with students' performance.
3	I think my students' attitude towards their teacher is important in affecting their academic achievement.
4	My students have a clear vision and goals to achieve in their learning.
5	I believe that my students believe in their capability of thinking independently and dealing with challenges to achieve their goals.
6	I believe that students' communication and collaboration in learning will improve their performance.
Attitude towards Learning (PASS) and SAT Achievement:	
7	I understand that students improve their attitude towards preparing for SAT tests in order to achieve their goals.
8	I think students' attitude towards learning are important in affecting their SAT scores.
9	I think that students' attitude towards the subject affects their performance in SAT tests.
10	I think students' self-confidence in the subject is important in predicting their SAT scores
Do you think that your attitude towards learning (PASS) can help in predicting students' SAT scores? Explain why	

Table (3. 10): Teachers' Questionnaire Items
(Source: Author)

3.6.2.3 Student Questionnaire

The students' questionnaire (Appendix F) was used to collect data about students' perceptions of the relationship between each type of assessment and students' academic achievement. The questionnaire was designed for grade 9-12 students in US-curriculum schools participating in MAP, CAT4, PASS, and SAT. The questionnaire was divided into two parts, similar to the

leadership and teacher questionnaires. Hence the goal was to investigate the different types of assessments; the study aimed to discover the perceptions of students who had experience in those assessments. Therefore, at the beginning of each section, there was a question about how many years the student has been taking each assessment. In the self-reporting statements in Part B (see Table (3.11) below), the focus was on students' perceptions and practices related to the impact of their current academic attainment in MAP, aptitude level in CAT4, and attitude towards learning using PASS on predicting SAT achievement. The statements also captured the students' perceptions about using these assessments to achieve their target In SAT and the relationship between each type of assessment and the SAT. The questionnaires were completed by 797 students in grade 9-12.

Section (I) Academic Factor (Attainment in MAP)	
1	I am aware of my strengths and weaknesses in the subject based on MAP reports.
2	I am aware of how to use the MAP test to help me improve my learning.
3	I know I can use the information in the MAP report to master mathematical skills.
4	I adjust my plans for learning based on the results I get from the MAP test and MAP Goal Sheets.
5	I check my progress in the subject based on my progress in the MAP test.
6	I use the MAP Goal Sheet frequently to reflect on my achievement.
Measures of Academic Progress (MAP) and SAT Achievement:	
7	I seek to connect what I learn from MAP to achieve my SAT target.
8	I think MAP tests are helpful in improving my scores in SAT.
9	I think my MAP score is important in predicting my SAT scores.
10	I try to set my SAT goals based on my current MAP-RIT score or percentile.
Do you think that MAP can help you in predicting your SAT scores? Explain why	

Section (II) Cognitive Factor (Aptitude)	
1	I am aware of my strengths and weaknesses in the subject based on CAT4 reports.
2	I am aware of how to use the CAT4 report to help me improve my learning.
3	I know I can use the information in my CAT4 report to master mathematical skills.
4	I adjust my plans for learning based on the recommendation I get from the CAT4 test results and report.
5	I check my progress during a learning task using the advice I got from CAT4.
6	I use the CAT4 report and recommendation frequently to improve my learning strategies and skills.

Cognitive Ability Test (CAT4) and SAT Achievement	
7	I seek to connect what I learn about my cognitive abilities from the CAT4 report to achieve my SAT target.
8	I think my cognitive ability (verbal, quantitative, non-verbal reasoning, and spatial ability) level is helpful in improving my scores in SAT.
9	I think my cognitive ability level is important in predicting my SAT scores.
10	I try to set my SAT goals based on my current cognitive ability- CAT4 level.
Do you think that CAT4 can help you in predicting your SAT scores? Explain why	
Section (III) Affective Factor (Attitude towards Learning)	
1	I understand that my attitude towards school affects my performance in assessments.
2	I am satisfied with my performance.
3	I think my attitude toward my teacher is important in affecting my academic achievement.
4	I have a clear vision and goals to achieve in my learning.
5	I believe that I am capable of thinking independently and dealing with challenges to achieve my goals.
6	I believe that my communication and collaboration in learning will improve my performance.
Attitude towards Learning (PASS) and SAT Achievement:	
7	I seek to improve my attitude towards preparing for SAT to achieve my goals.
8	I think my attitude towards learning is important in affecting my SAT scores.
9	I think that my attitude towards the subject affects my performance in SAT tests.
10	I think my self-confidence in the subject is important in predicting my SAT scores.
Do you think that your attitude towards learning (PASS) can help you in predicting your SAT scores? Explain why	

Table (3. 11): Students' Questionnaire Items
(Source: Author)

3.6.3 Focus Group Interviews

The interviews with the focus groups were conducted in the second phase of the study after analysing the quantitative data from the first phase. Focus group results were used in the overall research study to understand the perspectives of participants, to add depth and understanding to the findings, and to triangulate with the quantitative results from phase one of the study. The researcher chose a semi-structured interview with a focus group because the use of obtained qualitative data was a convenient and effective tool to enhance the interpretation of the statistical analysis of the questionnaires and assessment data (Leech & Onwuegbuzie, 2007). The focus group methodology is qualitative and exploratory in nature and is not intended to

provide data that is generalisable to other schools. Focus groups are designed to draw out perceptions from participants about a particular topic and to generate ideas and concepts that will help the reader understand the subject area under study (Johnson & Christensen, 2020). The output from the focus group study is typically used to supplement and explicate constructs from the quantitative findings that are based upon large samples from well-defined populations.

As explained by Johnson and Christensen (2020), the goal of the focus group is to understand and explore the perceptions of the participants related to a specific topic. Fraenkel and Wallen (2012) added that the interview is defined as a verbal response to structured inquiries to gather information about the subject, with a decent opportunity to request further clarification to participants' responses when needed. Additionally, an interview creates opportunities for the researcher to ensure the accuracy and clarity of the gathered information, collected data, and any issues related to the study (Fraenkel, Wallen & Hyun, 2015). The semi-structured interviews specifically provide the researcher with deeper insights by making the participants' thinking visible through discussion, follow-up questions, listening to their different points of view, and giving the participants more space to freely express and elaborate on their opinion (Creswell, 2014; Fraenkel, Wallen & Hyun, 2015; Seidman, 2013). Accordingly, the semi-structured interview questions were developed based on the findings from the data analysis of the quantitative data in phase one.

In the current study, the semi-structured interviews were conducted with four different categories of focus groups: senior and shared leadership teams (Appendix G), leaders with teaching roles and teachers (Appendix H), students (Appendix I), and parents (Appendix J). The initial plan was to have a purposeful selection of participants in all the groups. However, due to the restrictions during the Covid-19 pandemic and lockdown, the researcher had a limited access to parents' and students' selection which changed the sampling from purposeful

to convenience. The leadership teams consisted of seven senior leaders and two middle/shared leaders without a teaching role. The second focus group consisted of four middle leaders with teaching roles and 15 English and mathematics teachers. Categorising them to leaders with teaching roles and leaders without a teaching role affects the flow of the follow-up questions and reflection during the interview. The researcher wanted to compare and contrast the perceptions of teaching and non-teaching positions. Thirty-two students took part in the interview in the focus group, while eight parents formed the parents' focus group.

To ensure the validity of the interview questions, a professor and another researcher reviewed the questions, and modifications took place where needed (Johnson & Christensen, 2020). At the same time, the questions were piloted with three teachers and leaders in the field to enhance the collected data's trustworthiness and ensure the clarity of the questions (Cohen, Manion & Morrison, 2018). The questions were mirrored in each focus group to add more depth and clarify the points related to the different stakeholders' perceptions about the impact of the used assessments on students' academic achievement. The researcher aimed to discuss the topic from different perspectives based on each participant's role related to that topic.

The researcher followed the research protocols by explicitly stating the interview's aim and filling in the participants' demographic information. Each interview took between 45 to 60 minutes and was conducted on 'Zoom meeting', where the meetings were recorded after taking the participants' approval. All collected data was saved in a secure, protected folder on a password-protected computer.

3.7 Procedures and Data Analysis

Each type of data from both phases was analysed individually based on the proposed research methods using descriptive and inferential statistics to allow the researcher to investigate data further and consider the characteristics of the population, rather than rely on simple data

(Bryman, 2012; Johnson & Christensen, 2020). The following steps explain the procedure and data analysis process.

Step 1: MAP, CAT4, PASS, and SAT reports were collected. The reports were in the form of Excel, .CSV, and PDF files. Students' MAP, CAT4, PASS, and SAT scores were categorised in nine levels based on their MAP %ile, CAT4-Stanine, PASS ile, and finally SAT scores. Table (3.12) below shows the categorisation of data from all the used assessments. Based on the MAP-NWEA developer, the students' MAP scores in 41-61%ile are considered average, equivalent to the CAT4's mean score of Stanine-5. Similarly, MAP-%ile is aligned to SAT scores that vary from 200-800, where 490-520 is considered average in SAT and equivalent to 41-60%ile in MAP (Thum, 2011). All students' assessment data was compiled in one Excel file. Data was revised and checked by another data analyst to ensure the accuracy and that no student was missing scores from any of the assessments. Any student who was missing a score was excluded. Simultaneously the questionnaires were administered electronically to all the participants, based on their role.

Assessment and Scale	Very Low	Below Average		Average			Above Average		Very High
CAT4 Stanine ST	1	2	3	4	5	6	7	8	9
MAP Percentile %ile	1 – 4	5-10	11 – 20	21 – 40	41 – 60	61 – 70	71 – 80	81 – 90	91–100
PASS Percentile %ile	0-5			6-20	21-30		31-100		
SAT User Score	200-340	350-380	390-420	430-480	490-520	530-550	560-590	600-650	660-800

Table (3. 12): Assessment Alignment and Types of Scores
(Source: Author)

Step 2: All quantitative data from the assessment was analysed using the Statistical Package for Social Science (SPSS) software. The correlational analysis was conducted to find the relationship between the variables individually, and then combined. Due to the nature of the variables and because they were all parametric, the Pearson correlation test was applied (Cohen, Manion & Morrison, 2018). The findings from step 2 answered the first study question completely.

Step 3: Multiple regression analysis was administered on the variables from the assessment data. The purpose of this step was also to develop the prediction equations of the dependent variable (SAT-English and SAT-Math) by the independent variables (MAP, CAT4, and PASS), each individually or compiled. The findings from step 3 answered the second study question.

Step 4: The self-reporting statements (30 closed-ended items) from leaders', teachers', and students' questionnaires were analysed using descriptive statistics. The three open-ended questions in each questionnaire were analysed based on the participants' answers to yes or no and the reason behind their answers. The reasons presented by the participants were summarised and categorised based on keywords. The keywords were used to generate themes according to each factor (MAP, CAT4, PASS). These were presented as percentages in figures in each section, supported by a table listing the main comments stated by the participants. Findings from the questionnaires were compared to the findings from the correlation and regression analysis of assessment data. Based on the comparison, themes were created, and the open-ended questions for the semi-structured interviews with focus groups were developed for the study's phase two. This step represented the end of phase one of the study.

Step 5: The semi-structured interviews with the focus groups were conducted. Qualitative data collected from the interview questions with the different focus groups was transcribed and analysed in themes to compare with the assessment data findings and the prediction equation in the discussion part. The primary purpose of analysing this qualitative data was to make sense of the findings and categorise them under themes (Creswell, 2014; Leech & Onwuegbuzie, 2007). Therefore, 13 focus groups were video recorded via Zoom Cloud Meetings software, and each lasted between 45 to 60 minutes. The recordings were transcribed, and the transcripts were used in the data analysis. Steps of data analysis taken are presented in Figure (3.5) below.

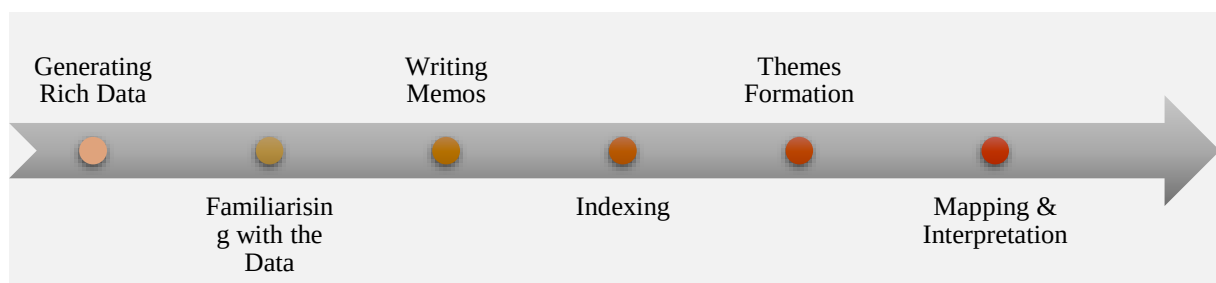


Figure (3. 5): Focus Groups Data Analysis Process

(Source: Author)

The findings from steps 4 and 5 answered the third study question fully, to find the stakeholders' perceptions about the role of attainment in MAP, aptitude level, and attitude in predicting students' achievement in SAT.

3.8 Pilot Study

Piloting the tools is an essential process in every research to study the validity and reliability of the developed tool (Fraenkel, Wallen & Hyun, 2015) and enlighten the statement of investigation and its strategies (Glesne, 2011). Accordingly, piloting the tool was conducted as part of a fundamental scale methodological test (Fraenkel & Wallen, 2012) and as a mini type of full-scale examination of the tool. All the items in the questionnaires were tested to ensure consistency and that the developed tool was reliable and valid (Fraenkel, Wallen & Hyun,

2015). To enhance the validity and reliability of the tools, external researchers and educators reviewed the tools. The anonymity in the whole process increased the reliability because the participants were encouraged to be honest and transparent in their responses. The instrumentation did not involve any questions about the name of the participants or the school they work in.

The inter-item coefficient that determines the internal consistency reliability was calculated (Phelan & Wren, 2005) and the Cronbach's Alpha correlation coefficient was also tested (Cohen, Manion & Morrison, 2018). According to Cohen, Manion and Morrison (2018), Cronbach's Alpha coefficient should be higher than 0.90 to indicate that the tool is highly reliable, while any value below 0.60 is considered unacceptable. Thus, any value between 0.80-0.90 is considered highly reliable, while any value between 0.70-0.79 is considered reliable, and any value between 0.60-0.69 is marginally reliable (Cohen, Manion & Morrison, 2018).

3.8.1 Reliability

The consistency and the stability of the results define the term 'Reliability' (Johnson & Christensen, 2020). Reliability is established when the measures are used more than one time and the results produced are consistent. Accordingly, three expert researchers reviewed the questionnaires to ensure the items' clarity and accuracy, which enhanced the instruments' reliability and validity (Simon, 2011). After reviewing the questionnaires by other researchers and educators, a few changes took place. The questionnaires did not include any information about participants' names or schools to ensure complete anonymity and to encourage participants to be open in their responses.

The questionnaire was adapted from the Metacognitive Awareness Inventory (MAI) by Schraw and Dennison (1994). MAI is one of the most frequently used self-reporting tools in

metacognition research (Balcikanli, 2011; Schraw & Dennison, 1994; Yildiz et al., 2009). After the original (MAI) tool was developed by Schraw and Dennison (1994), several researchers adapted and modified the instrument to be used as a self-reporting tool that measures the metacognitive awareness of teachers and their teaching practices (Balcikanli, 2011) and students' metacognitive awareness (Yildiz et al., 2009). As a result, the tool is proven to have high validity of around 0.794 and reliability of high alpha scores (0.79-0.85) tested by Cronbach's Alpha (Balcikanli, 2011, pp.1323-1325). In addition, other inventories were created to capture students' self-reporting about their learning processes in a particular subject and to measure their metacognitive awareness in that subject, like the Self-Efficacy and Metacognition Learning Inventory-Science (SEMLI-S) (Thomas, Anderson & Nelson, 2008). The SEMLI-S was also piloted with around 500 secondary students and showed that it fits the Rasch model with a reliability of 0.68-0.85 Cronbach's Alpha scores. SEMLI-S was modified later on to be used in chemistry (Sandi-Urena, Cooper & Stevens 2011), biology (Aurah, 2013), physics (Chantharanu-wong, Thathong & Yuenyong 2012; Nashon & Nielson 2011; Thomas 2011), and physics and mathematics (Abdul Hadi, 2014). In a study by Abdul Hadi (2014) the SEMLI reliability test indicated a high reliable Cronbach-Alpha's score of 0.94.

Additionally, a convenient sampling process took place in piloting the questionnaire in which 12 leaders and 12 teachers participated. Twenty-eight grade 9-12 students participated in piloting the students' questionnaire. The 28 students comprised 14 female and 14 male students. Based on the feedback from the participants during the piloting stage, a few modifications were implemented to suit the study objectives and simplify the language used in the questionnaires. Cronbach's Alpha indicates the instrument's reliability, as shown in Table (3.13) for staff and Table (3.14) for students. The results concluded a very highly reliable consistent 30 items for staff questionnaires (Cronbach's Alpha = 0.912) and a highly reliable students' questionnaire (Cronbach's Alpha = 0.863). The inter-item correlation matrix in

leaders and teachers' and students' questionnaires is high $\alpha > 0.05$ and indicated a positive relationship between variables (Appendix K).

Case Processing Summary			
		N	%
Cases	Valid	24	92.3
	Excluded ^a	2	7.7
	Total	26	100.0
a. Listwise deletion based on all variables in the procedure.			
Reliability Statistics			
Cronbach's Alpha	N of Items		
.912	30		

Case Processing Summary			
		N	%
Cases	Valid	27	93.1
	Excluded ^a	2	6.9
	Total	29	100.0
a. Listwise deletion based on all variables in the procedure.			
Reliability Statistics			
Cronbach's Alpha	N of Items		
.863	30		

| Table (3. 13): Reliability Test of Leaders & Teachers' Questionnaire | | Table (3. 14): Reliability Test of Students' Questionnaire | |

3.8.2 Validity

The term 'Validity' is defined as the capacity to quantify what is expected to be measured (Johnson & Christensen, 2020). Creswell (2014) suggested that validity be tested from different aspects to ensure construct, internal, external, and statistically valid conclusions. For example, the sampling of the students who participated in the quantitative part is a purposeful comprehensive selection to minimise the internal validity threat. The students who participated in the questionnaire were selected as a comprehensive sampling. On the other hand, the leaders and teachers who participated were selected as purposeful comprehensive sampling to ensure that they were the ones who dealt with the same students participating in the study. The parents and students who participated in the focus groups were a convenience selection, but they were among the ones who answered the questionnaire. The selection of sites was based on the criteria required by the study, which included schools that conduct the four types of assessment under

investigation. All the above ways of sampling enhanced the maturation of the internal validity by selecting equivalent participants (Fraenkel, Wallen & Hyun, 2015).

The questionnaires were sent to experts in the field to ensure content validity (Fraenkel, Wallen & Hyun, 2015), then they were piloted and tested for validity and reliability. During piloting of the study, the researcher tested the internal validity of the questionnaires. Construct validity was assessed through convergent validity and discriminant validity. Convergent validity assesses the degree to which two measures of the same concept are correlated, and high correlations here indicated that the scale is measuring the intended concept. Discriminant validity is the degree to which two conceptually similar concepts are distinct, and low correlations here indicated that the scale is sufficiently different from the other concept (Srinivasan & Lohith, 2017). One widely used method of simultaneously establishing convergent and discriminant validity is the Multi-Trait and Multimethod Matrix (MTMM). The basic concept of MTMM is that correlation among the scores of the same construct should be the highest correlation in the matrix (Krishnaswamy et al., 2006).

In the current research, the data collected from the pilot study was analysed using SPSS v.26. The correlation coefficients of measures of all the three constructs of the questionnaire were established. Table (3.15) gives the correlation between the scores of the three domains: Academic Factors, Cognitive Factors, and Affective Factors displayed below the diagonal of the table measuring convergent validity. As the measure (construct) has multiple items, if the items reflect the construct, then it is expected that the average intercorrelation values are the highest in the matrix; this condition is satisfied as correlation coefficients between the three constructs were 0.834, 0.566, and 0.470 and thereby support convergent validity.

Discriminant validity is the concept that measures of different constructs should not correlate highly with each other. In the current pilot study, each construct was measured by a different set of items, and hence it was expected that the average cross-construct correlations would be low. The values above the diagonal of Table (3.15) seem lower than those below the diagonal, which is evidence of discriminant validity.

Correlations			
Pearson Correlation			
	Academic Factors	Cognitive Factors	Affective Factors
Academic Factors	1	.614	.320
Cognitive Factors	.834	1	.294
Affective Factors	.566	.470	1

Note: Average correlation values above diagonal were calculated using Inter-item Correlation Coefficients MS Excel, see the Appendix K

Table (3. 15): Convergent and Discriminant Validity –
Average Correlation between Constructs

The students' scores were extracted from the document analysis of the assessment reports. The reports were generated by well-known assessment tools in the field and were tested for validity and reliability in many previous studies. Students' scores were revised by another data analyst to identify any missing information and to ensure accuracy.

Johnson and Christensen (2014) elaborate on 'Legitimation' as one of the measures that refer to the quality of the mixed-method research. The term legitimation is used in mixed-method research while the term validity is used in quantitative study, and the term trustworthiness is used in a qualitative study. Legitimation is considered in the mixed-method design when the researcher advocates pluralism in the research design process (Onwuegbuzie & Johnson, 2006). The nine types of legitimations involve insider-outsider, sample integration, conversion, sequential, weakness minimisation, paradigmatic mixing, political, multiple validates, and commensurability legitimation (Onwuegbuzie & Johnson, 2006; p.60). Hence a mixed-method

design combines the strengths and specific weaknesses of both quantitative and qualitative research methods; the challenge in validating the findings arises due to integrating both methods (Onwuegbuzie & Johnson, 2006).

This section discusses how the researcher addressed internal and external validity threats from different aspects: research design, sampling, instrumentation, data analysis, and data interpretation (Johnson & Christensen, 2020). Validity and reliability in the current study were ensured in each phase of the study where following a mixed-method study approach helped in maximising the collection of evidence from two approaches rather than one approach, to minimise the weaknesses (Creswell & Plano Clark, 2018; Johnson & Christensen, 2020; Tashakkori & Teddlie, 2010). Integrating quantitative and qualitative methods in the explanatory sequential mixed-method design fulfilled the study objectives and reflected the philosophical beliefs about the study, which has been explained explicitly by the researcher. Additionally, a purposeful and comprehensive sampling process fulfilled the requirement of both quantitative and qualitative approaches. The integration in sampling and using different instrumentation created opportunities to make meta-inferences and generalisations. At the same time, the utilisation of the outcome from one approach and adding more depth and elaboration by the second approach enhance the reliability and validity of the study's findings (Creswell, 2014). Hence the researcher is the primary instrument for collecting qualitative data; issues related to trustworthiness and credibility are raised (Merriam & Associates, 2002). Interviews were recorded and transcribed electronically then revised by two researchers to avoid any bias. Quantitative and qualitative data were analysed and validated by the researcher and another expert in the field to avoid any threats to external validity due to bias in interpreting data or inaccurate conclusions (Fraenkel, Wallen & Hyun, 2015).

3.9 Ethical Considerations

Initial approval was requested from the Ethics Committee in the British University in Dubai (BuiD) (Appendix B). The researcher followed all the ethical codes of conduct, and hence the study is considered a low risk; the research's ethics form approval was obtained from BuiD based on that. Following the practice in educational research (Cohen, Manion & Morrison, 2018), a study consent form and the purpose of the study letter were shared with the site and participants to run the study. The permission letter to conduct the study was shared with each school (Creswell, 2014). Another approval was obtained from the sites to give access and to conduct the study (Appendix C). Hence each research requires a 'gatekeeper' (Barrett, 2006) who will help in approving and facilitating the study process. Meetings took place with each school director or principal to discuss the data collection process and to agree on the timeline for running the questionnaires and the focus group interviews.

The questionnaires and focus group interviews started with an explanation of the purpose of the study. The researcher also clarified the participants' right to withdraw at any point, the confidentiality of the study, and the anonymity of sites and participants. The participants signed a consent form to be part of the study. This process secured the trustworthiness of the qualitative data and the validity of the quantitative ones (Cohen, Manion & Morrison, 2018; Onwuegbuzie & Johnson, 2006). The researcher considered the adequate number of samplings to ensure the validity and reliability of the findings. The questionnaires were distributed to all secondary students as comprehensive sampling, so no students were excluded or targeted. This process did not involve any selection or exclusion for specific students to ensure the participants' anonymity and confidentiality and help the students feel comfortable (Cohen, Manion & Morrison, 2018). At the same time, a convenience sampling method was adapted for parents and students focus group interviews to eliminate any pressure on stakeholders and efficiently recruit participants who were willing to take part in the interview. The protocol and

code of ethics of data collection during interviews were followed (Johnson & Christensen, 2020). The purpose of the study was explained to the participants at the beginning of the interview, and their approval was taken to be part of the interview. The interviews were conducted online using the 'Zoom meeting' program and recorded after the participants' approval.

All information about the site and participants was kept anonymous and confidential, and the names of schools and participants were coded. Questionnaires were distributed and saved electronically using an online application called JotForm. Each school had its own link to its questionnaires. However, all responses from participants were saved electronically and anonymously. In assessment data, students' school IDs were used instead of their names for confidentiality. The positionality in research reflects the researcher's position in the study (Savin-Baden & Major, 2013), so the researcher ensured that there was no bias and it is insider-outsider following the pragmatic philosophy through utilising eclectic methodology. Another researcher reviewed the analysis of the collected data and the interpretation of interviews to avoid any personal influence of the researcher (Fraenkel & Wallen, 2012). Finally, the researcher was keen on carrying out the study professionally, following the code of conduct in all the stages of the study and considering the transparency in the exploration proposition to direct the research (Johnson & Christensen, 2020). The researcher informed schools that findings would be shared to benefit the policymakers and to feedback the data-driven decisions. The interviews transcripts were offered to be shared with the participants upon their request. Finally, the researcher offered further information about the topic after finishing the study to any school that had requested it.

Chapter Four:

Data Analysis and Results of Phase One

4.1 Introduction

Chapter four presents the analysis of the students' assessment data obtained through collecting students' scores from the schools' documents. The aim was to test the research hypotheses and to find the regression model. The researcher used the Statistical Product and Services Solutions version 26 (SPSS v.26) software to run the descriptive and inferential statistics. The analysis is presented as follows:

- 1) Descriptive summary of assessment scores was conducted to test the normality of the data.
- 2) Correlational analysis was applied to find the relationships between the independent variables and dependent variables to answer the first study question:

RQ1: What is the relationship between students' attainment in MAP, aptitude level in CAT4, attitude towards learning in PASS, and SAT achievement?

- 3) Multiple regression analysis was conducted to test whether or not students' attainment, aptitude, and attitude towards learning (independent variables) could predict SAT scores (dependent variables). The same analysis was performed for SAT-Math scores and SAT-English scores. This step was done to find the regression models and the prediction equations for SAT-English and Math. Therefore, this analysis answers the second study question:

RQ2: How can the attainment in MAP, aptitude level in CAT4, and attitude towards learning in PASS predict students' achievement in SAT?

The last part of chapter four presents the analysis of leaders and teachers' questionnaires, followed by the students' questionnaires. First, each questionnaire was statistically summarised through performing descriptive and inferential statistics, validated by applying Exploratory

Factor Analysis (EFA), then AMOS-24 to perform the Confirmatory Factor Analysis (CFA). Second, stakeholders' responses were compared to find the relationships between the measured perceptions of participants. Therefore, the analysis of the questionnaires contributed to the answer of the third study question:

RQ3: What are the stakeholders' perceptions about the role of attainment in MAP, aptitude level in CAT4, and attitude towards learning in predicting students' SAT achievement?

4.2 Results of Document Analysis of Students' Assessment Data

MAP, CAT4, PASS, and SAT assessment scores were collected from the document analysis of assessment reports. The assessment scores of the whole population of 797 students from grades 9-12 students were collected. The participating students were only the students who took part in the four assessments: MAP, CAT4, PASS, and SAT. No participants were excluded except the ones who missed any of the assessments. Accordingly, 603 students' assessment scores remained after deleting any incomplete record. As shown in the descriptive summary in Table (4.1), a total of 603 students, consisting of 319 female and 284 males, had assessment scores for the four assessments. The female students represented 53.0% of the total sample, while male students represented 47.0%. In terms of students' grades, the large majority of the students were in grades 11 and 12. A total of 32.7% of the students were in grade 12 and 35.5% in grade 11, representing 68.2% of the total sample, while 17.3% were in grade 10 and 14.5% were in grade 9.

Grade	N	%	Gender	N	%
Grade 9	87	14.5%	Female	319	53.0%
Grade 10	104	17.3%	Male	284	47.0%
Grade 11	214	35.5%	Total Number of Students	603	
Grade 12	198	32.7%			

Table (4. 1): Students' Demographic Summary

The following assessment data was collected for each student:

- MAP:
 - MAP-Mathematics percentile (%ile).
 - MAP- Reading %ile and MAP- Language Usage %ile.
- CAT4: Mean Stanine (ST) score.
- PASS: A total of nine %iles for each student for the following PASS factors:
 - PASS-1: Feeling about School
 - PASS-2: Perceived Learning Capability
 - PASS-3: Learner Self-regard/Self-worth
 - PASS-4: Preparedness for Learning
 - PASS-5: Attitude to Teachers
 - PASS-6: General Work Ethic
 - PASS-7: Confidence in Learning
 - PASS-8: Attitude to Attendance
 - PASS-9: Response to Curriculum Demands
- Scholastic Assessment/Aptitude Test (SAT):
 - SAT-English: Score range from 200-800
 - SAT-Mathematics: Score range from 200-800

4.2.1 Descriptive Summary of Assessment Scores

In this section, the summary of descriptive statistics for the four assessment scores is presented in Table (4.2). The descriptive statistics in the table indicated that all variables were approximately normally distributed for two reasons: (1) the mean and the 5% Trimmed Mean values were very close indicating that the outlying values existing in the distribution are not influential, so they **do not** influence the data in any statistical process, (2) the values of the Skewness and Kurtosis were within the normal range. West et al. (1996) proposed a reference

of substantial departure from normality as an absolute Skew value > 2 , and an absolute Kurtosis (proper) value > 7 . Out of the 603 students' SAT scores, there were only 169 SAT-English scores.

Assessment Type	N	M	5% TM	Med	SD	Min	Max	Sku.	Kurt.
*SAT- Math	603	434.67	431.98	430.00	72.823	290	710	.573	.301
*SAT- English	169	447.66	442.78	440.00	56.894	280	670	1.461	3.331
MAP- Math	600	50.34	50.35	48.00	29.187	1	99	.055	-1.260
MAP- Reading	600	35.40	34.38	30.00	27.001	1	95	.432	-1.026
MAP-Language	600	41.89	41.34	38.00	28.081	0	97	.240	-1.153
CAT4	601	3.60	3.57	4.00	1.334	1	8	.375	-.083
PASS-1 Feelings about School	603	50.33	50.35	49.30	31.081	1	100	-.052	-1.345
PASS-2 Perceived Learning Capability	603	59.08	59.92	63.80	29.864	1	100	-.364	-1.153
PASS-3 Learner Self-regard	603	46.15	45.72	43.80	31.257	1	100	.214	-1.336
PASS-4 Preparedness for Learning	603	60.67	61.67	66.10	28.586	1	100	-.410	-.963
PASS-5 Attitude to Teachers	603	57.22	57.90	64.00	30.925	1	100	-.368	-1.179
PASS-6 General Work Ethic	603	47.29	47.04	44.50	31.307	0	100	.122	-1.303
PASS-7 Confidence in Learning	603	52.10	52.29	51.20	30.289	1	100	-.056	-1.288
PASS-8 Attitude to Attendance	603	53.32	53.57	54.80	30.093	0	100	-.113	-1.321
PASS-9 Response to Curriculum Demands	603	40.93	40.12	37.30	29.771	0	98	.378	-1.180

Note: N: Number of Valid Cases, M: Mean, TM: Trimmed Mean, Med: Median, SD: Standard Deviation, Min: Minimum, Max: Maximum, Sku: Skewness, Kurt: Kurtosis

*SAT-Math and SAT-English: Dependent variables

Table (4. 2): Descriptive Summary of Assessment Scores for
MAP, CAT4, PASS, and SAT (Source: Author)

In addition, the Normal Q-Q plots show no severe deviation of the points from the diagonal line indicating no noticeable deviation from normality. The following figures (Figure 4.1 to Figure 4.15) illustrate the Normal Q-Q for each type of the assessments.

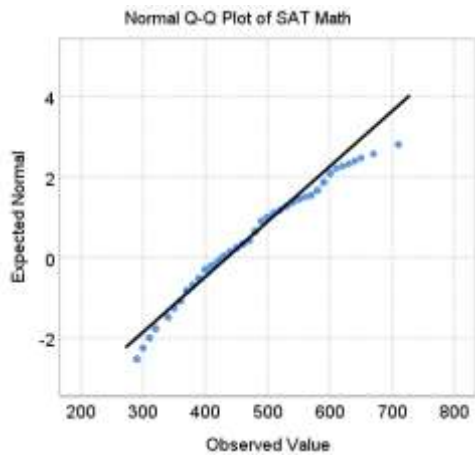


Figure (4. 1): Normal Q-Q Plot of SAT-Math

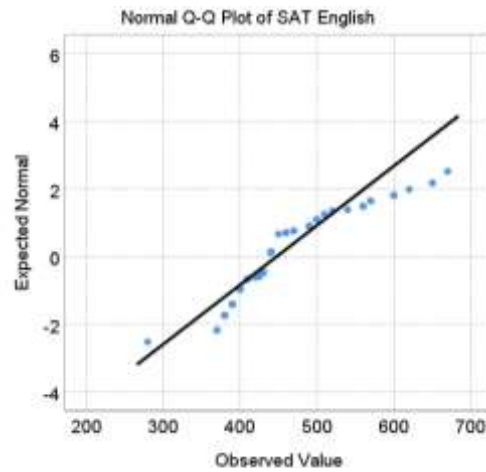


Figure (4. 2): Normal Q-Q Plot of SAT-English

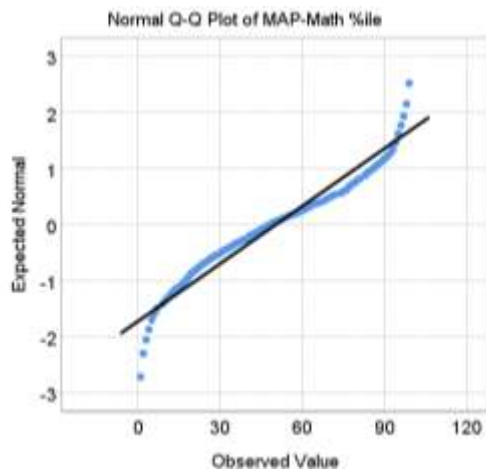


Figure (4. 3): Normal Q-Q Plot of MAP-Math

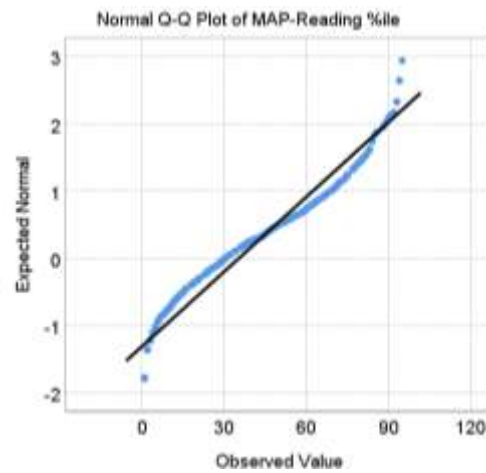


Figure (4. 4): Normal Q-Q Plot of MAP-Reading

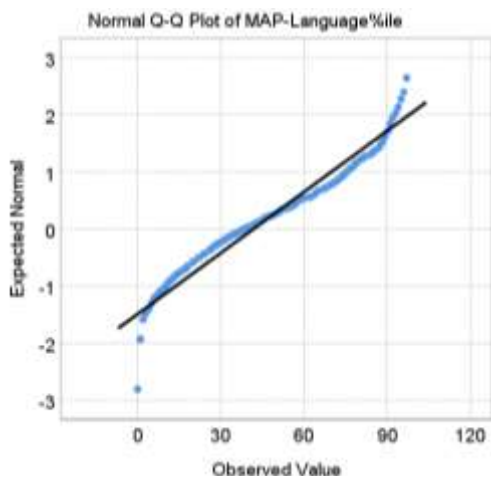


Figure (4. 5): Normal Q-Q Plot of MAP-Language

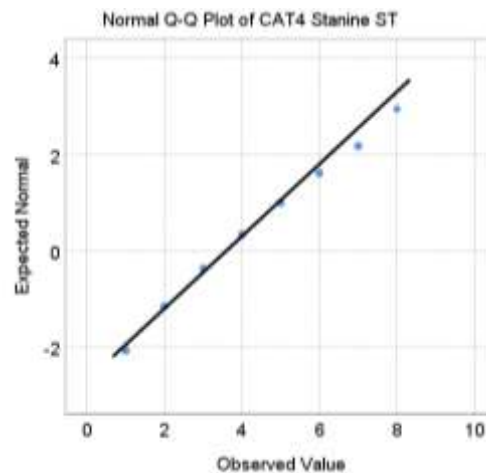


Figure (4. 6): Normal Q-Q Plot of CAT4

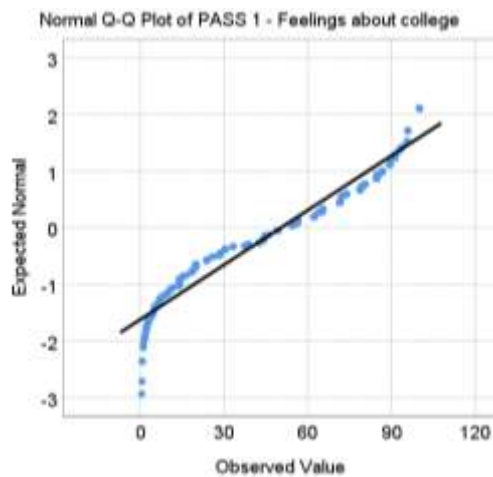


Figure (4. 7): Normal Q-Q Plot of PASS-1
Feelings about School

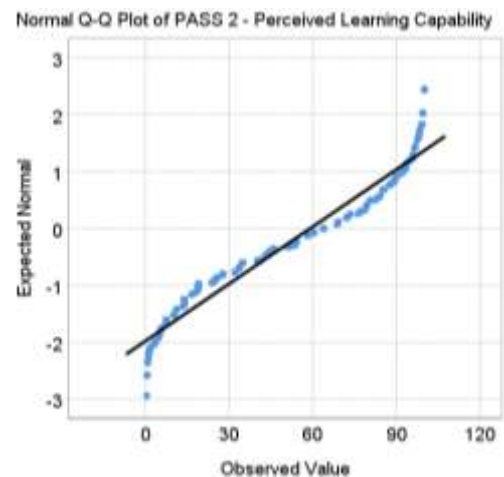


Figure (4. 8): Normal Q-Q Plot of PASS-2
Perceived Learning Capability

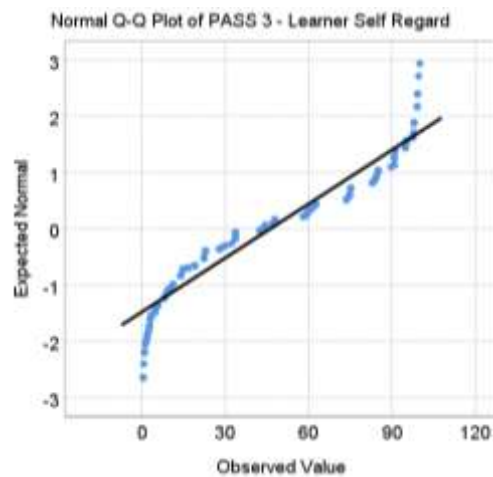


Figure (4. 9): Normal Q-Q Plot of PASS-3
Learner Self-regard

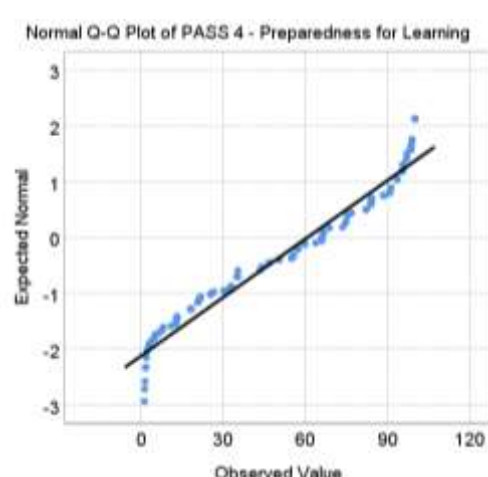


Figure (4. 10): Normal Q-Q Plot of PASS-4
Preparedness for Learning

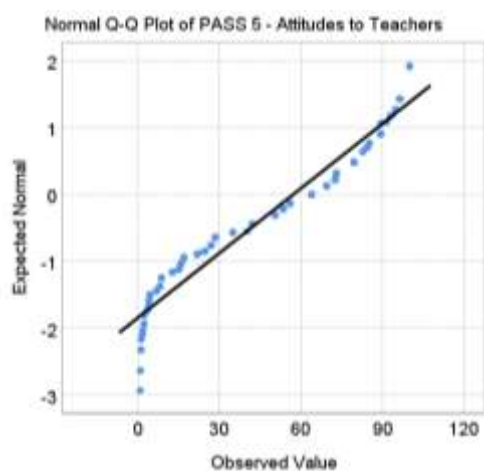


Figure (4. 11): Normal Q-Q Plot of PASS-5
Attitudes to Teachers

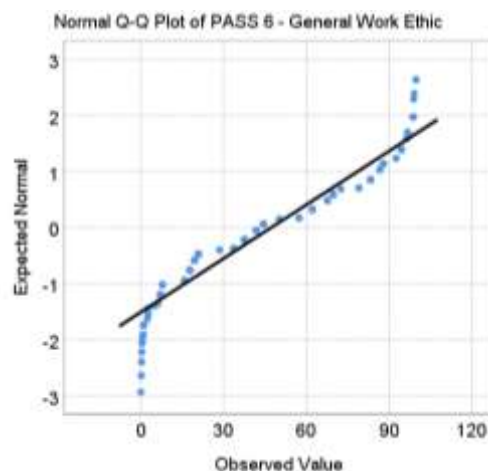


Figure (4. 12): Normal Q-Q Plot of PASS-6
General Work Ethic

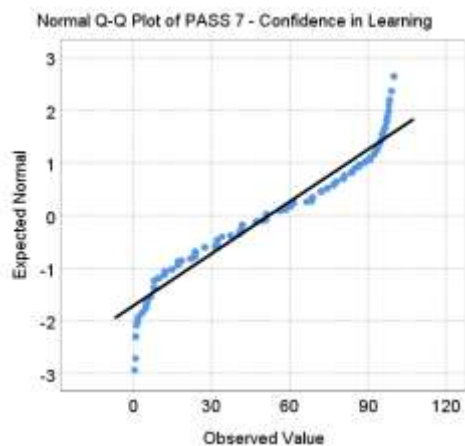


Figure (4. 13): Normal Q-Q Plot of PASS-7
Confidence in Learning

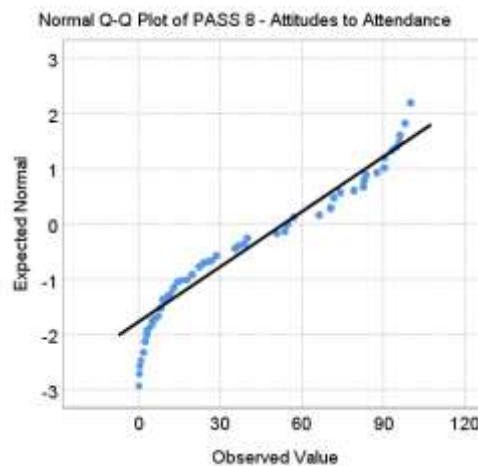


Figure (4. 14): Normal Q-Q Plot of PASS-8
Attitudes to Attendance

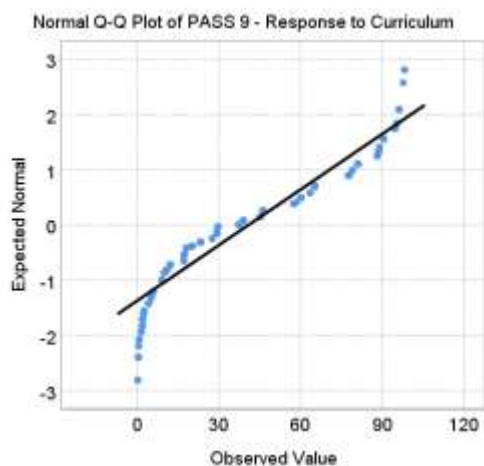


Figure (4. 15): Normal Q-Q Plot of PASS-9
Response to Curriculum Demands

Figures (4.1-4.15) (Source: Author)

4.2.2 The Relationship between the Students' Attainment, Aptitude, Attitude, and SAT Achievement

Pearson's r correlation coefficients were computed and reported in Table (4.3) to assess the relationship between the study's independent (MAP, CAT4, PASS) and dependent variables (SAT).

Variables (independent & dependent variables)	SAT- Math	SAT- English	MAP-Math	MAP-Reading	MAP-Language Usage	CAT4- Aptitude	PASS 1- Feelings about School	PASS 2- Perceived Learning Capability	PASS 3- Learner Self-regard	PASS 4 Preparedness for Learning	PASS 5- Attitudes to Teachers	PASS 6- General Work Ethic	PASS 7- Confidence in Learning	PASS 8- Attitudes to Attendance	PASS 9- Response to Curriculum Demands
SAT-Math	1														
SAT-English	.754	1													
MAP-Math	.623	.548	1												
MAP-Reading	.522	.597	.695	1											
MAP-Language Usage	.543	.592	.727	.817	1										
CAT4- Aptitude	.524	.455	.660	.646	.678	1									
PASS 1-Feelings about School	.069	-.137	.042	.053	.022	-.001	1								
PASS 2- Perceived Learning Capability	.247	.123	.222	.278	.263	.211	.497	1							
PASS 3- Learner Self-regard	.326	.148	.352	.319	.298	.346	.266	.386	1						
PASS 4-Preparedness for Learning	.212	.088	.222	.289	.240	.181	.667	.658	.357	1					
PASS 5- Attitudes to Teachers	-.014	.001	.018	.042	.012	.006	.619	.462	.134	.574	1				
PASS 6- General Work Ethic	.053	.056	.147	.095	.081	.122	.460	.413	.381	.449	.442	1			
PASS 7- Confidence in Learning	.182	.153	.116	.133	.110	.114	.444	.660	.286	.527	.369	.342	1		
PASS 8- Attitudes to Attendance	.034	-.157	.010	.003	-.020	-.043	.800	.424	.366	.528	.454	.405	.428	1	
PASS 9- Response to Curriculum Demands	.253	.107	.342	.301	.288	.289	.271	.293	.795	.281	.169	.367	.183	.294	1

Independent Variables: MAP, CAT4, PASS 1-9

Dependent Variables: SAT-Math, SAT- English

Table (4. 3): Pearson's r Correlation Coefficients

The correlational analysis indicated that there is a positive correlation between some pairs of variables and the following was concluded and detailed in Table (4.4): There is a strong positive correlation between students' academic attainment in MAP and their SAT

achievement in both Math and English. There is a strong positive correlation between students' aptitude (CAT4) and their achievement in SAT-Math while there is moderate positive correlation with SAT-English. There is a positive relationship between students' perceived learning capability, self-regard, preparedness for learning, confidence in learning, response to curriculum and SAT-Math. There is a positive relationship between students' perceived learning capability, self-regard, confidence in learning, response to curriculum and SAT-English. However, there is no correlation between students' feelings about school, attitudes toward teachers and subject, general work ethic and SAT-Math scores. There is no correlation between students' attitude towards teachers, preparedness for learning, general work ethic and SAT-English scores. Attitudes toward teachers and general work ethic were common in having no correlation with achievement in both SAT-Math and SAT-English. Feelings about school and attitudes to attendance have small negative correlation with SAT-English.

The Correlation between SAT-Math and each Assessment	The Correlation between SAT-English and each Assessment
MAP and SAT-Math	MAP and SAT-English
• There is a strong positive correlation between SAT-Math and MAP-Math, $r = 0.623$. • There is a strong positive correlation between SAT-Math and MAP- Reading, $r = 0.522$. • There is a strong positive correlation between SAT-Math and MAP-Language, $r = 0.543$.	• There is a strong positive correlation between SAT-English and MAP-Math, $r = 0.548$. • There is a strong positive correlation between SAT-English and MAP- Reading, $r = 0.597$. • There is a strong positive correlation between SAT-English and MAP-Language, $r = 0.592$.
CAT4 and SAT-Math	CAT4 and SAT-English
• There is a strong positive correlation between SAT-Math and CAT4, $r = 0.524$.	• There is a moderate positive correlation between SAT-English and CAT4, $r = 0.455$.
PASS and SAT-Math	PASS and SAT-English
• There is a moderate positive correlation between SAT-Math and PASS-3 (Learner Self-regard), $r = 0.326$. • There is a small positive correlation between SAT-Math and PASS-2 (Perceived Learning Capability), $r = 0.247$.	• There is a small positive correlation between SAT-English and PASS-2 (Perceived Learning Capability), $r = 0.123$. • There is a small positive correlation between SAT-English and PASS-3 (Learner Self-regard), $r = 0.148$.

The Correlation between SAT-Math and each Assessment	The Correlation between SAT-English and each Assessment
• There is a small positive correlation between SAT-Math and PASS-4 (Preparedness for Learning), $r = 0.212$. • There is a small positive correlation between SAT-Math and PASS-7 (Confidence in Learning), $r = 0.182$. • There is a small positive correlation between SAT-Math and PASS-9 (Response to Curriculum Demands), $r = 0.253$. • There is no correlation between SAT-Math and PASS-1 (Feelings about School), PASS-5 (Attitudes to Teachers), PASS-6 (General Work Ethic), and PASS-8 (Attitudes to Attendance).	• There is a small positive correlation between SAT-English and PASS-7 (Confidence in Learning), $r = 0.153$. • There is a small negative correlation between SAT-English and PASS-1 (Feelings about School), $r = -0.137$. • There is a small negative correlation between SAT-English and PASS-8 (Attitudes to Attendance), $r = -0.157$. • There is a small positive correlation between SAT-English and PASS-9 (Response to Curriculum Demands), $r = 0.107$. • There is no correlation between SAT-English and PASS-4 (Preparedness for Learning), PASS-5 (Attitudes to Teachers), and PASS-6 (General Work Ethic)

r: correlation coefficient reflects the strength of the relationship between the two variables

Table (4. 4): The Correlation between SAT and each Assessment
(Source: Author)

The analysis also indicated the relationship between the independent variables. The detailed correlational analysis is reported in (Appendix L). However, the below points summarise main findings:

- There is a strong positive correlation between students' SAT-Math and SAT-English scores, $r = 0.754$.
- There is a strong positive correlation between MAP-Math and MAP- Reading; between MAP-Math and MAP-Language Usage; between MAP- Reading and MAP-Language Usage.
- There is a strong positive correlation between CAT4 and each of the Map-Reading, MAP-Language Usage and MAP-Math scores.

- The PASS factors: Students' perceived learning capability, preparedness for learning, general work ethic and confidence in learning have a small positive correlation with the CAT4 and each of the MAP assessments.
- There is no correlation between the PASS factors: Attitudes to teachers and attendance, feelings about school and CAT4 and each of the MAP assessments.
- Learner self-regard has a moderate positive correlation with the CAT4, MAP- Reading, and MAP-Math.
- Response to curriculum demands has a small positive correlation with CAT4 but moderate positive correlation with MAP- Reading and MAP-Math.

4.2.3 Predictability of Students' Achievement in SAT by Attainment, Aptitude and Attitude towards Learning Scores

Multiple regression analysis was conducted to test whether or not MAP, CAT4, and PASS test scores could predict SAT tests scores and to create the prediction equations. Hence the collected data was not based on random sampling; studying the variables' relationship and predictability were based on correlation and regression coefficients and effect size rather than using the p-values or confidence intervals (Gorard, 2015; Gorard & Gorard, 2016). In this study, SAT-Math and SAT-English were used as the dependent variables, while the independent variables included MAP- Math %ile, MAP- Reading %ile, MAP- Language Usage %ile, CAT4 Stanine scores, and the nine PASS factors representing the attitudes toward learning. In correspondence, before considering regression results, the following regression assumptions were examined.

1) Regression Assumptions:

Testing the assumptions of multiple regression is an important process to utilize regression and to avoid biased estimates of relationships or standard errors (Chatterjee & Hadi, 2012; Cohen et al., 2003). This process is important as a prerequisite step before drawing conclusions from regression models which enhance the trustworthy conclusions (Williams, Grajales & Kurkiewicz, 2013).

Regression Assumption 1: The relationship between the independent variables and the dependent variable is linear. Partial regression plots attached (Appendix M) for Model-1 and (Appendix N) for Model-2 were checked and they revealed linear combinations between the dependent variables and the independent variables. Therefore, this assumption had been successfully met.

Regression Assumption 2: There is no multicollinearity in your data. In a multiple regression model, it is important to study the intercorrelations between the independent variables. The occurrence of high intercorrelations between the independent variables leads to misleading or skewed results (Cohen et al., 2003). Therefore, in the current study the analysis of collinearity statistics was conducted and showed that this assumption has been met, as the Variance Inflation Factor (VIF) scores were well below 10 and tolerance scores above 0.2. These findings indicate that there is no multicollinearity in the data. The collinearity statistics were reported in regression output tables attached (Appendix O)

Regression Assumption 3: The values of the residuals are independent. The Durbin-Watson statistic should have a value between 0 and 4 to indicate there is no autocorrelation detected in the data. This means that the correlation is modelled between the data points well. As shown in Appendices O & P, the obtained Durbin-Watson statistic value was around 2 (Durbin-Watson = 1.618 for Model 1 and 1.678 for Model 2) which showed that this assumption had been met and there was no autocorrelation problem in both models.

Regression Assumption 4: The variance of the residuals is constant. The plots of standardised residuals vs standardised predicted values attached (Appendix Q) showed no obvious signs of funnelling, suggesting the assumption of homoscedasticity had been met. This means that the variance of the dependent variables (MAP, CAT4, and PASS) was the same for all data.

Regression Assumption 5: The values of the residuals are normally distributed. The P-P plots for the two models attached in Appendix Q suggested that the assumption of normality of the residuals have been met. No deviations from normality are obvious, which is confirmed by the histograms attached in Appendix Q.

Regression Assumption 6: There are no influential cases biasing the model. Cook's Distance is used in regressions analysis to identify influential outliers in the independent variables which might affect the regression model negatively (Cohen et al., 2003). The analysis showed that Cook's Distance values were all under 1 (min = 0 and max = 0 for Model-1, and min = 0.03 and max = 0.11 for Model-2), suggesting individual cases were not unduly influencing the model.

In conclusion, regression assumptions were all met, and this assured regression analysis output was valid (Cohen et al., 2003).

2) Regression Model-1: Predicting SAT-Math Score

In Model-1, as shown in Figure (4.16) below, SAT-Math score was the dependent variable while students' academic attainment (MAP-Math, MAP- Reading, MAP-Language Usage), students' aptitude (CAT4 Stanine), and students' attitude towards learning (PASS-1 to PASS-9) were the independent variables.

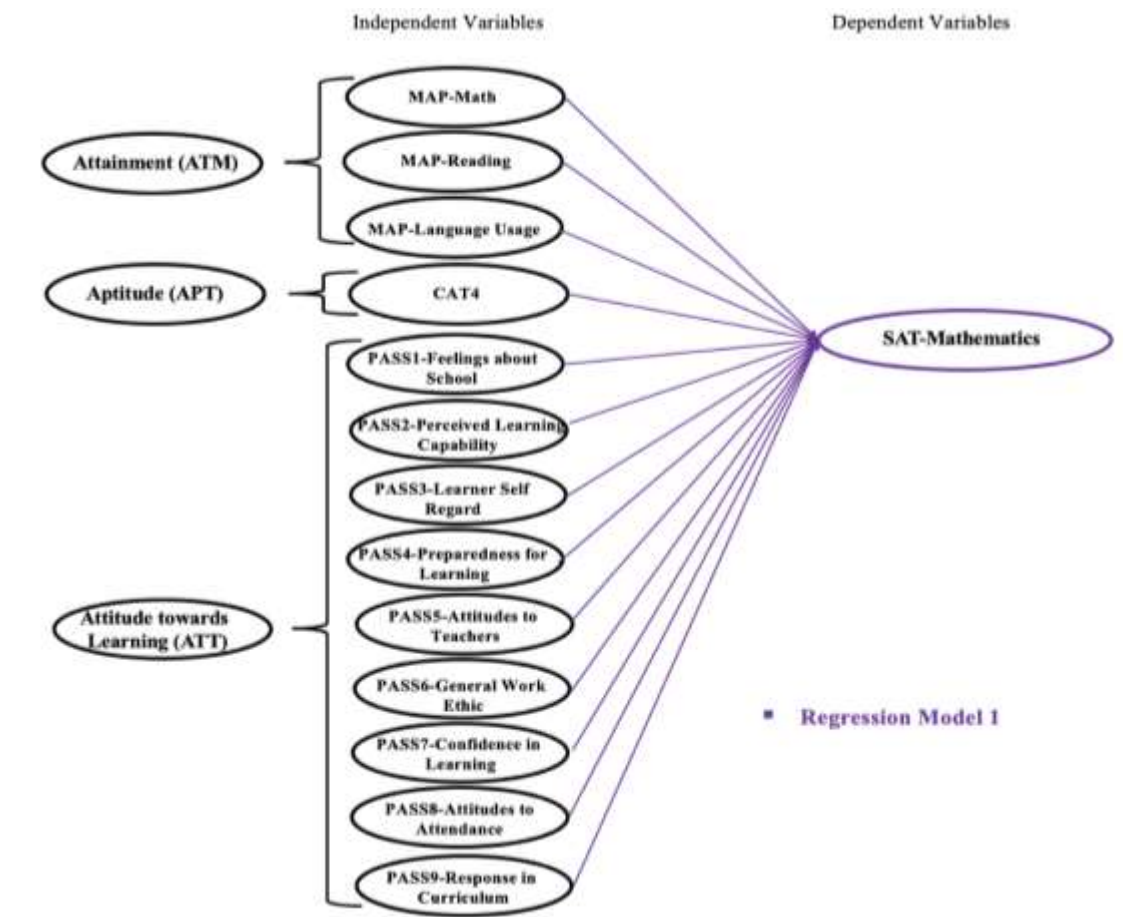


Figure (4. 16): Regression Model-1
(Source: Author)

Model-1: the regression results are presented in Appendix O and summarised in Table (4.5), indicating that the model could explain 44.7% of the variance in SAT-Math scores with large effect size (0.808), $F(13,584) = 36.249$, $R^2 = 0.447$, $f^2 = 0.808$. The overall effect size indicates a truly large effect, according to Cohen (1988) where f^2 value of 0.02, 0.15, 0.35 are considered small, medium, and large effect size respectively.

Dependent Variable: SAT-Math	Coefficients			
Independent Variables (Predictors)	B	95% CI	β	f^2
Constant/Intercept	335.877	[319.351,352.403]	-	-
MAP-Math	1.021	[.782,1.259]	.412	.072
MAP- Reading	.083	[-.215,.381]	.031	.000
MAP-Language Usage	.201	[-.100,.502]	.078	.002
CAT4- Aptitude	7.258	[2.385,12.131]	.134	.008
PASS 1 – Feelings about School	.254	[-.036,.543]	.109	.003
PASS 2 – Perceived Learning Capability	.126	[-.105,.357]	.052	.001
PASS 3 – Learner Self-regard	.381	[.123,.639]	.165	.008
PASS 4 – Preparedness for Learning	.032	[-.221,.285]	.013	.000
PASS 5 – Attitudes to Teachers	-.178	[-.374,.018]	-.076	.003
PASS 6 – General Work Ethic	-.268	[-.440, -.095]	-.116	.009
PASS 7 – Confidence in Learning	.176	[-.022,.374]	.074	.003
PASS 8 – Attitudes to Attendance	-.166	[-.425,.092]	-.069	.002
PASS 9 – Response to Curriculum Demands	-.180	[-.431,.071]	-.074	.002

B: Unstandardized Coefficient; CI: Confidence Interval for B.

β : Beta Standardized Coefficient; f^2 : Effect Size

Table (4. 5): Model-1 Multiple Regression Results for Predicting SAT-Math

(Source: Author)

Focusing only on the coefficients (B) and the effect size (f^2) in Table (4.5) for each predictor individually indicated that students' attainment in MAP-Math ($B = 1.021$, $f^2 = 0.072$) had a correlation coefficient of 1.021 and a small-medium effect size which was the highest among all predictors, while students' aptitude ($B = 7.258$, $f^2 = 0.008$) had the highest correlation coefficient and an effect size of 0.008. Learners' self-regard ($B = 0.381$, $f^2 = 0.008$) had a correlation coefficient of 0.381 and an effect size of 0.008. General work ethic ($B = -0.268$, f^2

= 0.009) had a negative correlation coefficient and an effect size of 0.009, while the rest of the predictors either had no effect size or below 0.02.

Moreover, the contribution of each variable was also measured by the value of the standardised B; that is β (or Beta). The most positive contributing variable was the MAP-Math score with $\beta = 0.412$, followed by learner self-regard with $\beta = 0.165$, aptitude with $\beta = 0.134$, then feelings about school with $\beta = 0.109$.

In order to write a regression equation to predict SAT-Math, the regression coefficients were used from Table (4.5) above.

The prediction equation for SAT-Math indicated that an average student would obtain a score of around (335.877) holding other predictors constant.

$$\begin{aligned} \textbf{SAT Math} = & 335.877 + 1.021(\text{MAP Math}) + 0.083(\text{MAP Reading}) + 0.201(\text{MAP} \\ & \text{Language}) + 7.258(\text{CAT4 Aptitude}) + 0.254(\text{PASS1 Feeling about School}) + \\ & 0.126(\text{PASS2 Perceived Learning Capability}) + 0.381(\text{PASS3 Learner Self-Regard}) + \\ & 0.032(\text{PASS4 Preparedness for Learning}) - 0.178(\text{PASS5 Attitude to Teachers}) - \\ & 0.268(\text{PASS6 General Work Ethic}) + 0.176(\text{PASS7 Confidence in Learning}) - \\ & 0.166(\text{PASS8 Attitudes to Attendance}) - 0.180(\text{PASS9 Response to Curriculum} \\ & \text{Demands}) \end{aligned}$$

Therefore 1%ile increase in MAP-Math would increase SAT-Math score by 1.021, 1%ile increase in MAP-Reading would increase SAT-Math by 0.083, 1%ile increase in MAP-Language would increase SAT-Math by 0.201, 1 Stanine ST increase in CAT4-Aptitude would increase SAT-Math by 7.258, 1%ile increase in feelings about school, perceived learning capability, learner self-regard, preparedness for learning, and confidence in learning would increase SAT-Math by 0.254, 0.126, 0.381, 0.032, and 0.176 respectively. However, 1%ile

increase in attitudes to teachers, general work ethic, attitudes to attendance, and response to curriculum demands would decrease MAP-Math score by 0.178, 0.268, 0.166, and 0.180 respectively.

3) Regression Model-2: Predicting SAT-English Score

In Model-2, as shown in Figure (4.17) below, SAT- English score was the dependent variable, while students' academic attainment (MAP- Math, MAP- Reading, MAP-Language Usage), students' aptitude (CAT4 Stanine), and students' attitude towards learning (PASS-1 to PASS-9) were the independent variables.

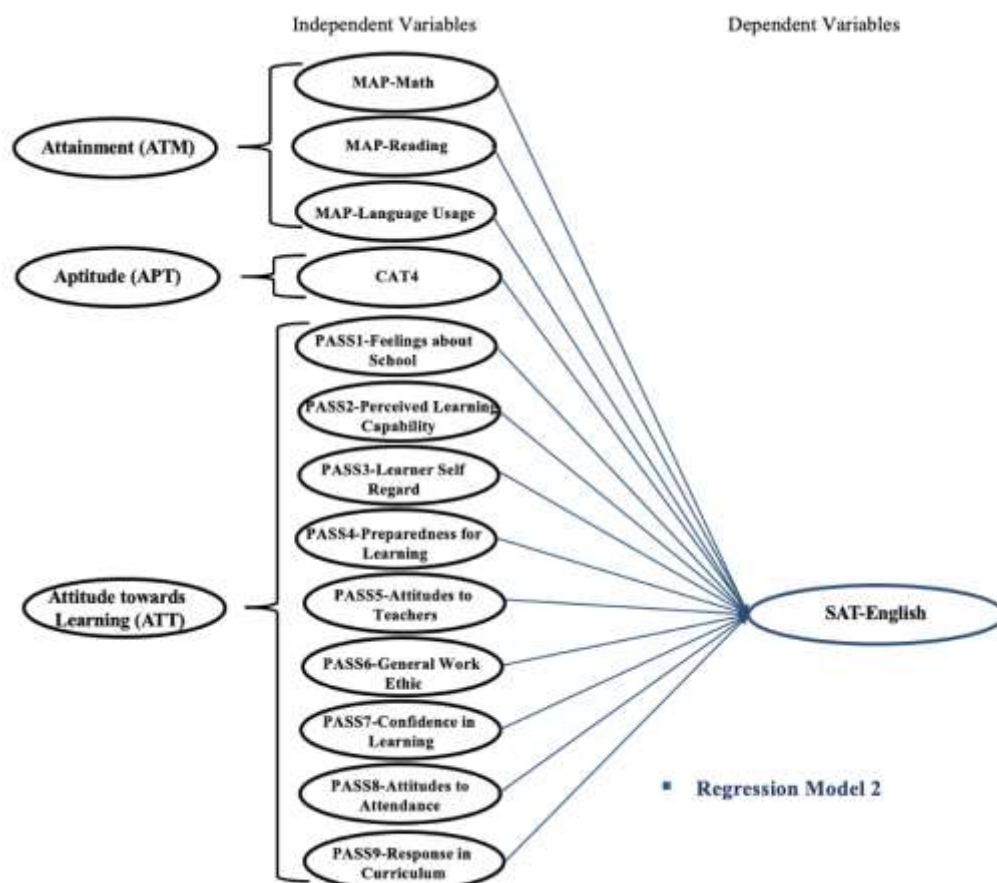


Figure (4. 17): Regression Model-2
(Source: Author)

Model-2: The regression results are presented in Appendix P and summarised in Table (4.6), indicating that the model could explain 42.9% of the variance in SAT-English scores with large

effect size, $F(13,152) = 8.771$, $R^2 = 0.429$, $f^2 = 0.751$. The overall effect size indicates a large effect according to Cohen (1988).

Dependent Variable: SAT-English	Coefficients			
Independent Variables (Predictors)	B	95% CI	β	f^2
Constant/Intercept	404.116	[376.783,431.450]	-	-
MAP-Math	.284	[-.149,.717]	.155	.006
MAP- Reading	.641	[.119,1.163]	.318	.023
MAP-Language Usage	.400	[-.147,.947]	.208	.008
CAT4-Aptitude	-2.031	[-9.537,5.476]	-.051	.001
PASS 1 – Feelings about School	-.068	[-.540,.404]	-.038	.000
PASS 2 – Perceived Learning Capability	.008	[-.354,.370]	.004	.000
PASS 3 – Learner Self-regard	.106	[-.328,.540]	.059	.001
PASS 4 – Preparedness for Learning	.076	[-.339,.490]	.037	.000
PASS 5 – Attitudes to Teachers	-.115	[-.475,.244]	-.062	.002
PASS 6 – General Work Ethic	.088	[-.232,.408]	.048	.001
PASS 7 – Confidence in Learning	.330	[.002,.657]	.178	.015
PASS 8 – Attitudes to Attendance	-.255	[-.700,.190]	-.138	.005
PASS 9 – Response to Curriculum Demands	-.273	[-.716,.170]	-.141	.006

B: Unstandardized Coefficient; CI: Confidence Interval for B.

β : Beta Standardized Coefficient; f^2 : Effect Size

Table (4. 6): Multiple Regression Results for Model-2

(Source: Author)

Studying the coefficients (B) and the effect size (f^2) in Table (4.6) for each predictor individually indicated that students' attainment in MAP- Reading ($B = 0.641$, $f^2 = 0.023$) had the highest correlation coefficient of 0.641 and a small effect size, confidence in learning ($B =$

0.330, $f^2 = 0.015$) also had small effect size, while MAP- Language ($B = 0.400$, $f^2 = 0.008$), and MAP- Math ($B = 0.284$, $f^2 = 0.006$) had effect size below 0.02. On the other hand, attitudes to attendance ($B = -0.255$, $f^2 = 0.005$), and response to curriculum demands ($B = -0.273$, $f^2 = 0.006$) had negative correlation coefficients with effect size below 0.02, while students' aptitude ($B = -2.031$, $f^2 = 0.001$), feelings about school ($B = -0.068$, $f^2 = 0.000$), and attitudes to teachers ($B = -0.115$, $f^2 = 0.002$), had negative correlation coefficients with almost no effect size.

Moreover, the contribution of each variable was measured by the value of the standardised B; that is β (or Beta). The most positive contributing variable was the MAP-Reading score with $\beta = 0.32$, followed by MAP- Language usage with $\beta = 0.208$, confidence in learning with $\beta = 0.178$, then MAP-Math with $\beta = 0.155$.

Regression Equation for Prediction SAT-English

In order to write a regression equation to predict SAT-English, the regression coefficients were used from Table (4.6) above. The prediction equation for SAT-English indicated that an average student would obtain a score of around (404.116) holding other predictors constant.

$$\begin{aligned} \textbf{SAT English} = & 404.116 + 0.284(\text{MAP Math}) + 0.641(\text{MAP Reading}) + \\ & 0.400(\text{MAP Language}) - 2.031(\text{CAT4 Aptitude}) - 0.068 (\text{PASS1 Feeling about} \\ & \text{School}) + 0.008 (\text{PASS2 Perceived Learning Capability}) + 0.106 (\text{PASS3} \\ & \text{Learner Self-Regard}) + 0.076(\text{PASS4 Preparedness for Learning}) - 0.115 \\ & (\text{PASS5 Attitude to Teachers}) + 0.088(\text{PASS6 General Work Ethic}) + 0.330 \\ & (\text{PASS7 Confidence in Learning}) - 0.255(\text{PASS8 Attitudes to Attendance}) - \\ & 0.273(\text{PASS9 Response to Curriculum Demands}) \end{aligned}$$

Therefore 1%ile increase in MAP-Math, MAP-Reading, and MAP-Language Usage would increase SAT-English score by 0.284, 0.641, and 0.400 respectively. One Stanine increase in

aptitude would decrease SAT-English by 2.031, 1%ile increase in perceived learning capability, learner self-regard, preparedness for learning, general work ethic, and confidence in learning would increase SAT-English by 0.008, 0.106, 0.076, 0.088, and 0.330 respectively. 1%ile increase in feelings about school, attitudes to teachers, attitudes to attendance, and response to curriculum demands would decrease MAP-English score by 0.068, 0.115, 0.255, and 0.273 respectively.

4.3 Stakeholders' Questionnaire Results

The questionnaires were sent to five US curriculum schools that implement the four types of assessments: MAP, CAT4, PASS, and SAT. The main purpose of the questionnaire was to obtain the stakeholders' perceptions about the role of academic attainment, aptitude level, and attitude towards learning in students' achievement in SAT. Each questionnaire consisted of two parts: part one about the participants' demographic information and part two about participants' perceptions. Part two consisted of 30 self-reporting statements categorized under three sections covering the academic, cognitive, and affective factors. Each factor involved 10 self-reporting statements and one open-ended question. The statements captured the participants' perceptions about using these assessments to achieve the SAT's target and the relationship between each type of assessment and the SAT. At the end of each section there was one open-ended question to give the participants a space for elaboration on the predictability of SAT by one of the other assessments: MAP, CAT4, and PASS.

4.3.1 Leaders' and Teachers' Questionnaire Results

The main purpose of the leaders' and teachers' questionnaires was to capture their perceptions about the role of students' academic attainment in MAP, aptitude level, and attitude towards learning in SAT achievement.

4.3.1.1 Demographic Information

A total of 36 leaders and 48 teachers (N = 84) participated in the study by responding to the study questionnaire. Descriptive summary including frequencies and percentages of demographic characteristics for leaders and teachers is presented in Table (4.9). Female participants represent the larger proportion of the sample (70.2%). Lebanese represented the largest proportion of the sample (33.3%), followed by Jordanians (13.1%), and Egyptians (11.9%). Most participants (77.4%) noted their first language was Arabic while 16.7% noted English as their first language.

Demographics		Participants		
		Leaders	Teachers	Total
Gender		Number (%)	Number (%)	Number (%)
	Female	25 (69.4)	34 (70.8)	59 (70.2)
	Male	11 (30.6)	14 (29.2)	25 (29.8)
Nationality				
	American	6 (16.7)	2 (4.2)	8 (9.5)
	British	1 (2.8)	2 (4.2)	3 (3.6)
	Canadian	4 (11.1)	4 (8.3)	8 (9.5)
	Czech	1 (2.8)	1 (2.1)	2 (2.4)
	Egyptian	5 (13.9)	5 (10.4)	10 (11.9)
	Emirati	-	1 (2.1)	1 (1.2)
	German	2 (5.6)	-	2 (2.4)
	Indian	-	1 (2.1)	1 (1.2)
	Iraqi	-	1 (2.1)	1 (1.2)
	Irish	-	3 (6.3)	3 (3.6)
	Jordanian	3 (8.3)	8 (16.7)	11 (13.1)
	Kenyan	-	1 (2.1)	1 (1.2)
	Lebanese	10 (27.8)	18 (37.5)	28 (33.3)
	Pakistani	1 (2.8)	-	1 (1.2)
	Palestinian	2 (5.6)	1 (2.1)	3 (3.6)
	Syrian	1 (2.8)	-	1 (1.2)

Demographics		Participants		
		Leaders	Teachers	Total
First Language (Mother Tongue)				
	Arabic	26 (72.2)	39 (81.3)	65 (77.4)
	English	7 (19.4)	7 (14.6)	14 (16.7)
	Other	3 (8.3)	2 (4.2)	5 (6.0)
Second Language				
	Arabic	2 (5.6)	1 (2.1)	3 (3.6)
	English	28 (77.8)	42 (87.5)	70 (83.3)
	Other	6 (16.7)	5 (10.4)	11 (13.1)

Percentages and totals are based on respondents. Dichotomy group tabulated at value 1.

Table (4. 7): Demographic Information (gender and nationalities) of Leaders (n = 36) and Teachers (n = 48); N = 84. (Source: Author)

As shown in Table (4.8), Leaders' and teachers' current roles and specialisation were listed. The highest percentage of leaders was in the role of Head of Department/Coordinator. None of the teachers were Directors or Heads of Department. For specialisation, there was a difference between leaders and teachers in terms of Math and other specialisations. That is, teachers were specialized in subjects more than Leaders. For other demographic characteristics, leaders' and teachers' samples were similarly distributed and hence their responses can be viewed simultaneously; no differences were based on their demographic characteristics.

Demographics		Participants		
		Leaders	Teachers	Total
Current Role		Number (%)	Number (%)	Number (%)
Academic Advisor		4 (11.1)	2 (4.2)	6 (7.1)
Assessment (Director/HoD/Coordinator)		2 (5.6)	-	2 (2.4)
Assistant/Vice Principal		1 (2.8)	-	1 (1.2)
Coach		6 (16.7)	9 (18.8)	15 (17.9)

Demographics	Participants		
	Leaders	Teachers	Total
Current Role	Number (%)	Number (%)	Number (%)
Curriculum (Director/HoD/Coordinator)	6 (16.7)	-	6 (7.1)
Deputy Director	2 (5.6)	-	2 (2.4)
Director General	1 (2.8)	-	1 (1.2)
Head of Department/Coordinator	8 (22.2)	6 (12.5)	14 (16.7)
Head/Coordinator of Inclusion (Special Educational Needs)	1 (2.8)	-	1 (1.2)
Principal/Superintendent	4 (11.1)	-	4 (4.8)
Social/Career Counsellor	2 (5.6)	-	2 (2.4)
Teacher/Lead Teacher	4 (11.1)	36 (75.0)	40 (47.6)
Others	4 (11.1)	3 (6.3)	7 (8.3)
Specialisation			
English	10 (29.4)	12 (25.0)	22 (26.8)
Humanities	-	1 (2.1)	1 (1.2)
Math	13 (38.2)	30 (62.5)	43 (52.4)
Science	2 (5.9)	7 (14.6)	9 (11.0)
Other	13 (38.2)	4 (8.3)	17 (20.7)

Percentages and totals are based on respondents. Dichotomy group tabulated at value 1.

Table (4. 8): Demographic Information (roles and specialisations) of Leaders (n = 36) and Teachers (n = 48); N = 84 (Source: Author)

Table (4.9) below shows participants' academic qualifications and years of experience. The overall sample was made up of qualified educators as the majority (51.2%) held Master's degrees, 40.5% held Bachelor's degrees, and 8.3% held a PhD/Doctorate. Moreover, participants seemed well experienced, specifically 46.4% of the sample had more than 15 years of overall experience and 42.9% had from eight to 15 years' experience. The majority (64.2%) had from one to seven years of experience in the current school.

Demographics		Participants		
		Leaders	Teachers	Total
Qualifications – Highest Degree		Number (%)	Number (%)	Number (%)
	Bachelor	11 (30.6)	23 (47.9)	34 (40.5)
	Master	21 (58.3)	22 (45.8)	43 (51.2)
	PhD/Doctorate	4 (11.1)	3 (6.3)	7 (8.3)
Overall Years of Experience				
	4-7 years	6 (16.7)	3 (6.3)	9 (10.7)
	8-11 years	7(19.4)	15 (31.3)	22 (26.2)
	12-15 years	4 (11.1)	10 (20.8)	14 (16.7)
	Over 15 years	19 (52.8)	20 (41.7)	39 (46.4)
Years of Experience in the Current School				
	1-3 years	14 (38.9)	13 (27.1)	27 (32.1)
	4-7 years	10 (27.8)	17 (35.4)	27 (32.1)
	8-11 years	4 (11.1)	11 (22.9)	15 (17.9)
	Over 11 years	8 (22.2)	7 (14.6)	15 (17.9)

Percentages and totals are based on respondents. Dichotomy group tabulated at value 1.

Table (4. 9): Demographic Information (qualifications and years of experience) of Leaders (n = 36) and Teachers (n = 48); N = 84
(Source: Author)

4.3.1.2 Leaders' and Teachers' Perceptions about Students' Attainment, Aptitude, Attitude, and SAT Scores

This section presents the descriptive statistics for leaders and teachers' perceptions about Academic, Cognitive, and Affective Factors. Perceptions of leaders and teachers are summarised in terms of frequencies, percentages, mean, standard deviation, and relative agreement.

I) Academic Factor – Attainment

As shown in Figure (4.18), teachers seemed to have more experience in using the MAP test than leaders, specifically 85.5% of teachers had at least four years of experience using the MAP test, while 55.8% of leaders had the same experience. On the other hand, 44.1% of leaders had

less experience (less than four years), while 24.4% of teachers had the same amount of experience.

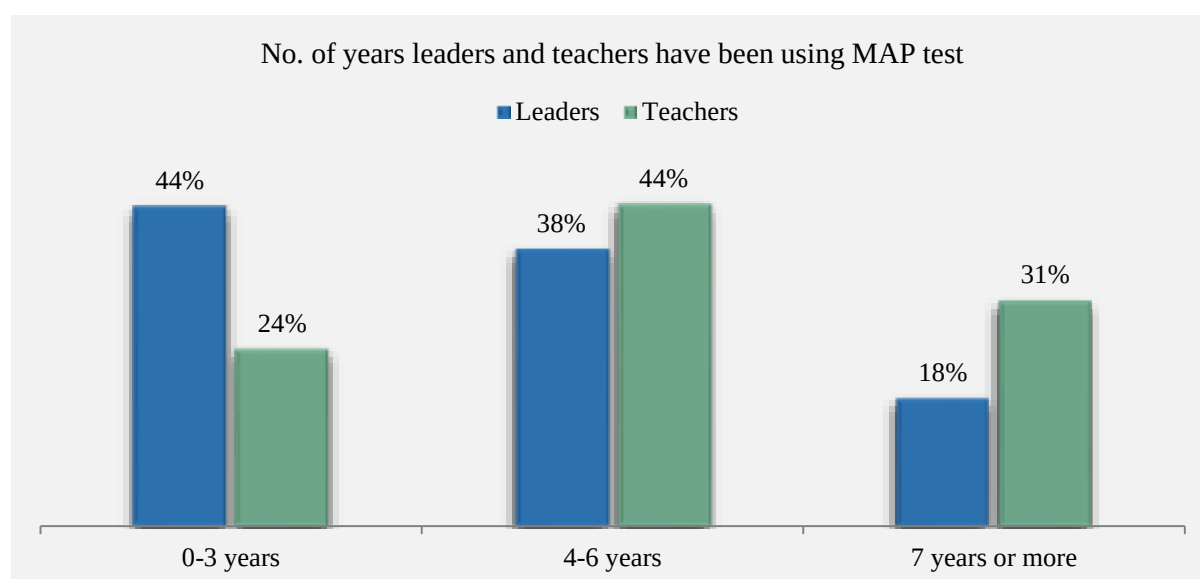


Figure (4. 18): No. of Years Leaders and Teachers Used the MAP Test
(Source: Author)

The Relationship between Attainment (MAP) and Achievement in SAT

The following part investigates the relationship between the MAP test and students' achievement in SAT. The percentages of participants responses are plotted in Figure (4.19) for leaders and in Figure (4.20) for teachers. The results show that, overall, leaders have higher Relative Agreement (RA = 83.6%) than teachers (RA = 76.8%).

As shown in Figure (4.19), overall leaders' responses showed that the highest agreement was with statement (3): "I encourage students to use the information in the MAP report to improve their academic knowledge and skills", followed by statement (2): "I believe that training students on using the MAP test report helps them to improve their learning", then statement (6): "I recommend using MAP Goals or the MAP 'Student Goal Setting Worksheet' frequently to reflect with students on their achievement". The common point between the three statements was that leaders believe and encourage the practice of using MAP reports and reflecting on goals to improve students' learning and enhance academic achievement. The minimum

agreement was with statement (8): “I think MAP tests are helpful in improving students’ scores in SAT”. In conclusion, leaders’ agreement on the role of the MAP test in students’ general academic achievement is higher than their agreement with the role of the MAP test in students’ achievement in SAT specifically.

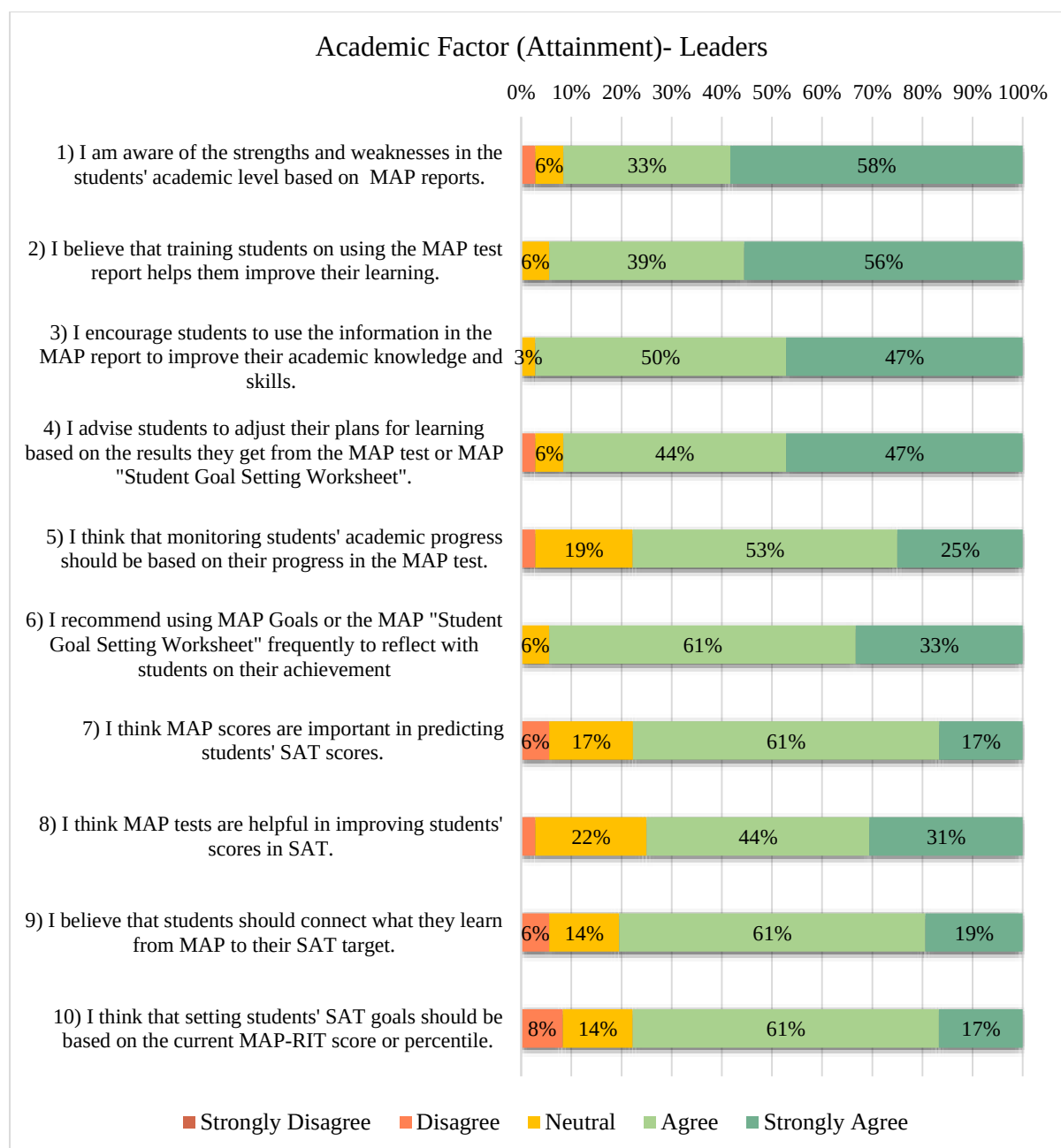


Figure (4. 19): Leaders’ Perceptions about Academic Factors (%)

(Source: Author)

As shown in Figure (4.20), overall teachers’ responses showed that the highest agreement (94%) was with statement (1): “I am aware of the strengths and weaknesses in the students’

academic level based on MAP reports”, followed by (91%) statement (3): “I encourage my students to use the information in the MAP report to improve their academic knowledge and skills”, then statement (5): “I monitor students’ academic progress based on their progress in the MAP test.” The minimum agreement (44%) was with statement (10): “I try to set students’ SAT goals based on the current MAP-RIT score or percentile”.

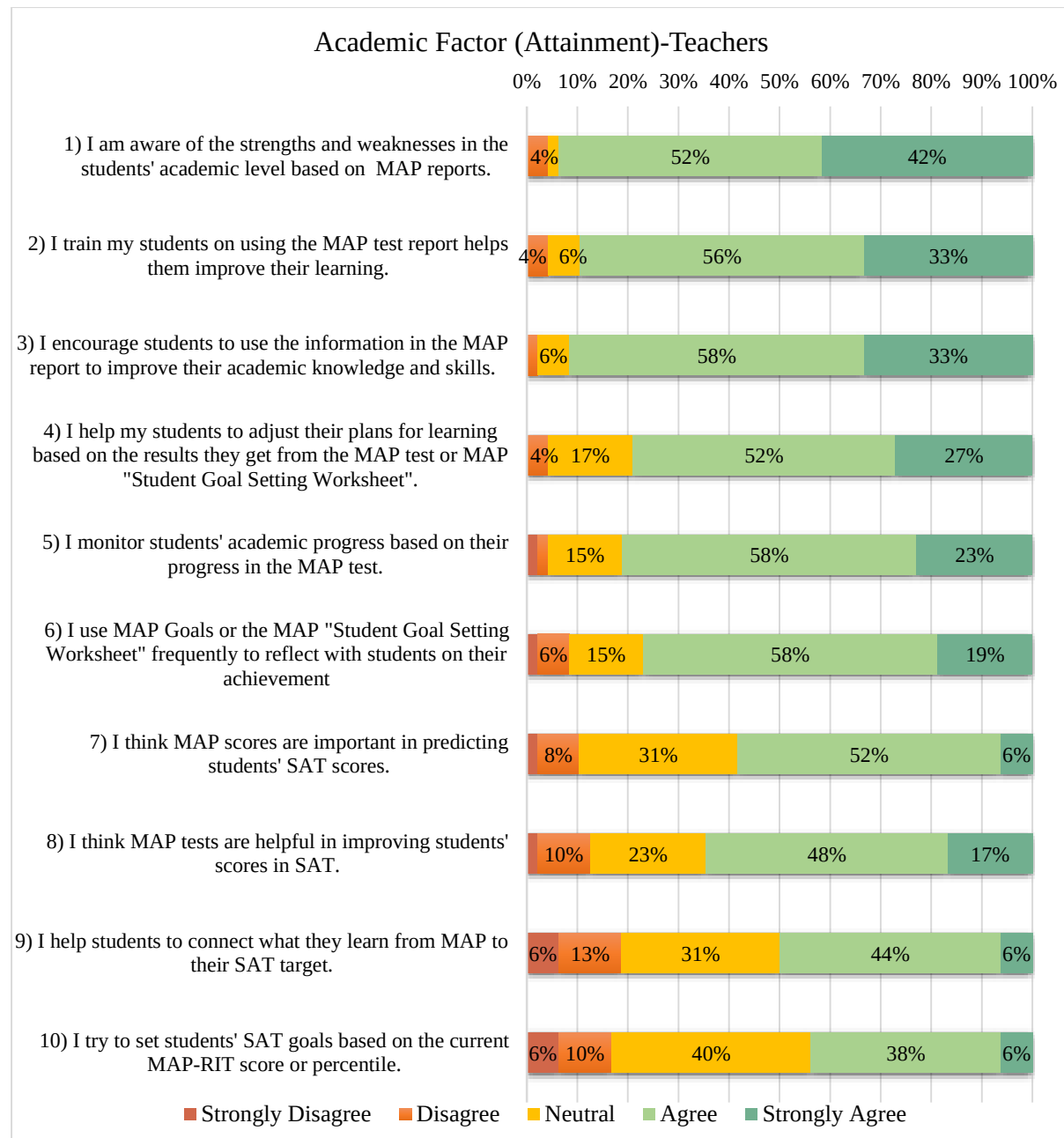


Figure (4. 20): Teachers’ Perceptions about Academic Factors (%)

(Source: Author)

In conclusion, teachers' agreement with the role of the MAP test in students' learning and general academic achievement was higher than their agreement with the role of the MAP test in students' achievement in SAT specifically.

In general, leaders and teachers agree on the use of the MAP test to enhance students' learning and the importance of reflection and setting goals using the MAP Goal Sheet. However, they showed lower agreement with the relationship between MAP and SAT and the role of MAP in SAT scores.

Comparison between Leaders and Teachers Perceptions

In Table (4.12), perceptions of leaders and teachers are summarised. The descriptive summary of the academic factors' 10 statements is presented in Table (4.10), including frequencies and percentages of response scores, mean, standard deviation, and relative agreement. The results show that overall leaders have higher (RA= 83.6%) than teachers (RA= 76.8%). In terms of statements, the following results were found:

- Leaders had higher RA (90.0%) than teachers (83.8%) with statement number (2): "I believe that training students on using the MAP test report helps them improve their learning".
- Leaders had higher RA (87.2%) than teachers (80.4%) with statement number (4): "I advise students to adjust their plans for learning based on the results they get from the MAP test or MAP Student Goal Setting Worksheet".
- Leaders had higher RA (85.6%) than teachers (77.0%) with statement (6): "I recommend using MAP Goals or the MAP Student Goal Setting Worksheet frequently to reflect with students on their achievement".

- Leaders had higher RA (77.8%) than teachers (70.4%) with statement (7): “I think MAP scores are important in predicting students’ SAT scores”.
- Leaders had higher RA (78.8%) than teachers (66.2%) with statement (9): “I believe that students should connect what they learn from MAP to their SAT target”.
- Leaders had higher RA (77.2%) than teachers (65.4%) with statement (10): “I think that setting students’ SAT goals should be based on the current MAP-RIT score or percentile”.

Attainment MAP	Leaders								Teachers							
	SD	D	N	A	SA	M	SDv	RA	SD	D	N	A	SA	M	SDv	RA
1	-	1	2	12	21	4.47	.736	89.4%	-	2	1	25	20	4.31	.719	86.2%
		2.8%	5.6%	33.3%	58.3%					4.2%	2.1%	52.1%	41.7%			
2	-	-	2	14	20	4.50	.609	90.0%	-	2	3	27	16	4.19	.734	83.8%
			5.6%	38.9%	55.6%					4.2%	6.3%	56.3%	33.3%			
3	-	-	1	18	17	4.44	.558	88.8%	-	1	3	28	16	4.23	.660	84.6%
			2.8%	50.0%	47.2%					2.1%	6.3%	58.3%	33.3%			
4	-	1	2	16	17	4.36	.723	87.2%	-	2	8	25	13	4.02	.785	80.4%
		2.8%	5.6%	44.4%	47.2%					4.2%	16.7%	52.1%	27.1%			
5	-	1	7	19	9	4.00	.756	80.0%	1	1	7	28	11	3.98	.812	79.6%
		2.8%	19.4%	52.8%	25.0%				2.1%	2.1%	14.6%	58.3%	22.9%			
6	-	-	2	22	12	4.28	.566	85.6%	1	3	7	28	9	3.85	.875	77.0%
			5.6%	61.1%	33.3%				2.1%	6.3%	14.6%	58.3%	18.8%			

Attainment MAP	Leaders								Teachers							
	SD	D	N	A	SA	M	SDv	RA	SD	D	N	A	SA	M	SDv	RA
7	-	2	6	22	6	3.89	.747	77.8%	1	4	15	25	3	3.52	.825	70.4%
		5.6%	16.7%	61.1%	16.7%				2.1%	8.3%	31.3%	52.1%	6.3%			
8	-	1	8	16	11	4.03	.810	80.6%	1	5	11	23	8	3.67	.953	73.4%
		2.8%	22.2%	44.4%	30.6%				2.1%	10.4%	22.9%	47.9%	16.7%			
9	-	2	5	22	7	3.94	.754	78.8%	3	6	15	21	3	3.31	.993	66.2%
		5.6%	13.9%	61.1%	19.4%				6.3%	12.5%	31.3%	43.8%	6.3%			
10	-	3	5	22	6	3.86	.798	77.2%	3	5	19	18	3	3.27	.962	65.4%
		8.3%	13.9%	61.1%	16.7%				6.3%	10.4%	39.6%	37.5%	6.3%			
Total	-	3.1%	11.1%	50.8%	35.0%	4.18	.444	83.6%	2.1%	6.5%	18.5%	51.7%	21.3%	3.84	.597	76.8%

RA: Relative Agreement, calculated as % of Mean/5.

(Likert Scale: SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree)

Table (4. 10): Descriptive Summary of Leaders and Teachers' Perceptions about Academic Factors (Source: Author)

Table (4.11) summarises the themes from leaders' and teachers' statements which were reported differently according to each stakeholder. The table also represented the comparison between leaders' and teachers' responses based on means difference (MD). Overall, all leaders and teachers have different ranking for their agreement with the 10 statements related to students' attainment in MAP, $MD_{Leaders} = 1.178$ and $MD_{Teachers} = 0.835$. Leaders had their highest agreement with statement number (2) about the belief that training students on using the MAP test report helps them improve their learning, while teachers had their highest agreement with statement number (1) about the awareness of the strengths and weaknesses in the students' academic level based on MAP reports. Leaders and teachers had similar

agreement rankings for statements number 4 and 10 which reflects their perception about the use and importance of MAP goals in learning plans and reflection.

Academic Factors (Attainment) Statements	Leaders		Teachers	
	MD ^a	Rank	MD ^a	Rank
1) The awareness of the strengths and weaknesses in the students' academic level based on MAP reports.	1.472	2	1.313	1
2) The belief that training students on using the MAP test report helps them improve their learning.	1.500	1	1.188	3
3) Encouraging students to use the information in the MAP report to improve their academic knowledge and skills.	1.444	3	1.229	2
4) Advising students to adjust their plans for learning based on the results they get from MAP tests or MAP 'Student Goal Setting Worksheets'.	1.361	4	1.021	4
5) Monitoring students' academic progress should be based on their progress in MAP tests.	1.000	7	.979	5
6) The use of MAP Goals Sheets to reflect with students on their achievements.	1.278	5	.854	6
7) The importance of MAP scores in predicting students' SAT scores.	.889	9	.521	8
8) The importance of MAP tests to improve students' scores in SAT.	1.028	6	.667	7
9) The importance of connecting between the learning from MAP and the SAT target.	.944	8	.313	9
10) Setting SAT goals based on the MAP-RIT score or percentile.	.861	10	.271	10
Academic Factors	1.178		.835	

a. MD: Mean Difference between the mean of each statement and 3

Table (4. 11): Comparison between Leaders and Teachers' Responses on Academic Factors
(Source: Author)

II) Cognitive Factor-- Aptitude

As noted in Figure (4.21), the percentages show that almost all leaders and teachers (97.0%-97.7%) had been using the CAT4 test for less than seven years.

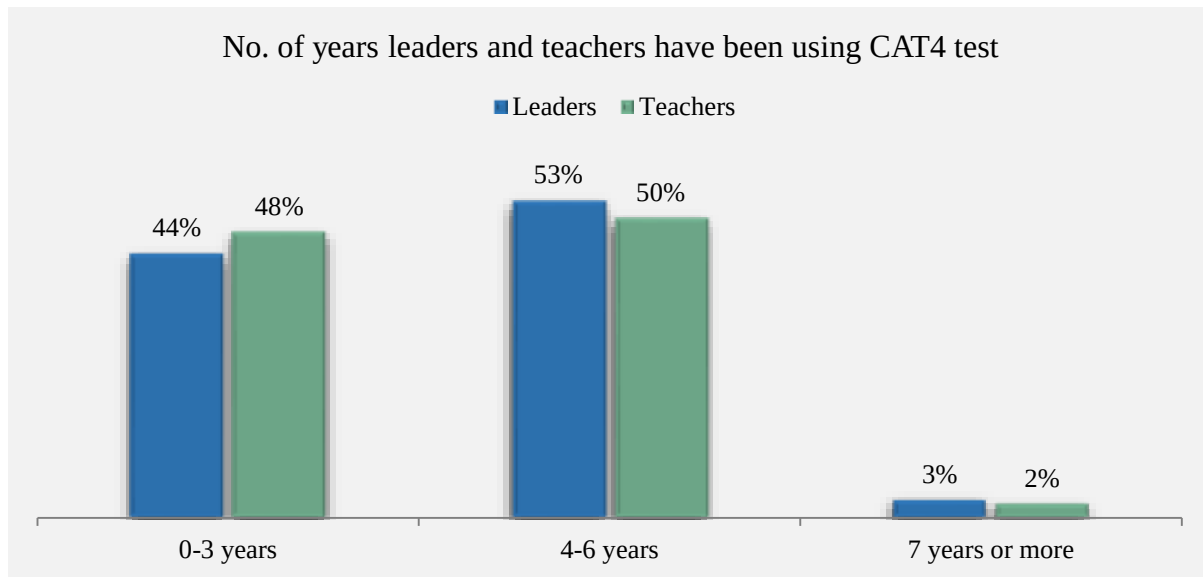


Figure (4. 21): No. of Years Leaders and Teachers Used the CAT4 Test

(Source: Author)

The Relationship between Aptitude (CAT4) and Achievement in SAT

The following part investigates the relationship between the CAT4 and students' achievement in SAT. The percentages of participants responses are plotted in Figure (4.22) for leaders and in Figure (4.23) for teachers. As shown in Figure (4.22), overall leaders' responses showed that the highest agreement (95%) was with statement (6): "I recommend using the CAT4 report and recommendation frequently to improve students' learning strategies and skills", followed by statement (1): "I am aware of the strengths and weaknesses in the students' cognitive ability level based on CAT4 reports", then statements (3) and (4) had similar (89%) agreement about the use of CAT4 reports to set goals and plans for learning. The common point between the four statements was that the leaders believe in the use of CAT4 recommendation to improve students learning skills and outcomes. The lowest agreement (58%) was with statement (10): "I think that setting students' SAT goals should be based on their current cognitive ability--CAT4 level". In conclusion, leaders' agreement with the role of using the CAT4 test in students' academic achievement in general is higher than their agreement with the role of the CAT4 test in students' SAT scores specifically.

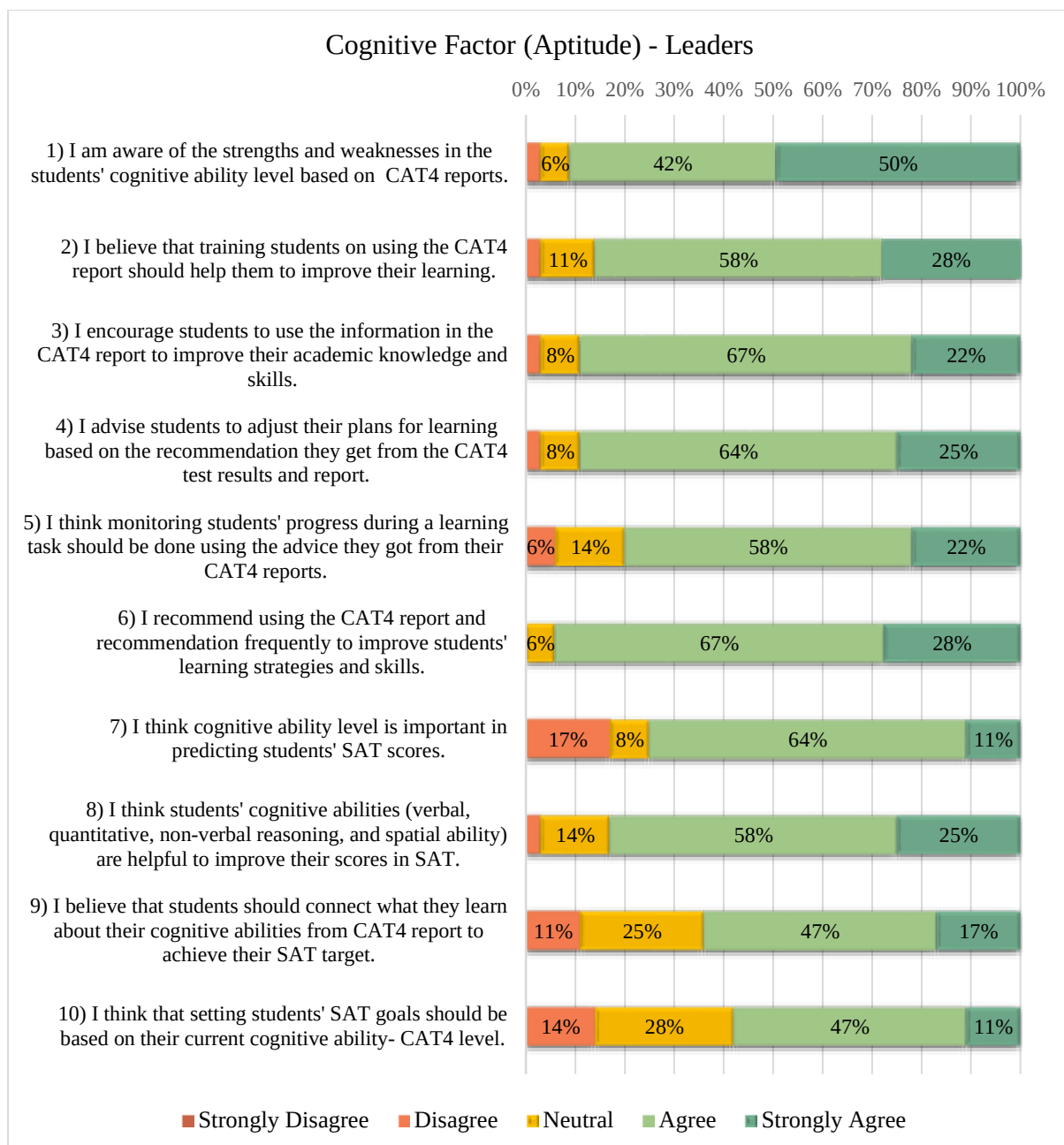


Figure (4. 22): Leaders' Perceptions about Cognitive Factors (%)
(Source: Author)

As shown in Figure (4.23), overall teachers' responses showed that the highest agreement (83%) was with statement (1): "I am aware of the strengths and weaknesses in the students' cognitive ability level based on CAT4 reports", followed by an agreement of 77% for statement (5): "I monitor students' progress during a learning task using the advice I got from their CAT4 reports". Then 73% for statement (6): "I use the CAT4 report and recommendation frequently to improve my students' learning strategies and skills". The common point between the three

statements was that the teachers believe in the usefulness of the CAT4 report to support students and to improve students' progress and learning skills. The lowest agreement (39%) was with statement (10): "I think that setting students' SAT goals should be based on their current cognitive ability – CAT4 level". In conclusion, similar to leaders, teachers' agreement on the role of the CAT4 test in students' academic achievement in general is higher than their agreement with the role of the CAT4 test in students' SAT scores specifically.

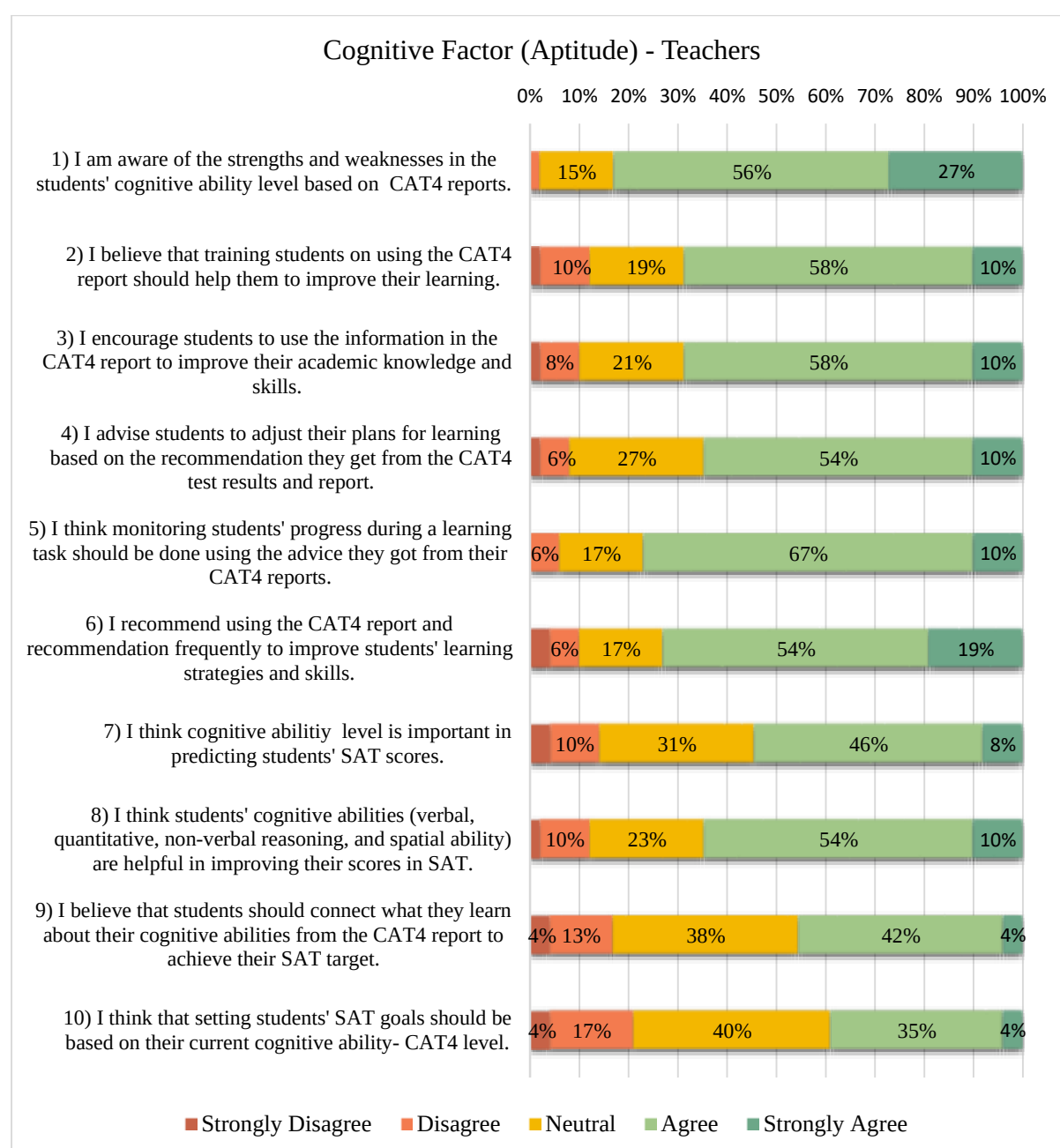


Figure (4. 23): Teachers' Perceptions about Cognitive Factors (%)
(Source: Author)

This section discusses the relationship between the CAT4 test and students' achievement in SAT. As reported in Table (4.12), perceptions of leaders and teachers are summarised. The results show that overall leaders have higher (RA= 79.8%) than teachers (RA= 72.2%). In terms of statements, the following results were found:

- Overall, leaders had higher Relative Agreement (RA) (of 79.8%) than teachers (72.2%).
- Leaders had higher RA (82.2%) than teachers (73.0%) for statement number (2): “I believe that training students on using the CAT4 report should help them improve their learning”.
- Leaders had higher RA (81.6%) than teachers (73.4%) for statement (3): “I encourage students to use the information in the CAT4 report to improve their academic knowledge and skills”.
- Leaders had higher RA (82.2%) than teachers (73.0%) for statement (4): “I advise students to adjust their plans for learning based on the recommendation they get from the CAT4 test results and report”.
- Leaders had higher RA (84.4%) than teachers (75.4%) for statement (6): “I recommend using the CAT4 report and recommendation frequently to improve students' learning strategies and skills”.
- Leaders had higher RA (81.2%) than teachers (72.0%) for statement (8): “I think students' cognitive abilities (verbal, quantitative, non-verbal reasoning, and spatial ability) are helpful in improving their scores in SAT”.
- Leaders had higher RA (73.8%) than teachers (65.8%) for statement (9): “I believe that students should connect what they learn about their cognitive abilities from the CAT4 report to their SAT target”.

	Aptitude CAT4	Leaders						Teachers					
1		-		1	2.8%	2	5.6%	15	41.7%	18	50.0%	M	SD
				1	2.8%	4	11.1%	21	58.3%	10	27.8%	SDv	RA
2		-		1	2.8%	3	8.3%	24	66.7%	8	22.2%	4.39	.728
				1	2.8%	3	8.3%	23	63.9%	9	25.0%	4.11	.708
3		-		2	5.6%	5	13.9%	21	58.3%	8	22.2%	4.08	0.649
				2	5.6%	5	13.9%	21	58.3%	8	22.2%	4.11	.667
4		-		0	0.0%	2	5.6%	24	66.7%	10	27.8%	3.97	.774
				0	0.0%	2	5.6%	24	66.7%	10	27.8%	4.22	.540
5		-		6	16.7%	3	8.3%	23	63.9%	4	11.1%	3.69	.889
				6	16.7%	3	8.3%	23	63.9%	4	11.1%	3.69	.889
6		-		1	2.8%	5	13.9%	21	58.3%	9	25.0%	4.06	.715
				1	2.8%	5	13.9%	21	58.3%	9	25.0%	4.06	.715
7		-		4	11.1%	9	22.2%	17	47.2%	6	16.7%	3.69	.889
				4	11.1%	9	22.2%	17	47.2%	6	16.7%	3.69	.889
8		-		2	5.6%	5	13.9%	21	58.3%	8	22.2%	3.97	.774
				2	5.6%	5	13.9%	21	58.3%	8	22.2%	3.97	.774
9		-		2	5.6%	3	8.3%	23	63.9%	4	11.1%	4.08	0.649
				2	5.6%	3	8.3%	23	63.9%	4	11.1%	4.08	0.649
10		-		1	2.1%	5	10.4%	27	56.3%	13	27.1%	3.65	.887
				1	2.1%	5	10.4%	27	56.3%	13	27.1%	3.65	.887
11		-		1	2.1%	4	8.3%	28	58.3%	5	10.4%	3.67	0.859
				1	2.1%	4	8.3%	28	58.3%	5	10.4%	3.67	0.859
12		-		1	2.1%	3	6.3%	26	54.2%	5	10.4%	3.65	.838
				1	2.1%	3	6.3%	26	54.2%	5	10.4%	3.65	.838
13		-		1	2.1%	3	6.3%	26	54.2%	5	10.4%	3.81	.704
				1	2.1%	3	6.3%	26	54.2%	5	10.4%	3.81	.704
14		-		2	4.2%	3	6.3%	26	54.2%	9	18.8%	3.77	.973
				2	4.2%	3	6.3%	26	54.2%	9	18.8%	3.77	.973
15		-		2	4.2%	5	10.4%	22	45.8%	4	8.3%	3.44	.943
				2	4.2%	5	10.4%	22	45.8%	4	8.3%	3.44	.943
16		-		1	2.1%	11	31.3%	26	54.2%	5	10.4%	3.60	.893
				1	2.1%	11	31.3%	26	54.2%	5	10.4%	3.60	.893
17		-		2	4.2%	18	51.4%	20	58.8%	2	6.3%	3.29	.898
				2	4.2%	18	51.4%	20	58.8%	2	6.3%	3.29	.898
18		-		2	4.2%	20	58.8%	2	6.3%	2	6.3%	65.8%	
				2	4.2%	20	58.8%	2	6.3%	2	6.3%	65.8%	

Aptitude CAT4	Leaders								Teachers							
	SD	D	N	A	SA	M	SD _v	RA	SD	D	N	A	SA	M	SD _v	RA
10	-	5	10	17	4	3.56	.877	71.2%	2	8	19	17	2	3.19	.915	63.8%
		13.9%	27.8%	47.2%	11.1%				4.2%	16.7%	39.6%	35.4%	4.2%			
Total	-	6%	13%	57%	24%	3.99	.481	79.8%	3%	9%	25%	53%	11%	3.61	.664	72.2%

RA: Relative Agreement, calculated as % of Mean/5.

(Likert Scale: SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree)

Table (4. 12): Descriptive Summary of Leaders and Teachers' Perceptions about Cognitive Factors (Source: Author)

Table (4.13) summarises the themes from leaders' and teachers' statements which were reported differently according to each stakeholder. The table also represented the comparison between leaders' and teachers' responses based on means difference (MD). In terms of statements, leaders and teachers agree with statements differently, $MD_{Leaders} = 0.989$ and $MD_{Teachers} = 0.615$. For instance, the most agreed with statement by leaders and teachers was statement (1) about the awareness of the strengths and weaknesses of the students' cognitive ability levels based on CAT4 reports. Though the second most agreed with item by leaders was statement (6) about the recommendation to use the CAT4 report frequently to improve students' learning strategies and skills, while for teachers it was statement (5) about the monitoring of students' progress during a learning task using the advice they got from their CAT4 reports. Statement (10) had the lowest agreement rate from leaders and teachers about using CAT4 reports to set students' SAT goals.

Cognitive Factor (Aptitude) Statements	Leaders		Teachers	
	MD ^a	Rank	MD ^a	Rank
1) The awareness of the strengths and weaknesses in the students' cognitive ability level based on the CAT4 reports.	1.389	1	1.083	1
2) The belief that training students on using the CAT4 reports helps them improve their learning.	1.111	3	.646	5
3) The encouragement to students to use the information in the CAT4 reports to improve their academic knowledge and skills.	1.083	5	.667	4
4) The belief in the importance of students adjusting their plans for learning based on the recommendation they get from the CAT4 test results and report.	1.111	3	.646	5
5) The monitoring of students' progress during a learning task using the advice they got from their CAT4 reports.	.972	7	.813	2
6) The recommendation to use the CAT4 report frequently to improve students' learning strategies and skills.	1.222	2	.771	3
7) The belief in the importance of cognitive ability levels in predicting students' SAT scores.	.694	8	.438	8
8) The belief that students' cognitive abilities (verbal, quantitative, non-verbal reasoning, and spatial ability) are helpful in improving their scores in SAT.	1.056	6	.604	7
9) The belief that students should connect what they learn about their cognitive abilities from CAT4 reports to their SAT target.	.694	8	.292	9
10) The belief that setting students' SAT goals should be based on their current cognitive ability-CAT4 level.	.556	10	.188	10
Cognitive Factors	.989		.615	

a. MD: Mean Difference between the mean of each statement and 3

Table (4. 13): Comparison between Leaders' and Teachers' Responses on Cognitive Factors
(Source: Author)

III) Affective Factor – Attitude towards Learning

In Figure (4.24), the percentages show that almost all leaders and teachers (97.0%-97.7%) had been using the PASS test for less than seven years.

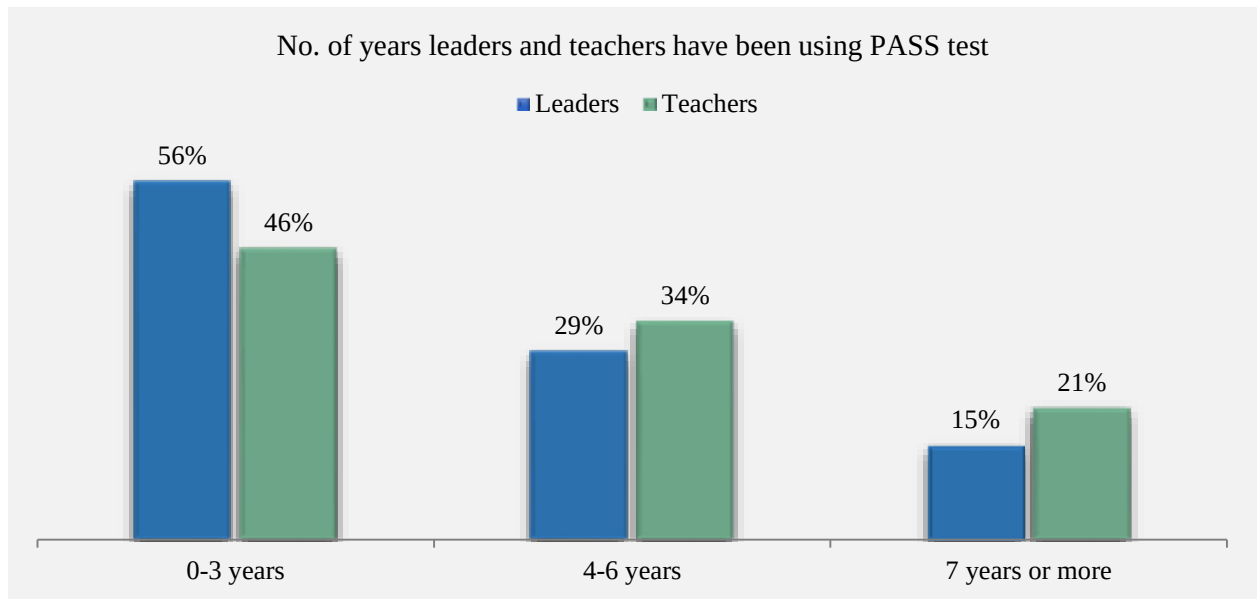


Figure (4. 24): No. of Years Leaders and Teachers Used the PASS Test

(Source: Author)

The Relationship between Attitude (PASS) and Achievement in SAT

The following section investigates the relationship between the PASS which reflects the students' attitude towards learning and students' achievement in SAT. The percentages of participants responses are plotted in Figure (4.25) for leaders and in Figure (4.26) for teachers. As shown in Figure (4.25), overall leaders' responses showed that the highest agreement (100%) was with statement (6): "I believe that student communication and collaboration in learning will improve their performance". This was followed by statements 1, 3, and 9 equally with 97% agreement-- statement (1): "I am aware that students' attitude towards school affects their performance in assessments.", statement (3): "I think that students' attitude towards their teacher is important in affecting their academic achievement", and statement (9): "I think that students' attitude towards the subject affect their performance in SAT tests". The common point between the three statements was that the leaders believe that students' attitude towards school, teacher, and subject had the highest impact on students' achievement in assessments. The lowest agreement (42%) was with statement (5): "I think that our students believe in their

capability of thinking independently and dealing with challenges to achieve their goal”. Another lower agreement was 47% with statement (2): “I am satisfied with students’ performance”.

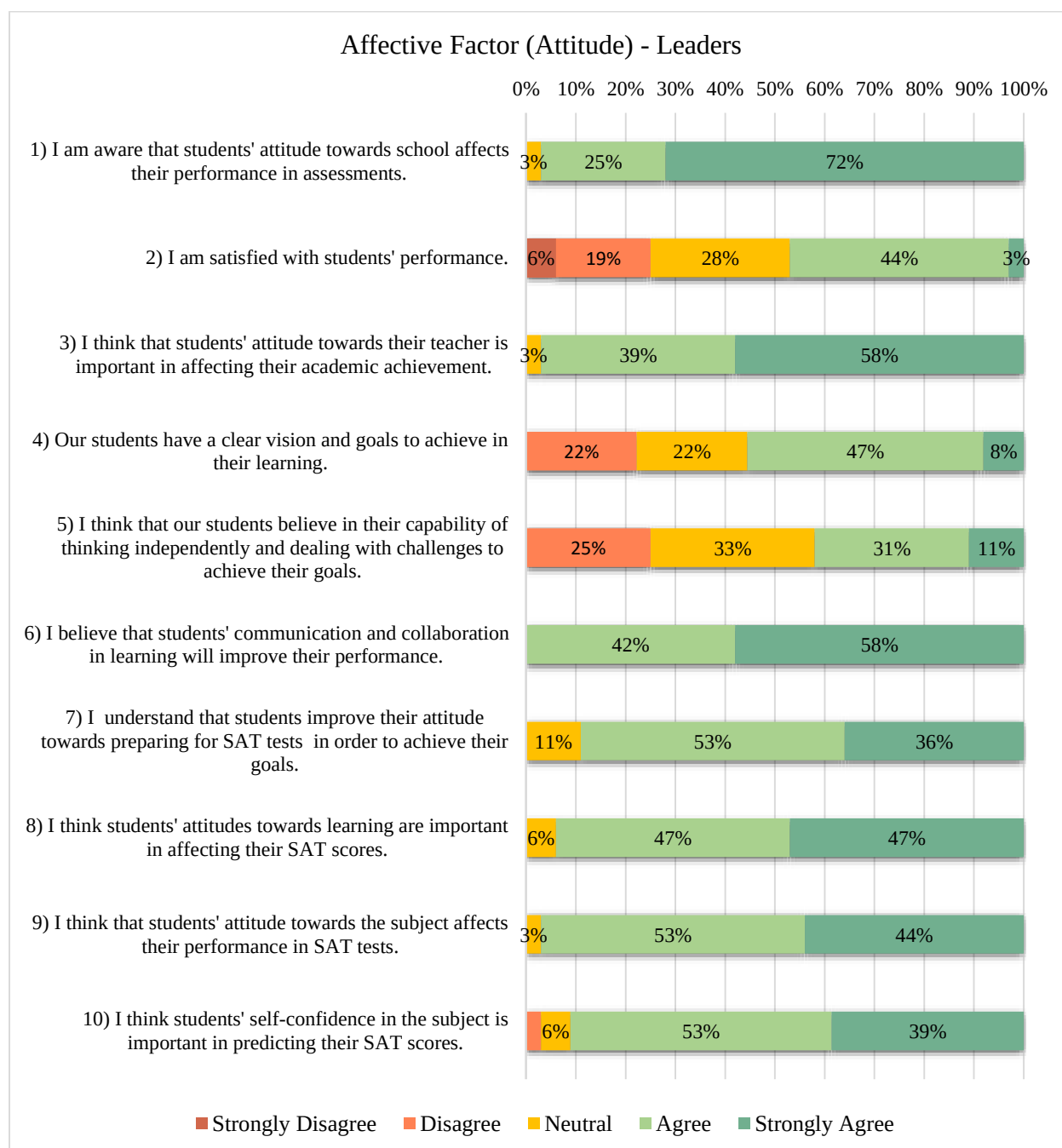


Figure (4. 25): Leaders’ Perceptions about Affective Factors (%)

(Source: Author)

As shown in Figure (4.26), overall teachers' responses showed that the highest agreement (96%) is with statement (1): "I understand that my students' attitude towards school affects their performance in assessments". Then there was a 94% agreement with statement (6): "I believe that student communication and collaboration in learning will improve their performance", followed by 92% agreement with statement (3): "I think that students' attitude towards their teacher is important in affecting their academic achievement". The previous findings indicate that regardless of the exact percentage of agreement, leaders and teachers agreed on the role of students' attitude towards school and their teacher in academic achievement. At the same time, they agreed on the impact of collaboration and communication on students' achievement. The lowest agreement (48%) was with statement (2): "I am satisfied with students' performance". Another lower agreement (52%) was with statement (5): "I think that our students believe in their capability of thinking independently and dealing with challenges to achieve their goals". Both statements had lowest agreement in both leaders' and teachers' responses.

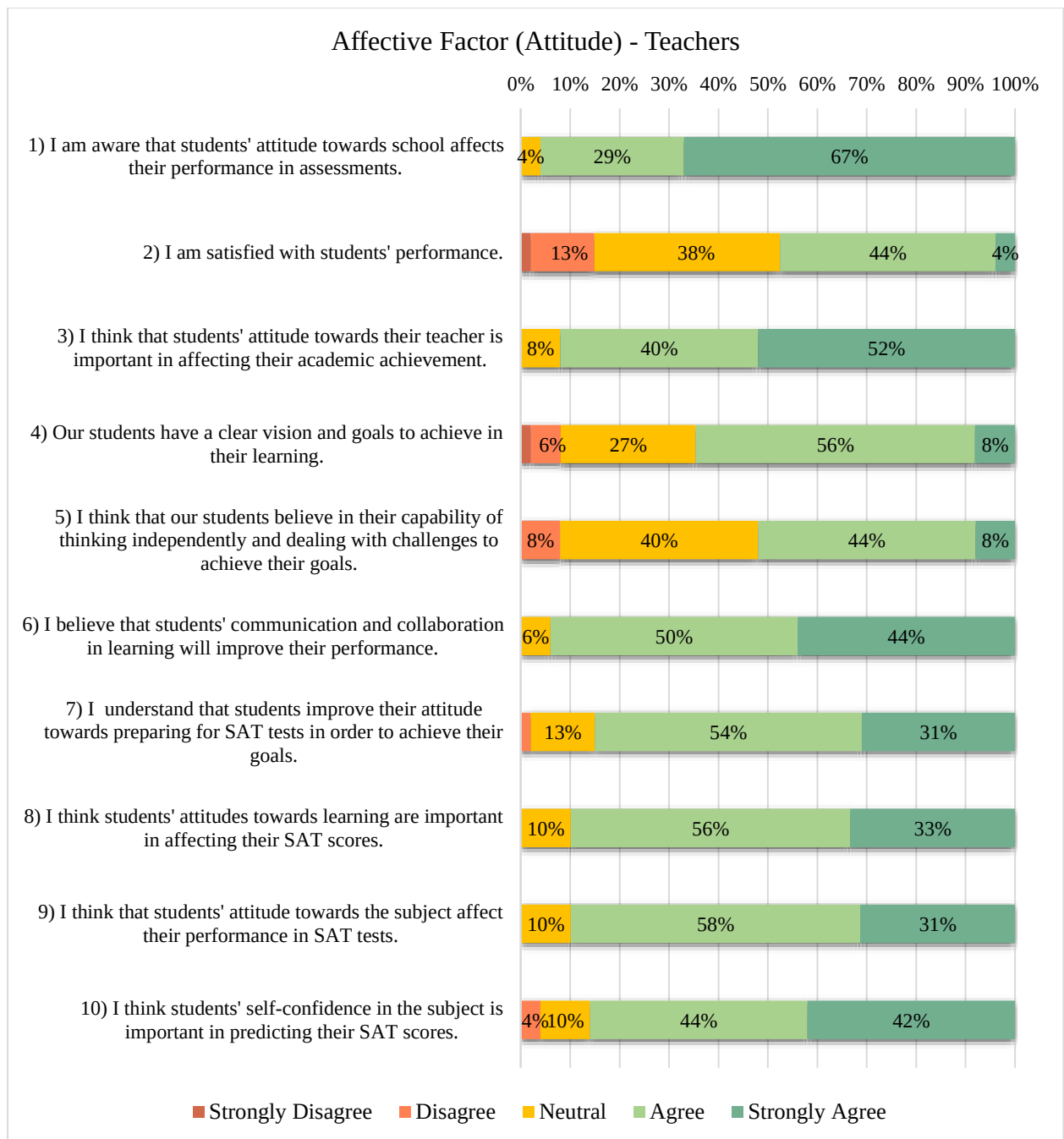


Figure (4. 26): Teachers' Perceptions about Affective Factors (%)

(Source: Author)

As shown in Table (4.14), perceptions of leaders and teachers are summarized and compared. The descriptive statistics including mean, standard deviation, and RA indicate that there were no considerable difference between leaders and teachers in terms of their perceptions of the relationship between students' attitude towards learning and their academic achievement in SAT. Overall, both groups of participants had high relative agreement to the affective factors,

where leaders had RA = 82.2% and teachers had RA = 81.4%. RA values for all statements are reported in the table by leaders and teachers.

Attitude PASS	Leaders						Teachers									
	SD	D	N	A	SA	M	SD	D	N	A	SA	M	SDv	RA		
1	-	-	1	9	26	4.69	.525	93.8%	-	-	2	14	32	4.63	.570	92.6%
			2.8%	25.0%	72.2%						4.2%	29.2%	66.7%			
2	2	7	10	16	1	3.19	.980	63.8%	1	6	18	21	2	3.35	.838	67.0%
	5.6%	19.4%	27.8%	44.4%	2.8%				2.1%	12.5%	37.5%	43.8%	4.2%			
3	-	-	1	14	21	4.56	.558	91.2%	-	-	4	19	25	4.44	.649	88.8%
			2.8%	38.9%	58.3%						8.3%	39.6%	52.1%			
4	-	8	8	17	3	3.42	.937	68.4%	1	3	13	27	4	3.63	.815	72.6%
		22.2%	22.2%	47.2%	8.3%				2.1%	6.3%	27.1%	56.3%	8.3%			
5	-	9	12	11	4	3.28	.974	65.6%	-	4	19	21	4	3.52	.772	70.4%
		25.0%	33.3%	30.6%	11.1%					8.3%	39.6%	43.8%	8.3%			
6	-	-	-	15	21	4.58	.500	91.6%	-	-	3	24	21	4.38	.606	87.6%
				41.7%	58.3%						6.3%	50.0%	43.8%			
7	-	-	4	19	13	4.25	.649	85.0%	-	1	6	26	15	4.15	.714	83.0%
			11.1%	52.8%	36.1%					2.1%	12.5%	54.2%	31.3%			
8	-	-	2	17	17	4	-	8	-	5	27	16	4	-	8	4

Attitude PASS	Leaders								Teachers							
	SD	D	N	A	SA	M	SDv	RA	SD	D	N	A	SA	M	SDv	RA
9	-	-	1	19	16	4.42	.554	88.4%	-	-	5	28	15	4.21	.617	84.2%
			2.8%	52.8%	44.4%						10.4%	58.3%	31.3%			
10	-	1	2	19	14	4.28	.701	85.6%	-	2	5	21	20	4.23	.805	84.6%
		2.8%	5.6%	52.8%	38.9%					4.2%	10.4%	43.8%	41.7%			
Total	.6%	6.9%	11.4%	43.3%	37.8%	4.11	.331	82.2%	.4%	3.3%	16.7%	47.5%	32.1%	4.07	.377	81.4%

RA: Relative Agreement, calculated as % of Mean/5.

(Likert Scale: SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree)

Table (4. 14): Descriptive Summary of Leaders and Teachers' Perceptions about Affective Factors (Source: Author)

Table (4.15) summarises the themes from leaders' and teachers' statements which were reported differently according to each stakeholder. The table also represented the comparison between leaders' and teachers' responses based on means difference (MD). Overall, leaders and teachers have similar level of agreement with the role of students' attitude towards learning in their academic achievement in general and in SAT scores, $MD_{Leaders} = 1.108$ and $MD_{Teachers} = 1.075$. Participants' agreement with items was almost the same in both groups; specifically, leaders and teachers agreed the most with statement (1) about the awareness of students' attitude towards school affecting their performance in assessments, and they agreed the least with statement (2) about their satisfaction with students' performance.

Affective Factors (Attitude) Statements	Leaders		Teachers	
	MD ^a	Rank	MD ^a	Rank
1) The awareness of students' attitude towards school affects their performance in assessments.	1.694	1	1.625	1
2) The satisfaction with students' performance.	.194	10	.354	10
3) The belief that students' attitude towards their teacher is important in affecting their academic achievement.	1.556	3	1.438	2
4) The belief that students have a clear vision and goals to achieve in their learning.	.417	8	.625	8
5) The belief that students believe in their capability of thinking independently and dealing with challenges to achieve their goals.	.278	9	.521	9
6) The belief that students' communication and collaboration in learning will improve their performance.	1.583	2	1.375	3
7) The understanding that students improve their attitude towards preparing for SAT tests in order to achieve their goal.	1.250	7	1.146	7
8) The belief that students' attitudes towards learning are important in affecting their SAT scores.	1.417	4	1.229	4
9) I think that students' attitude towards the subject affects their performance in SAT tests.	1.417	4	1.208	6
10) I think students' self-confidence in the subject is important in predicting their SAT scores.	1.278	6	1.229	4
Affective Factors	1.108		1.075	

a. MD: Mean Difference between the mean of each statement and 3

Table (4. 15): Comparison between Leaders' and Teachers' Responses on Affective Factors
(Source: Author)

4.3.1.3 Leaders' and Teachers' Perceptions about the Predictability of Students' SAT Scores by Attainment, Aptitude, and Attitude

This section includes the analysis of the three open-ended questions at the end of each factor within the questionnaire. The open-ended question from each section explores the leaders' and teachers' perceptions about the predictability of students' achievement in SAT based on their MAP, CAT4, and PASS scores. The reasons presented by the leaders and teachers were summarised and categorized based on keywords into main themes according to each factor (MAP, CAT4, PASS). These were presented as percentages in figures in each section supported by a table listing the main comments stated by the participants.

I) Predictability of SAT Scores by Students' Attainment in MAP

Most leaders (82.4%) and teachers (74.5%) believed that MAP can help in predicting students' SAT scores (see Figure (4.27) below). Figure (4.28) summarises the main reasons categorized under themes related to leaders' and teachers' answers. Among leaders and teachers who said "Yes", 63.8% thought that the reason was that MAP can measure different aspects of students' knowledge, skills, and progress level.

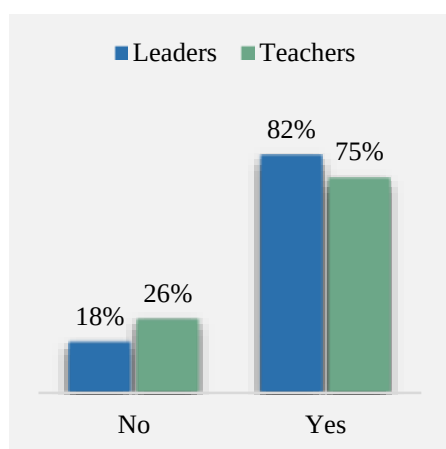


Figure (4. 27): Do you Think that MAP can help in Predicting Students' SAT Scores?

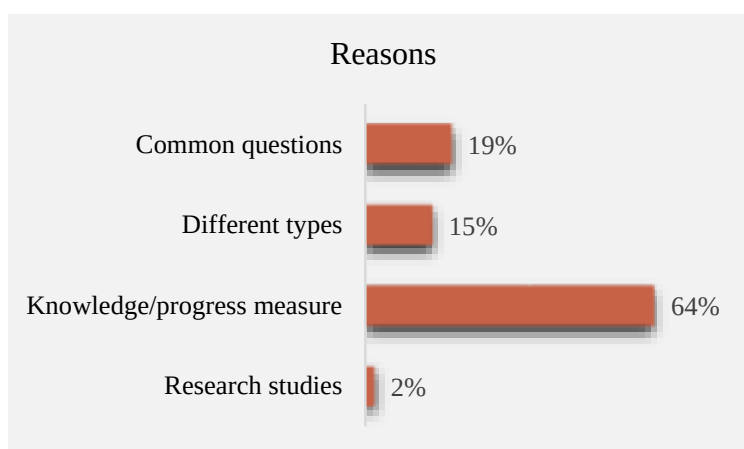


Figure (4. 28): Reasons why Leaders and Teachers think that MAP can help in Predicting Students' SAT Scores.

Table (4.16) summarises all leaders' and teachers' comments with respect to MAP in terms of the "knowledge and progress measure" theme. Leaders highlighted the role of the MAP in helping students understand their strengths and weaknesses in learning and performance. Leaders also shed light on the MAP test as a tool to benchmark students' level against the curriculum standards and to track students' progress. Teachers stated similar reasons to leaders and added that MAP helped in identifying students who are on track or in need of support to achieve their learning goals.

Theme 1: Knowledge and progress measure	
Leaders	Teachers
- MAP allows students to understand the strengths and weaknesses as their RIT scores indicate whether they are below/on/or above grade level expectations. Targeted goal settings and practice will gear students towards filling in leaning gaps and skills that are needed to achieve SAT university standard expectations - It is related to the students' academic achievement and is aligned with the standards. MAP would act as a screening tool. - MAP can help us understand learning trends to see if a student can handle the rigor of the SAT. - As both measures students' quality of learning in common subjects and students sit for MAP in high school. - It helps to know if the students are on track to be ready to do SAT. MAP scores are early indicators of college readiness that can enable teachers to identify students who are off-track and put in place the appropriate interventions. - MAP exams measure the students' progress and growth and SAT tests the knowledge of the students and how well they can apply it. - MAP measures the academic progress and according to studies MAP scores are considered a good prediction to success on the SAT test Benchmark Scores. - MAP is indicative of student performance on benchmark assessments and helps in conceptual understanding. - It will measure many aspects of understanding and skills. - Since MAP measures the growth of each student it will help in predicting his SAT score that will test his knowledge. - It provides students with a clear idea of their points of strengths and weaknesses. - MAP test assesses their performance and gives an indication of their SAT score.	- It shows the weaknesses and gaps in students' knowledge that need to be filled. - MAP constantly measures the growth of the student. Therefore, MAP score is an indicator whether the student will succeed in getting a high score in SAT, or not. - MAP shows the areas of weakness where the student should focus on. - MAP exams measure the students' progress and growth and SAT tests the knowledge of the students and how well they can apply it. - MAP assessments measure a student's progress in school, and teachers use MAP scores to keep track of the student's growth in basic skills and work on the weaknesses. Therefore, this is an effective tool to predict what the score in SAT would be. - It gives an indication about the student academic level. - Possibly when looking at general academic level, however the exams are very different. - MAP analysis can show the strength and weakness of each student's knowledge and skill. - It will enhance their performance. - Since MAP measures the growth of each student it will help in predicting his SAT score that will test his knowledge. - It is reflecting the learning ability which has an impact on the achievements. - MAP results show the level of students and compare them to their global level which for sure helps to predict their marks. - Because MAP is considered as early indicators of college readiness, the results of MAP test can enable teachers to identify students who are off-track and put in place the appropriate interventions. It is also an important indicator for the students' attainment in core subjects. The students' MAP score can give a prediction of their SAT.

Table (4. 16): Reasons why Leaders and Teachers think that MAP can help in Predicting Students' SAT Scores: "Knowledge/Progress Measure" Theme

The second theme indicated by around 19.1% of leaders and teachers was that MAP and SAT share “common questions”. As summarised in Table (4.17), they think since MAP is a comprehensive test that contains all types of questions, especially in Maths, SAT would have some common questions and problems that require the same way of solving those students used in MAP.

Theme 2: Common questions	
Leaders	Teachers
▪ Similar approach in assessments and subject. ▪ Yes, due to similar areas being tested. However, it depends on when the students take the MAP test and when they take the SAT tests.	▪ MAP questions include content materials that are embedded in SAT as well. The multiple-choice questions in MAP help students to adapt different types of techniques to answer SAT questions like eliminating options, replacing and checking. ▪ SAT and MAP are assessments that test students in different domains aligned with different standards. Certain types of questions are common. ▪ The mental Math and analysing problems used in the MAP test are also required in the SAT. ▪ Both are standard and common code based. ▪ MAP covers all skills. ▪ The skills that are targeted in SAT are based on the standards, benchmarks, skills and competencies that students need to cover before graduation. In a way the two tests stem from the same educational tree.

Table (4. 17): Reasons Why Leaders and Teachers think that MAP can help in Predicting Students’ SAT Scores: “Common Questions” Theme

The third theme confirmed the second theme where 14.9% of participants mentioned that the “MAP test has different types of questions” and students practice them, mastering the skills required for the SAT. One leader stated:

“MAP and SAT have proven to be correlated. Research studies and NWEA provide data that show students who are on track with their MAP benchmark score achieve the needed college entry benchmarks on SAT Critical Reading test and Math.”

As shown in Table (4.18), leaders and teachers who did not think that MAP could help in predicting students' SAT scores stated that they thought this because they believed that the two tests were different regarding questions asked, end goals, and concepts. They also mentioned that the MAP test was not accurate and contained ambiguous questions that confuse students in the way they had to solve the questions. They added, the SAT scores were influenced by other factors, not just the academic level assessed in MAP.

Theme 3: MAP has different types of questions	
Leaders	Teachers
As students get exposed to different types of questions and practice solving them in different ways.	- As students get exposed to different types of questions and practice solving them in different ways. - Master the basic skills in many domains in mathematics. - More practice in different type of questions. - MAP tests consist of different types of questions and different skills and are similar to SAT tests. - It uses past statistics and predictive algorithms. - It provides a lot of predictive details.

Table (4. 18): Reasons Why Leaders and Teachers think that MAP can help in Predicting Students' SAT Scores: "MAP has Different Types of Questions" Theme

II) Predictability of SAT Scores by Students' Aptitude Level in CAT4

Most leaders and teachers (85.3% and 66.0% respectively) believed that CAT4 can help in predicting students' SAT scores (see Figure (4.29)). It is worthy to note that the percentage of leaders who answered "Yes" (85.3%) was higher than the percentage of teachers (66.0%).

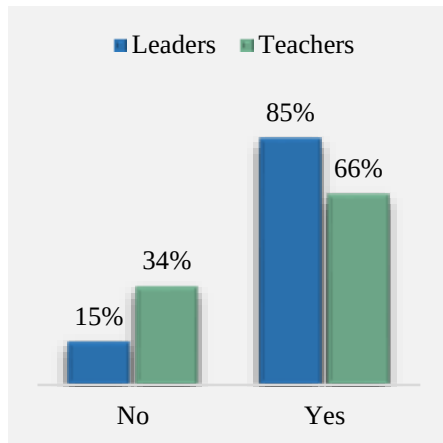


Figure (4. 29): Do you Think that CAT4 can help in Predicting Students' SAT Scores?

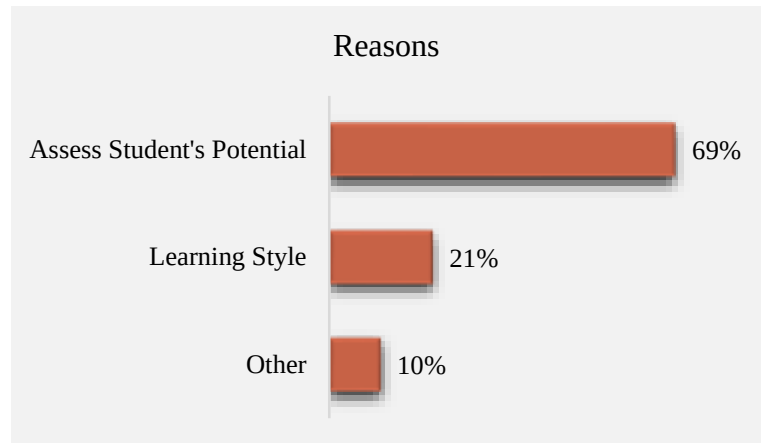


Figure (4. 30): Reasons Why Leaders and Teachers think that CAT4 can help in Predicting Students' SAT Scores

Among those who answered “Yes”, 69.0% attributed their answer to the fact that CAT4 is an assessment of students’ potential and strengths. As shown in Figure (4.30), the main reasons categorized under themes related to leaders’ and teachers’ answers. Details are provided in Table (4.19) and Table (4.20) per theme.

Theme 1: Assess student’s potential	
Leaders	Teachers
▪ If used to help students understand their cognitive preferences, students and teachers will build on that and will use the data to help students achieve their best potential. ▪ CAT4 helps us understand the brain’s capacity and potential. ▪ Cognitive ability can allow us to understand how a student could perform on an achievement test like the SAT. ▪ As students know their strengths and work on the areas to be improved. ▪ The CAT4 is similar to an IQ test for adults and gives a baseline for the potential and strengths of each student. It highlights any weaknesses they might have in SAT especially in scientific subjects. ▪ CAT4 measures how well a student can learn or his ability to learn, while SAT measures the knowledge of the students.	▪ Yes, it gives an indication of their abilities. ▪ As student know their strengths and work on the areas to be improved. ▪ For students to understand strengths and weaknesses and build their skills accordingly. CAT4 analysis can show where the strength and weakness of each student is. ▪ From CAT4 we can know the ability of students and the way they are thinking. ▪ CAT4 provides a clear view of every student’s true potential, which might help predict their scores. ▪ CAT4 shows the students their cognitive abilities. Scores followed the abilities. ▪ CAT4 assessment should help students and their teachers understand how they learn and what their academic potential might be. It assesses how students think in areas that are known to make a difference to learning. The teacher will be able to decide about the pace of learning that is right for a student and

Theme 1: Assess student's potential	
Leaders	Teachers
▪ For students to understand strengths and weaknesses and build their skills accordingly. ▪ CAT4 batteries that include verbal, non-verbal, quantitative and spatial reasoning reveal hidden potential to make a difference to learning and achievement. Students who score Stanine 6 and above in CAT4 are most likely to achieve high scores in SAT test. ▪ CAT4 provides a clear view of every student's true potential, which might help predict their scores. So, the CAT4 test assesses their performance and gives an indication of their score in their SAT. ▪ Yes, due to the diagnostic ability of the 4 batteries. More importantly it can provide teachers and learners a better understanding of how they best learn to achieve their potential.	whether additional support or challenge is needed. Once the data is used effectively, the students' skills will improve, and this will reflect on their assessments results as MAP and SAT. ▪ CAT4 provides data on students' potential for achievement. It helps us and where to set the right targets. For example, students with low CAT4 verbal reading scores need to be closely monitored by the English department and focus on a verbal reasoning must be put in place. If this is not addressed, SAT Critical Thinking scores will most likely turn out to be low, implying students are not college ready for reading. This would also apply to math. This is why CAT4 should be used to help set goals and intervention plans.

Table (4. 19): Reasons Why Leaders and Teachers think that CAT4 can help in Predicting Students' SAT Scores: "Assess Student's Potential" Theme

As summarised in Table (4.20), the second reason provided by 20.7% of leaders and teachers was that CAT4 helps students improve their learning styles and hence helps them achieve better scores in SAT. Two teachers agreed that: "SAT needs reasoning and it depends on cognitive abilities," and a leader said that "CAT4 guides students to their strengths that they can focus on improving their performance in SAT".

Theme 2: Learning style	
Leaders	Teachers
▪ Learning styles help students improve their understanding and performance.	▪ Part of the CAT4 shows analysis techniques that help students break down a question and answer it. ▪ Help students to think out of the box. ▪ More practicing in different type of questions.

Table (4. 20): Reasons Why Leaders and Teachers think that CAT4 can help in Predicting Students' SAT Scores: "Learning Style" Theme

Reasons provided by participants who did not think that CAT4 can help in predicting students' SAT scores included their confidence in the reliability of the CAT4 test and results. In addition,

they agreed that: “CAT4 only assesses students’ cognitive ability and has nothing to do with the SAT”.

III) Predictability of SAT Scores by Students’ Attitudes toward Learning in PASS

Most leaders (82.4%) and teachers (83.0%) agreed that students’ attitude towards learning can help in predicting students’ SAT scores (see Figure (4.31)). As shown in Figure (4.32), 37.1% of leaders and teachers who answered “Yes” believed that positive attitude definitely leads to better results. Detailed reasons are listed in Table (4.21).

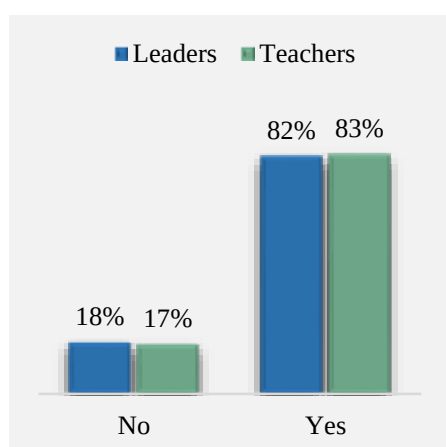


Figure (4. 31): Do you Think that Students’ Attitude towards Learning can help in Predicting Students’ SAT Scores?

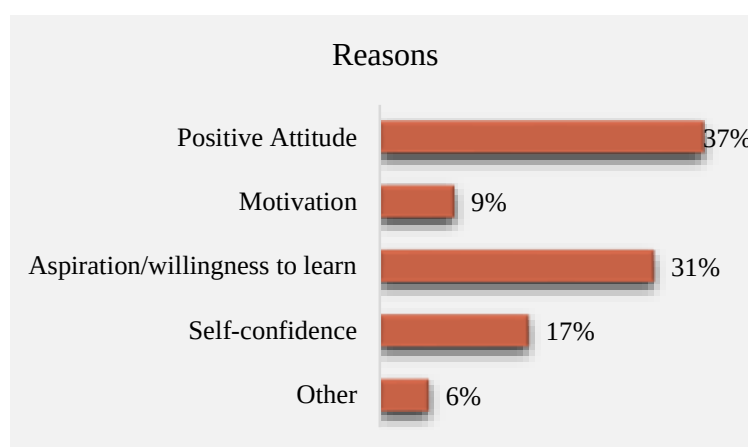


Figure (4. 32): Reasons why Participants think that Students’ Attitude towards Learning can help in Predicting Students’ SAT Scores

Theme 1: Positive Attitude	
Leaders	Teachers
▪ I always believe in the positive attitude’s impact on many areas in academic and professional life. ▪ Attitude to learning is a major game player. An unlimited pool of data exists that proves negative attitude to learning limits performance, discourages and even limits learning and growth. If attitude to learning is positive, students, with the help of teachers, will set the right goals and work to achieve them. MAP goals/CAT4 understanding with the right attitude will help students reach/achieve needed SAT results.	▪ Positive attitude leads to positive thinking. ▪ Yes, this is a very important component. If a student has a good attitude to learning and school, they will work hard to improve. ▪ I think that students’ attitude towards learning can help in predicting their SAT score. Students with positive attitude towards learning are self-motivated and they will constantly improve their learning, gain information, and prepare for such exams. ▪ I always believe in the positive attitude’s impact on many areas in academic and professional life.

Theme 1: Positive Attitude	
Leaders	Teachers
▪ The students' attitude towards learning is very important and has a direct impact on their progress and future. The students should be responsible for their learning. If they do not have the positive attitude towards learning, they will not be able to progress as expected throughout their journey. Therefore, their attitude will affect their progress and attainment and their test scores accordingly. However, I think that since SAT is used for their college admission which will determine their future career, some students can push themselves with help of their parents and teachers to get better scores in SAT.	It develops the human's potential to generate more of his strength. ▪ Positive attitude means hard work and doing your best. ▪ If a student has a positive attitude, then he can practice more, which will give a better score. ▪ Positive and right attitude is really helpful because it shows how much the student is ready for the SAT test. ▪ Student with positive attitude towards learning have clear goals to achieve, and SAT nowadays is mandatory for university admission. ▪ Positive attitude influences the students' learning habits. ▪ Students need to have positive attitude towards learning and if they do, this can impact their SAT scores.

Table (4. 21): Reasons Why Leaders and Teachers think that PASS can help in Predicting Students' SAT Scores: "Positive Attitude" Theme

Other participants (representing 31.4%) said that students' aspiration and willingness to learn encourage them to plan and do their best to achieve higher scores in the SAT (see Table (4.22)).

Theme 2: Aspiration and willingness to learn	
Leaders	Teachers
▪ Creating a love for learning allows students to be independent and lifelong learners. Skills are needed for SAT and life. ▪ The SAT is an exam that requires planning. If a student is more willing to learn and is devoted to their studies, they will be able to plan and prepare effectively so that they earn a strong score. ▪ Their attitudes show to what extent they are willing to improve and score well in their SAT. ▪ Students taking ownership of their learning perform better. ▪ Definitely, attitude towards learning affects students' efforts and plans to achieve their academic goals.	▪ Yes, students who are willing to score high in assessments, put in more effort during all assessments to make sure they score high. ▪ If they love to learn they will practice and they will achieve high scores. ▪ The student's attitude has a great impact on their progress. They should be responsible for their learning. If they do not have the positive attitude towards learning, they will not be able to progress as expected throughout their learning journey. However, since SAT is important for their college admission and their future career, I think some students can push themselves to perform better in SAT with the support of their parents and teachers. ▪ Serious students work properly during exams.

Table (4. 22): Reasons Why Leaders and Teachers think that PASS can help in Predicting Students' SAT Scores: "Aspiration &Willingness to Learn" Theme

Self-confidence was the third reason, provided by 17.1% of participants, stating that self-confidence encourages students to focus and perform better when solving a difficult question, which improves their mindset (see Table (4.23)).

Theme 3: Self-confidence	
Leaders	Teachers
▪ Attitude toward school and self-confidence are best indications related to high achievement. ▪ Yes, I am confident there is a direct correlation between students PASS scores and SAT scores. Greater self-belief, well-being, confidence and positive attitudes correspond to a greater growth mindset in learning.	▪ Self-confidence and attitude are major factors for achieving a good score in SAT, since time is a major factor and self-confidence helps the student to focus on the questions and avoid panic because of short time assigned for the questions. ▪ If a student is confident and positive, he is likely to exert more effort. ▪ PASS in short is a psychometric assessment that indicates how the students are confident, ready and motivated to learn. Analysing the PASS-9 factors will show either the students' engagement or disengagement in their learning and this should be predicting their scores in SAT scores especially with the intervention plans provided by the PASS test provider. ▪ Students will have more confidence tackling a test or problem if they like the subject they are learning.

Table (4. 23): Reasons Why Leaders and Teachers think that PASS can help in Predicting Students' SAT Scores: "Self-confidence" Theme

Another reason was motivation, provided by 8.6% of participants, where participants stated that motivated students obtained better results (see Table (4.24)).

Theme 4: Motivation	
Leaders	Teachers
▪ Attitude is everything. If students believe they can, are motivated to do so and if they are willing to put in the work, they will move mountains.	▪ Motivated students try to solve hard questions, ask when questions are not clear, use all previous knowledge and integrate concepts to reach an answer. They do not give up easily. ▪ You can tell students only take it seriously from Grade 11 onwards. This is too late. Students Grade 10 and below are still too heavily dependent on their teacher to tell them what to do, they do not know how to work independently. Once the motivated students understand how important SAT tests are, they are invested in working hard, but not before.

Table (4. 24): Reasons Why Leaders and Teachers think that PASS can help in Predicting Students' SAT Scores: "Motivation" Theme

4.3.1.4 Factor Analysis for Leaders' and Teachers' Questionnaire

Leaders' and teachers' questionnaire validity and reliability were assessed by conducting Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA).

Exploratory Factor Analysis (EFA)

Before considering the results of the EFA, the following assumptions were checked and validated.

Number of Participants: EFA is generally regarded as a technique for large sample sizes (N), with $N = 50$ as a reasonable absolute minimum (de Winter et al., 2009). In their study, a comprehensive overview of the conditions in which EFA can yield good quality results for N below 50 was offered. In the current study, the leaders and teachers sample total was 84, which is a reasonable sample size for factor analysis.

Sampling Adequacy: The results of the Kaiser-Meyer-Olkin (KMO) Test are reported in Table (4.25). $KMO = 0.767$, which is above the required threshold of 0.7 (Leech et al., 2005), indicated that enough items are predicted by each factor. The Bartlett's Test of Sphericity is $\chi^2(435) = 1845.921$, which indicated that the variables are correlated highly enough to provide a reasonable basis for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.767
Bartlett's Test of Sphericity	Approx. Chi-Square	1845.921
	df	435

Table (4. 25): KMO and Bartlett's Test for Leaders and Teachers' Questionnaire
(30 items) (Source: Author)

The MSA values in Table (4.26) ranged between 0.398 and 0.869. The two low MSA values belong to item 24 and 25, indicating that these two variables have low sampling adequacy. Communality values in Table (4.26) show only item 25 had communality below 0.2 (Samuels, 2017).

Leaders' and Teachers' Questionnaire (30 Items)	MSA	Communalities
1) I am aware of the strengths and weaknesses in the students' academic level based on MAP reports.	.851	.595
2) I believe that training students on using the MAP test report helps them improve their learning.	.786	.624
3) I encourage students to use the information in the MAP report to improve their academic knowledge and skills.	.771	.717
4) I advise students to adjust their plans for learning based on the results they get from the MAP test or MAP "Student Goal Setting Worksheet".	.644	.550
5) I think that monitoring students' academic progress should be based on their progress in the MAP test.	.828	.420
6) I recommend using MAP Goals or the MAP "Student Goal Setting Worksheet" frequently to reflect with students on their achievement	.846	.503
7) I think MAP scores are important in predicting students' SAT scores.	.726	.463
8) I think MAP tests are helpful in improving students' scores in SAT.	.750	.417
9) I believe that students should connect what they learn from MAP to their SAT target.	.850	.604
10) I think that setting students' SAT goals should be based on the current MAP-RIT score or percentile.	.823	.665
11) I am aware of the strengths and weaknesses in the students' cognitive ability level based on CAT4 reports.	.825	.504
12) I believe that training students on using the CAT4 report should help them in improving their learning.	.739	.483
13) I encourage students to use the information in the CAT4 report to improve their academic knowledge and skills.	.727	.556
14) I advise students to adjust their plans for learning based on the recommendation they get from the CAT4 test results and report.	.803	.495
15) I think monitoring students' progress during a learning task should be done using the advice they got from their CAT4 reports.	.803	.541
16) I recommend using the CAT4 report and recommendation frequently to improve students' learning strategies and skills.	.814	.554
17) I think cognitive ability levels are important in predicting students' SAT scores.	.869	.668
18) I think students' cognitive abilities (verbal, quantitative, non-verbal reasoning, and spatial ability) are helpful in improving their scores in SAT.	.833	.706
19) I believe that students should connect what they learn about their cognitive abilities from the CAT4 report to achieve their SAT target	.817	.734
20) I think that setting students' SAT goals should be based on their current cognitive ability-CAT4 level.	.764	.783
21) I am aware that students' attitude towards school affect their performance in assessments.	.734	.399
22) I am satisfied with students' performance.	.526	.379
23) I think that students' attitude towards their teacher is important in affecting their academic achievement.	.773	.446
24) Our students have a clear vision and goals to achieve in their learning.	.480	.348

Leaders' and Teachers' Questionnaire (30 Items)	MSA	Communalities
25) I think that our students believe in their capability of thinking independently and dealing with challenges to achieve their goals.	.398	.152
26) I believe that students communication and collaboration in learning will improve their performance.	.662	.346
27) I understand that students improve their attitude towards preparing for SAT tests in order to achieve their goals.	.777	.324
28) I think students' attitudes towards learning are important in affecting their SAT scores.	.641	.460
29) I think that students' attitude towards the subject affects their performance in SAT tests.	.784	.557
30) I think students' self-confidence in the subject is important in predicting their SAT scores.	.753	.360

Table (4. 26): MSA and Communalities for the Teachers' and Leaders' Questionnaire (30 items) (Source: Author)

Correlation

Investigating the correlation matrix of the leaders and teachers' questionnaire items attached (Appendix R) it was found that almost all correlation coefficient values exceeded 0.3, suggesting reasonable factorability. Given these overall indicators, factor analysis was deemed to be suitable with all 30 items.

Exploratory Factor Analysis Results

Principal Components Analysis (PCA) with Promax Rotation was conducted to assess the underlying structure for the 30 items of the leaders and teachers' questionnaire. Three factors were requested, so the items were designed to index three domains: Academic Factors (Attainment/ATM), Cognitive Factors (Aptitude/APT), and Affective Factors (Attitude/ATT). After rotation, the first factor explained 9.9% of the variance, the second factor explained 32.8%, and the third factor explained 8.5%, with total variance of 51.2% explained. Table (4.27) displays the items and factor loadings for the rotated factors, with eigenvalues in Figure (4.33) and percentage of variance explained. All items strongly loaded on the component they

pertained to. Although the reliability measures (Cronbach's Alpha) of the first two factors were high (0.917 and 0.891) and for the third factor was acceptable (0.664), the factor structure of the extracted factors was slightly different from the hypothesized factor structure. Yet, the extracted factor solution indicated a valid and reliable factor structure.

Leaders' and Teachers' Questionnaire – 30 Items		Factors		
		APT	ATM	ATT
9	I believe that students should connect what they learn from MAP to their SAT target.	.692		
10	I think that setting students' SAT goals should be based on the current MAP-RIT score or percentile.	.802		
12	I believe that training students on using the CAT4 report should help them in improving their learning.	.421	.359	
15	I think monitoring students' progress during a learning task should be done using the advice they got from their CAT4 reports.	.487		
16	I recommend using the CAT4 report and recommendation frequently to improve students' learning strategies and skills.	.497	.311	
17	I think cognitive ability levels are important in predicting students' SAT scores.	.812		
18	I think students' cognitive abilities (verbal, quantitative, non-verbal reasoning, and spatial ability) are helpful in improving their scores in SAT.	.840		
19	I believe that students should connect what they learn about their cognitive abilities from the CAT4 report to their SAT target	.951		
20	I think that setting students' SAT goals should be based on their current cognitive ability-CAT4 level.	1.007	-.331	
1	I am aware of the strengths and weaknesses in the students' academic level based on MAP reports.		.818	
2	I believe that training students on using the MAP test report helps them in improving their learning.		.868	
3	I encourage students to use the information in the MAP report to improve their academic knowledge and skills.	-.345	.924	
4	I advise students to adjust their plans for learning based on the results they get from the MAP test or MAP "Student Goal Setting Worksheet".		.806	
5	I think that monitoring students' academic progress should be based on their progress in the MAP test.		.462	
6	I recommend using MAP Goals or the MAP "Student Goal Setting Worksheet" frequently to reflect with students on their achievement		.670	
7	I think MAP scores are important in predicting students' SAT scores.	.398	.411	
8	I think MAP tests are helpful in improving students' scores in SAT.		.402	
11	I am aware of the strengths and weaknesses in the students' cognitive ability level based on CAT4 reports.		.651	
13	I encourage students to use the information in the CAT4 report to improve their academic knowledge and skills.	.306	.568	

Leaders' and Teachers' Questionnaire – 30 Items		Factors		
		APT	ATM	ATT
14	I advise students to adjust their plans for learning based on the recommendation they get from the CAT4 test results and report.	.389	.450	
21	I am aware that students' attitude towards school affect their performance in assessments.			.572
22	I am satisfied with students' performance.			-.622
23	I think that students' attitude towards their teacher is important in affecting their academic achievement.			.626
24	Our students have a clear vision and goals to achieve in their learning.	.333		-.546
25	I think that our students believe in their capability of thinking independently and dealing with challenges to achieve their goals.			-.350
26	I believe that students' communication and collaboration in learning will improve their performance.			.537
27	I understand that students improve their attitude towards preparing for SAT test in order to achieve their goals.			.429
28	I think students' attitudes towards learning are important in affecting their SAT scores.			.636
29	I think that students' attitude towards the subject affects their performance in SAT tests.			.662
30	I think students' self-confidence in the subject is important in predicting their SAT scores.			.528
Eigenvalue		9.8	3.0	2.5
% of Variance (total = 51.2%)		32.8	9.9	8.5
Cronbach's Alpha		.917	.891	.664

Extraction Method: Principal Component Analysis. ATM: Attainment, APT: Aptitude, ATT: Attitude
Rotation Method: Promax with Kaiser Normalization.
Rotation converged in 5 iterations.

Table (4. 27): Pattern Matrix^a | Factor Loadings from PCA with Promax Rotation for a Three-Factor Solution for Leaders and Teachers' Questionnaire (N = 84)
(Source: Author)

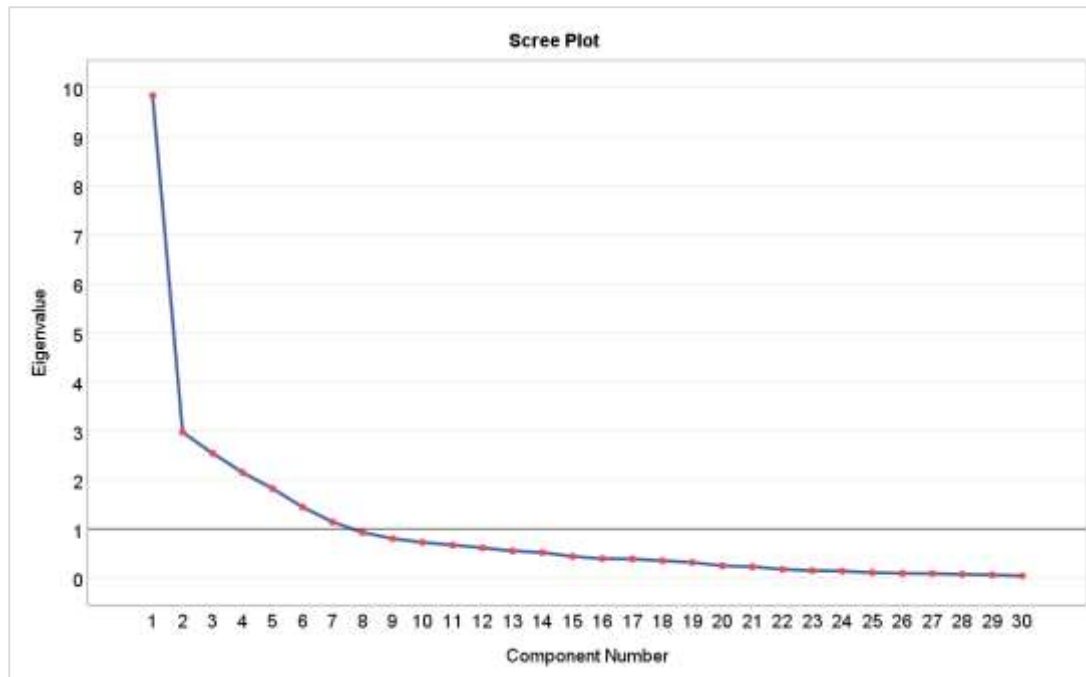


Figure (4. 33): Scree Plot | EFA (Principal Component Analysis with Promax Rotation) for Leaders' and Teachers' Questionnaire

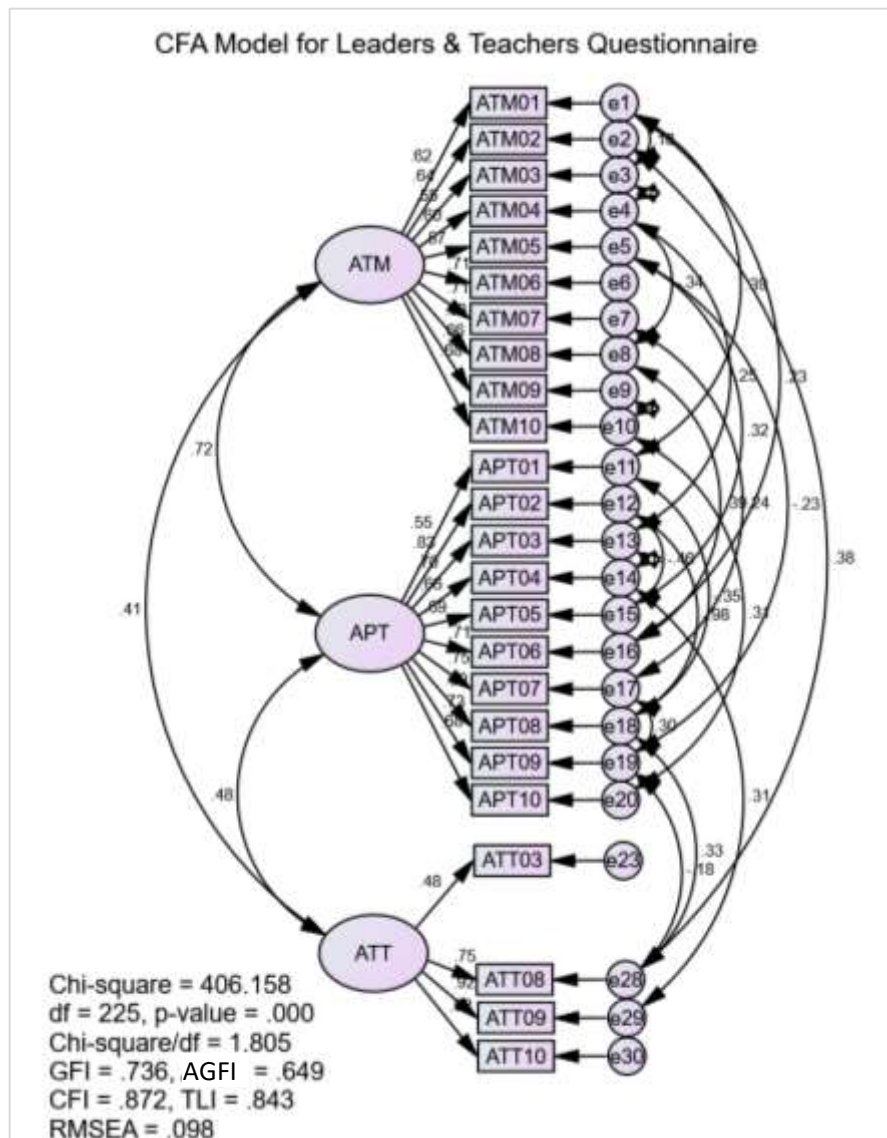
Confirmatory Factor Analysis (CFA)

CFA was conducted using AMOS 24 to assess the leaders' and teachers' questionnaire validity and reliability. Validity tests of construct validity and convergent validity were conducted. In the leaders' and teachers' questionnaire there were 30 items around which the questionnaire was framed, and the responses were collected from leaders and teachers. The 30 observed variables (indicators) were conceptually related to three latent variables: Attainment-ATM (Academic Factor), Aptitude-APT (Cognitive Factor), and Attitude-ATT (Affective Factor).

Model Fit

The model parameters were estimated using maximum likelihood. The hypothesized three-factor model did not show an adequate fit outcome, as shown in Figure (4.34).

A series of CFAs were conducted with the removal of poor fit items from the model to achieve the best fit model, with the fit indices indicated in Table (4.28).



ATM: Attainment, APT: Aptitude, ATT: Attitude, df: Degrees of freedom,
 GFI: Goodness of Fit Index, AGFI: Adjusted Goodness of Fit Index,
 CFI: Comparative Fit Index, TLI: Tucker Lewis Index,
 RMSEA: Root Mean Square Error of Approximation

Figure (4. 34): CFA Measurement Model of Leaders and Teachers' Questionnaire
(Source: Author)

Chi-square statistic χ^2 was 406.158 (degrees of freedom df = 225), with a ratio of χ^2/df value being 1.805 less than 3.00 thus exhibiting a good fit (Byrne, 2010). GFI was 0.736 and AGFI was 0.649, which was lower than the acceptable model fit (Shevlin & Miles, 1998). CFI and TLI was 0.872 and 0.843 respectively, indicating poor fit (Hu & Bentler, 1999). The obtained RMSEA value was 0.098, which exceeded 0.08, indicating that the hypothesized model cannot

be generalized to the population (MacCallum et al, 1996). Therefore, it can be concluded that the overall model fit indices indicated that the hypothesized model needed more improvement.

Index	Criterion	Model
Chi-square (χ^2)	Low	406.158
Degrees of freedom (df)	≥ 0	225
Normed Chi-square (χ^2/df)	< 3.0	1.805
Goodness of Fit Index (GFI)	$> .90$	.736
Adjusted Goodness of Fit Index (AGFI)	$> .90$	.649
Comparative Fit Index (CFI)	$> .90$	.872
Tucker Lewis Index (TLI)	$> .90$	.843
Root Mean Square Error of Approximation (RMSEA)	$\leq .08$	.098

Table (4. 28): Fit Indices for Measurement Model of Leaders and Teachers' Questionnaire
(Source: Author)

Psychometric Checks of the Model

The standardised factor loadings, Cronbach's Alpha (α), Composite Reliability (CR) and Average Variance Explained (AVE) values for the measurement model of leaders' and teachers' perceptions are summarised in Table (4.31) and presented in detail in Appendix S. As can be seen from the table, the factor loadings for all items were greater than 0.60, with the minimum loading being 0.622 and maximum loading of 0.826, except for the first three items of ATM having factor loadings of 0.383, 0.52, and 0.552. However, the items were loading on the Academic Factors with high reliability measures. Except for ATM items, the AVEs of the other two factors of the model (APT and ATT) were greater than 0.50, hence supporting their convergent validity (Hair et al., 2010). According to Fornell and Larcker (1981), an AVE of 0.40 is acceptable when the construct's CR is greater than 0.70. As shown in Table (4.29), the AVE for ATM (0.407), therefore, it is acceptable as the CR value is 0.872, supporting the claims of convergent validity and reliability.

Factors & Indicators	Factor Loading Results		
	Cronbach's Alpha (α)	Composite Reliability (CR)	Average Variance Explained (AVE)
Academic Factors – Attainment	.882	.872	.407
Cognitive Factors – Aptitude	.907	.912	.510
Affective Factors – Attitude	.664	.794	.504

Table (4. 29): Convergent Validity Estimates from CFA on Leaders' and Teachers' Questionnaire-Standardized Factor Loadings

The model's discriminant validity was evidenced by AVE factors, which were higher than the squared Shared Variance (SV) for all the constructs (Fornell & Larcker, 1981). Discriminant validity was also established by inter-factor correlation values with a cut-off value below 0.85, thus also providing strong evidence for discriminant validity (Awang, 2015; Fang, Zakaria & Shokory, 2016). Table (4.30) illustrates the results for discriminant validity. The factors' AVEs are presented along the diagonal, inter-factor correlations are located above the diagonal, while the squared inter-factor correlation values (also known as SV) are presented below the diagonal. The inter-factor correlation values of the dimensions were below 0.85 with a minimum value of 0.398 and a maximum value of 0.694, hence providing evidence for the model's discriminant validity. Moreover, the model's AVE and SV met the requirement. Thus, these findings provided evidence for the model's discriminant validity.

Factors	Academic Factors Attainment (ATM)	Cognitive Factors Aptitude (APT)	Affective Factors Attitude (ATT)
Academic Factors- Attainment (ATM)	.638	.694	.398
Cognitive Factors- Aptitude (APT)	.523	.714	.480
Affective Factors- Attitude (ATT)	.170	.228	.710

Table (4. 30): Discriminant Validity for Leaders' and Teachers' Perceptions Model

4.3.2 Students' Questionnaire Results

The main purpose of the students' questionnaire was to capture the students' perceptions about the role of their current academic attainment in MAP, aptitude level in CAT4, and attitude towards learning level in PASS in SATs scores.

4.3.2.1 Demographic Information

A total number of 797 students from five schools answered the questionnaires fully. Any incomplete questionnaire was discarded. The students were from grades 9-12. The demographic summary is presented in Table (4.31) below. The largest proportion of students were from Grade 12 (33.4%), followed by almost similar proportions from Grades 9, 10, and 11; 23.5%, 20.2%, and 23.0% respectively. The first language (mother tongue) of most of the participating students (92.7%) was Arabic, while the second language was English (88.2%). Female students represented 53.3% of the total participants and male students represented 46.7%. Students' ages ranged between 13 and 19, with a mean age of 15.85 years and standard deviation of 1.238 years. The main base of the sample nationality was Emirati students representing 86.6% of the participants.

Demographics		Frequency	Percent	Demographics		Frequency	Percent
School				Nationality			
	School A	11	1.4		Algerian	1	.1
	School B	46	5.8		American	4	.5
	School C	401	50.3		Afghan	1	.1
	School D	311	39.0		British	3	.4
	School E	28	3.5		Bulgarian	2	.3
					Canadian	5	.6
Gender					Chinese	1	.1
	Female	426	53.5		Egyptian	10	1.3
	Male	371	46.5		Emirati	690	86.6

Demographics		Frequency	Percent	Demographics	Frequency	Percent
Grade Level				French	1	.1
	Grade 9	187	23.5	Indian	1	.1
	Grade 10	161	20.2	Iranian	12	1.5
	Grade 11	183	23.0	Iraqi	8	1.0
	Grade 12	266	33.4	Irish	1	.1
Age (M = 15.85, SD = 1.238)				Jordanian	11	1.4
	13	11	1.4	Kuwaiti	1	.1
	14	132	16.6	Lebanese	8	1.0
	15	165	20.7	Libyan	2	.3
	16	197	24.7	Moroccan	2	.3
	17	244	30.6	Nigerian	2	.3
	18	46	5.6	Pakistani	1	.1
	19	2	.3	Palestinian	3	.4
First Language (Mother Tongue)				Russian	1	.1
	Arabic	739	92.7	Saudi	10	1.3
	English	43	5.4	South African	1	.1
	Other	15	1.9	Spanish	1	.1
Second Language				Sudanese	3	.4
	Arabic	82	10.3	Syrian	10	1.3
	English	703	88.2	Turkish	1	.1
	Other	12	1.5			

Table (4. 31): Demographic Information of Students (N=797)

4.3.2.2 Students' Perceptions about their Attainment, Aptitude, Attitude, and SAT

Scores

This section presents the descriptive statistics of students' perceptions about each type of assessment categorized under the three domains: Academic Factors (Attainment in MAP), Cognitive Factors (Aptitude level in CAT4), and Affective Factors (Attitude in PASS).

I) Academic Factors – Attainment in MAP

Figure (4.35) below illustrates the number of years the students have been taking the MAP test. The data shows that most students (52.6%, 410 students) have been taking the MAP for 4-6 years, 33.8% (263 students) have been taking the MAP for 7 years or more, and 13.6% (106 students) have been taking the test for less than 4 years.

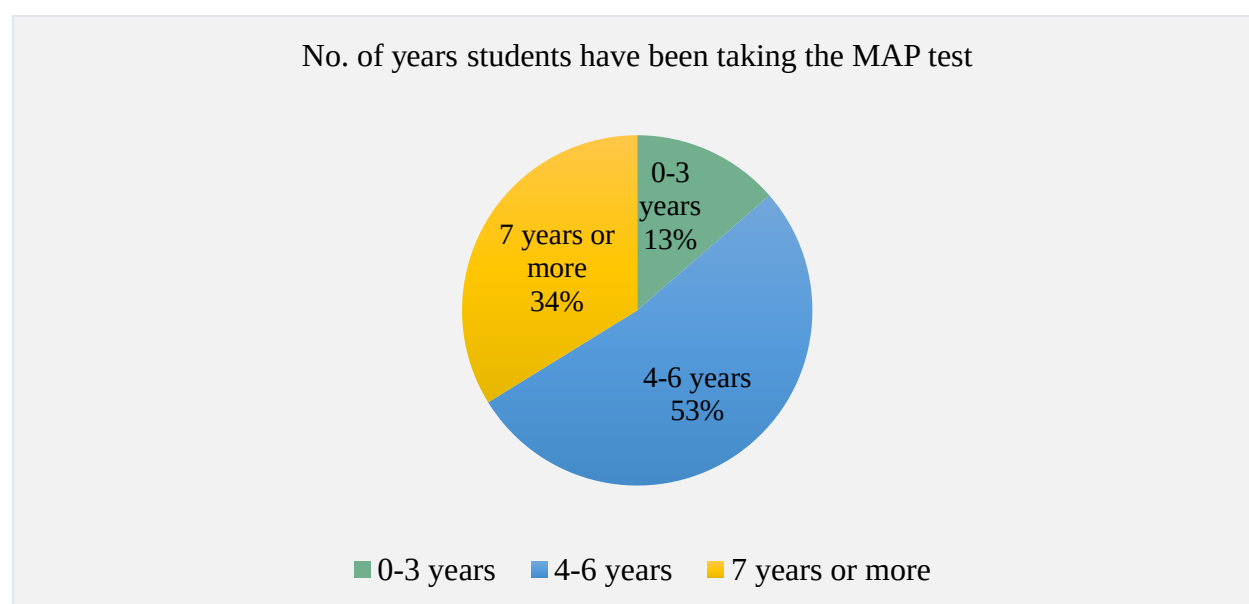


Figure (4. 35): No. of Years Students Participated in the MAP Test

(Source: Author)

The following part is an investigation of the relationship between the MAP test and students' academic achievement in SAT. The descriptive summary of the Academic Factors' ten statements is presented in Table (4.34) below, including frequencies and percentages of response scores, mean, standard deviation, and RA.

Overall, respondents showed a RA of 76.8% with a grand mean score of 3.84 and standard deviation of 0.794, indicating that their agreement with Academic Factors was not very strong, yet was above 3 (Neutral). The RA of the ten statements ranged from a minimum of 72.2% for

statement number (6): “I use the MAP goal sheet frequently to reflect on my achievement” to a maximum of 82% for statement number (1): “I am aware of my strengths and weaknesses in the subject based on MAP reports”. The responses to the statements about the role of MAP in SAT achievement indicated a RA varying from a minimum agreement of 53.3% on statement number (10): “I try to set my SAT goals based on my current MAP-RIT score or percentile”, to a maximum of 61.9% for statement number (8): “I think MAP tests are helpful in improving my scores in SAT”. The response score percentages are graphically illustrated in Figure (4.32). From the statistics reported in Table (4.32) and Figure (4.36), the following findings are concluded:

1. 68.8% of students are aware of their strengths and weaknesses in a subject based on MAP reports.
2. 69.6% of students are aware of how to use the MAP test to help them improve their learning.
3. 62.5% of students know they can use the information in the MAP report to master mathematical skills.
4. 55.1% of students adjust their plans for learning based on the results they get from the MAP test and MAP Goal Sheets.
5. 56.2% of students check their progress based on their progress in the MAP test.
6. 50.6% of students use the MAP goal sheet frequently to reflect on their achievement.
7. 57.1% of students seek to connect what they learn from the MAP to achieve their SAT target.
8. 61.9% of students think MAP tests are helpful in improving their scores in SAT.
9. 56.3% of students think their MAP score is important in predicting their SAT scores.
10. 53.3% of students try to set their SAT goals based on their current MAP-RIT score or percentile.

Academic Factors (Attainment) Statements	Likert Scale					Statistics		
	SD (1)	D (2)	N (3)	A (4)	SA (5)	Mean	SD	RA*
1) I am aware of my strengths and weaknesses in the subject based on MAP reports.	10	43	196	159	389	4.10	1.027	82.0%
	1.3%	5.4%	24.6%	19.9%	48.8%			
2) I am aware of how to use the MAP test to help me improve my learning.	23	50	169	191	364	4.03	1.086	80.6%
	2.9%	6.3%	21.2%	24.0%	45.7%			
3) I know I can use the information in the MAP report to master the mathematical skills.	23	61	215	137	361	3.94	1.134	78.8%
	2.9%	7.7%	27.0%	17.2%	45.3%			
4) I adjust my plans for learning based on the results I get from the MAP test and MAP Goal Sheets.	37	86	235	128	311	3.74	1.212	74.8%
	4.6%	10.8%	29.5%	16.1%	39.0%			
5) I check my progress based on my progress in the MAP test.	33	104	212	132	316	3.75	1.222	75.0%
	4.1%	13.0%	26.6%	16.6%	39.6%			
6) I use the MAP Goal Sheet frequently to reflect on my achievement	42	116	236	116	287	3.61	1.252	72.2%
	5.3%	14.6%	29.6%	14.6%	36.0%			
7) I seek to connect what I learn from MAP to achieve my SAT target.	23	94	225	118	337	3.82	1.185	76.4%
	2.9%	11.8%	28.2%	14.8%	42.3%			
8) I think MAP tests are helpful in improving my scores in SAT.	26	59	219	160	333	3.90	1.128	78.0%
	3.3%	7.4%	27.5%	20.1%	41.8%			
9) I think my MAP score is important in predicting my SAT scores.	28	87	233	145	304	3.77	1.172	75.4%
	3.5%	10.9%	29.2%	18.2%	38.1%			
10) I try to set my SAT goals based on my current MAP-RIT score or percentile.	27	116	229	118	307	3.71	1.214	74.2%
	3.4%	14.6%	28.7%	14.8%	38.5%			
Total	3.4%	10.2%	27.2%	17.6%	41.5%	3.84	.794	76.8%

*. RA: Relative Agreement, calculated as % of Mean/5.

(Likert Scale: SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree)

Table (4. 32): Descriptive Summary of Students' Perceptions about Academic Factors
(Source: Author)

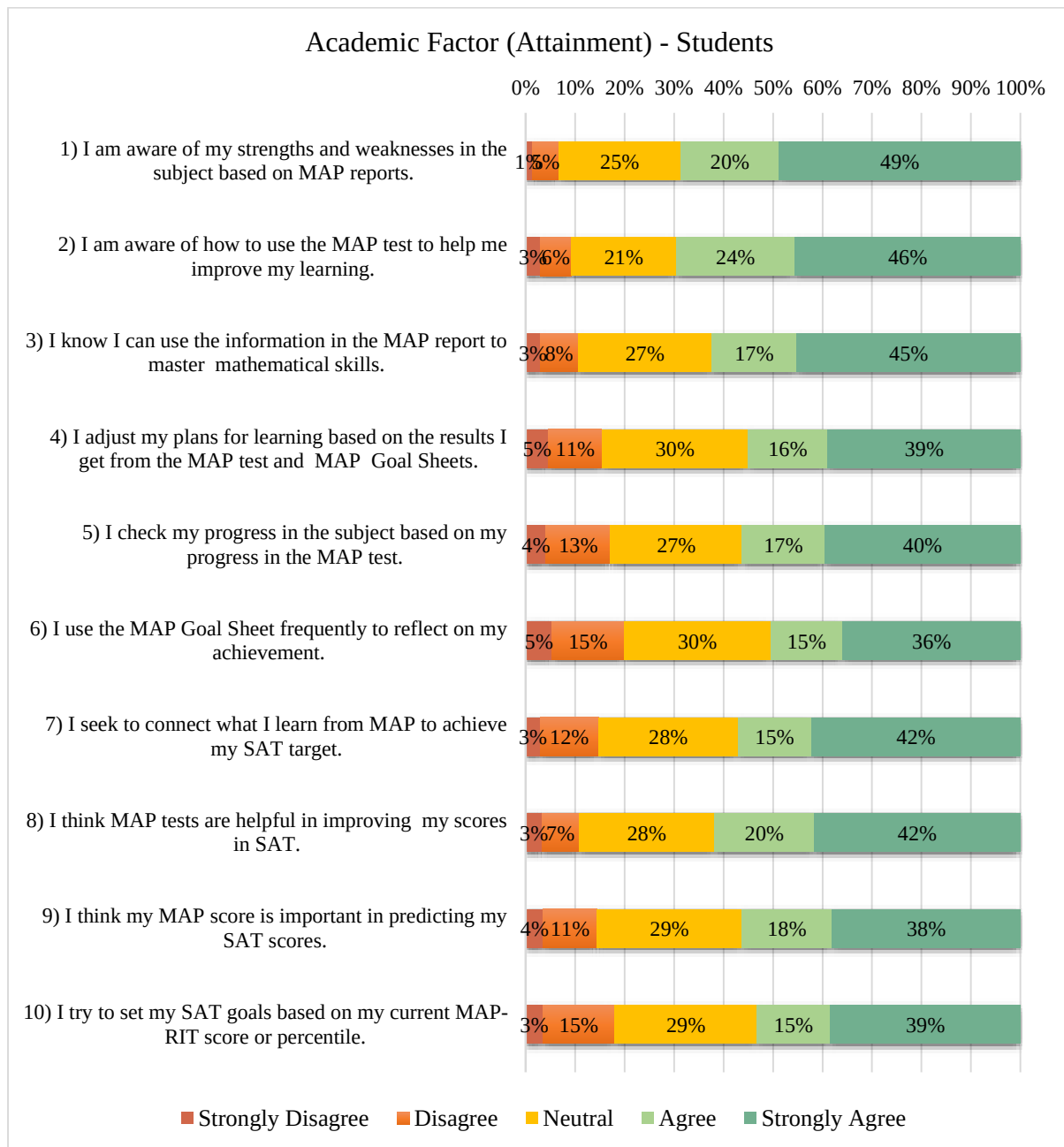


Figure (4. 36): Students' Perceptions about Academic Factors – Attainment (%)

(Source: Author)

II) Cognitive Factors – Aptitude

Figure (4.37) below illustrates the number of years the students have been taking the CAT4 test. The data shows that a large majority of students (67.5%, 538 students) have been taking

the CAT4 for less than 4 years, while 26.4% (211 students) have been taking the CAT4 test for 4-6 years, and only 6% (48 students) have been taking the test for 7 years or more.

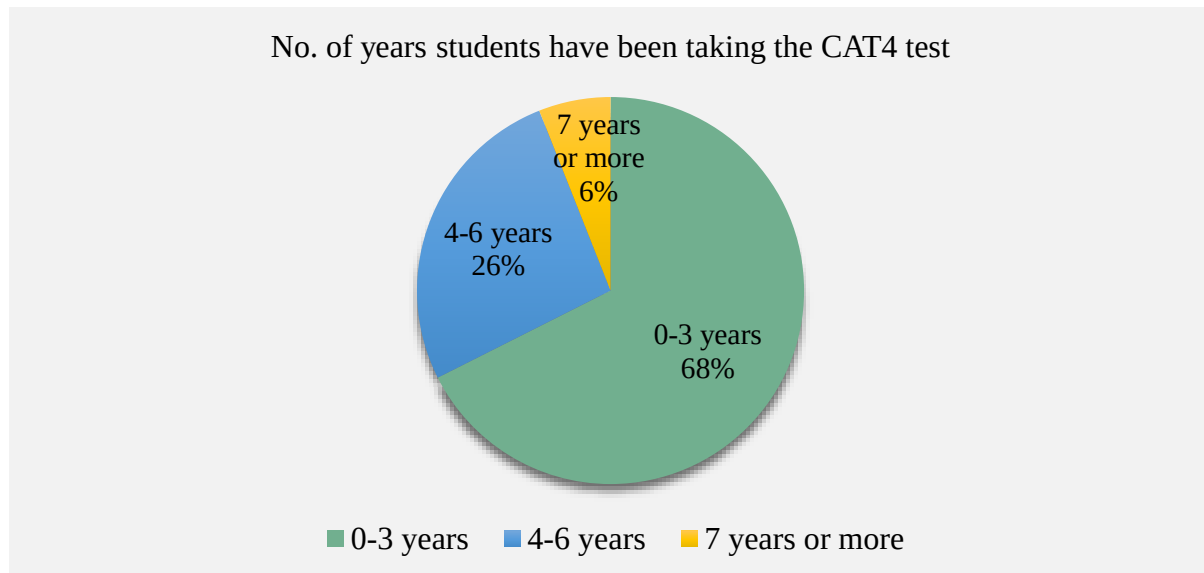


Figure (4. 37): No. of Years Students Participated in the CAT4 Test

(Source: Author)

This section investigates the relationship between the CAT4 and students' academic achievement in SAT. The ten statements measuring the Cognitive Factors (Aptitude) are statistically described in Table (4.33) below, indicating a lower RA of students' responses to Cognitive Factor statements than their responses to the Academic Factors (Attainment).

Overall, respondents showed a RA of 70%, with a grand mean of 3.50 and standard deviation of 0.967. The RA values for the ten cognitive factors statements ranged between a minimum of 67.6% for statement number (6): "I use the CAT4 report and recommendation frequently to improve my learning strategies and skills" to a maximum of 73.2% for statement number (8): "I think my cognitive ability (verbal, quantitative, non-verbal reasoning, and spatial ability) level is helpful in improving my scores in SAT". On the other hand, within the responses to the statements about the role of CAT4 in SAT achievement, the RA varied from (68.2%) for

the statement number (10): “I try to set my SAT goals based on my current cognitive ability-CAT4 level” to a maximum of 73.2% for statement number (8): “I think my cognitive ability level is helpful in improving my scores in SAT”. With the given results, summarised in Table (4.35) and presented graphically in Figure (4.38), the following findings are concluded:

1. 45.8% of students are aware of their strengths and weaknesses in a subject based on CAT4 reports.
2. 46.7% of students are aware of how to use the CAT4 report to help them improve their learning.
3. 44.3% of students know they can use the information in their CAT4 report to master mathematical skills.
4. 42.2% of students adjust their plans for learning based on the recommendation they get from the CAT4 test results and report.
5. 40.3% of students check their progress during a learning task using the advice they got from CAT4.
6. 39.5% of students use the CAT4 report and recommendation frequently to improve their learning strategies and skills.
7. 41.7% of students seek to connect what they learn about their cognitive abilities from the CAT4 report to achieve their SAT target.
8. 50.1% of students think their cognitive ability (verbal, quantitative, non-verbal reasoning, and spatial ability) level is helpful in improving their scores in SAT.
9. 46% of students think their cognitive ability level is important in predicting their SAT scores.
10. 41.8% of students try to set their SAT goals based on their current cognitive ability-CAT4 level.

Cognitive Factors (Aptitude) Statements	Likert Scale					Statistics		
	SD (1)	D (2)	N (3)	A (4)	SA (5)	Mean	SD	RA*
1) I am aware of my strengths and weaknesses in the subject based on CAT4 reports.	42	110	280	103	262	3.54	1.225	70.8%
	5.3%	13.8%	35.1%	12.9%	32.9%			
2) I am aware of how to use the CAT4 report to help me improve my learning.	43	101	281	113	259	3.56	1.215	71.2%
	5.4%	12.7%	35.3%	14.2%	32.5%			
3) I know I can use the information in my CAT4 report to master mathematical skills.	37	104	303	95	258	3.54	1.199	70.8%
	4.6%	13.0%	38.0%	11.9%	32.4%			
4) I adjust my plans for learning based on the recommendation I get from the CAT4 test results and report.	45	126	290	89	247	3.46	1.235	69.2%
	5.6%	15.8%	36.4%	11.2%	31.0%			
5) I check my progress during a learning task using the advice I got from CAT4.	48	142	286	83	238	3.40	1.248	68.0%
	6.0%	17.8%	35.9%	10.4%	29.9%			
6) I use the CAT4 report and recommendation frequently to improve my learning strategies and skills.	59	134	289	78	237	3.38	1.270	67.6%
	7.4%	16.8%	36.3%	9.8%	29.7%			
7) I seek to connect what I learn about my cognitive abilities from the CAT4 report to achieve my SAT target.	57	109	299	79	253	3.45	1.260	69.0%
	7.2%	13.7%	37.5%	9.9%	31.7%			
8) I think my cognitive ability (verbal, quantitative, non-verbal reasoning, and spatial ability) level is helpful in improving my scores in SAT.	38	81	279	116	283	3.66	1.194	73.2%
	4.8%	10.2%	35.0%	14.6%	35.5%			
9) I think my cognitive ability level is important in predicting my SAT-scores.	49	85	296	103	264	3.56	1.222	71.2%
	6.1%	10.7%	37.1%	12.9%	33.1%			
10) I try to set my SAT goals based on my current cognitive ability-CAT4 level.	56	129	279	95	238	3.41	1.260	68.2%
	7.0%	16.2%	35.0%	11.9%	29.9%			
Total	5.9%	14.1%	36.2%	12.0%	31.9%	3.50	.967	70.0%

*. RA: Relative Agreement, calculated as % of Mean/5.

(Likert Scale: SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree)

Table (4. 33): Descriptive Summary of Students' Perceptions about Cognitive Factors

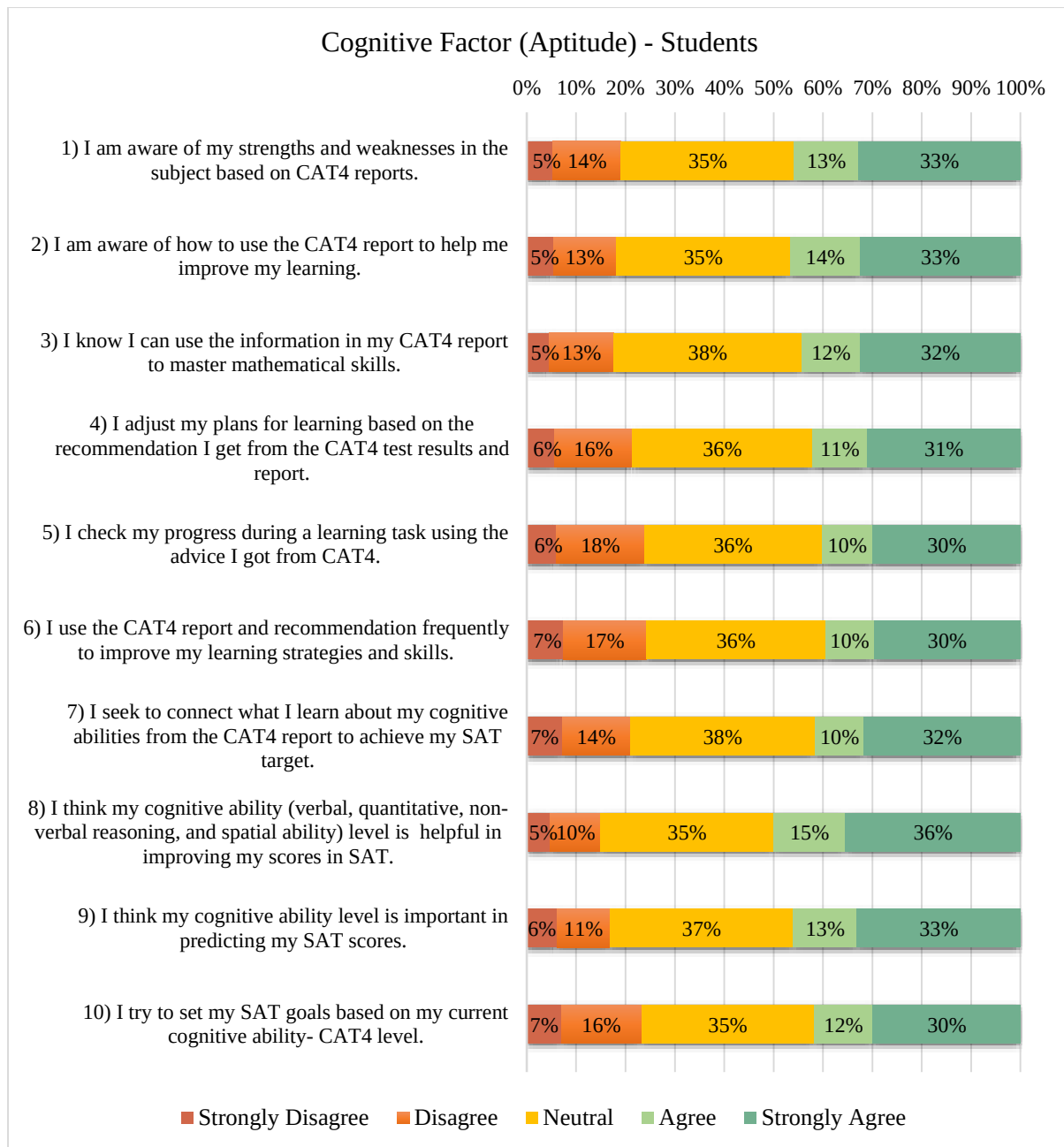


Figure (4. 38): Students' Perceptions about Cognitive Factors – Aptitude (%)

(Source: Author)

III) Affective Factors – Attitude towards Learning

Figure (4.39) below illustrates the number of years the students have been taking the PASS test. The data concludes that most students (80%, 644 students) have been taking the PASS test

for less than 4 years, 11.8% (94 students) have been taking the PASS test for 4-6 years, and only 7.4% (59 students) have been taking the test for 7 years or more.

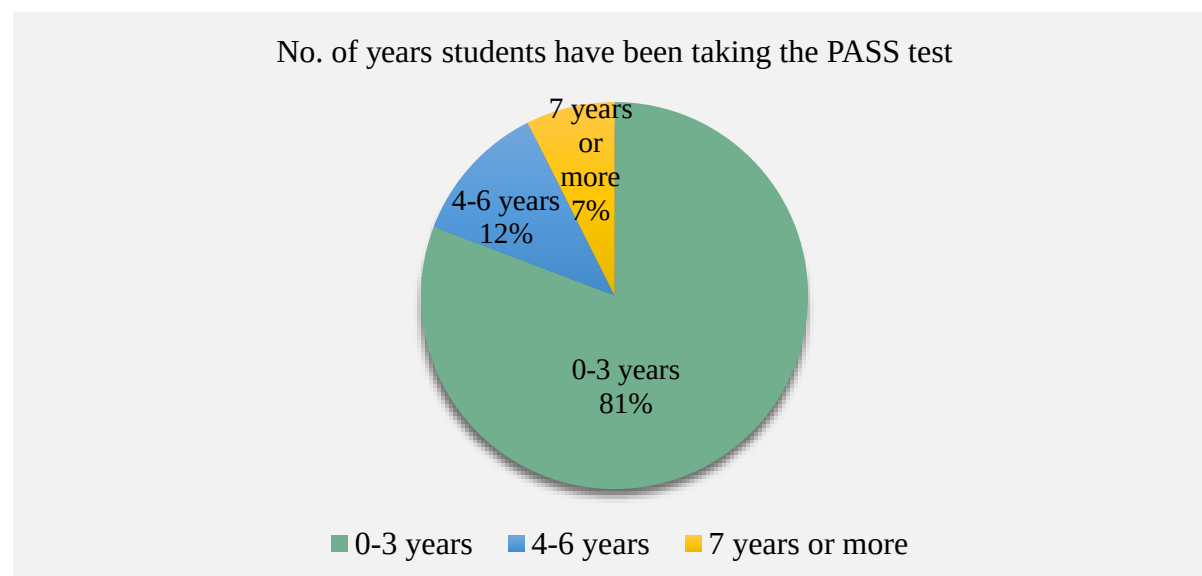


Figure (4. 39): No. of Years Students Participated in the PASS Test

(Source: Author)

In the ten self-reporting statements in Part B of the questionnaire shown in Table (4.34) below, the focus is on investigating the students' perceptions and practices related to the role of their attitude towards learning in SAT achievement.

Affective Factor (Attitude towards Learning) Statements	Likert Scale					Statistics		
	SD (1)	D (2)	N (3)	A (4)	SA (5)	Mean	SD	RA*
1) I understand that my attitude towards school affects my performance in assessments.	48	45	239	196	269	3.74	1.158	74.8%
	6.0%	5.6%	30.0%	24.6%	33.8%			
2) I am satisfied with my performance.	55	65	268	131	278	3.64	1.227	72.8%
	6.9%	8.2%	33.6%	16.4%	34.9%			
3) I think my attitude towards my teacher is important in affecting my academic achievement.	42	40	229	230	256	3.78	1.111	75.6%
	5.3%	5.0%	28.7%	28.9%	32.1%			

Affective Factor (Attitude towards Learning) Statements	Likert Scale					Statistics		
	SD (1)	D (2)	N (3)	A (4)	SA (5)	Mean	SD	RA*
4) I have a clear vision and goals to achieve in my learning.	47	52	254	179	265	3.71	1.166	74.2%
	5.9%	6.5%	31.9%	22.5%	33.2%			
5) I believe that I am capable of thinking independently and dealing with challenges to achieve my goals.	47	43	235	183	289	3.78	1.166	75.6%
	5.9%	5.4%	29.5%	23.0%	36.3%			
6) I believe that my communication and collaboration in learning will improve my performance.	49	40	239	195	274	3.76	1.158	75.2%
	6.1%	5.0%	30.0%	24.5%	34.4%			
7) I seek to improve my attitude towards preparing for SAT to achieve my goals.	45	45	267	170	270	3.72	1.154	74.4%
	5.6%	5.6%	33.5%	21.3%	33.9%			
8) I think my attitude towards learning is important in affecting my SAT scores.	48	71	249	156	273	3.67	1.203	73.4%
	6.0%	8.9%	31.2%	19.6%	34.3%			
9) I think that my attitude towards the subject affects my performance in SAT tests.	50	56	256	156	279	3.70	1.195	74.0%
	6.3%	7.0%	32.1%	19.6%	35.0%			
10) I think my self-confidence in the subject is important in predicting my SAT scores.	47	53	251	161	285	3.73	1.183	74.6%
	5.9%	6.6%	31.5%	20.2%	35.8%			
Total	6.0%	6.4%	31.2%	22.0%	34.4%	3.72	.944	74.4%

*, RA: Relative Agreement, calculated as % of Mean/5.

(Likert Scale: SD: Strongly Disagree; D: Disagree; N: Neutral; A: Agree; SA: Strongly Agree)

Table (4. 34): Descriptive Summary of Students' Perceptions about Affective Factors

The descriptive statistics of students' self-reporting statements indicated that the RA of students to the affective factors is 74.4%, with a grand mean of 3.72 and standard deviation of 0.944. RA values for the ten statements ranged between a minimum of 72.8% for the statement (2): "I am satisfied with my performance" and a maximum of 75.6% for statement (3): "I think my attitude towards my teacher is important in affecting my academic achievement" and statement (5): "I believe that I am capable of thinking independently and dealing with challenges to achieve my goals".

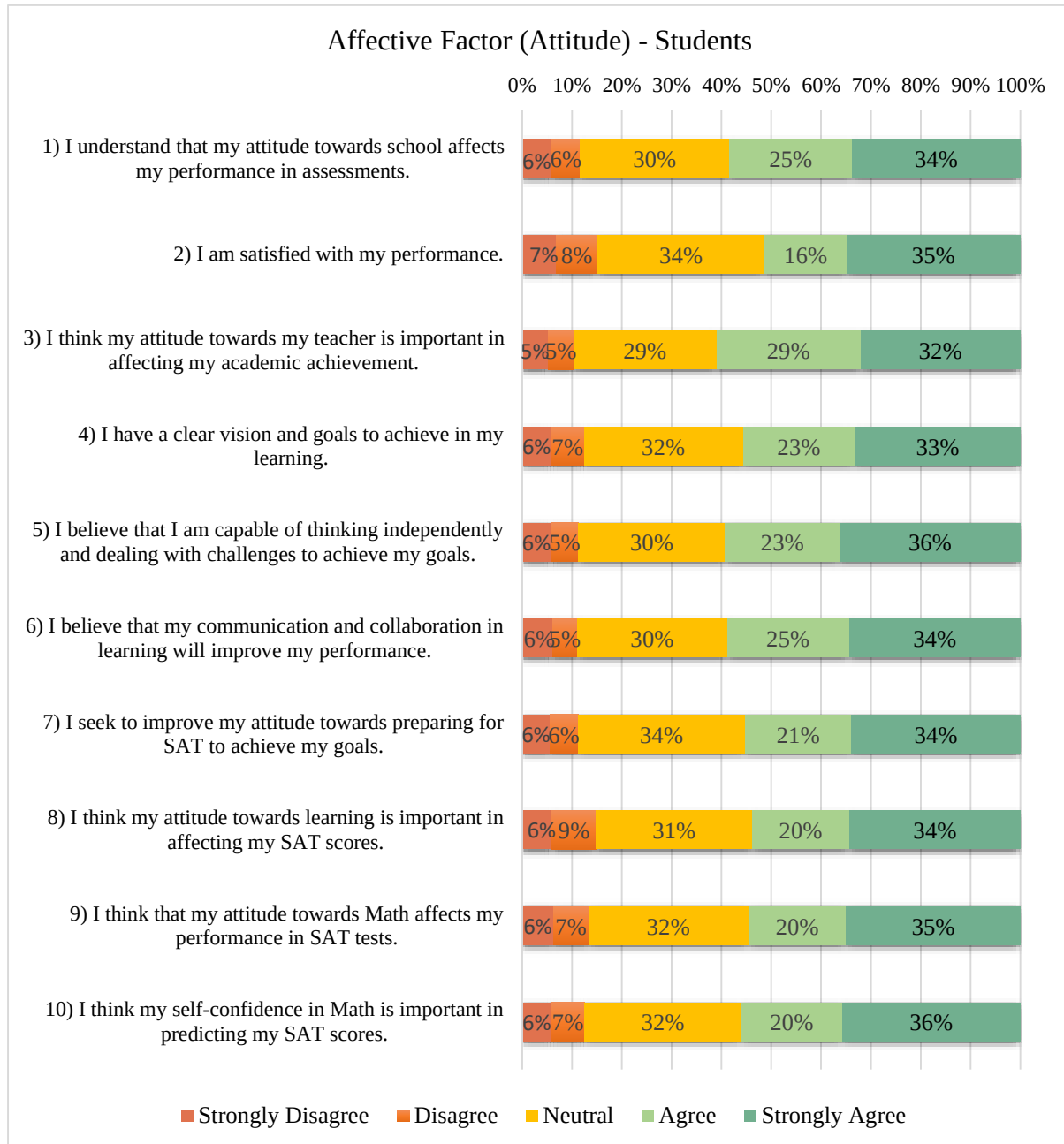


Figure (4. 40): Students' Perceptions about Affective Factors-Attitude towards Learning (%)

Based on the students' responses illustrated in Figure (4.40), the following conclusions can be made:

1. 58.3% of students understand that their attitude towards school affects their performance in assessments.
2. 51.3% of students are satisfied with their performance.

3. 61% of students think their attitude towards their teacher is important in affecting their academic achievement.
4. 55.7% of students have a clear vision and goals to achieve in their learning.
5. 59.2% of students believe that they are capable of thinking independently and dealing with challenges to achieve their goals.
6. 58.8% of students believe that their communication and collaboration in learning will improve their performance.
7. 55.2% of students seek to improve their attitude towards preparing for SAT to achieve their goals.
8. 53.8% of students think their attitude towards learning is important in affecting SAT scores.
9. 54.6% of students think that their attitudes toward a subject affect performance in SAT tests.
10. 56% of students think their self-confidence in a subject is important in predicting SAT scores.

4.3.2.3 Students' Perceptions about the Predictability of their SAT Scores by Attainment, Aptitude, and Attitude

This section includes the analysis of the three open-ended questions at the end of each factor within the questionnaire. The open-ended question from each section investigates students' perceptions about the predictability of their academic achievement in SAT based on the MAP, CAT4, and PASS scores.

The section below presents the results from the students answers in relation to each question associated with the MAP, CAT4, and PASS scores. The reasons presented by the students were summarised and categorized based on keywords into main themes according to each factor

(MAP, CAT4, and PASS) and presented as percentages in figures in each section supported by a table listing the main comments stated by the participants.

I) Predictability of SAT Scores by Students' Attainment (MAP)

Most (76%) of the students felt that MAP can help them in predicting their results in SAT (see Figure (4.41) below) and students mentioned several reasons for their answers (see Figure (4.42)). Overall, students who answered “Yes” indicated that they believed MAP could help them in predicting their results in SAT because a MAP test is generally similar to a SAT test.

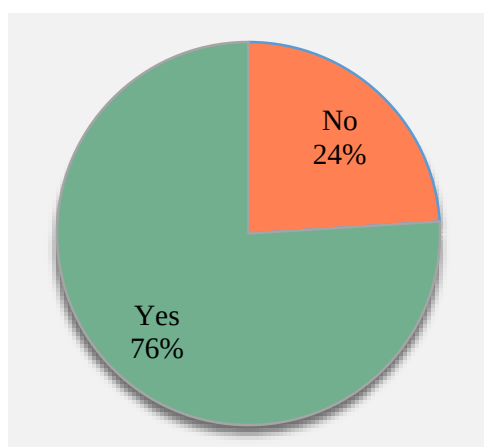


Figure (4. 41): Do you Think that MAP can help you in Predicting your Results in SAT?

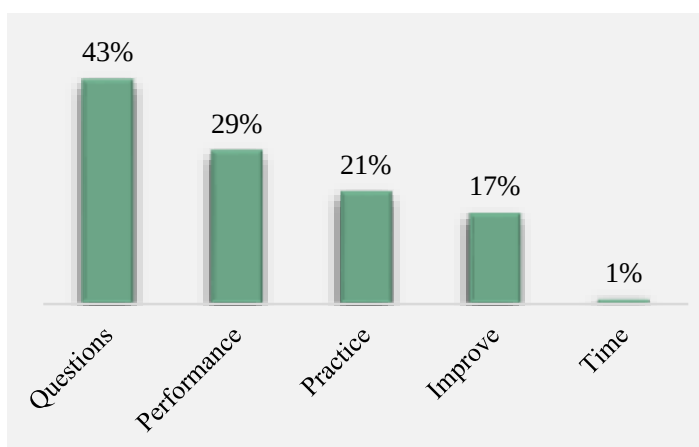


Figure (4. 42): Reasons that 76% of Students Think that MAP can help them in Predicting their Results in SAT

A total of 544 students gave valid answers to this question, where 42.9% of them indicated that MAP tests were similar to SAT-Math. This was because the MAP test had various higher-level questions, especially in Math, which helped students to estimate the SAT-Math questions. They also indicated that solutions to Math questions in MAP helped them estimate the concept they would use in solving SAT-Math questions. Also, 29.3% of students stated that the MAP test was a guide and a starting point for them as it indicated their performance through their scores, which showed them their weakness and strength points that would help them in preparing for the SAT test. Their performance in MAP (through their scores) helped them predict SAT scores. This means that students believe when they answer higher-level MAP questions it

improves their critical thinking and prepares them to answer higher level questions required for SAT.

Another reason was provided by 21.4% of students, who stated the MAP test can be used as a practise test since they take it several times, and therefore it improves their skill in answering SAT questions. The minority of students (17.3%) believed that the MAP test improved their Math and English skills which helped them perform better in SAT. Few students (0.7%) mentioned that the MAP testing session provided sufficient time to answer all the questions and think carefully before submitting the answer.

In conclusion, as stated by students, MAP tests provide students with the necessary previous knowledge, higher-level thinking skills, and time management skills. It also helps them improve their Math and English skills, to adopt critical thinking, to learn and practise new concepts, and use their scores to predict their SAT scores. On the other hand, students (24%) who did not think MAP can help them in predicting their results in SAT attributed their answer with “No” with their belief that the two tests are totally different. They felt MAP did not help them to practise for SAT, and that SAT was more serious and needed more time to prepare for.

II) Predictability of SAT Scores by Students’ Aptitude (CAT4)

This section presents the students’ perceptions on whether CAT4 helps in predicting students’ achievement in SAT and also provides an explanation for their perceptions. Slightly more than half (51.6%) of the students felt that CAT4 could help them predict their SAT-Math scores (see Figure (4.43) below). Reasons mentioned by students are graphed in Figure (4.44). Out of 402 students who answered “Yes”, 31.1% mentioned that they believed that CAT4 could help them in predicting their SAT scores because it made substantial improvements in different aspects such as general knowledge, critical thinking, Geometry skills, English skills, learning new

concepts and new ways of thinking. Moreover, 30.3% said that both tests shared common questions, for instance CAT4 included all levels of questions related to different areas of language, Math, and Geometry, and SAT was all about English and Math. Also, 27.6% said the CAT4 test showed them their academic level by providing them scores indicating their weaknesses and strengths that would provide them with focus areas needed to improve overall achievement in the SAT-Math test. So, in one way or another, the two tests are related. Finally, 12.7% of the students considered the CAT4 test as a practice activity; they said that it helped them practise and prepare for the SAT test.

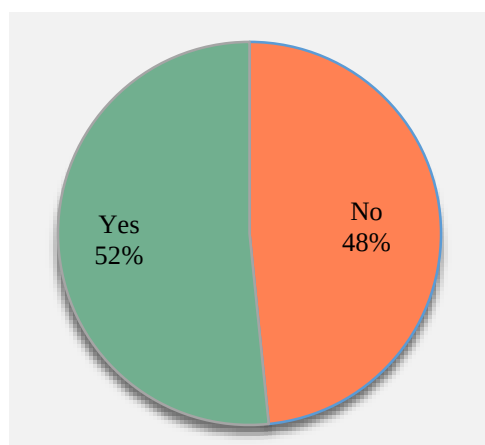


Figure (4. 43): Do you Think that CAT4 can help you in Predicting your SAT Scores?

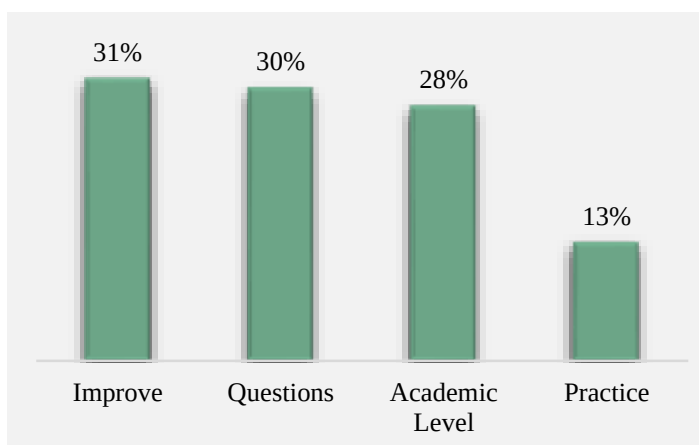


Figure (4. 44): Reasons that 51.6% of Students Think that CAT4 can help them in Predicting their Results in SAT.

On the other hand, students who answered “No” provided different reasons for why they did not think CAT4 could help them in predicting their SAT scores; see Figure (4.45). Out of 377 students who answered “No”, 256 students provided valid responses, indicating these reasons. The large minority (44.1%) of students did not know the reason why they did not think CAT4 could help them in predicting SAT scores without providing reasons. However, they felt there was no relation between CAT4 and SAT. Among those, there were students who took CAT4 a long time ago, so they did not remember how they did, or they did not have access to their scores.

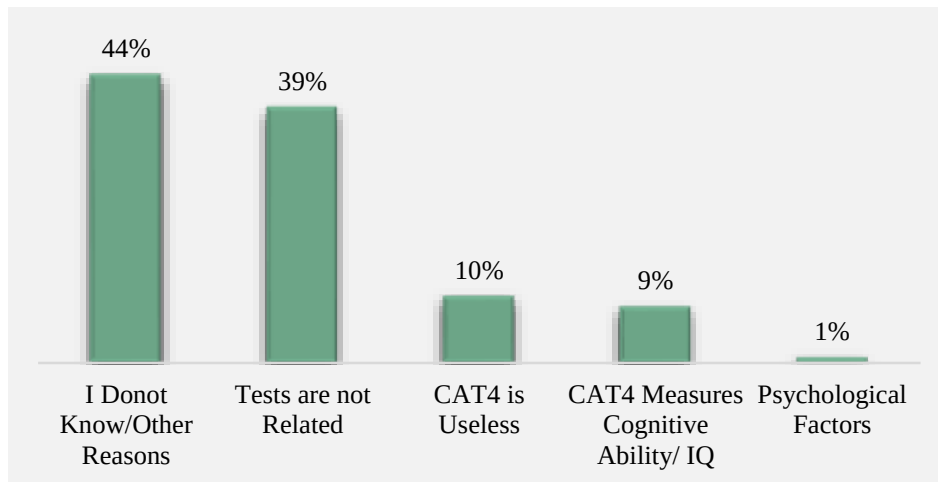


Figure (4. 45): Reasons that 48.4% of Students do not Think that CAT4 can help them in Predicting their Results in SAT

Similar to what has been presented by students in relation to the MAP test, 39.1% of students who said “No” believed that the tests had no relationship to one another in terms of material and questions. They mentioned that CAT4 was all about words, shapes, and patterns while SAT was about long readings, contextual questions, and solving problems. Students also mentioned that they did not take the CAT4 test seriously because they did not need to prepare for it, while SAT was taken more seriously, and they took time to study and prepare for it. Few (10.2%) students said CAT4 was useless, nonsense, or a waste of time. Some of them said it was a “kids’ test” (very easy) and could not be compared to an important test like SAT. Also, some students believed that CAT4 questions were misleading because some questions were confusing for them; there was no clear explanation of questions, and they did not know how to solve them. Another reason was mentioned by 8.6% of the students that CAT4 measures general knowledge, IQ, and/or cognitive abilities, and it has very few reading or Math questions compared to SAT-English and SAT-Math. Finally, two students said that sometimes stress and anxiety affect students’ final scores.

III) Predictability of SAT Scores by Students' Attitude towards Learning (PASS)

The last section presents the students' perceptions and reasons on whether attitude towards learning helps in predicting their achievement in SAT. The large majority (73.9%) of students felt their attitude towards learning could help them in predicting their SAT scores, as shown in Figure (4.46) below. The reasons for their answering "Yes" are presented in Figure (4.47) below, indicating that 43.3% of them believed that their positive attitude towards learning in terms of hard work, practising, and commitment to studying and learning substantially affected their SAT scores. The second reason, considered by 23.9% of students, was mindset, perception, being positive (or having a positive view), and/or motivation. That is, students believed that the way they think, their work ethics, and attitude towards all learning aspects affected their achievement in SAT. For instance, being positive with a good mindset and optimism lead to being motivated to learn more and improve learning with more effort. Also, 16.6% of students stated that having the will to learn (determination), love to learn (passion), and self-confidence improved their SAT scores.

At lower percentages, 10.4% of students thought of their attitude towards learning as a guide for them, for instance, doing all that they had to do (to achieve the best) would lead to better SAT scores. Consequently, 6.9% of students believed that their attitude toward their teachers and their feelings about school affected their achievement in SAT. They added that if they focused on what their teachers said and did, they would achieve higher scores in SAT. Similarly, they thought that their attitude towards learning would depend on their teachers' attitude in the class. Other reasons included some keywords like imagination, aspiration, and attitude (attitude towards learning or towards life in general).

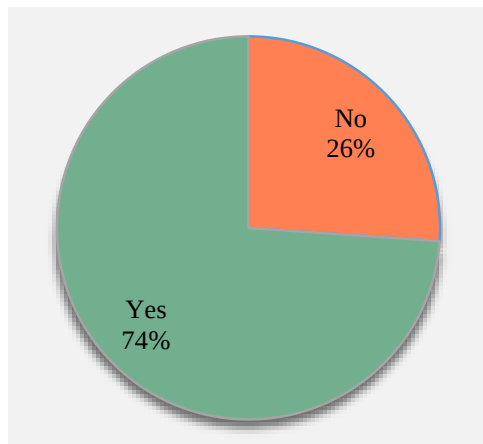
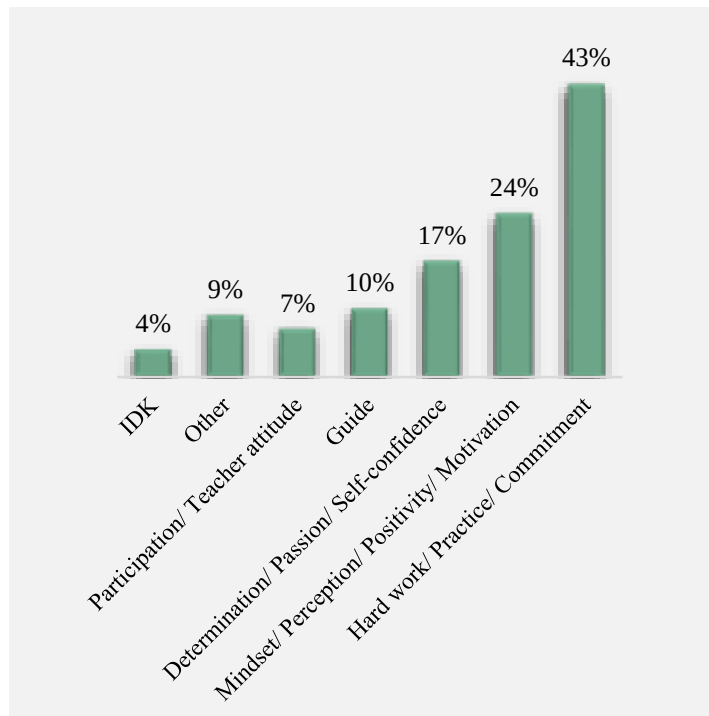


Figure (4. 46): Do you Think that your Attitude towards Learning can help you in Predicting your SAT-Math Scores?



IDK: I Do not Know

Figure (4. 47): Reasons that 73.9% of Students Think that their Attitude towards Learning can help them in Predicting their Results in SAT

On the other hand, students who said “No” (26.1%), stated the following reasons for their answer:

- Attitude does not reflect our knowledge
- Teachers are unpredictable
- Predicting the SAT score is very difficult
- Attitude is subjective/not reliable
- SAT is confusing/hard
- Attitude is based on behaviour in class
- SAT depends on my focus/efforts
- SAT is about Math and English skills, not attitude
- SAT depends on more factors than attitude which need to be taken into consideration

4.3.2.4 Factor Analysis for Students' Questionnaire

In the present study, factor analysis was conducted to analyse the questionnaire structure, to identify the interrelationships among the set of observed variables (questionnaire items), and then to group this set or a smaller set of these variables into dimensions/domains or factors that have common characteristics (Nunnally & Bernstein, 1994). The researcher conducted two types of FA, namely EFA and CFA.

Exploratory Factor Analysis (EFA)

EFA is generally used to discover the factor structure of a measure and to examine its internal reliability (Anderson, 2005). Before studying the EFA results, the following assumptions were tested. This was carried out through performing the factor analysis procedure in SPSS 24, using the 30 items in the students' questionnaire, measuring Academic Factors (Attainment/ATM), Cognitive Factors (Aptitude/APT), and Affective Factors (Attitude/ATT).

Number of Participants

Researchers typically recommend a minimum number of participants depending on the number of items being analysed; specifically, a common rule of thumb is 20 participants per item (Bourne et al., 2021). Therefore, for the 30-item questionnaire, a minimum of 600 participants was recommended to be confident of a robust solution. There were 797 participant students responding to the questionnaire, and hence, there were enough participants in the dataset to have a reliable solution.

Sampling Adequacy

This is statistically tested by the Kaiser-Meyer-Olkin (KMO) statistic (see Table (4.35) below). The table shows that $KMO = 0.96$, which is above the required threshold of 0.7 (Leech et al., 2005), indicating that enough items are predicted by each factor. The Bartlett's Test of

Sphericity is $\chi^2(435) = 14559.419$, which indicates that the variables are correlated highly enough to provide a reasonable basis for factor analysis.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.960
Bartlett's Test of Sphericity	Approx. Chi-Square	14559.419
	df	435

Table (4. 35): KMO and Bartlett's Test for Students Questionnaire (30 items)
(Source: Author)

Also, it is important to examine the diagonal elements of the anti-image correlation matrix (the individual measure of sampling adequacy MSA); the value should be above the bare minimum of 0.5 for all variables (Kaiser, 1974). In Table (4.36), all values of MSA exceeded 0.9. After factor extraction, the variables' communalities were considered, which represented the amount of variance in each variable that could be explained by the retained factor. According to communality values in Table (4.36), none of the variables should be dropped as all communalities were above 0.2 (Samuels, 2017).

Questionnaire Items	MSA	Communalities
1) I am aware of my strengths and weaknesses in the subject based on MAP reports.	.929	.342
2) I am aware of how to use the MAP test to help me improve my learning.	.936	.454
3) I know I can use the information in the MAP report to master mathematical skills.	.953	.485
4) I adjust my plans for learning based on the results I get from the MAP test and MAP Goal Sheets.	.954	.555
5) I check my progress in the subject based on my progress in the MAP test.	.955	.439
6) I use a MAP Goal Sheet frequently to reflect on my achievement.	.958	.463
7) I seek to connect what I learn from MAP to achieve my SAT target.	.961	.508
8) I think MAP tests are helpful in improving my scores in SAT.	.951	.481
9) I think my MAP score is important in predicting my SAT scores.	.957	.510
10) I try to set my SAT goals based on my current MAP-RIT score or percentile.	.952	.495
11) I am aware of my strengths and weaknesses in the subject based on CAT4 reports.	.965	.526
12) I am aware of how to use the CAT4 report to help me improve my learning.	.953	.631

Questionnaire Items	MSA	Communalities
13) I know I can use the information in my CAT4 report to master mathematical skills.	.966	.640
14) I adjust my plans for learning based on the recommendation I get from the CAT4 test results and report.	.973	.656
15) I check my progress during a learning task using the advice I got from CAT4.	.958	.659
16) I use the CAT4 report and recommendation frequently to improve my learning strategies and skills.	.959	.639
17) I seek to connect what I learn about my cognitive abilities from CAT4 report to achieve my SAT target.	.968	.675
18) I think my cognitive ability (verbal, quantitative, non-verbal reasoning, and spatial ability) level is helpful in improving my scores in SAT.	.961	.528
19) I think my cognitive ability level is important in predicting my SAT scores.	.965	.584
20) I try to set my SAT goals based on my current cognitive ability-CAT4 level.	.968	.639
21) I understand that my attitude towards school affects my performance in assessments.	.967	.584
22) I am satisfied with my performance.	.971	.543
23) I think my attitude towards my teacher is important in affecting my academic achievement.	.951	.701
24) I have a clear vision and goals to achieve in my learning.	.968	.671
25) I believe that I am capable of thinking independently and dealing with challenges to achieve my goals.	.952	.671
26) I believe that my communication and collaboration in learning will improve my performance.	.963	.701
27) I seek to improve my attitude towards preparing for SAT to achieve my goals.	.968	.678
28) I think my attitude towards learning is important in affecting my SAT scores.	.954	.672
29) I think that my attitude towards the subject affects my performance in SAT tests.	.960	.659
30) I think my self-confidence in the subject is important in predicting my SAT scores.	.963	.645

Table (4. 36): MSA and Communalities for the Students Questionnaire (30 items)
(Source: Author)

Correlation

Investigating the correlation matrix of the students' questionnaire items attached (Appendix T), it was found that almost all of the correlation coefficient values exceeded 0.3, suggesting reasonable factorability. Given these overall indicators, factor analysis was deemed to be suitable with all 30 items.

Exploratory Factor Analysis Results

Principal Components Analysis (PCA) with Promax rotation was conducted to assess the underlying structure for the 30 items of the students' questionnaire. Three factors were requested because the items were designed to index three domains: Academic Factors (Attainment/ATM), Cognitive Factors (Aptitude/APT), and Affective Factors (Attitude/ATT). After rotation, the first factor explained 5.4% of the variance, the second factor explained 13.5%, and the third factor explained 39.1% of the variance, with total variance explained of 58.1%. Table (4.37) displays the items and factor loadings for the rotated factors, with Eigen values in Figure (4.48) and percentage of variance explained. All items strongly loaded on the component they pertained to.

Students' Questionnaire – 30 Items	Factors		
	ATM	APT	ATT
1) I am aware of my strengths and weaknesses in the subject based on MAP reports.	.685		
2) I am aware of how to use the MAP test to help me improve my learning.	.706		
3) I know I can use the information in the MAP report to master mathematical skills.	.710		
4) I adjust my plans for learning based on the results I get from the MAP test and MAP Goal Sheets.	.750		
5) I check my progress in the subject based on my progress in the MAP test.	.642		
6) I use the MAP Goals Sheet frequently to reflect on my achievement.	.531		
7) I seek to connect what I learn from MAP to achieve my SAT target.	.624		
8) I think MAP tests are helpful in improving my scores in SAT.	.649		
9) I think my MAP score is important in predicting my SAT scores.	.586		
10) I try to set my SAT goals based on my current MAP-RIT score or percentile.	.570		
11) I am aware of my strengths and weaknesses in the subject based on CAT4 reports.		.715	
12) I am aware of how to use the CAT4 report to help me improve my learning.		.817	
13) I know I can use the information in my CAT4 report to master mathematical skills.		.746	
14) I adjust my plans for learning based on the recommendation I get from the CAT4 test results and report.		.819	
15) I check my progress during a learning task using the advice I got from CAT4.		.807	

Students' Questionnaire – 30 Items	Factors		
	ATM	APT	ATT
16) I use the CAT4 report and recommendation frequently to improve my learning strategies and skills.		.833	
17) I seek to connect what I learn about my cognitive abilities from my CAT4 report to achieve my SAT target.		.809	
18) I think my cognitive ability (verbal, quantitative, non-verbal reasoning, and spatial ability) level is helpful in improving my scores in SAT.		.689	
19) I think my cognitive ability level is important in predicting my SAT scores.		.700	
20) I try to set my SAT goals based on my current cognitive ability-CAT4 level.		.821	
21) I understand that my attitude towards school affects my performance in assessments.			.729
22) I am satisfied with my performance.			.699
23) I think my attitude toward my teacher is important in affecting my academic achievement.			.857
24) I have a clear vision and goals to achieve in my learning.			.806
25) I believe that I am capable of thinking independently and dealing with challenges to achieve my goals.			.840
26) I believe that my communication and collaboration in learning will improve my performance.			.870
27) I seek to improve my attitude towards preparing for SAT to achieve my goals.			.805
28) I think my attitude towards learning is important in affecting my SAT scores.			.788
29) I think that my attitude towards the subject affects my performance in SAT tests.			.806
30) I think my self-confidence in the subject is important in predicting my SAT scores.			.794
Eigenvalue	1.6	4.1	11.7
% of Variance (total = 58.1%)	5.4	13.5	39.1

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

Rotation converged in 5 iterations.

Table (4. 37): Pattern Matrix^a | Factor Loadings from PCA with Promax Rotation for a Three-Factor Solution for Students' Questionnaire (N = 797)

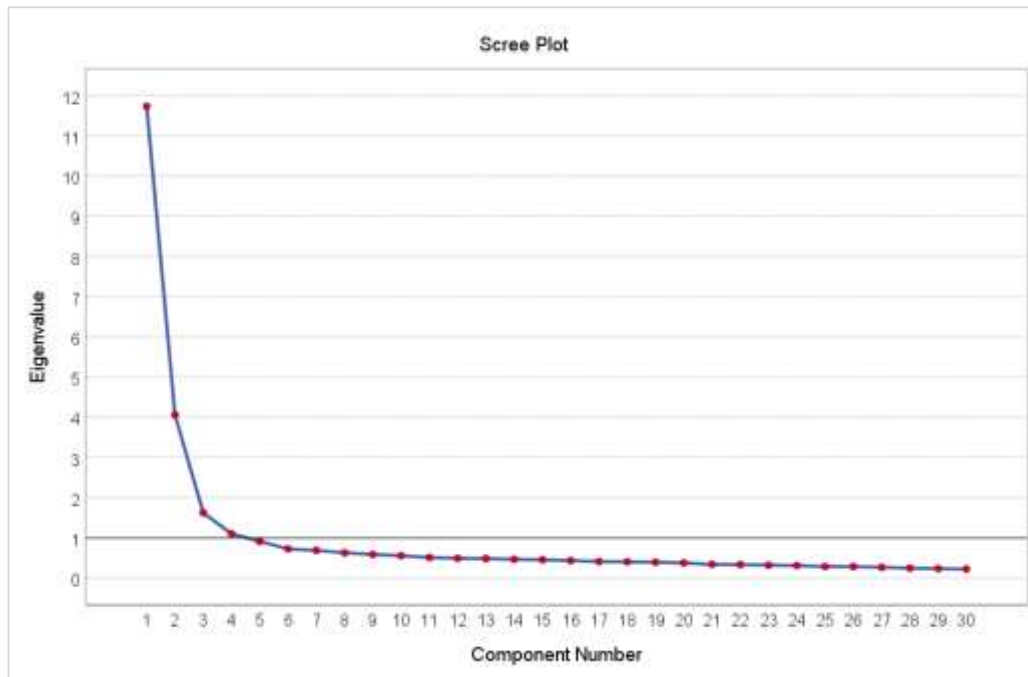


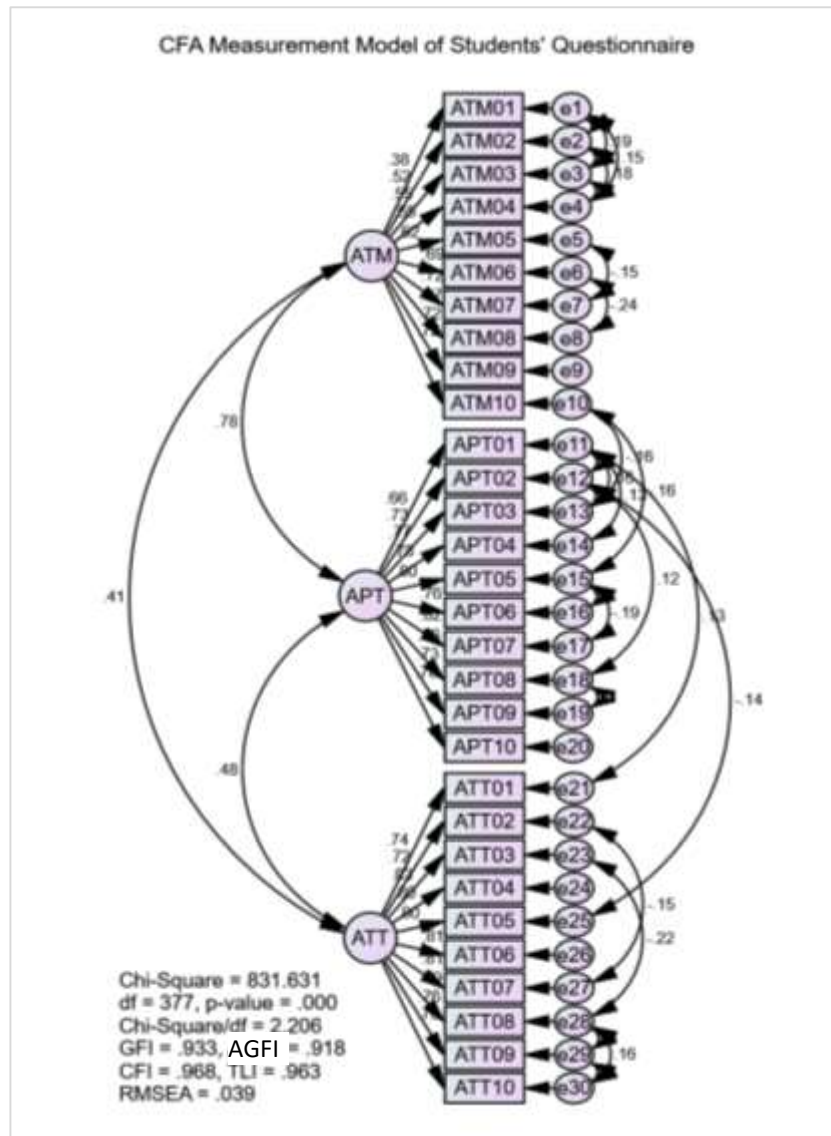
Figure (4. 48): Scree Plot | EFA (Principal Component Analysis with Promax Rotation) for Students Questionnaire

Confirmatory Factor Analysis (CFA)

CFA was conducted using AMOS 24 to assess the students' questionnaire validity and reliability specifically, to determine whether the 30 variables measured the construct they were assigned to adequately. Some of the important validity tests generally considered included construct validity and convergent validity. In the students' questionnaire, there were 30 variables with which the questionnaire was framed, and the responses were collected from students. The 30 observed variables (indicators) were conceptually related to three latent variables: Academic Factors, Cognitive Factors, and Affective Factors.

Model Fit

The model parameters were estimated using maximum likelihood. The hypothesized three-factor model manifested an adequate fit outcome, as shown in Figure (4.49).



ATM: Attainment, APT: Aptitude, ATT: Attitude, df: Degrees of freedom,
 GFI: Goodness of Fit Index, AGFI: Adjusted Goodness of Fit Index,
 CFI: Comparative Fit Index, TLI: Tucker Lewis Index,
 RMSEA: Root Mean Square Error of Approximation

Figure (4. 49): CFA Measurement Model of Students Questionnaire

(Source: Author)

As shown in Table (4.38), Chi-square statistic χ^2 was 831.631 (degrees of freedom df = 377), with a ratio of χ^2 /df value being 2.206 less than 3.00, thus exhibiting a good fit (Byrne, 2010). GFI was 0.933 and AGFI was 0.918, which was an acceptable model fit (Shevlin & Miles, 1998). CFI and TLI were 0.968 and 0.963, respectively, indicating excellent fit (Hu &

Bentler, 1999). The obtained RMSEA value was 0.039, which is less than 0.08, indicating that the hypothesized model can be generalized to the population (MacCallum et al., 1996).

Therefore, it can be concluded that the overall model fit indices are within the acceptable recommended values as proposed by the researcher, and hence the hypothesized model fits with the sample data.

Index	Criterion	Model
Chi-square (χ^2)	Low	831.631
Degrees of Freedom (df)	≥ 0	377
Normed Chi-square (χ^2/df)	< 3.0	2.206
Goodness of Fit Index (GFI)	$> .90$	.933
Adjusted Goodness of Fit Index (AGFI)	$> .90$	.918
Comparative Fit Index (CFI)	$> .90$	.968
Tucker Lewis Index (TLI)	$> .90$	.963
Root Mean Square Error of Approximation (RMSEA)	$\leq .08$	.039

Table (4. 38): Fit Indices for Measurement Model of Students' Questionnaire
(Source: Author)

Psychometric Checks of the Model

In order to assess the validity and reliability of the questionnaire (measurement model), three psychometric checks were performed: reliability analysis, convergent validity, and discriminant validity. According to Awang (2015), a factor loading of 0.60 and above for each item would indicate a high convergent validity. Convergent validity was also assessed through CR and AVE. The required levels of CR and AVE should be equal to or more than 0.60 and 0.50 respectively (Hair et al., 2010). CR and AVE were also used to establish the reliability of the measurement model. CR is an alternative measure to Cronbach's Alpha; it is recommended by Chin (1998) as an ideal measure to overcome some deficiencies in Cronbach's Alpha. The CR should be 0.60 or higher, while the minimum threshold for an AVE should be 0.50 or higher to indicate adequate reliability (Awang, 2015). The standardised factor loadings, Cronbach's

Alpha (α), CR and AVE values for the measurement model of students' perceptions are summarised in Table (4.39) below presented in detail in Appendix U.

Factors & Indicators	Factor Loading Results		
	Cronbach's Alpha (α)	Composite Reliability (CR)	Average Variance Explained (AVE)
Academic Factors – Attainment	.872	.867	.401
Cognitive Factors – Aptitude	.931	.928	.563
Affective Factors – Attitude	.940	.940	.609

Table (4. 39): Convergent Validity Estimates from CFA on Students' Questionnaire-Standardised Factor Loadings

As can be seen from Table (4.39) and Appendix U, the factor loadings for all items were greater than 0.60 with the minimum loading being 0.622 and maximum loading of 0.826, with the exception of the first three items of Academic Factors which had factor loadings of 0.383, 0.52, and 0.552. Therefore, the items showed high reliability measures. All the items were retained in the model. Apart from the Academic Factors, the AVEs of the other two dimensions of the model (Aptitude and Attitude) were greater than 0.50 which supported their convergent validity (Hair et al., 2010). According to Fornell and Larcker (1981), an AVE of 0.40 is acceptable when the construct's CR is greater than 0.70. In this case, the AVE for AF (0.401) was therefore acceptable as the CR value for the dimension of Academic Factors was 0.867, supporting the claims of convergent validity and reliability.

Discriminant validity was used to measure the extent to which a factor really varies from other factors. The model's discriminant validity was evidenced by AVE factors, which were higher than the squared SV for all the factors (Fornell & Larcker, 1981). Discriminant validity was also established by inter-factor correlation values with a cut-off value below 0.85, thus also providing strong evidence for discriminant validity (Awang, 2015; Fang, Zakaria & Shokory,

2016). Table (4.40) illustrates the results for discriminant validity. The factor's AVEs are presented along the diagonal, inter-factor correlations are located above the diagonal, while the squared inter-factor correlation values (also known as SV) are presented below the diagonal. The inter-factor correlation values of the dimensions were below 0.85, with a minimum value of 0.391 and a maximum value of 0.697, hence providing evidence for the model's discriminant validity. Moreover, the model's AVE and SV met the requirement. Thus, these findings provided evidence for the model's discriminant validity.

Factors	Academic Factors Attainment (ATM)	Cognitive Factors Aptitude (APT)	Affective Factors Attitude (ATT)
Academic Factors- Attainment (ATM)	.633	.697	.391
Cognitive Factors- Aptitude (APT)	.607	.750	.463
Affective Factors- Attitude (ATT)	.170	.228	.780

Table (4. 40): Discriminant Validity for Students' Perceptions Model

4.4 Summary of Phase One Results

Analysis of students' assessment data and stakeholders' questionnaires are summarised as follows:

4.4.1 The Relationship between the Attainment, Aptitude, Attitude towards Learning, and SAT achievement

- There is a strong positive correlation between students' achievement in SAT-Math and their academic attainment in MAP-Math, MAP- Reading, and MAP-Language.
- There is a strong positive correlation between students' achievement in SAT-English and their academic attainment in MAP-Math, MAP-Reading, and MAP-Language.
- There is a positive correlation between students' aptitude and their achievement in SAT-Math and SAT-English. This relationship is strong in Math but moderate in English.

- There is a moderate positive correlation between learners' self-regard level and their achievement in SAT-Math, while the relationship is small positive correlation with SAT-English.
- There is a small positive correlation between students' achievement in SAT-Math and their perceived learning capability, preparedness for learning, confidence in learning, and response to curriculum demands.
- There is a small positive correlation between students' achievement in SAT-English and their self-regard, perceived learning capability, confidence in learning, and response to curriculum demands.
- There is a small negative correlation between students' achievement in SAT-English and their feelings about school and attitudes to attendance.
- There is no correlation between students' achievement in SAT-English and their preparedness for learning, attitudes to teachers, and general work ethic.
- There is no correlation between students' achievement in SAT-Math and their feelings about school, attitudes to teachers and attendance, and general work ethic.

4.4.2 The Predictability of SAT Achievement by Students' Attainment, Aptitude, and Attitude towards Learning

Two prediction models were concluded and were tested and proved to be valid:

- Model-1: Multiple regression results indicated that students' attainment in MAP, Aptitude (CAT4), and attitudes toward learning (PASS) could explain 44.7% of the variance in SAT-Math scores with large effect size of 0.808.

$$F(13,584) = 36.249, R^2 = 0.447, f^2 = 0.808.$$

- Prediction equation was created based on the regression coefficients. The equation indicated that an average student would obtain a score of around (335.877) holding other predictors constant. Therefore, the prediction equation of SAT-Math is:

$$\begin{aligned} \text{SAT Math} = & 335.877 + 1.021(\text{MAP Math}) + 0.083(\text{MAP Reading}) + 0.201(\text{MAP Language}) \\ & + 7.258(\text{CAT4 Aptitude}) + 0.254(\text{PASS1 Feeling about School}) + \\ & 0.126(\text{PASS2 Perceived Learning Capability}) + 0.381(\text{PASS3 Learner Self-regard}) + \\ & 0.032(\text{PASS4 Preparedness for Learning}) - 0.178(\text{PASS5 Attitude to Teachers}) - \\ & 0.268(\text{PASS6 General Work Ethic}) + 0.176(\text{PASS7 Confidence in Learning}) - \\ & 0.166(\text{PASS8 Attitudes to Attendance}) - 0.180(\text{PASS9 Response to Curriculum Demands}) \end{aligned}$$

- Model-2: Multiple regression results indicated that students' attainment in MAP, aptitude level, and attitudes toward learning (PASS) could explain 42.9% of the variance in SAT-English scores with large effect size of 0.751.

$$F(13,152) = 8.771, R^2 = 0.429, f^2 = 0.751$$

- The prediction equation indicated that an average student would obtain a score of around (404.116) holding other predictors constant. Therefore, the prediction equation of SAT-English is:

$$\begin{aligned} \text{SAT English} = & 404.116 + 0.284(\text{MAP Math}) + 0.641(\text{MAP Reading}) + \\ & 0.400(\text{MAP Language}) - 2.031(\text{CAT4 Aptitude}) - 0.068(\text{PASS1 Feeling about School}) \\ & + 0.008(\text{PASS2 Perceived Learning Capability}) + 0.106(\text{PASS3 Learner Self-regard}) \\ & + 0.076(\text{PASS4 Preparedness for Learning}) - 0.115(\text{PASS5 Attitude to Teachers}) \\ & + 0.088(\text{PASS6 General Work Ethic}) + 0.330(\text{PASS7 Confidence in Learning}) - \\ & 0.255(\text{PASS8 Attitudes to Attendance}) - 0.273(\text{PASS9 Response to Curriculum Demands}) \end{aligned}$$

4.4.3 Stakeholders' Perceptions about the Role of Attainment, Aptitude, and Attitude towards Learning in Predicting SAT achievement

- Both leaders and teachers have high agreement with the role of students' current attainment in MAP in predicting students' achievement in SAT. Leaders had higher RA (83.6%) than teachers (RA = 76.8%). The highest agreement was with the use of MAP reports to reflect and improve learning outcomes. The lowest agreement was on using students' MAP scores to set SAT goals.
- Most leaders (82.4%) and teachers (74.5%) believed that students' attainment in MAP could help in predicting their SAT scores mainly because MAP measures students' knowledge, skills, and progress.
- Both leaders and teachers have high agreement with the role of students' aptitude level in their achievement in SAT. Leaders had higher RA (79.8%) than teachers (RA= 72.2%). The highest agreement was with the use of CAT4 reports to understand learners' strengths and weaknesses. The lowest agreement was on using students' aptitude level to set SAT goals.
- Most leaders (85.3%) and teachers (66.0%) believed that students' aptitude level could help in predicting their SAT scores. The main reason was the nature of SAT; that it requires reasoning skills, which are mainly based on students' cognitive ability level and potential.
- Both leaders and teachers have high agreement with the role of students' attitudes towards learning in their achievement in SAT. Leaders had a RA of 82.2% while teachers had a RA of 81.4%. The highest agreement was with the role of students' attitude towards school in their performance in SAT. The lowest agreement was on the satisfaction with current student performance.
- Most leaders (82.4%) and teachers (83.0%) believed that students' attitude towards learning could help in predicting their SAT scores. There were two main reasons: the role

of general positive attitude on students' performance, and students' self-regard and work ethic (motivation to succeed).

- Students showed a RA of 76.8% with a grand mean score of 3.84 and standard deviation of 0.794, which indicated that students' agreement with the role of using MAP to achieve SAT scores was not very strong. The highest agreement was with the use of MAP to understand weaknesses and strengths. The lowest agreement was regarding using MAP to set SAT goals. Most (76.0%) students felt that MAP could help in predicting SAT scores.
- Students showed a RA of 70.0%, which indicated that students' agreement with the role of CAT4 in achieving SAT scores was lower than their agreement with the role of MAP in achieving the SAT scores. The highest agreement was with the students' belief that their aptitude level helped in improving SAT scores. They showed lower agreement with their use of the CAT4 report to improve learning strategies. When they explained the reasons, slightly more than 52.0% of students thought their aptitude could help in predicting SAT scores. Around 39.0% believed there was no relationship between CAT4 and SAT.
- Students showed a RA of 74.4% which reflected students' agreement with the role of their attitude towards learning in predicting SAT scores. They showed high agreement with the statement: "I am satisfied with my performance". Interestingly, 73.9% explained that their attitude affected their SAT scores because if they had a positive attitude, they would be motivated, work hard, have high self-regard and show a positive work ethic.
- All questionnaires were tested for validity, reliability, and factor analysis. The results showed a valid and reliable students' perception questionnaire model. The leaders' and teachers' perception questionnaires model showed a valid and reliable model fit but required further modification in the affective factor only to be generalized to the population.

Chapter Five:

Data Analysis and Results of Phase Two

This chapter summarises findings from the semi-structured interviews and focus groups that involved senior and shared leadership teams, teachers, parents, and students. It answers the third study question providing more in-depth investigation about the role of attainment in MAP, aptitude in CAT4 and attitude towards learning in SAT achievement. The themes obtained through discussions with the participants maximise the researcher's interpretations of the findings from the phase one assessment and questionnaire data.

5.1 Focus Groups Interview Results

This section relates to the qualitative part of the research that represents phase two of the study. Thirteen focus groups were conducted as part of the research study that explored the role of students' attainment, aptitude, and attitude in predicting SAT achievement. Focus group participants included seven senior school leaders, six shared leaders, seven English teachers, eight mathematics teachers, thirty-two students, and eight parents (see Table (5.1) below).

Participant Category	Total Number of Participants in Focus Groups			Number of Focus Groups
	Female	Male	Total	
Senior Leadership	4	3	7	1
Director General	1	1	2	
Principals	2	1	3	
Directors of Assessment/Curriculum/Academics	1	1	2	
Shared Leadership	5	1	6	3
Subject Head of Department/Coordinator	3	1	4	
Career/University Counsellor	2	-	2	

Participant Category	Total Number of Participants in Focus Groups			Number of Focus Groups
	Female	Male	Total	
Teachers	9	6	15	3
English Teachers	6	1	7	
Mathematics Teachers	3	5	8	
Students	22	10	32	4
Grade 9	3	-	3	
Grade 10	5	2	7	
Grade 11	8	3	11	
Grade 12	6	5	11	
Parents	8	-	8	2
Total	48	20	68	13

Table (5. 1): Summary of Focus Group Participants

The following sections report on the methodology employed and the findings. The analysis and results of interviews are organised by each participant group where one or several focus groups were conducted. The analysis begins with the focus groups conducted with school staff members, leaders, and teachers, and then follows with the focus groups with students and parents.

The purpose of the conducted focus group interviews was to provide initial insight into the role of students' attainment, aptitude, and attitude in predicting SAT scores in the context of US-curriculum schools in the UAE. Specifically, the study sought to better understand participants' perceptions about the four assessments-- SAT, MAP, CAT4, and PASS-- and the relationship between the SAT and the other three assessments. The focus group interviews had specific objectives:

1. To gain insight into participants' perceptions about the SAT and how it differs from the MAP or internal assessment.

2. To gain insight into participants' perceptions about the MAP, CAT4, and students' attitude towards learning (PASS test).
3. To gain insight into participants' opinions about the main challenges in achieving the required scores in SAT.
4. To gain insight into participants' thoughts about communication from their school about the use of students' CAT4, MAP and PASS to predict SAT.
5. To gain insight into participants' thoughts about which assessment is accurate in predicting SAT.

The first step of reporting data analysis results began during the data collection, by proceeding with the discussion and collecting as much rich data as possible from the interviews, complementing them with typing up of the recorded information. Data was grouped from all conducted focus group interviews for each question. In the second step, the researcher was familiarised with the data, by listening to the recordings, transcribing the focus group responses, and reading the transcripts in their entirety several times. Then, the researcher moved to the third step, where memos, short phrases, ideas, or concepts arising from the text, which were to be the bases for developing categories, were written. Constant comparison analysis type (coding) (Leech & Onwuegbuzie, 2007) was used to code the responses under the preidentified themes, as shown in Table (5.2) below. In step four, the descriptive statements that have been formed are indexed. This involves highlighting and sorting out quotes and making comparisons both within and between cases. Moving to step five, the researcher charts the quotes from their original context and rearranges them under newly developed appropriate thematic content. In the final step, the researcher makes sense of the individual quotes and needs to be imaginative and analytical enough to see the relationship between the quotes and the links between the data as a whole.

5.1.1 Thematic Analysis Results

This section presents findings from the focus group interviews in the form of what participants said in response to specific semi-structured questions. The information in this section represents the researchers' interpretation based upon a content analysis of the typed transcripts from the online meetings categorised under the themes, as shown in Table (5.2) below.

Themes Developed		
Theme 1 Stakeholders' perceptions about each assessment	Theme 2 The role of attainment, aptitude, and attitude towards learning in predicting SAT achievement	Theme 3 Factors affecting SAT achievement
a) Stakeholders' perceptions about achievement (SAT) b) Stakeholders' perceptions about attainment (MAP) c) Stakeholders' perceptions about aptitude (CAT4) d) Stakeholders' perceptions about attitude towards learning (PASS)	a) The relationship between MAP, CAT4, PASS assessments and SAT b) The role of MAP, CAT4 and PASS in SAT achievement	a) Academic factors b) Cognitive factors c) Affective factors

Table (5. 2): Focus Group Interviews' Themes

The upcoming sections presented the analysis and results categorised per theme with an exploration of relevant stakeholders.

5.1.1.1 Stakeholders' Perceptions about Attainment, Aptitude, Attitude towards Learning, and SAT achievement

Theme 1(a): Stakeholders' perceptions about achievement (SAT)

Leaders agreed that the SAT is a standardised assessment aligned with the Common Core standards. They believed that SAT aims to evaluate students' understanding or aptitude which

prepares them for college. That is, SAT is a cumulative skills assessment and is presented in the standardised form for students who do not have exit exams at the end of the school year, which is standardised across the entire school system.

Below are illustrative quotations of the leaders' perceptions which were revealed during the focus group discussion:

"I think SAT is an assessment that looks to evaluate a student's ability to reason and to answer a series of questions based on information that they are given or information that they presume to already know. I believe that it is an assessment that is certainly geared to those students in American curriculum schools." (Director General)

"I would say, knowing from personal experience as well, there are different systems around the SAT and presented as standardised test for students who do not have exit exams at the end of the school year, which is standardised across the whole entire school system." (Career Counsellor)

"...the SAT is like a standardised test basically in America that evaluates students' understanding and their aptitude that prepares them for college, different ranges of scores get you entrance into different levels and tiers of universities..." (Head of the English Department)

From another perspective, leaders see that SAT is a big disadvantage for international students as it is mainly designed for native English speakers. They agree that it's a test that all students think they have to do it anyway, but that it does not reflect the real level of students' aptitude if they are non-native speakers. Below are illustrative quotations from the focus groups:

"...Also, I find out the SAT does have some limitations for students who speak English as their second or third language because the language is quite high, the use of certain vocabulary words may even trump native English speakers... so I do find that the SAT has some benefits to students and can help universities admit students, but it can also be a large disadvantage for international students or students who have language barriers especially after the age of 10 when their mind and their cognitive abilities have already adjusted to their first language." (Career Counsellor)

Teachers provided their thoughts and perceptions about the SAT and how they viewed it. Both English and mathematics teachers felt the SAT was an important and valuable exam. Teachers

also believed that there had been some developments regarding preparations for the SAT at their schools. Their points of view about the SAT can be listed as follows:

1. SAT includes general topics covering up to grade 9.
2. SAT is a useful and challenging test for students.
3. SAT is a summative test for the learning journey throughout the students' school years.
4. SAT is very rigorous and challenging enough to test students.
5. SAT is very inclusive and a very intense exam.

Below are illustrative quotations of the teachers' perceptions which were revealed during the focus group discussion:

"Personally, I look at the SAT as a summative test for the learning journey for the students throughout the whole school years; it includes everything, they have most of the skills that they have got through the years, so it is really an important test even if our students do not need it for a specific university, I think they should sit for it." (Math Teacher)

"It is very challenging and hard. I think critical thinking skills and also advanced language skills in reading are required– I'm talking about English and language organisation of ideas stated and unstated details; so altogether in one, so student is a great thinker but not as great at the language." (English Teacher)

Students believed that SAT was an exam that tests their abilities in mathematics and English. They believed it was an important test, even those students who had not yet taken it. They believed it was an important prerequisite test for entering college. They also knew that it was a hard test and that students needed a lot of practises for a long time ahead of the test to prepare them for it. This was why some students were stressed out just thinking how difficult a test it was.

"...it's an exam to test your abilities in math and English depending on questions, multiple choice questions, and open-ended questions." (Student)

"...I personally feel like the test is not actually a good measure of subject's knowledge, it's rather a skill... it's about how I can approach this question, how I can understand this question fast enough and know what they're looking for. I do not like the idea of it, because it's not graded ..." (Student)

“...for me I have not taken it yet but some of my friends did and they emphasised how long and stressful and tiring it was, because like when they were preparing for it they did not prepare as long hours continuous, they would like take breaks occasionally and they would do it in shorter periods, so they were kind of surprised by the continuous stress they had to set for long hours.” (Student)

“...for me I believe that SAT is really important as it compares us with one another as in a worldwide level rather just our school level, for example, so that’s the way to determine our levels in a fair way; some schools are easier, or some schools are harder so it would only be fair for colleges to just based on a test such as SAT.” (Student)

“...basically, what I know according to my perception is that the SAT test is like the entrance exam for most of the colleges and basically for the abroad universities too; this test like standardised your thinking and thinking skills.” (Student)

“I believe that this test is actually there to test our standard anticipation, tests our basic knowledge... we do not study a specific lesson to go to that test, but we just go and rely on our previous knowledge from the several years we studied at school.” (Student)

“...there was once a time where it was important but now I personally, I’m just doing it for the school for the requirement, otherwise none of us wanted it.” (Student)

“I think it’s significant because it’s required, mostly all of the universities in UAE and in the state require SAT...” (Student)

Students believed that schools should provide them with appropriate and sufficient practice materials by integrating some of the questions into sheets or whatever means so they could use these to prepare for the SAT. They elaborated:

“...I think that in order to prepare for the essay, teachers should maybe integrate some of the questions that are mainly or commonly found in the essay section. This will help in easing the stress during the real test.” (Student)

“...I think the school should focus more on how we could manage our time when it comes to long exams because it was very challenging to read everything in that section (English) [and] also answer all questions.” (Student)

“I feel like just how the school prepares us for the MAP using the 20 questions practice test, they should do the same for other assessments like SAT. The kind of questions in MAP is different than the SAT.” (Student)

Parents did not seem to have deep knowledge of the characteristics of the SAT. They saw SAT as a hard exam for their children, but they believed it was useful and necessary for them to take.

“SAT is a different levels exam; first level that all students can pass very easily, the medium level that most students also pass, and the level that needs more thinking abilities, especially Math part, it needs more time, more tutoring, more practice, etc.” (Parent)

“Students were under pressure but now they know SAT was useful for colleges. They always felt tired of it, yes, it was good for them in the short-term as they could know how they were doing, but it was more effective in the long term.” (Parent)

“My daughter has not done that SAT yet but I did it many years ago, when I wanted to go into university. So, it helped me a lot with my language and everything. I feel that my daughter knows the importance of SAT because I showed her my score and I showed her how I got accepted into a good university based on that. So, I think she knows that she should take it seriously to get accepted into a good university and the major she wants.” (Parent)

Theme 1(b): Stakeholders’ perceptions about attainment (MAP)

Leaders indicated that MAP was a test used to measure students’ progress, modify the curriculum, and create action plans. However, SAT was done with a specific objective to prepare students for university admission. Leaders believed that MAP is essential for curriculum review and ensuring that the planned and taught curriculum is aligned with the required standards per grade level. Based on the MAP results, leaders and teachers can indicate the level of the students’ performance. MAP results helped leaders judge the quality of the teaching and learning based on the resulted level of students’ attainment and progress. When leaders were asked about their perception about MAP, they provided some differences between the MAP and the SAT. They stated that the level of questions in the SAT was harder than those in the MAP. One leader strongly believed that MAP was strongly related to the SAT exam.

“First of all, MAP is a computerised not a paper and pencil test and it is an adaptive test where you start at a certain point and then depending on your answers it takes you up or down, while SAT test does not go the same way. It’s standardised, you have to answer all the questions, the way even it’s getting corrected, it’s different.” (Principal)

“Using MAP reports help the school to create action plan instantly, where you can look at educators and the senior leadership and you can use it to look at your curriculum quality. You can use MAP to help students to reach the required grade level because MAP identifies strengths and weaknesses.” (Head of Assessment)

“MAP tests cumulative skills to evaluate if the students are ready for college... the MAP assessment is measuring the students’ progress from time to time to see whether the students are ready for the next step and building these skills to be ready at the end of the academic year to be ready for the SAT assessment. We share with parents and students the MAP Setting Goal Sheet so they can work on individual targets with teachers. It’s like building the knowledge skills for the students and by the end, the SAT is accumulative assessment overall for these skills and knowledge.” (Head of Curriculum)

“...we see that so many times the students just randomly answer when it comes to MAP or even when it comes to CAT4. I am sure when it comes to SAT, I hear the students themselves saying how they are managing the questions so there are some factors that are related with the students themselves but when it comes to numbers then for sure there must be a correlation between them.” (University Counsellor)

Teachers noted that MAP is an adaptive test and MAP questions are easier than SAT questions.

They believe that MAP questions are mainly based on their language skills.

“Well, the MAP tests language skills in reading, comprehension and language skills: There is a very considerable difference in level between SAT-English and MAP-English. SAT is a combination of highly advanced language skills and high critical thinking skills as well, and a good background of vocabulary and sentence structure. MAP does not focus on that. We share with students’ MAP goal sheet to set targets.” (English Teacher)

“MAP is somehow adapted; it depends on the student responses. Style of the questions is close to the text and the way of the internal exams. On the other hand, you will see in the SAT exam the way of presenting the question is more advantage and you have to think carefully to understand the meaning of the question; you might have a very big question but at the same time it is silly that you must work within one second. For SAT, the standards are G11 standards, but the MAP is adaptive, so it's why there is a difference.” (Math Teacher)

Students felt that the MAP test was related to what they had learned, where it tested the acquired knowledge. They saw it as a practice to prepare them for the SAT exam. Nevertheless, they believed that MAP and SAT were totally different tests, for the following reasons:

- There is no time limit in the MAP, while there is a time limit in SAT.
- Questions in MAP vary according to students’ level. However, questions in SAT follow a curve that makes questions extremely easy or extremely hard, which consequently changes the score.

- MAP-English is easier and puts less stress on students than SAT.
- In MAP students sometimes get help from teachers.
- It is important to take MAP at least once a year because it is a practice for SAT.
- MAP test is computerised.
- MAP measures academic level of students throughout the year, while SAT is related more to critical thinking, reading, and writing.
- MAP reports help students set goals and understand why and how to achieve them.
- MAP prepares students for college tests.

Below are illustrative quotations from the students' focus groups:

“The MAP test is a computerised test which helps us improve learning, and this helps even the school to know our level, will even help us to go with our level and help to improve, while this test is just for the college, it's just for the admissions but we could even like between ourselves, check what is our negative aspects and positive aspects.” (Student)

“...MAP test was different to everybody that was doing the MAP test because depending on how you answer the questions the MAP test will become easier or harder, but the SAT, everybody has the same questions and like that, same work.” (Student)

“...the main good thing about the MAP is when you finish your MAP test you get automatic report, which tells you what your weaknesses in which you can use to study everything that could help with SAT.” (Student)

Parents' views were not far from those of leaders and teachers. Parents stated that MAP revealed more about students' academic level, while SAT was an assessment necessary for college. Few parents noted that SAT was just a pressure on students and that MAP was not useful for preparing for SAT. Moreover, parents stated that in the past, before they got the MAP results, students did not take the SAT seriously, but after they started getting exam marks, students took the exam more seriously and had the desire to succeed and obtain high marks.

Below are illustrative quotations from the focus groups:

“MAP is a very excellent test. It helps us know exactly where our children are in the academic level, without any previous study or exams. In the past, we used not to have after-test results, so children never took it seriously; but now when MAP shows real marks after exams, students started to take it much more seriously. When it was applied in grade 12, it really affected their marks.” (Parent)

“MAP is an indicator of our children’s level internationally and compared to other schools. But I do not expect it to be useful for SAT.” (Parent)

“...my daughter said some questions in MAP were in SAT ... but I think MAP is useful somehow to students for the SAT preparation.” (Parent)

Parents also stated that their schools communicated the date of the MAP assessment with them, and that they liked this type of communication. They also mentioned that teachers told students about the exams and kept encouraging them to practise and get prepared. They added that:

“School is very active, announcing for the tests and encouraging students to prepare for the tests about a week earlier.” (Parent)

“I think it is good to involve parents in assessments’ communication so we will know more about the assessments to discuss them with our kids. This will enhance our kids’ attitude towards the tests.” (Parent)

“Yes, teachers always encourage students.” (Parent)

Theme 1(c): Stakeholders’ perceptions about aptitude (CAT4)

All interviewed **leaders** agreed that the CAT4 is an assessment that tests students’ abilities and potentials, and that it is not an academic test. They saw it as a very important test although it was not taken seriously by students or by their parents, and they felt it was important to inform parents about the importance of this test. Leaders also mentioned that the CAT4 is more beneficial to teachers and educators in general, as it provides hints and clues about the learning style of students. Senior leaders suggested that frequent meetings be conducted for parents to teach them about the CAT4, and for educators in order to teach them how to use this test to monitor the progress of students’ performance and their learning styles in order to adapt their teaching strategies to help students achieve their targets.

“...I think the CAT4 falls under another category of assessment. CAT4 measures the ability and the potential of the student. It is not an academic test, but it measures the cognitive ability ... it tells me the best approach or the best way to teach or the best learning strategies to teach my students...” (English Coordinator)

“...CAT4 is a very important test, but the question is how it is applied, are the students really being informed about their cognitive abilities, ... are the teachers able to individualise that learning experience to meet students’ needs? I think this is where we struggle a little bit in schools that are using such kind of assessment. It is good data to have, but if I’m not a teacher that follows up with this child for more than one year, the way where it is actually being applied that the whole might be over two or three years... we look at the Scandinavian countries, they really stay with their teacher for so many years and the teacher will be able to get the child from one path into the next and really know the development... With us, different teachers see the child different times during the day; the next year they might have totally different teachers and here we start again, so maybe in terms of administration really need to make sure that whatever has been gathered as data and info goes to the next level so that they can build on it rather than start from scratch...” (Director of Curriculum)

“I remember when I used to follow up on the students at risk, the head of assessment started with me several times to help me use this tool when sitting with the parents or the teachers to show them what the problem of the student is, and I agree it is an amazing tool, but are teachers ready to use it? I was evaluating the PE teacher’s class and part of the evaluation tool is looking at the CAT4... maybe a coaching program should be focusing more on this...” (Director of Inclusion)

“...absolutely I think for a lot of students, understanding this information is helpful. When I advise them on their electives, if a student comes to me and says I want to take advanced physics and their grades are on the border of what we can accept for the course, we would need this information to see... I also think long-term it is helpful to have this information as a trend, to look at trends for the student, because maybe there will be different pathways that are more suited for them depending on their aptitude, I think the test is very individualised which is super helpful and allows me to see where they have been and where they are going and where they want to go, and if that is the best for them at the time.” (Career Counsellor)

“...I have to think about the parents, maybe as well we need to educate parents about CAT4 and MAP. I know that at the beginning of the year, we do the orientation and then we send them this video and this information, but we all know that parents lose interest due to repetition. Better if we do small parents engagement sessions, for example: If we have like five minutes on the impact of the CAT4, how we use it, and engage parents and students in that conversation. I see parents’ and students’ attitude when we discuss MAP and CAT4, they look at them as something the school is doing... will it affect the grades? Does it show in the report card? Will this help students to pass? What does that mean? ... So, helping the parents to understand it might be also a good tool so students can take those tests seriously...” (Director of Academics)

“...CAT4 is linked with the thinking skills and the skills the students learned at school. They have quantitative questions, interpretation and analysis of the understanding of the words of letters and shapes. It’s somehow linked to some academic parts or skills.

It gives teachers more opportunity to understand students' learning styles so teachers can plan differentiated activities ...” (Head of English)

Few **teachers** believed that CAT4 was not an important test, and some had bad experiences with it. Teachers added that CAT4 did not measure the real abilities and skills of students. They did not think that there is a strong link between CAT4 and SAT assessments. Other teachers thought that CAT4 was more useful for them than for students, as it provided them with the methods of teaching, and creating questions, etc.

“CAT4 can help the teacher in the way he is teaching the student, like the best way the student will learn and reach his potential. So, this is the importance of CAT4; not to predict the marks of the students. CAT4 is supposed to help teachers to plan for the instructions in class.” (Math Teacher)

From a teaching perspective, regarding practices in the classroom, a teacher felt that students did not use the information from the CAT4 to study or to improve their academic performance:

“I think CAT4 is more helpful for us as teachers. It is a useful tool for us more than it is for students. I do not think that students ever refer to them, but when we explain to them for example, you are in this group because of CAT4 results, you are doing this because of that, this task is for you, I want you to improve, some of them start to look to the CAT4 differently.” (English Teacher)

Students' Perceptions: Two students did not find CAT4 useful at all. Some students could not remember it clearly as they are currently in grade 12 and they had taken it in grade 9; however, they had positive attitudes towards it. Other students found CAT4 useful and said it had helped them develop their skills. They believed that receiving their CAT4 reports helped them know their strengths and weak points so they could focus on areas where they needed to improve. Some students also believed that this test was useful for teachers to help them develop their teaching methods.

“I feel like it changes how we focus and understand the question more, so we can know and understand which answer it goes to.” (Student)

“...I think it would help us develop a sense of being a self-learner so, for example, when revising for a test even for a midterm or a quiz, maybe I would go for listening to

an audio rather than just reading from a book because I know that it is more helpful for me and it is a better way, I know better mechanism [for] study.” (Student)

“For me the test is actually pretty fun; it is like testing your skills rather than your academics...” (Student)

“Sorry to say that it was so pointless, like I do not see the point of it.” (Student)

“I cannot quite remember exactly since we are in grade 12, so we cannot remember that much about the CAT4, but what I can recap is that it is more of a diagnostic assessment, they get to check our abilities...” (Student)

“I think that it is mostly for us and for the school to know how we learn better. I think the CAT4 test is more of how a person can get the information...” (Student)

“I see that CAT4 is similar to an IQ test since both of them give you the base of the potential strengths and it helps me with the visual ability and verbal ability, so this actually helps you to improve your weakness, and for example, if you face challenges in the visual abilities then you might go and practise this.” (Student)

“So, after we received our reports, not only teachers got the reports to help us and to know how to teach us, but also students were able to understand ways to learn better. The report gives suggestions to further develop our skills.” (Student)

Parents provided their views about the CAT4 as a tool that helps students to understand their learning preference and how to improve academically:

“In my point of view, CAT4 is highly related to improving students’ academic level; as it creates a competitive atmosphere where students become more interested in knowing how their peers performed in the test, and they take it seriously.” (Parent)

“I think both the MAP and the CAT4 are important because the CAT4 measures the cognitive ability so it is good for the kids to know that it is not only about knowledge, but there are also other criteria that they can be good and really show that they are talented, if that makes sense.” (Parent)

Theme 1(d): Stakeholders’ perceptions about attitude towards learning (PASS)

Leaders explained exactly what the PASS test measures, and that they believed it is a very important test. They explained how students were connected to learning, school, and teachers; that is, the psychological factor is the most important. They said test highlights factors about the relationship between students, teachers, and school which played a significant role in their learning attitude and consequently in their performance level. They believed that the PASS was

important when it came to learning about students' attitudes so that they could follow their progress. They also said that MAP, CAT4, and PASS helped them to develop a teaching plan as it showed the result of their teaching strategies applied. Leaders also talked about the dependency of students on teachers, which raised the idea that the mindset inside schools should be changed by giving students the chance to make their decisions and learn to be more responsible.

"I think that, when we are talking about triangulation, PASS would be the third element that we look at; we have an academic test and the cognitive ability and also, we need to take a look at the students' attitude because it is one of the pillars that will be completing the learner profile. When we look at the PASS, it has at least nine factors and they are mainly split into different domains. So, I guess it is important for us to know, for example, how the students are feeling about the school, how do they feel about their teachers, their attitude to attend the school on a regular basis or not, how they see themselves as learners, if they are prepared for learning or not, self-regard, and I guess the nine factors are really important for us to have a full picture about the student profile." (Director of Assessment)

"Our students are still very immature towards their attitude to learning in general, and no matter how much you try to educate and do, there is still a lot of dependency on the teacher. We need to change the mindset of students about caring for only graded assessment." (School Principal)

"...an amazing tool and me working on the wellbeing report, I feel like I need to maybe link it more with the PASS because so many questions and criteria are linked together, and some of them are very similar, but I think we need to focus more on the data of the PASS in the lower grades because this is something that you teach the kids as early as lower elementary." (Parent Relation Executive)

"I have had over 150 interviews with staff and students in the last month and one of my questions was how we look at PASS; but again, we keep thinking of our school from what happened this year during Covid-19. Recently we had a science fair and ICT fair where we found that when you start giving the students opportunities then I believe their whole attitude towards their learning, their whole attitude towards the school and whole community will change, because they feel that they are part of it. Attitude affects learning, and vice versa." (Principal)

"I find attitude toward learning highly affect students' performance. So having the tool to measure students' attitude towards learning, school, teachers; their perceived learning capability is very important. I think the biggest place for me to use PASS data [is]starting from grade 8 because students do not fully understand the repercussions of their actions when they approach high school and when they are moving into grade 10... all of the decisions they make in high school with their courses and study habits affect their future. The attitude to learning is one of the important factors for us to

identify the students' needs for support. Attitude might be coming from the home or might come from the fact they maybe struggle in their classes..." (Vice Principal)

"... I want to talk about the attitude of students toward international exams, this is a very important point because till this minute many students believe that MAP will not affect their final report card, although we mentioned that MAP has a factor of 10% and depends on how you progressed. Students are not taking that seriously. However, for the SAT they put their effort but not to the max. I can see in the SAT, some of them know for sure that this is related to their equivalency of the American high school diploma towards the general secondary certificate. So, they know how much it's important to get that required score... Their attitude towards SAT is more positive because they link SAT to the equivalency. Students know that they have to do an English proficiency test even if they did SAT, so some of them skip the English section. That's why some finish in a very short time and some students take their time." (Head of English)

"It is important to understand the student's attitude and feeling towards the school and the teachers because it affects students' response to curriculum and perceived learning capability. PASS will highlight how we are going to plan for interventions and how we can address the issues related to students' behaviour, attitude, and improve their self-regard..." (Principal)

"...One of the famous quotes is: 'your attitude, not your aptitude, will determine your altitude'. We think of that as educators because we can use different strategies. We also need to understand the students' relationship with learning, we do not know how their families raised [them], looking at education. Students' relationship with teachers and peers are also important because it affects the learning environment. Students with learning difficulties are proved to be highly affected by their experience in their school." (Head of Inclusion)

Teachers believed that learning about students' attitudes is very important, and that students' wellbeing is the most important among all factors affecting their academic performance. They believed that if students are happy and ready to learn, they can work confidently and perform better. Therefore, they felt that students should learn about the importance of the PASS so they could have more potential to improve their performance. Teachers elaborated that:

"...PASS gives us insight on students' wellbeing, and they should feel like the school cares, that the ministry cares, and want to know what their obstacles are or where their strengths are..." (English Teacher)

"Definitely, students' wellbeing comes first before academics because if student is happy, is ready to learn, PASS gives us a base where we can work on when a student is not happy. It is very challenging for us as educators to improve or to work on specific skills when students have negative attitude." (Math Teacher)

"Students who are confident about themselves and their teachers, those who have good attitudes towards their teachers get support from the teachers. I think they will be more

committed to learning because I think students associate learning with teachers, ...so good communication between both teachers and students has positive impact on students' performance in tests as well." (English Teacher)

"...they need to know the value of why you are doing PASS... they actually care to share their opinion... we have to be very careful with the students; this generation is very smart, very picky, very critical..." (English Teacher)

Students strongly believed that their attitude toward learning was a significant factor that impacts their academic performance. They also mentioned that the PASS test was not reliable because those students with psychological problems did not give valid answers to the test questions. They felt that therefore, an incorrect picture of students' attitudes went to the educators, so they did not see the real problems.

"I think the PASS itself, it is kind of ironic, because the objective of the exam is to see how the students are feeling and their psychological status. So, if the students actually answered truthfully then the school would know but most likely a lot of students or as I said, ironically the students who are confident and happy or satisfied they are going to have answered correctly, when the people with the students who have like psychological problems, or they are afraid or they have confidence issues they will not answer accurately because they do not want to share their opinion... I think it is very important, but we need to raise awareness to make the students aware they should answer correctly so the school can take measures against it or fix things..." (Student)

Students also highlighted their attitude towards the subject and how it affects their self-regard.

They added that:

"...my relationship with the subject does affect my results differently, for me is for example I love math and I do not really like science and guess what, my lowest scores in science and my high scores in math..." (Student)

Most of the students had a common point which was the effect of their attitude towards teachers and the support they received from the school and teachers on their academic performance.

They explained that:

"I think that teachers' attitude towards us and the school environment definitely affect how we feel towards a specific subject or a specific test or anything. Because it depends on how they talk about it with us, and it depends on their own attitude towards us. It depends on how teachers talk about specific subjects and how passionate they are themselves ... I wanted to say that if I do not like the teacher or the way she teaches, I

would not participate in class, I would not focus and I feel like it is not fun, and it is not that important, and I do not want anything to do with that class. Then later I will struggle when it is time to study for the exam ...” (Student)

“...I have noticed that whenever for example my entire class does not like a specific teacher their attitude toward the subject really changes, but if the teacher is changed or like the next year and the same subject but a different teacher, I see their attitude and their participation really is affected because of the teacher change so it definitely affects the students in general...” (Student)

“...I wanted to add that personally I get affected a lot by the teacher’s attitude and just what’s going on in class, however I try to fight that feeling and force myself to do my best because I know that I should not let that affect me and affect my grades, so, I try to work harder and participate. I think that also changes the teacher’s attitude later on.” (Student)

“I think a lot of things play a major factor in how students perform in any exam. One more [than]most, it is based on how you like the subject, how good you are, how well the teacher teaches. However, I do not think that all the tests are going to have much significant impact on our academic achievement unless teachers actually use the information in the tests then change the methods they use in teaching, be flexible with the different types of students they have in the class. Definitely all of these steps play a major role in students’ performance.” (Student)

Some students added to the previous points the effect of their general work ethic, and school environment and their feelings about school on their motivation to learn and their preparedness for learning:

“Yes, definitely my attitude affects my learning; for example, even if I find the subject hard and difficult but I get support from the school and teacher then I would do everything to succeed. My teacher helped me so much and they did everything for me not to feel bad about my performance. So, I try to do my best and submit my work on time and this has the biggest effect...” (Student)

“...this test is going to be ideal to address students’ issues towards their learning environment and so on, the type of support students’ need emotionally. At the end this will improve us academically.” (Student)

Other students discussed the impact of emotions like anxiety, perceived learning capability, and confidence in learning on their preparedness for learning:

“I think the PASS test would really help us as students because it explores our feelings and fears. I have anxiety of big exams and I have an anxiety in a certain topic or in a certain situation. I cannot work in groups because I have this anxiety but when the school does this test, maybe teachers will know us better and help me improve this anxiety and yeah, it might help many other students too.” (Student)

“...there is a huge impact of self-esteem and self-confidence that’s marks and effects the academic performance; this actually helps us to focus and learn more and our school has this career counselling where we could always go to her and speak to her, and this helps us to understand about our college life...” (Student)

“...I think that confidence is a key factor because I know some students in my class with low confidence and the teachers work to motivate them to work harder for the SAT. I know some of them that cancelled the test because they were not confident, they were not motivated enough to study for it, to prepare for it at home.” (Student)

Parents noted that their children’s attitude depended on the attitude of their teachers in the class. They believed that teachers have a fundamental role in drawing students to like them, and further to love their subject, and hence love learning. Parents highlighted that:

“It is very effective: teacher behaviour attracts students’ attention. In my child’s class, the teacher always makes useful discussions with students. Before, my son did not care about the subject, especially in days he attended the class online, because he was not in direct contact with the teacher. But on days when he attended school, his teacher’s motivation and encouragement stimulated him and was very effective in improving his academic performance.” (Parent)

“Teachers have a fundamental role in making students love the subject and be more creative and get their performance improved, especially when a student has learning difficulties.” (Parent)

“...I will talk from a parent and teacher’s point of view. The results helped me to put the appropriate class activities for students. I could know how they think. So, I put activities for each group of students based on their mental abilities and also for the assessment, and consequently it will affect my students.” (Parent)

“I think PASS helps students to take control of their own learning one way and give their own opinion about things.” (Parent)

5.1.1.2 Stakeholders’ Perceptions about the Role of Attainment, Aptitude, and Attitude towards Learning in Predicting SAT Achievement

Theme 2(a): The relationship between MAP, CAT4, PASS assessments and SAT

Leaders indicated that currently, their schools used one or more of the assessments (MAP, CAT4, and PASS) for curriculum review and to track students’ progress. So far, they did not have a solid, clear way to triangulate the data numerically to help in setting targets for SAT.

However, they had some trials of working on the data qualitatively to track students' performance, follow up on behavioural issues using PASS, or to identify gifted and talented students using CAT4 and MAP, and to help them develop their skills.

“For us as school leaders, we try to make use of MAP, CAT4, PASS, and SAT data to triangulate to serve internal purposes like getting feedback about teaching, learning, and curriculum. At the moment we do not put the SAT's target using the three assessments' scores. We use the student profile in MAP because it can tell us as from grade 5 upward if the student can get the required score in SAT. This information was given by the NWEA-MAP company. So, we get to know if the students are on the right track to achieve the SAT target. There are some recommendations and action plans that need to be in place to put them right on the right track...” (Director of Assessment)

“...so far, we have only used MAP, CAT4 and the internal assessment to track the classes and students. ... I am curious to know more about the link between the SAT and MAP. Actually, I found in NWEA training that there is a study of college readiness benchmark where they correlate the MAP to SAT. I hope they start to link and set SAT's target based on other test scores. We use the CAT4 and MAP to identify gifted and talented students based on criteria given by each exam providers. We compare the results of the identified students, and it is interesting that in some cases they are aligned and in other cases they are not.” (Head of Inclusion)

“... I think MAP and SAT [are] both norm-based assessments, but MAP is going to be unique to the student and gives us more insight into where the student is now relative to their own pathway; I also find that the MAP allows for more differentiation and for different types of learners whereas the SAT tends to be and is meant to be unique to all, structured that way.” (Deputy Director)

When asked questions about the relationship between all the assessments, most of the **leaders** during the focus group discussions gave more attention to the relationship between MAP and SAT. For example, the following quotes below show how the relationship was presented:

“SAT has level of questions that are harder and deeper than that in the MAP... SAT is like college readiness assessment, and it assesses cumulative skills to check if students are ready for college... The MAP assessment is mainly tracking the students' progress in the standards over time, while SAT is accumulative assessment for these skills and knowledge.” (Principal)

“MAP test is a measurement of your academic progress so when I am using it in a school across the grades K-12 covering the grade level standards, it gives me a really good indicator of my students: are they on level, below level, above level, what do I need to do, how do I plan, review the curriculum, identify the gaps, so I think MAP and SAT are correlated...” (Head of Curriculum)

“During the academic year, teachers and students use MAP reports to understand their weaknesses, when they have to focus, in which area from the learning continuum they need to focus on. It is important also for the student to understand their level because they are taking the SAT in grades 11 and 12 ...” (Curriculum Coordinator)

Teachers mainly were focusing on the relationship between MAP and SAT. They did not draw connection between all the assessments at the same time. Most teachers stated that the SAT is very different from the MAP due to the nature of MAP as an adaptive test, while SAT depends on the grade 10 to 12 standards. Therefore, it is not easy to link SAT scores to MAP scores. Other teachers pointed to the common content knowledge and skills in both SAT and MAP so they can provide students with practicing questions. Some teachers mentioned that MAP test results were not valid like SAT scores because of students’ attitude. Some teachers felt MAP and SAT could be connected in one way or another, and stated they discussed results with students so they could make the link. There was no systematic way of doing that.

“SAT depends on Grades 10 to 12 standards; it is more subjective. I do not think if the student has good potential in MAP, so he is able to do well in the SAT exam. I know some students that have abilities; they have some good potential, but it is a different style, they have to practise for the SAT specifically.” (English Teacher)

“It depends on the validity, if the MAP scores are valid... I can assure you they were reflecting the students’ levels... Some students have negative attitude because the test is not graded so they answer the questions randomly. Accordingly, their scores are not valid” (English Teacher)

“... If you know the techniques then you might use that technique for the MAP and SAT as well, so somehow, they are covering many topics. Most of the topics are similar to each other.” (Math Teacher)

“Due to the common types of questions in MAP and SAT, we tried to divide the domain of the math: algebra, geometry, probability, data analysis; to integrate similar questions from SAT exam in the domain they fall under, to give more focus on similar questions... then we give students like a full SAT practice. From that you start with each one-by-one and each single question we extend it to different ideas.” (Math Teacher)

A large majority of **students** focused on the link between MAP and SAT because they have similar types of questions. At the end of the focus group interviews, students indicated that they were interested in discussing and stating their feedback about the topic under study.

Students elaborated on the importance role of explaining the purpose and use of each type of assessment and how they could be utilised so students could get the maximum benefits:

“... and if the school can discuss with students the aim behind each assessment, this would be beneficial. If teachers also can spend more time explaining the assessment reports so we can understand how to use them effectively.” (Student)

“I wish that I was aware of the benefit of each assessment and the relationship between them. I could have prepared for them in a different way” (Student)

Students also highlighted the benefit of having the experience of SAT exam conditions and using CAT4 and PASS data to support students.

“I think if all the assessments in school happened under the same conditions like the SAT with the same type of questions, that would be the right fit for the students to know their actual level. If the school explains to students, why they are taking CAT4 and PASS, so we understand their value. I also think the school needs to make more initiative or maybe some workshops to enhance students’ confidence to express their feelings. We have a social counsellor, but we want to be encouraged to improve our study skills, motivation, and engagement. All of this will help in boosting confidence and maybe create an environment where students want to share their feelings.” (Student)

Theme 2(b): The role of MAP, CAT4 and PASS in SAT achievement

Leaders’ perceptions are that students do not link their performance in SAT to their results in any or all of MAP, CAT4, or PASS assessments. However, educators themselves do make that link; that is, leaders like to see the whole image from their perspective in order to be able to evaluate where their students stand.

“SAT has a similar questions style like MAP. CAT4 helps teachers recognise the learning styles of students and usually the students who are good in the quantitative part of CAT4 are scoring high in SAT-math exam ... Usually students who scored well in MAP, above 61 percentile, are the ones who score 650 -700 and minimum of 550, so there is a very positive correlation between the MAP and the SAT; I think who will score high in CAT4 will have high score in MAP and SAT too and vice versa, so there is a correlation between the assessments’ scores...” (Head of Math Department)

“Not really, no, I do not think it is in the perception of students that they link between all of the assessments. However, when it comes to SAT, they do because a lot of things will depend on their SAT scores such as university acceptance and admission. For me we had some students last year that have some issues and I was looking at their CAT4 specifically along with their MAP. I did that to plan something for students.” (Career Counsellor)

“...MAP, CAT4, and students’ attitude will not give you 100% like a view of what you expect but it is a very strong indicator; the three data together and looking at them and trying to link them can help in indicating students’ overall performance” (Director General)

“I think certain assessments are correlated. If English is my mother tongue, I would be doing good in the verbal reasoning as well, if it’s not my mother tongue I do not think it will be affecting that much my quantitative scores, spatial ability, and the non-verbal reasoning so it will be affecting to a certain extent. So, MAP-Language and MAP-Reading is connected to CAT4-Verbal while MAP-Math is connected to CAT4-Quantitative questions. Both will reflect my SAT scores.” (Vice Principal)

“I could say self-independence is needed for the students to be ready for the exams...We cannot work MAP without knowing the cognitive ability, or without the PASS they will give you indication about the student as we set their learning targets” (Principal)

“Within departmental action plans, we focus on reading Lexile levels to track progress and compare to students’ MAP- Reading scores. I would say the relationship between the different tests, MAP and SAT, is only going to give us part of the data. We do not have a metric factor in how the students can handle the pressure and how they respond to that pressure. Tests provide another layer of stress, so getting information about students’ anxiety level and confidence in learning along with their cognitive ability is important to guide students in their university choices.” (University Counsellor)

Teachers generally highlighted that students’ attitude towards either the teacher, school, subject, or their self-confidence could really affect their academic performance and can predict their SAT scores. They believe that students’ wellbeing significantly affected their academic performance.

“I think that all assessments affect the students’ achievements. If you are to compare students’ achievement with their attitudes or their feelings about school environment, friends and attendance would help in understanding their performance. For example, you will find the impact of their attitude on their performance in assessments like MAP or what they are achieving basically in school. But I do not think attitude affects their CAT4 because CAT4 has to do with their cognitive abilities rather than their willingness to study, or to prepare, or to answer questions in assessments.” (English Teacher)

“Of course, there is a relation; an angry student or let us say [not] behaving student, will never like the school, so it will affect, of course, his scores whether it’s a SAT exam or the performance in general in the school.” (Math Teacher)

“We are sharing the marks and reports with students and parents. We give individual feedback and advice especially about what they need to do to reach their goals and to progress. Students who are below the 41 percentiles are considered at risk and we put them on individual learning plans. Even if we have plans in place, we found that not only academic level affects performance. Students’ attitude affects their performance, and this is evident in the case of At-Risk students.” (English Teacher)

Teachers indicated that they did not have specific plans for integrating the results of MAP, CAT4, and PASS to predict the SAT score; however, they were trying to facilitate the preparation and practising of these exams for students. Also, teachers did not think that students would connect the results of their MAP to their SAT scores.

“Personally, I review the results of our students to have a general idea. I think we need to analyse them more and to link them to the students for differentiation...” (Math Teacher)

“Five or ten per cent of the students might think about predicting SAT using MAP but most of them, they are not going to think about it in this way.” (Math Teacher)

“For the planning part I think there was no fixed systematic kind of strategic plan to emphasise or infuse that prediction.” (Math Teacher)

Students felt that SAT scores depended on different factors, such as their ability to understand the questions and ability to tolerate the pressure of limited time for solving many questions. Some students said the MAP test could be connected to the SAT score because they shared common math questions. They highlighted that their ability and test-taking skills were main factors, along with their knowledge in reaching their goals in SAT. They did not make direct predictions quantitatively between SAT scores and the other assessments.

“I think it is based on you because it is not only the ability of solving math problems or understanding a paragraph in English, but also how you understand the question or how you understand the tricks of the actual question. Part of it is related to your potential in general and thinking skills.” (Student)

“...what you need to be good in is tolerance conditioning, where you have good time management and focus on speed. It is more like physical skills than mental skills because I was doing this test for four to five hours. So, it is not only knowledge.” (Student)

“I think that only the MAP is most likely to predict the final score for the SAT exam because it is more academic compared to other assessments. CAT4 or PASS do not really prepare you for the subject as much as the MAP does.” (Student)

“I agree with my friends that MAP is closer to the SAT. I do not like the CAT4 test. I want to highlight that SAT practice sessions are the most important...” (Student)

“I remember one day they distributed the results and then we were discussing about it to learn more about our abilities and understand what is written on the results, and this even affected our knowledge afterwards.” (Student)

“CAT4 gave a huge help for me because it made it clear that I would only understand through text so that also made the teacher know how to teach me in different styles to make it suitable for every student.” (Student)

“I know students scored high in English and math in school but still did not do well in SAT. SAT does not really depend on your school level...” (Student)

“...I only believe the MAP is the closest to predict SAT. The other two tests are just for the school. We do not take some tests seriously because they are ungraded, like MAP and CAT4. So, I do not think they can predict SAT.” (Student)

Parents’ views were not far from those of leaders and teachers. Parents felt that MAP revealed more about students’ academic level, while SAT was an assessment necessary for college. A few parents stated that SAT is just put pressure on students and that MAP was not useful for SAT. Parents’ perceptions indicated agreement with the role of the student’s attitude towards learning, particularly that motivation is the strongest indicator to academic achievement.

“...MAP assesses their level in early stage, so they can improve their level in enough time or keep their level. The student can know their mark and where they stand, and if it is low, they feel that they should work on it to improve it. For SAT, I think it is very important. I think SAT is a preparation for college.” (Parent)

“My daughter passed her physics exam at a qualifying level for college, but she was not satisfied with her mark, so she has retaken the exam to reach her goal. I think that learning behaviour (motivation) of students is very important.” (Parent)

5.1.1.3 Stakeholders' Perceptions about Factors Affecting SAT Achievement

Theme 3(a). Academic Factors Affecting SAT Achievement

Leaders indicated the major challenges students face in achieving their required SAT scores, among which were the following:

- Weak English language or English being the second language.

“I will say for English, it is the students’ prior knowledge and language skills. Some of the vocabulary in the test is not familiar for the students. So, students who have English as a second language, they may not have come into contact with those words, and they may not understand a lot of the vocabulary ...” (Head of English)

- There is a gap between internal assessments and international assessments, which leaves students behind the grade level.

“...We are using a different lens and I will be speaking about the gap; we have some students in middle school or lower secondary behind the grade level. This is evident from the internal assessment and MAP test. MAP allows us to benchmark the student and identify their current grade level. Therefore, there is a need for intervention to bridge the gap and to train students on similar type of questions. This kind of action plan should accelerate students’ progress to reach college readiness level.” (Principal)

Teachers highlighted several challenges that prevent students from achieving the required results in the SAT:

- The types of questions in the SAT were not included in the curriculum. Teachers also clarified that in the last two years online learning had a negative impact on students’ academic achievements.
- The big gap between the school’s curriculum level and the SAT test type, where students’ level was much lower.

“...I know in grade 9,10, and 11, we just [do] the spiral review, which is things that they studied before so regarding the content we are giving the students the chance to recall information from the past ... I could see how hard we worked to deliver the curriculum for the students so that when they reach grade 11, they are fully ready for SAT, so if a student follows exactly what is given in the grade, he should be fully ready for the SAT...” (Math Teacher)

“...test is too difficult for them because our curriculum is a bit weaker than the requirements. We have students with big gap therefore, we are teaching to bridge the gap which causes a delay in the covered content knowledge and standards... students are not ready to take the test ...” (English Teacher)

- Teachers also highlighted that time factor was a significant challenge as students did not have enough time to practise for the SAT and they were not prepared because they were always busy with other school assessments.

“Students are frustrated because of the number of assessments and the length of those assessments. Their lack of independent learning skills is affecting their readiness and self-confidence, and this affects their results in SAT. ...” (English Teacher)

Students believed that it is all about more practice to be prepared to the types of question.

“...it’s just about practicing, and once you get used to the format of the questions you begin to memorise patterns in their questions...one more thing that affects it is the techniques of answering the multiple-choice questions, where different strategies were used when answering questions.” (Student)

Theme 3(b). Cognitive Factors Affecting SAT Achievement

Leaders indicated that students are not used to the high level of reasoning problems which hinders them to achieve their required SAT scores.

“I believe that one of the challenges is students’ reasoning skills so now we emphasise on the reasoning problems and it’s a part of our internal assessment. Other skills like critical thinking and higher order thinking skills should be embedded in internal assessment and daily practice to boost students’ confidence and decrease the anxiety when they see similar questions in external exams. Students also lack seriousness and the ability to think independently.” (Director of Curriculum)

Teachers highlighted another big challenge which was students’ issue with long-term memory, and students of grades 10 to 12 particularly could not remember what they learned in grade 8.

Students highlighted the role of ability and potential to achieve the required SAT scores.

“...it is just like about your ability and your capability of answering the questions I think like in the school days we practised enough specially that we had two years to practice from grade 11... I am just advising the younger generation to start earlier from grade 9.” (Student)

Parents believed in enhancing the students’ skills by covering deep content knowledge and improving their writing skills.

“I have two points to mention. First, I see the preparatory level in English and Math in our schools was not at the required level for the international learning. For example, English, composition is very important, but it is ignored in our schools. Teachers give very high marks for very easy and simple compositions, so students grow up with weak ability to express themselves in English. I remember in Math, when a lesson was difficult it was covered very quickly. Second, doing a trial test inside the school, help in preparing the students to take similar test in content and to sit for long hours.” (Parent)

Theme 3(c). Affective Factors Affecting SAT Achievement

Leaders indicated the major challenges students face in achieving their required SAT scores, among which were the following:

- Students were not serious enough towards their learning.
- Sometimes motivation was not effective because of many reasons, such as lack of parents’ involvement, lack of motivation, lack of follow-up, lack of self-efficacy, lack of self-confidence, the absence of goals... etc.
- Students are not used to long hours of sitting for assessments, as in the SAT.

“I would like to emphasise two factors: low motivation and lack of study skills...Students panic and suffer from exam anxiety. In certain cases, there is a lack of parents’ involvement, so students do not feel that they are supported. Sometimes students tend to blame the school and teachers for not getting high scores.” (University/Career Counsellor)

“I guess students’ preparedness for learning and their study skills. For example, students use calculator and when they take exam that does not allow the use of calculator, they struggle. I think the school should consider preparing students to take external exams by aligning school curriculum and practices with the requirements to those exams. Exam techniques and time management skills are also crucial and hinder some students from achieving the required scores. Running the PSAT exams also help the students to be prepared for the SAT, help the school to modify the curriculum, teaching and learning processes accordingly. Students should be trained to have long hours exams which is a challenge when they set for the SAT...Students are not exposed to such assessment combining or having two parts of English and math at the same time with the long time to set.” (Head of Assessment)

Teachers believed that students needed to be more responsible supported by teachers’ encouragement. Moreover, students’ passion was a basic factor in achieving the required results in SAT. Preparedness for learning was a significant challenge as students did not have enough time to practise for the SAT because they were always busy with other school assessments.

“I do feel that they are not taking it seriously. They are also not used to those types of questions. They need more exam preparation and to use their logical thinking and reasoning skills.” (Math Teacher)

“I think the students are bored of assessments and they do not take it seriously or feel confident about their ability.” (English Teacher)

“...Grade 10 to 12 students should be more responsible towards doing online assessments, practising them by themselves, start working seriously. We should encourage them, but they should do the work independently...” (Math Teacher)

Students pointed to self-confidence and preparedness for learning as main factors affecting SAT achievement.

“...it is quite simple if you just try to control your emotion and look at it that you have to prepare well. It does not matter how good you perform as long as you do your best and you are satisfied that you actually tried your hardest, and then if you do not like the results, you can always retake the SAT...” (Student)

“...if you are not proud of yourself or confident, your performance will be affected. Especially if you have test anxiety, you can start practicing and preparing early so you will not panic.” (Student)

Parents strongly believed that students need to spend a longer time preparing and practising for this type of international exams. They also believed that students' engagement and motivation play a main role.

“Students need better methods for preparation and practice, they need more creativity and a sense of competition, enthusiasm, and offering prizes for better performance. In general, more motivation. Students are bored of routine work, like logging into a program and just solve problems. We need to think out of the box and improve the Math level in our schools by engaging the students.” (Parent)

“A solid discipline should take place for SAT preparation, as done with the MAP test, so that students would take it more seriously.” (Parent)

5.2 Summary of Phase Two Results

The following section of the chapter summarises the leaders', teachers', parents', and students' perceptions about the relationship between students' attainment (MAP), aptitude (CAT4), attitudes toward learning (PASS), and SAT achievement. The stakeholders' perceptions about the role of those assessments in students' SAT achievement are also summarised.

5.2.1 Leaders' Perceptions about the Role of the Attainment, Aptitude, and Attitude towards Learning in SAT Achievement

- Most **leaders** agreed that the SAT was a cumulative assessment that evaluates students' content knowledge, skills, and aptitude which prepares them for college. SAT content is covered by the Common Core Standards. They felt SAT did not reflect the real level of students' aptitude if they were non-native speakers.
- **MAP and SAT:** SAT is more challenging than MAP. There is a strong correlation between MAP and SAT exams. They also indicated that MAP is a test used to measure students' progress, but SAT is done to evaluate academic achievement.

- **CAT4 and SAT:** CAT4 assesses students' abilities and potential and is not a curriculum-based assessment. CAT4 is more beneficial for educators to differentiate and meet learners' needs. CAT4 guides teachers and students to utilise learning styles to improve students' performance in MAP and SAT.
- **PASS and SAT:** PASS is important because it covers the psychological factors that affect students' achievement in SAT. They highlighted that the relationship between students, teachers, and school played an important role in students' learning attitude, and consequently in their performance in SAT. Leaders also pointed to the need for independent learning skills to enhance accountability.
- **Role of MAP, CAT4, and PASS in Predicting SAT Achievement:** Leaders indicated that these assessments were linked and used for curriculum review and to track students' progress. So far, they did not have a solid, clear way to triangulate the data numerically to help in predicting SAT scores. However, data is used qualitatively to track students' performance and follow up on behavioural issues. CAT4 and MAP are used to identify gifted and talented students. Leaders agreed that students did not link their performance in SAT to their results in any of, or all of, MAP, CAT4, and PASS. They agreed on the use of the relationship between MAP and SAT to predict SAT scores more than the use of CAT4 and PASS.
- **Factors affecting students' SAT achievement:**
 - **Academic Factors:** gaps in knowledge, weakness in English language and math.
 - **Cognitive Factors:** lack of reasoning skills.
 - **Affective Factors:** negative attitude towards the SAT, lack of motivation, lack of parental involvement, lack of follow-up, low self-efficacy, and self-confidence. Anxiety and lack of test-taking skills.

5.2.2 Teachers' Perceptions about the Role of the Attainment, Aptitude, and Attitude towards Learning in SAT Achievement

- **Most teachers** agreed that SAT was a useful and challenging test for students. They defined SAT as a summative test for the learning journey, and stated it covered the content knowledge until grade 11. They felt SAT was an inclusive and intense exam. Both English and mathematics teachers stated the SAT was an important and valuable exam.
- **MAP and SAT:** MAP questions are easier than SAT, but both are covered by the standards taught in school.
- **CAT4 and SAT:** Most teachers agreed that CAT4 is useful for teachers to differentiate and design learning activities. The minority believed that CAT4 was not an important test because it does not measure the real abilities and skills of students and felt the link between SAT and CAT4 was very weak.
- **PASS and SAT:** Teachers agreed that students' wellbeing and attitude were the most important among all factors in affecting academic performance.
- **Role of MAP, CAT4, and PASS in Predicting SAT Achievement:** Most teachers agreed about the predictability of SAT by MAP, however, they added that it is not easy to link SAT scores to MAP scores. They agreed on the absence of a systematic way to predict SAT scores. Some contradicting views appeared, as some mentioned that MAP test results are not valid as SAT scores are, while others said that SAT can be predicted by MAP scores. Teachers agreed on using the assessment reports to discuss performance and target academic goals. Teachers highlighted that students' attitudes towards teacher, school, and subject and their self-confidence affected their academic performance and could predict

their SAT scores. Teachers indicated that they did not have specific plans for integrating the results of MAP, CAT4, and PASS to predict SAT scores.

- **Factors affecting students' SAT achievement:**

- **Academic Factors:** gaps in content knowledge, weakness in language.
- **Cognitive Factors:** difficulties in recalling information, issues with long-term memory, weakness in reasoning skills.
- **Affective Factors:** negative attitude towards the test, lack of work ethic and motivation, anxiety. Issues in preparedness for learning.

5.2.3 Students' Perceptions about the Role of the Attainment, Aptitude, and Attitude towards Learning in SAT Achievement

- All students believed that SAT is an exam that tests their knowledge and abilities in mathematics and English. They believed it is an important and hard test. They highlighted the need for resources, practice time, and test-taking skills. Students believed that it is all about more practice, self-confidence, ability, and potential.
- **MAP and SAT:** MAP is less stressful than SAT. MAP prepares students for SAT and helps in setting goals. There is no time limit in MAP, which is different to SAT. Most students felt that MAP and SAT have different characteristics.
- **CAT4 and SAT:** Most students found CAT4 useful and helped them in developing their skills. They believed that receiving their CAT4 reports helped them know their strengths and weak points so they could focus on areas where they needed to improve. Some students also believed that this test is useful for teachers to help them develop their teaching methods. A few students stated that CAT4 is useful, or it is similar to the general intelligence test.

- **PASS and SAT:** Students strongly believed that their attitude toward learning is a significant factor that impacts their academic performance. They also mentioned that the PASS test is not reliable because students tend to hide their issues. Almost all students highlighted feelings about the subject, teacher, and school environment, self-regard, school and teacher's support, motivation, level of anxiety, confidence in learning, and study skills as factors impacting their performance in school in general and in SAT.
- **Role of MAP, CAT4, and PASS in Predicting SAT Achievement:** A large majority of students agreed on the link between MAP and SAT because they share common types of questions. They felt they could not predict their SAT scores based on any assessment, but they stated that MAP could predict SAT scores. Students concluded that SAT scores depend on different factors:
 - Students' ability to understand the questions
 - Self-control, confidence in learning
 - Time management
 - Cognitive ability
 - Test-taking skills
 - Mastery of content
- **Factors affecting students' SAT achievement:**
 - **Academic Factors:** practising the same type of questions and content knowledge. Reading and writing skills.
 - **Cognitive Factors:** reasoning skills and logical thinking.
 - **Affective Factors:** confidence in learning and self-regard.

5.2.4 Parents' Perceptions about the Role of the Attainment, Aptitude, and Attitude towards Learning in SAT Achievement

- In general, **parents** did not seem to have deep knowledge about SAT. They saw SAT as a hard exam for their children, but they believed it was useful and necessary for college readiness.
- **MAP and SAT:** Parents agreed that MAP helps to improve students' academic levels and SAT scores. However, a few parents stated that MAP was not helpful for SAT. Instead, they highlighted the role of marks in helping students take the test seriously and evaluate their performance related to the taught curriculum. In addition, they highlighted the importance of school communication related to assessment and their children's level and readiness.
- **CAT4 and SAT:** Parents viewed the CAT4 as a tool for helping students understand their learning preferences and how to improve academically.
- **PASS and SAT:** Parents pointed to motivation and feelings about teachers and subject as the most important factors that impact SAT scores.
- **Role of MAP, CAT4, and PASS in Predicting SAT Achievement:** Parents only highlighted the role of students' readiness, test-taking skills, and attitude, particularly motivation, as the strongest indicators that affected SAT scores. They connected the SAT to the students' academic attainment but not explicitly to the MAP.
- **Factors affecting students' SAT achievement:**
 - **Academic Factors:** practice and preparation for the needed content knowledge and writing skills.
 - **Cognitive Factors:** test-taking skills.
 - **Affective Factors:** students' engagement, motivation, feelings about teachers and subject.

Chapter Six: Discussion of Findings

This chapter presents a summary of the key findings, interpretations, and a discussion of the findings. The study findings are critically examined based on the outlined background. Hence a mixed-method approach was implemented to gather and to analyse quantitative and qualitative data. The results from the analysis of the different types of instruments over the two phases of the study are integrated and compared to answer the three research questions. Accordingly, the research findings are discussed in light of the conceptual and theoretical framework of the study. The chapter is organised into sections where titles of each section reflect the study questions.

6.1 Discussion

This section covers the interpretation of the key findings in light of their relevance to the conceptual and theoretical framework of the study supported by the literature review. The main purpose of the discussion is to concentrate on the role of different types of assessment within academic, cognitive, and affective factors in students' SAT achievement in US-curriculum schools in the UAE. The following sections cover the discussion and interpretation of each study question.

6.1.1 The Relationship between Students' Attainment in MAP, Aptitude Level in CAT4, Attitudes toward Learning in PASS, and SAT Achievement

Students' academic achievements have been investigated in light of the role of academic, cognitive, and affective domains (Agus et al., 2016; Christian, 2017; Detterman, 2016; Hattie,

2009; Richardson, Abraham & Bond, 2012). Students' attainment, aptitude, and attitudes toward learning have been highlighted as main factors in predicting achievement (Chingos, Whitehurst & Lindquist, 2014; Detterman, 2016). The literature concluded positive relationship between academic achievement in general and in specific domains and students' cognitive abilities (Deary et al., 2007; Salimabarkat & Anjum, 2017; Vaessen et al., 2017; Watkins, Lei & Canivez, 2007; Zieffler, Garfield & Fry, 2018), academic achievement and students' attitudes toward learning, self, and school (Lee & Stankov, 2016; Sadler et al., 2012; Sawalha, 2018; Schunk & Pajares, 2009; Seligman, 2012). Therefore, in the current study the researcher investigated the relationship between all the factors simultaneously, which are students' current attainment, aptitude, attitude towards learning, and overall achievement in SAT.

The correlational analysis of students' scores in MAP, CAT4, PASS, and SAT concluded the following relationships between them. A strong positive correlation was found between students' academic attainment in MAP and their SAT achievement in both math and English. This positive relationship was confirmed by previous studies indicating the positive correlation between MAP as a curriculum-based assessment and students' achievement where MAP scores predicted students' scores in different subjects (Al-Alwan, 2009; Gonzalez, 2015; Newton et al., 2007; Olani, 2009). Moreover, MAP has a positive relationship with students' reading fluency level (Cordray, 2013; Merino & Beckman, 2010) and mastery of mathematical knowledge and skills (Beesley et al., 2018). Hence MAP assessments are recognised in benchmarking students' levels and tracking their progress in literacy across reading, language usage, mathematics, and science (Barber, 2017; Beesley et al., 2018; Marshall, Smart & Alston, 2017); this reflects a logical positive relationship with SAT that assesses the students' readiness in English and mathematics. The current study findings are aligned with previous studies that

have indicated the validity of MAP assessment to predict the ACT and SAT scores (Brown, 2014).

The current study also concluded a strong positive relationship between students' aptitude (CAT4) and their achievement in SAT-Math, while there is a moderate positive correlation with SAT-English. Hence a learner's aptitude is considered one of the primary factors of academic achievement (Chen et al., 2012; Deary et al., 2007; Rohde & Thompson, 2007), and the findings from the current study confirm that line of research. According to information processing theories (Mayer, 1996) and the Information Processing Model of Learning and Memory (Schunk, 2012), learners' aptitude defines how they learn, think, reason, and process information. The theories highlighted the role of the development of cognitive and metacognitive abilities in enhancing students' achievement in general (Hong, 2018), reasoning, and problem-solving specifically (Kuo et al., 2013; Veenman, 2012). Hence the CAT4 test consists of four batteries that assess students' VR, NVR, QR, and SA; the test indicates the level of learners' thinking processes involved in those four abilities. Accordingly, the CAT4 questions rely on students' ability to think with words in answering VR questions, to have number sense in answering QR, to think with shapes and logic in NVR, and to think with shapes and space in SA questions. Simultaneously, solving SAT questions requires cognitive processes involved in reading, language usage, mental modelling, and analogical reasoning, which are activities performed differently based on the individual's cognitive abilities and performance in answering contextual questions like the ones in SAT-Math and SAT-English (Chen et al., 2012; Detterman, 2016). Cognitive processes' involvement was highlighted by research, especially students' SA, QR and NVR that have positive relationship and affect learners' performance in mathematics (Moore, 2010; Thompson, 2011; Veenman, 2012), which supports the current study's finding about the positive relationship between students' aptitude level and their achievement in SAT.

The study concluded from the correlational analysis between the PASS test's nine factors that contribute to students' attitudes toward learning and SAT-English and SAT-Math that a total of four factors have positive correlations with both SAT-English and SAT-Math; one factor has a positive correlation with SAT-Math and no correlation with SAT-English; two factors have small negative correlations with SAT-English and no correlation with SAT-Math; finally two factors have no correlation with both SAT-English and SAT-Math. The findings are interpreted in the light of the Social Cognitive Learning theory (SCLT) (Schunk, 2012) and based on previous discussion in literature that learners' attitudes toward learning can vary based on the subject and on the effect of combined factors (Elphinstone et al., 2019; McLeod, 1992; Sawalha & Sawalha, 2018; Seligman, 2012). For example, the learner's attitude towards mathematics refers to the learner's positive or negative degree of effect toward mathematics (McLeod, 1992). The following sections will interpret the findings related to the nine factors.

There is a positive relationship between students' perceived learning capability, self-regard, confidence in learning, response to curriculum demands, and both SAT-Math and SAT-English scores. The four factors are interrelated in many previous studies where learners' self-confidence in their abilities allows them to utilise their knowledge, skills, resources, and time effectively (Agus et al., 2016; Nasser, 2004; Stajkovic et al., 2018). Accordingly, learners' perceived learning capability entails the combined effects of learners' self-confidence in learning, self-regard and response to curriculum demands over time to achieve targets (Duckworth et al., 2007; O'Neal, 2019; Stajkovic et al., 2018). Students' confidence in learning to read has been connected to their attitudes toward reading which indicated the positive relationship between them. Students' confidence in learning, attitudes to reading, and enjoyment of learning to read are positively correlated with students' reading skills. However, only students' confidence in learning and attitudes to reading can predict variance in students' reading scores (McGeown et al., 2015).

The literature supports the positive relationship between students' self-regard and perceived learning capability, which enhances students' awareness of their abilities and accordingly increases confidence in learning and improves students' response to curriculum demands (Phan, 2014; Rosman, Mayer & Krampen, 2015; Stajkovic et al., 2018). Learners' belief in their own academic ability has been proven to have a positive relationship with academic achievement, especially at high school and university levels (Arens et al., 2017; De Ridder et al., 2012; Fives et al., 2014; Lone & Lone, 2016; Marsh et al., 2016; O'Neal, 2019; Pinxten et al., 2013). Interestingly, the literature also highlighted the mutual influence between academic achievement and self-concept (Fives et al., 2014; Pinxten et al., 2013). The current study found a positive relationship between learners' self-regard, perceived learning capability, and both English and mathematics achievement. Both relationships were supported by previous mathematics studies (Arens et al., 2017; Liem, McInerney & Yeung, 2015; Marsh et al., 2016; O'Neal, 2019) and English studies (Arens & Jansen, 2016). The strength of this relationship stems from the proven positive relationship between learners' self-concepts in English and mathematics (Martin et al., 2015). In contrast, a few studies concluded either a weak relationship or lack of relationship between self-regard and academic achievement (Demo & Parker, 1988; Stupnisky et al., 2007; Wintre et al., 2011), and between students' perceived competence in reading and reading scores (Fives et al., 2014).

The current study also discovered a positive relationship between students' preparedness for learning and SAT-Math scores. With SAT-English, there was not enough support to show a relationship. These findings are supported by the literature explaining the role of practising and teaching students learning strategies in improving students' content knowledge and attitudes toward the subject (Sawalha & Sawalha, 2018; Seligman, 2012). Students' preparedness for learning is also affected by subject difficulty which can increase their anxiety and therefore affect achievement negatively (Chiesi & Primi, 2009a). Studies about PASS factors categorised

the factors as mediators under self-efficacy either for academic success or self-regulation (Lambros, 2018). This categorisation included the preparedness for learning factor as a mediator under self-efficacy for self-regulation. This way of categorisation explains the small or lack of direct relationship between students' preparedness for learning and their SAT scores.

The study also concluded that feelings about school and attitudes to attendance have a small negative relationship with SAT-English and no relationship with SAT-Math. Although previous studies confirmed the positive relationship between students' attitudes toward mathematics and students' achievement in mathematics (Gardner, Lalonde & Pierson, 1983; Gonzalez, 2015; Guo et al., 2015; McLeod, 1992; O'Neal, 2019; Sorge & Schau, 2002), the findings from the current study pointed to the difference between students' feelings toward the subject and the school in general. Finally, the study also concluded that students' attitudes to teachers and general work ethic factors have no relationship with both SAT-English and SAT-Math. The findings from the current study echo the debate about the impact of teachers or students' motivation on academic achievement. Although some studies highlighted the significant relationship between teachers' effect on students' achievement and ignored students' characteristics (Johnson, 2016; Kim & Seo, 2018), the effect size was small and other studies considered students' characteristics and attitudes more important than the schools' (Chingos, Whitehurst & Lindquist, 2014; Cullen, Hardison, & Sackett, 2004; Detterman, 2016).

Moreover, it is worth highlighting that SCLT (Schunk, 2012) emphasises the critical effect of student-teacher relationships on students' feelings about school and sense of belonging to school (Finn, 1989; Voelkl, 1997), and students' attitudes toward teachers and school (Elliot & Dweck, 2005; Radel et al., 2010). It is also important to consider the type of learners, whether they are mastery-oriented learners or performance-oriented learners, when studying the

relationship between their feelings about school, attitudes toward teachers, general work ethic and academic achievement. As students' ability to see themselves achieving goals and mastering tasks can affect their ability to achieve (Covington, 2000; Hidi & Harackiewicz, 2000; Muis & Edwards, 2009; Pintrich & Schunk, 1996; Polychroni, Hatzichristou & Sideridis, 2012), so, according to the current study's findings, the participants expressed the influence of their attitudes toward teachers on their academic achievement. Still, the analysis of their assessment data did not support what they said. This might indicate the type of learners the participating students were; especially since performance-orientated learners might have null or negative relations with peers and teachers (Polychroni, Hatzichristou & Sideridis, 2012) and negative attitudes toward learning because they believe that ability controls achieving goals, rather than effort (Hidi & Harackiewicz, 2000), while mastery-orientated learners have positive attitudes toward peers and teachers (Polychroni, Hatzichristou & Sideridis, 2012) and learning because they relate achieving goals to their effort and strategy (Muis & Edwards, 2009; Pintrich & Schunk, 1996).

The findings about the absence of a relationship between students' attitudes toward teachers, general work ethic and both SAT-English and SAT-Math scores, while feelings about school and attitudes to attendance have small negative correlation with SAT-English and no correlation with SAT-Math, are arguable by previous studies. They are debatable topics in general where there is a line of studies that highlight the vital role of the school environment in developing students' academic self-concept and accordingly affecting academic performance (Becker et al., 2014; Hu et al., 2015). Peer relationships and attitude towards school were also found to affect academic performance (Becker et al., 2014; Hu et al., 2015). Other studies considered adding the level of anxiety and proved the positive relationship between attitudes toward mathematics, work ethic, level of anxiety, and students' achievement in math courses (Gardner, Lalonde & Pierson, 1983; Sorge & Schau, 2002).

The current study findings are supported by the previous literature which argued that teachers' and schools' effects on academic achievement decrease when other factors are included, such as students' characteristics, aptitude levels, and perceived learning capabilities (Chingos, Whitehurst & Lindquist, 2014; Detterman, 2016). Other studies debated that students' academic achievement is positively correlated with their cognitive abilities, characteristics, and attitudes more than the school they attend and teachers' effect (Cullen, Hardison & Sackett, 2004; Detterman, 2016). This debate in literature supports the current study findings that perceived learning capability, preparedness for learning, general work ethic, and confidence in learning have a small positive correlation with students' aptitude level and their attainment in MAP, while feelings about school, attitudes to teachers and attitudes to attendance have no relationship with students' aptitude level and their attainment in MAP.

Response to curriculum demands has a small positive correlation with CAT4 but moderate positive correlation with MAP-Reading and MAP-Math. Learner self-regard is the only factor that has a moderate positive correlation with students' aptitude level and their attainment in MAP-Reading and Math. Referring to the body of literature about self-regard, students with high self-regard have shown motivation to accept challenges, keep trying to achieve their academic goals (Baumeister et al., 2003; Stajkovic et al., 2018), and have positive dispositions about themselves and their learning experience (Hamaideh & Hamdan-Mansour, 2014). Self-regard has shown a positive impact on academic achievement (Saadat, Ghasemzadeh & Soleimani, 2012) where positive correlation was found with academic achievement in general (Saadat et al., 2012; Stupnisky et al., 2007) and with math and reading scores (O'Neal, 2019). Simultaneously, students' self-regulation skills enhance their perceived learning control and response to curriculum demands (Duckworth & Kern, 2011; Stadler et al., 2016), and developing students' positive attitudes (De Ridder et al., 2012).

In conclusion, the first study question was answered fully. The analysis of the quantitative data tested the study hypotheses and accepted the first two hypotheses by indicating: first, the positive correlation between students' academic attainment in MAP and their SAT achievement in both Math and English; second, the positive correlation between students' aptitude level in CAT4 and their achievement in SAT-Math, while it has a moderate positive correlation with SAT-English.

The study's third hypothesis was accepted partially because not all the PASS factors within the attitudes toward learning variable had a positive relationship with students' achievement in SAT. The findings indicated a positive relationship between students' perceived learning capability, self-regard, preparedness for learning, confidence in learning, response to curriculum and SAT-Math score. There is a positive relationship between students' perceived learning capability, self-regard, confidence in learning, response to curriculum and SAT-English. However, there is no correlation between students' feelings about school, attitudes toward teachers and subject, general work ethic, and SAT-Math scores. There is no correlation between students' attitude towards teachers, preparedness for learning, general work ethic, and SAT-English scores. Attitudes toward teachers and general work ethic were common in having no correlation with achievement in both SAT-Math and SAT-English. Feelings about school and attitudes to attendance have a small negative correlation with SAT-English.

By looking at the relationship between the different types of assessments forming the independent variables in the study, the results indicated strong positive relationships between students' attainment level in MAP-Math, MAP-Language Usage and MAP-Reading. This means there is a consistency in students' achievement level across the three MAP tests. The study concluded a strong positive relationship between students' attainment in MAP and their aptitude level. This finding is supported by numerous studies proving the significant positive

relationship between students' cognitive ability and their academic achievement (Best & Miller, 2010; Best, Miller & Jones, 2009; Best, Miller & Naglieri, 2011; Cragg & Gilmore, 2014; Gonzalez, 2015).

A large body of research highlights the relationship between academic achievement, higher order cognitive skills, and positive attitudes toward learning (Lipnevich et al., 2011; Sebesta, 2019; Shepard & Penuel, 2017; Volpe, 2016). Numerous studies support the study findings pointing to the positive relationship between students' aptitude and the variance in students' performance (Finn et al., 2014; Gonzalez, 2015; Reggianini, 2017) and academic achievement (Wai, Brown & Chabris, 2018). The literature concludes the positive relationship between academic achievement in general and in specific domains and cognitive ability (Deary et al., 2007; Salimabarkat & Anjum, 2017; Watkins, Lei & Canivez, 2007), academic achievement, and the student's attitude towards learning, self, and school (Schunk & Pajares, 2009). Interestingly, due to the nature of interrelation between cognitive and affective factors (Christian, 2017) like SAT, MAP, CAT4 and PASS, it is common to have different degrees of correlation based on the type of the variables (Farkas, 2003).

In conclusion, the literature supports investigating the factors combined because the interaction between the different factors influences the students' overall attitudes toward the learning experience in general and therefore academic achievement (Bandura, 1997; Grootenboer & Hemmings, 2007; Jacobs & Bleeker, 2004; Leder & Forgasz, 2006; O'Neal, 2019; Soni & Kumari, 2017). Certain factors are more situated in the learning context and may explain the variance in academic achievements (Credé, Tynan & Harms, 2017; Linnenbrink-Garcia & Patall, 2015; Richardson, Abraham & Bond, 2012; Sebesta,

2019). Considering some factors as mediators/moderators may help in explaining the relationship between the students' attitudes toward learning and their SAT-English and SAT-Math scores. Hattie (2009) studied a group of factors affecting academic achievement and highlighted that self-regard, perceived learning capabilities, and attitude towards mathematics had a high effect size of Cohen's value. Hattie's (2009) findings about the strong correlation specifically between self-regard, perceived learning capabilities, and students' academic achievement were also supported by other studies (Lee & Shute, 2010; Richardson, Abraham & Bond, 2012; Stankov, 2013).

6.1.2 The Predictability of Students' Achievement in SAT using their Attainment in MAP, Aptitude Level in CAT4, and Attitude towards Learning in PASS

Two equations and regression models were formulated to predict SAT-Math and SAT-English scores using the multiple regression analysis of students' attainment in MAP-Math, MAP-Reading, MAP-Language Usage, aptitude level in CAT4, and attitudes toward learning in the nine PASS factors. Accordingly, that finding accepted the fourth hypothesis of the study by confirming that students' attainment in MAP, aptitude level in CAT4, and attitude towards learning in PASS combined statistically predicted students' SAT achievement.

The first model could explain 44.7% of the variance in SAT-Math scores with large effect size $f^2 = 0.808$, according to Cohen (1988). SAT-Math could be predicted using the following equation:

$$\begin{aligned} \textbf{SAT Math} = & 335.877 + 1.021(\text{MAP Math}) + 0.083(\text{MAP Reading}) + 0.201(\text{MAP} \\ & \text{Language}) + 7.258(\text{CAT4 Aptitude}) + 0.254(\text{PASS1 Feeling about School}) + \\ & 0.126(\text{PASS2 Perceived Learning Capability}) + 0.381(\text{PASS3 Learner Self-Regard}) + \\ & 0.032(\text{PASS4 Preparedness for Learning}) - 0.178(\text{PASS5 Attitude to Teachers}) - \\ & 0.268(\text{PASS6 General Work Ethic}) + 0.176(\text{PASS7 Confidence in Learning}) - \\ & 0.166(\text{PASS8 Attitudes to Attendance}) - 0.180(\text{PASS9 Response to Curriculum} \\ & \text{Demands}) \end{aligned}$$

In predicting students' achievement in SAT-Math, students' aptitude level had the highest coefficient (B = 7.258), followed by attainment in MAP-Math (B = 1.021).

The second model could explain 42.9% of the variance in SAT-English scores with overall large effect size $f^2 = 0.751$, based on Cohen (1988). SAT-English could be predicted using the following equation:

$$\begin{aligned} \textbf{SAT English} = & 404.116 + 0.284(\text{MAP Math}) + 0.641(\text{MAP Reading}) + \\ & 0.400(\text{MAP Language}) - 2.031(\text{CAT4 Aptitude}) - 0.068 (\text{PASS1 Feeling about} \\ & \text{School}) + 0.008 (\text{PASS2 Perceived Learning Capability}) + 0.106 (\text{PASS3} \\ & \text{Learner Self-Regard}) + 0.076(\text{PASS4 Preparedness for Learning}) - 0.115 \\ & (\text{PASS5 Attitude to Teachers}) + 0.088(\text{PASS6 General Work Ethic}) + 0.330 \\ & (\text{PASS7 Confidence in Learning}) - 0.255(\text{PASS8 Attitudes to Attendance}) - \\ & 0.273(\text{PASS9 Response to Curriculum Demands}) \end{aligned}$$

In predicting students' achievement in SAT-English, students' attainment in MAP-Reading had the highest coefficient of (B = 0.641), followed by Map-Language Usage (B= 0.400). On the other hand, students' aptitude level had the highest negative coefficient (B = -2.031).

The literature that investigated the predictability of students' academic achievement highlighted previous studies similarly used students' MAP-Reading and MAP-Math percentiles to predict SAT scores (Thum, 2011; Thum & Matta, 2015). Both SAT and MAP questions are contextual questions that rely on students' proficiency level, literacy, and reasoning skills. Previous studies argued that academic achievement is predicted more accurately based on students' previous academic achievement combined with students' aptitude levels (Gonzalez, 2015; Lakin, 2012; Lohman, 2005). The current study findings supported that line of research especially when the regression analysis and prediction equations for both SAT-Math and SAT-English showed the high contribution of prior MAP and aptitude scores to the SAT scores. Interestingly, one score increase in students' aptitude level would increase SAT-Math score by 7.258 points and decrease SAT-English score by 2.031 points. It is worth considering that only 169 out of 603 students completed the English section in the SAT, because instead of taking the SAT-English they took another English proficiency test recommended by universities.

Among all the academic predictors, students' current attainment in MAP-Math was the strongest predictor of SAT-Math scores followed by students' attainment in MAP-Language Usage which is a crucial skill for solving mathematics problems. On the other hand, students' attainment in MAP-Reading followed by MAP-Language Usage are the strongest academic predictors of students' SAT-English scores. The findings are aligned with previous studies' findings (Al-Alwan, 2009; Newton et al., 2007; Olani, 2009) about the role of students' current academic attainment as a strong predictor of academic achievement. The nature of the MAP as an adaptive assessment used to benchmark students against the USCCSS and to measure their progress (Cordray et al., 2013) provided the predictability of students' readiness for college (Cizek & Gierl, 2016; NWEA, 2012; Paul, 2015). Simultaneously, SAT scores have been utilised to be one of the significant factors that predicted students' college readiness and

achievement (Dale & Krueger, 2011). Accordingly, in the current study, concluding that students' MAP scores are strong predictors of SAT scores is logical.

The SAT-Math prediction equation indicated that the learner self-regard factor and feeling about school respectively have a higher positive contribution compared to the rest of the PASS factors within the affective domain. Previous studies which investigated the role of combined affective factors in students' mathematics achievement concluded what was found in the current study, that students' attitudes toward self, school, and learning are general predictors of academic achievement in mathematics (Grootenboer & Hemmings, 2007; O'Neal, 2019; Viljaranta et al., 2014; Zan et al., 2006). In the current study, the resulted SAT-English prediction equation indicated that students' confidence in learning has the highest contribution among all the PASS factors. This finding is supported by a previous study that found that only students' confidence in learning and attitudes to reading can predict variance in students' reading scores (McGeown et al., 2015). However, adding to the previous factors, students' enjoyment of learning to read is positively correlated with students' reading skills but could not predict the variance in reading scores (McGeown et al., 2015).

When looking at all the factors combined, similar empirical studies either proposed or explained models that predict learners' academic achievement based on the interrelation between cognitive, affective, and academic factors (Aiken, 1980; Duckworth & Kern, 2011; Stadler et al., 2016; Nasser, 2004; Stankov et al., 2012). Some of the models could explain a high percentage of variance in students' academic achievement, such as the one in the current study, but the difference is in the combination of those factors explaining the variance in students' achievement. Prediction models that combine multiple sub-factors and variables

within the factors concluded improved accuracy (R^2) and effect size compared to the models with an individual factor or variable type (Hong, 2018; Moakler & Kim, 2014; Wang, 2013) which was evident in the current study.

For instance, one of the previous studies concluded similar results, where students' attitudes toward mathematics, anxiety, motivation, and mathematical aptitude explained around 36% of the variance in students' achievement in statistics (Nasser, 2004). While students' aptitude alone could explain 22% of the variance, the rest of the variables explained 14% of achievement variance. In the current study the students' attainment in English and mathematics were added to the predictors which increased the percentage of explained variance in SAT-Math scores. Simultaneously, students' attitudes toward learning variables were included as a multivariable rather than individually. This change in the investigated model by including attitudes toward learning as a multivariable by having the attitude towards teachers, schools, and learners' characteristics within the affective domain is supported by previous studies (Chingos, Whitehurst & Lindquist, 2014; Detterman, 2016) and proved by theoretical and empirical research (Aiken, 1980; Duckworth & Kern, 2011; Stadler et al., 2016; Nasser, 2004; Stankov et al., 2012). Therefore, the current study models were found to explain 44.7% of the variance in SAT-Math scores with effect size of 0.808 while the percentage went down to 42.9% in SAT-English with effect size of 0.751.

The above finding about math scores is aligned with Gonzalez (2015), that students' current mathematics attainment and their aptitude level predicted 44% of their achievement in a high-stake math assessment. In contrast, the VR level of students who are English language learners was found to affect their results in the verbal battery of aptitude assessments and therefore sometimes differs from their achievement in English assessments (Lakin, 2012). That case is applied in MAP and SAT where the questions are contextually not similar to the verbal battery

in CAT4 so students might get the big idea and answer the questions correctly without the need to understand each word individually. Moreover, other studies revealed that the school effect can explain 40% of the variance in students' achievement (Coleman et al., 1966; Gamoran & Long, 2006). The following section will reflect on the contribution of each variable to the predicting models.

Although many factors within the affective domains had a positive relationship with students' SAT scores in English and math, other factors had a negative or no relationship with SAT-English and SAT-Math scores. The literature supports the role of learner self-regard, confidence in learning and general work ethic as affective factors contributing to students' personal characteristics and attitudes along with students' aptitude level to predict SAT scores (Detterman, 2016). Students' personal characteristics and aptitude level are proved to be more influential on SAT scores than the schools' and teachers' effect (Chingos, Whitehurst & Lindquist, 2014; Detterman, 2016). When looking at the different factors combined, MAP encompasses students' involvement in the ongoing reflection process at least two times per year after each MAP test, when students reflect on previous attainment scores, set goals based on their projected growth given by the MAP, then monitor their own progress toward achieving those goals (Carver & Scheier, 2009; Oettingen & Gollwitzer, 2009). This process of MAP goal setting, monitoring attainment and progress is what is defined by the Goal Setting Theory (Locke & Latham, 2002). Hence, the MAP goal-setting process entails developing students' metacognitive awareness; it also affects the individual self-regulation skills and attitudes toward learning (Banks, 2020; Pintrich, 2000a). Accordingly, learners demonstrate metacognitively and behaviourally active engagement in their learning process. This engagement enhances learners' self-regard, perceived learning capability, and performance goals, which are strong predictors of high academic achievement (Schunk & DiBenedetto, 2014; Senko & Harackiewicz, 2005).

6.1.3 Stakeholders' Perceptions about the Role of Attainment in MAP, Aptitude, and Attitude towards Learning in Students' SAT Achievement

Study findings from the stakeholders' questionnaires and focus group interviews were combined and compared to answer the last study question in depth and to triangulate findings from closed-ended questions, constructed response questions, and semi-structured interview questions. The following sections answer the third study question fully, concerning the stakeholders' perceptions about the role of attainment in MAP, aptitude level in CAT4, and attitude towards learning in students' SAT achievement.

6.1.3.1 Leaders' and Teachers' Perceptions about the Role of Attainment in MAP, Aptitude, and Attitude towards Learning in Students' SAT Achievement

Both leaders and teachers have high agreement with the role of students' current attainment in MAP, students' aptitude level, and attitudes toward learning in students' achievement in SAT. The highest number of years leaders and teachers used the assessments was in MAP, followed by CAT4, then PASS. Teachers had more experience in MAP than leaders. In general leaders had a higher relative agreement than teachers in all three factors: attainment, aptitude, and attitudes toward learning. The highest percentage of leaders (85.3%) agreed on the predictability of SAT scores using students' aptitude level, then a similar percentage of leaders (82.4%) agreed on the use of MAP and attitudes toward learning. Teachers' agreement was in a different order where the highest percentage of teachers (83.0%) agreed on the predictability of SAT scores using students' attitudes toward learning, then (74.5%) using the current academic attainment, followed by (66.0%) using aptitude level.

The above findings reflect the difference between leaders' and teachers' perceptions about aptitude assessment and its use to predict students' academic achievement. These findings are aligned with the debate in literature about the most impactful factor on students' achievement. The literature review pointed to the interrelated relationship between students' achievement, aptitude level, and attitude towards learning. Although educators and studies highlight affective factors' long-term impact on academic achievement, studies have prioritised cognitive factors (Gal & Ginsburg, 1994; Vaessen et al., 2017; Zieffler, Garfield & Fry, 2018).

By reflecting on leaders and teachers' explanations, it is clear that both believe that students' attainment in MAP can help in predicting SAT because MAP mainly measures students' subject knowledge, skills, and progress, which align with the SAT. Both groups strongly agreed that the most important use of MAP reports is to reflect on and improve learning outcomes. Leaders had significantly higher relative agreement than teachers on the role of aptitude in students' achievement in SAT. The highest agreement was on the use of CAT4 reports to understand learners' strengths and weaknesses while the lowest agreement was on using students' aptitude level to set SAT goals. Students' intelligence was found to significantly impact students' academic achievement in large-scale studies (Watkins, Lei & Carnivez, 2007); the same impact was proven when investigating students' abilities in specific subjects such as English and mathematics (Arens et al., 2017; Deary et al., 2007; Kaufman et al., 2012; Marsh et al., 2016; O'Neal, 2019), and music (Mosing et al., 2014).

The participants who supported that CAT4 can predict SAT based their reasons on the nature of SAT, that it requires reasoning skills, which are mainly based on students' cognitive ability level and potential. However, the opposing group believed that the nature of CAT4 assessment is totally different than the SAT, which requires mastery of subject knowledge and skills. The teachers' perceptions may be related to their low experience with using CAT4 compared to

MAP, where 48% of teachers have been using CAT4 for less than three years versus 24% of leaders. Previous studies recommended providing teachers with proper professional development to utilise the aptitude test results effectively to meet students' needs, predict their achievement, and give feedback on teaching and learning processes (Gonzalez, 2015).

The commonality between leaders' and teachers' perceptions was their least agreement on using students' MAP scores and aptitude level to set SAT goals. When they elaborated on that point later on during the focus group, they indicated that the practice of setting goals with students takes place using current academic performance and achievement without explicitly referring to the SAT as a target. Most leaders and teachers highly agreed with the role of students' attitudes toward school in their performance in SAT because they believe in the role of general positive attitude, students' self-regard, and motivation to succeed in students' performance. This finding is aligned with previous studies confirming that attitude has a higher impact on achievement than cognitive ability (Lipnevich, Preckel & Krumm, 2016). The main reason is the role of students' attitudes toward the subject on affecting the level of engagement and performance (Lipnevich et al., 2011).

When exploring leaders' perceptions and relating them to the three domains, namely academic, cognitive, and affective, they believe that current academic attainment is highly correlated with SAT scores. Nevertheless, they highlighted that SAT does not reflect the real aptitude level of the students if they are English language learners. The same applies to MAP. Accordingly, most leaders believe that students' aptitude level using CAT4 guides teachers and students to utilise learning styles to improve students' performance in MAP and SAT. They believe that students' attitudes toward learning results cover the psychological factors that affect students' achievement in SAT. Attitudes toward teachers, feelings about school, self-regard, confidence in learning, and preparedness for learning are the main factors that affect students' SAT scores.

In conclusion, leaders highlighted the strong role of those factors in students' achievement, but they did not have a solid, clear way to triangulate the data numerically to help in predicting SAT scores. However, they stated that data is used qualitatively to track students' performance and follow up on behavioural issues. Leaders confirmed what students agreed on, that they do not numerically link their scores in SAT to their academic attainment, aptitude level, and attitudes toward learning.

When exploring teachers' perceptions and relating them to the three domains, namely academic, cognitive, and affective, they pointed out that MAP does not predict SAT accurately because it is easier than SAT. Teachers shared the same perception as leaders, that students' aptitude level using CAT4 supports teaching for effective learning to meet all learners' needs. In contrast to leaders, teachers did not make the link between students' aptitude and their scores in SAT. This finding confirms the role of utilising the cognitive ability test results in planning and differentiation to meet students' needs and predict achievement (Gonzalez, 2015). Students' self-regard, general work ethic, confidence in learning, and preparedness for learning are highlighted as main factors that affect and predict students' SAT scores.

In conclusion, the findings from the interview and open-ended questions are aligned to the questionnaire results. Most teachers agreed about the predictability of SAT using the MAP scores. However, they added that it is not easy to link SAT scores to MAP scores. They agreed on the absence of a systematic way to predict SAT scores. Assessment reports are used for reflection purposes and for setting learning goals but are not related to SAT scores. Teachers indicated that they do not have specific plans for integrating the results of MAP, CAT4, and PASS to predict the SAT scores. Teachers referred to parents' and students' responses to assessment demands which is a well-known reason affecting how teachers communicate

assessment information. The literature showed that teachers might be affected sometimes by parents' attitudes towards their children's results, so they do not communicate assessment policies and details clearly with parents (Harris, 2015; Harris & Brown, 2013). Moreover, the regular comprehensive surveys about stakeholders' perceptions of K-12 assessments indicate that leaders' perceptions about assessment support the use of assessment for school improvement, while teachers prefer using different types of assessment to get a full picture about their students (Bobowski, 2016).

6.1.3.2 Students' Perceptions about the Role of Attainment in MAP, Aptitude, and Attitude towards Learning in Students' SAT Achievement

Students showed the highest relative agreement with the role of their current attainment in MAP, followed by attitudes towards learning, then aptitude level in achievement in SAT. The highest number of years students had participated in the assessments was in MAP, followed by CAT4, then PASS. Most of the students (76.0%) felt that MAP can predict SAT scores, while (73.9%) felt that their attitudes toward learning affect their SAT scores. The lowest percent of students (52.0%) felt that their aptitude can help in predicting SAT scores. Students showed the highest agreement in the use of MAP to understand their weaknesses and strengths in subjects. The lowest agreement is using MAP to set SAT goals. In contrast, students' highest agreement was with the belief that their aptitude level helps in improving SAT scores.

Students showed lower agreement with their use of the CAT4 report to improve learning strategies. According to their response related to their attitudes toward learning, students had the highest agreement with their satisfied feeling about performance. This response indicated their high self-regard and confidence in learning. Most of the students specified that their

attitude affects their SAT scores because if they have a positive attitude, they will be motivated, work hard, have high self-regard, and show a positive work ethic. The literature confirmed the factors that affect achievement in SAT such as students' characteristics, attitudes, and aptitude (Cullen, Hardison, & Sackett, 2004; Detterman, 2016). The findings from those studies gave more attention to the students' characteristics which decrease the role of teachers' effects or schools in academic achievement in the presence of variables related to students' characteristics or background (Chingos, Whitehurst & Lindquist, 2014; Detterman, 2016).

When exploring students' perceptions and relating them to the three factors, namely academic, cognitive and affective, students prioritised their current academic attainment and mastery of content knowledge and skills in English and math. Students' responses to the questionnaire are aligned with what they elaborated on during the focus group interview. From the students' perspective, there was no numeric connection between SAT scores and any other assessment. A large majority of students agreed on the relationship between MAP and SAT and the use of MAP to predict SAT scores. It was clear that students were highlighting that the more confident they are about their subject knowledge and skills, and prepared for learning by reflecting and setting goals, the more they will achieve their target. This is aligned with the body of literature about the metacognitive aspects of students' preparedness for learning and confidence associated with the intuitive answers that predict the likelihood that learners might change answers (Agus et al., 2016; Stankov, 2013; Stankov et al., 2012; Thompson et al., 2011). Moreover, students who believe in their perceived academic control tend to have a high academic achievement (Richardson, Abraham & Bond, 2012; Stupnisky et al., 2012), utilise metacognitive strategies (Perry et al., 2001) and self-regulated learning and goal-setting strategies (Stankov et al., 2012; Phillips & Gully, 1997).

Students highlighted that their aptitude level and specifically CAT4 report is mainly for improving learning skills, enhancing the learning experience, and teaching strategies to meet their learning needs but there is no connection to SAT scores. They believed that attitude towards learning is a significant factor that impacts their academic performance. Almost all students highlighted attitudes to the subject and teacher, feelings about school, self-regard, confidence in learning, response to curriculum demands, and preparedness for learning as factors affecting their performance in school in general and achievement in SAT. The literature supports those findings (Detterman, 2016; Duckworth et al., 2007; Duckworth & Quinn, 2009; Sebesta, 2019) where students' positive attitude towards their teachers and the feedback provided by teachers affects students' self-concept (Prince & Nurius, 2014), helps them develop positive relationships with peers and positive attitudes toward learning in general (Calero et al., 2014; O'Neal, 2019).

Those findings are grounded to the SCLT (Schunk, 2012) proving the effect of student-teacher relationships on students' feelings about school, sense of belonging at school (Finn, 1989; Voelkl, 1997), and attitudes toward teachers and school (Elliot & Dweck, 2005; Radcliff et al., 2010). Interestingly, students did not highlight any attitude related to their perceived learning capabilities which involves determination, grit, and openness to learning. In contrast previous studies found that students' determination is one of the influential factors that play a main role in academic achievement, more than the school or teachers (Cullen, Hardison & Sackett, 2004; Detterman, 2016; Sebesta, 2019). Studies that explore students' perceptions about the role of assessment in achieving their goals are still underdeveloped (Christian, 2017; Vaessen et al., 2017).

6.1.3.3 Parents' Perceptions about the Role of Attainment in MAP, Aptitude, and Attitude towards Learning in Students' SAT Achievement

In general, parents' perceptions about SAT are that it is a hard and challenging exam. However, they believe it to be useful and a necessary indicator of college readiness. Parents did not, however, seem to have deep knowledge about SAT. Most parents agreed that MAP helps to improve students' academic levels and SAT scores. Few parents saw that MAP does not affect students' achievement in SAT. Parents supported the benefit of academic assessments to understand their children's readiness and they pointed to the importance of school communication related to that. Similar findings were concluded previously where parents were found to be more supportive of comparative use of MAP data than teachers, because comparative studies helped them understand their students' achievement level (Harris, 2015).

Parents highlighted that students' aptitude level can be a tool to understand learning preferences and to enhance academic performance and achievement in general. Students' motivation and attitudes toward teachers and subject were highlighted as important factors that affect SAT scores. Parents only highlighted the role of students' readiness, test-taking skills, and attitude, particularly motivation, as the strongest indicators that affect SAT scores. They connected the SAT score to the students' academic attainment but not explicitly to the MAP.

Parents' perceptions are aligned with teachers more than leaders. Interestingly, the literature review about parents' perceptions and attitudes towards school assessment concludes that once parents have a clear understanding about assessments, they fully support the assessment practices and teachers' judgement (Harris, 2015). Empirical studies have occasionally explored parents' perceptions about assessments and indicated that most parents found that using multiple assessments is helpful to provide feedback to the teachers and enhance students' learning process (Bobowski, 2016); they support implementing standardised assessments (Brookhart, 2013), and in some cases they prefer traditional assessments and reports

(Culbertson & Jalongo, 1999). Parents were found to support assessment and reporting because they provide them with tangible points to discuss their children's achievements (Harris, 2015).

When exploring parents' perceptions and relating them to the three domains, namely academic, cognitive, and affective, current subject attainment is revealed as the most important factor impacting SAT scores; this is followed by attitudes toward teachers, self-regard, preparedness for learning, and response to curriculum demands. Parents did not make any direct connection between MAP scores or CAT4 level and SAT scores. However, parents indicated that students' aptitude level can help in enhancing students' preparedness for learning, and then improve academic achievement. Therefore, students' aptitude level has an indirect relationship with academic achievement.

Parents' and students' perceptions are aligned where both referred to the importance of school guidance and engaging stakeholders in understanding the assessments and connecting them to maximise students' achievement. These findings are supported by other studies in the field where parents voiced their need to be supported by schools to understand the purpose and results of assessment, in order to support their children's learning (Bobowski, 2016; Popham, 2016). Parents' perceptions are aligned with other studies that investigated several factors and found that students' academic attainment was the strongest predictor of overall academic achievement (Al-Alwan, 2009; Newton et al., 2007; Olani, 2009), followed by other factors including aptitude level, gender, stress, and parents' education level.

6.2 Summary

Identifying the variables playing a main role in students' academic achievement and investigating them within the academic, cognitive, and affective domains is challenging due to interrelation between factors. However, the concluded relationship between variables showed

a variance in the role of students' achievement in SAT-Math and SAT-English scores. In the current study, the investigated factors comprised thirteen variables: MAP-Math, MAP-Reading, and MAP-Language Usage scores, aptitude level (CAT4), and nine PASS factors within students' attitudes towards learning. The findings are aligned with the literature, that previous academic attainment was the strongest predictor of academic achievement (Al-Alwan, 2009; Newton et al., 2007; Olani, 2009), followed by the rest of the factors. Interestingly, attitude towards teachers was not one of the predictors, although leaders', students', and parents' perceptions pointed to attitudes toward teachers as a strong predictor of students' achievement and engagement in a subject. However, as stated earlier in this chapter, Chingos, Whitehurst and Lindquist (2014) and Detterman (2016) highlighted that teachers' effect as a major contributor impacting students' achievement decreases when other factors related to students' characteristics or background are included.

Two prediction models were concluded and were tested and proved to be valid. The first equation predicted SAT-Math scores and could explain 44.7% of the variance in SAT-Math scores with effect size of 0.808. The second equation predicted SAT-English scores and could explain 42.9% of the variance in SAT-English scores with effect size of 0.751. Studies in the field of data mining and predicting students' performance are rapidly increasing in education to help in early intervention, to maximise achievement, and to investigate and design prediction models about possible factors related to students' aptitude and academic achievement (Brunner, Ludtke & Trautwein, 2008; Chen et al., 2012). Several studies have indicated the predictability of students' achievement in the summative assessments (CTB/McGraw-Hill, 2009; Gonzalez, 2015; NWEA, 2013; Reggianini, 2017) using benchmark assessments (Gonzalez, 2015), aptitude tests (Finn et al., 2014), and attitudes toward self and school indicators (Shepard & Penuel, 2017; Volpe, 2016).

Predicting students' academic achievement based on a combination of different factors within academic, cognitive, and affective domains is evident in research but mainly using two factors rather than three (CTB/McGraw-Hill, 2014; Finn et al., 2014; Gonzalez, 2015; Lipnevich et al., 2011; Reggianini, 2017; Shepard & Penuel, 2017; Volpe, 2016). A great body of literature has examined the relationship between students' characteristics and academic achievement to find the different variables that might affect students' achievement which have come into focus and debate (Detterman, 2016). For example, certain studies even argued that confidence could be a better predictor of academic achievement than self-efficacy (Stankov et al., 2012). In the current study, the findings from the analysis of assessment scores and stakeholders' perceptions are aligned on variables that play a role and predict students' achievement in SAT such as current academic attainment in English and mathematics. Moreover, the findings from both types of data pointed to misalignment in conclusion where the assessment scores showed the absence of the relationship between the students' 'attitudes toward teachers' factor and SAT achievement while stakeholders' perceptions were opposed to that finding. Learners' self-regard, perceived learning capabilities, confidence in learning, and response to curriculum demands were found to be the common attitude factors that are positively correlated with both SAT-English and math. Therefore, the study findings identified common factors that contribute to students' academic achievement which help schools in nurturing them and tracking their progress.

The findings from the study supported the role of educational assessments as powerful tools that provide feedback regarding the curriculum, teaching, and learning processes. Assessment for comparability and accountability purposes is valuable but at the same time, assessment is at the heart of political and policymakers' debates (Harris & Brown, 2009). In the UAE, assessments play a main role as key performance indicators reflecting the education sector's progress toward achieving the UAE's vision and national targets (UAE Centennial 2071;

2021). Students' attainment level in MAP, aptitude level in CAT4, and attitudes toward learning (PASS) have been triangulated to provide feedback regarding curriculum design and adaptation, teaching and learning skills, quality of internal assessment, use of assessment data, students' attainment and progress, students' personal and social development, and the quality of leadership. Therefore, the current study findings contribute to the body of knowledge about the use of different types of assessment and their role in predicting students' academic achievement. The findings can assess the quality of education offered in the schools.

Chapter Seven:

Conclusion and Recommendations

Chapter seven covers the conclusion and discussion of findings regarding the relationship between the used assessments, the prediction equations, and the stakeholders' perceptions. The summary of key findings and conclusion is discussed in light of their relevance to the theoretical and conceptual framework supported by the literature review. The chapter also includes the implications, limitations, and recommendations for future research.

7.1 Conclusion

The current study investigated the role of students' attainment, aptitude level, and attitudes toward learning in students' achievements in SAT. Four types of assessment implemented in US-curriculum schools in the UAE were utilised in the study: MAP, CAT4, PASS (predictors) and SAT (dependent variable). Following a sequential explanatory mixed-method design, over two phases, the relationship between the assessments was established, then two regression models and prediction equations were formulated to predict SAT-English and SAT-Math scores using students' attainment (MAP-Math, MAP-Reading, MAP-Language Usage), aptitude level (CAT4), and attitudes toward learning (PASS, nine factors). Finally, findings from analysis of assessment results were joined with more breadth and in-depth investigation

supported by stakeholders' perceptions about the role of the three different types of assessment in students' SAT achievement. Leaders, teachers, students, and parents were the targeted stakeholders in the study.

The study questions were fully answered where the results showed that attainment, aptitude and attitudes toward learning factors within the academic, cognitive, and affective domains explained 44.7% and 42.9% of the variance in students' academic achievements in SAT-Math and SAT-English respectively with overall effect sizes of 0.808 in SAT-Math and 0.751 in SAT-English. The effect size of individual factors varied from zero to 0.072. The results of the study emphasise the line of research that supports the positive relationship between each of students' academic attainment, aptitude, and attitudes toward learning and their academic achievement (Berkowitz & Stern, 2018; Detterman, 2016; Gonzales, 2015; Reggianini, 2017). Moreover, the study findings concluded an increase of the predictability percentage of students' achievement when the predictors are two or more different types of predictors rather than only one (Beesley et al., 2018; Chen et al., 2012; Detterman, 2016; Marshall, Smart & Alston, 2017). The researcher created Tables (7.1) and (7.2) to summarise and illustrate the relationships between the study variables.

The relationship between MAP, CAT4, PASS and SAT-Math	
---	--

	Legend: — Strong Positive Correlation - - - Moderate Positive Correlation Small Positive Correlation - . - . Small Negative Correlation - No line No Correlation
Prediction equation	SAT Math = 335.877 + 1.021(MAP Math) + 0.083(MAP Reading) + 0.201(MAP Language) + 7.258(CAT4 Aptitude) + 0.254(PASS1 Feeling about School) + 0.126(PASS2 Perceived Learning Capability) + 0.381(PASS3 Learner Self-regard) + 0.032(PASS4 Preparedness for Learning) - 0.178(PASS5 Attitude to Teachers) - 0.268(PASS6 General Work Ethic) + 0.176(PASS7 Confidence in Learning) - 0.166(PASS8 Attitudes to Attendance) - 0.180(PASS9 Response to Curriculum Demands)

Table (7. 1): The Relationship between Students' Attainment, Aptitude, Attitudes toward Learning & SAT-Math

The relationship between MAP, CAT4, PASS and SAT-English	
--	--

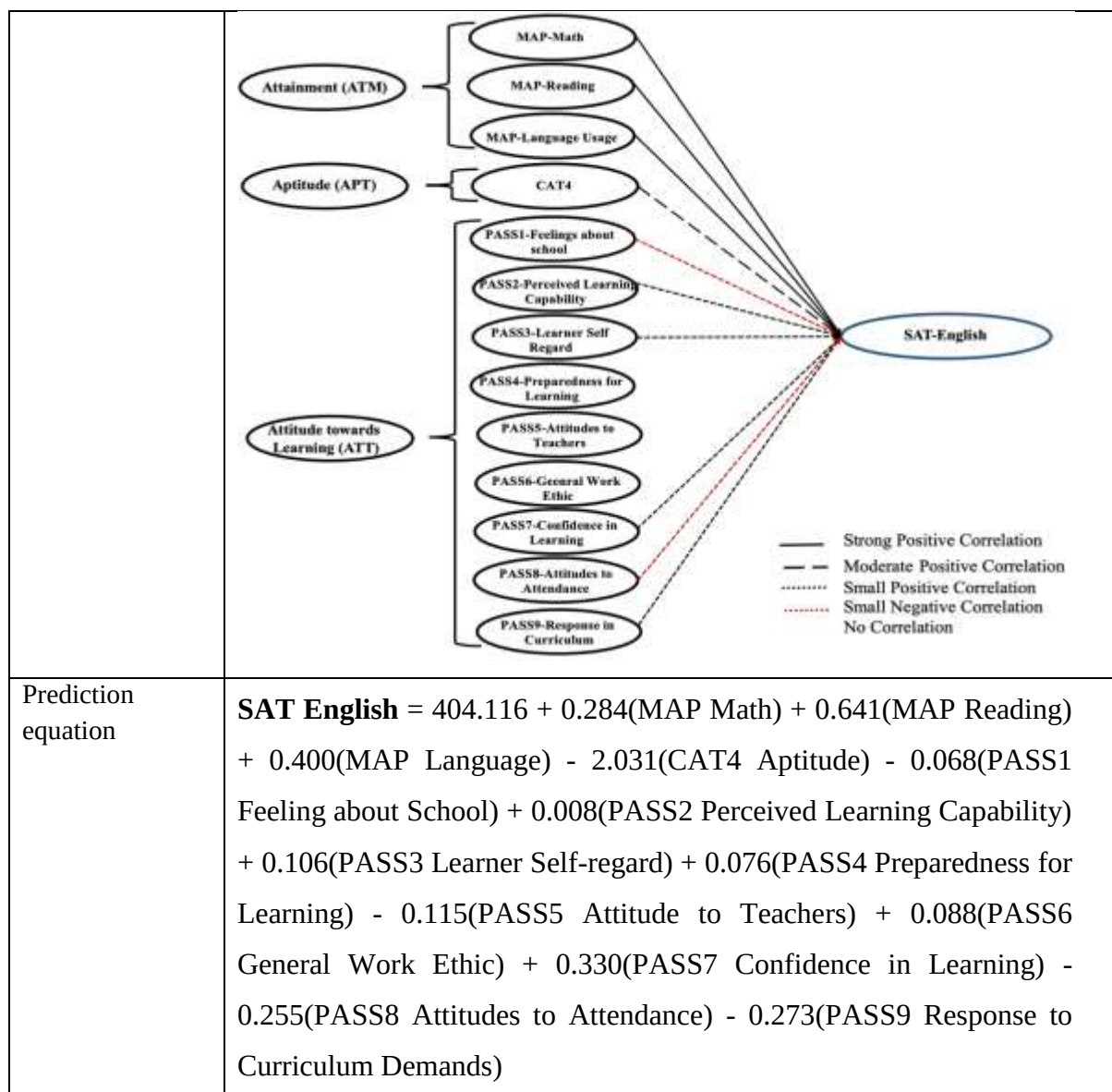


Table (7. 2): The Relationship between Students’ Attainment, Aptitude, Attitudes toward Learning & SAT-English

7.1.1 Attainment, Aptitude, and Attitude Factors within Academic, Cognitive, and Affective Domains

As shown in the figures above, the study found a strong positive relationship between students’ attainment in MAP-Reading, MAP-Language Usage, and MAP-Math and their achievement in both SAT-English and SAT-Math. There was a strong positive correlation between students’ achievement in SAT-Math and SAT-English, between MAP-Reading, MAP-Language Usage and MAP-Math, and between CAT4 and MAP-Reading, MAP-Language Usage and MAP-Math scores. There was also a small positive correlation between CAT4 and each factor of the

PASS, except Learner Self-regard, which had a moderate positive correlation with students' aptitude level. This indicates that students' achievement across subjects is consistent and aligned with their aptitude level. As shown in the figures, there is a strong positive relationship between students' aptitude and their achievement in SAT-Math, while there is a moderate positive correlation with SAT-English. This finding confirmed previous studies that indicated the role of learners' aptitude in academic attainment, and this role varies based on the academic subject (Donati, Meaburn & Dumontheil, 2019; Latzman et al., 2010).

All stakeholders participating in the study, including leaders, teachers, parents, and students, strongly agreed on the positive relationship between students' current academic attainment in English and math and their achievement in SAT. Although there was a difference in levels of agreement between leaders, teachers, students, and parents on the predictability of SAT scores by attainment scores in MAP, the overarching agreement was on the use of those assessments. The stakeholders mainly agreed on the use of assessment to reflect on students' current level, understand their learning needs, and customise the learning experience to enhance achievement and learning skills. Leaders seemed to have deeper understanding of each type of assessment, while teachers' perceptions are closer to parents' and students' perceptions. These findings are expected because it has also been highlighted in educational reforms and large-scale surveys that teachers communicate the assessment goals and feedback with students and parents in a way they can understand (Bobowski, 2016; Harris, 2015; Popham, 2016).

Students' aptitude level was looked at in the current study as a supporting tool that helps educators to understand students' learning needs and to provide feedback regarding teaching and learning processes. However, although assessment scores analysis showed that aptitude had a moderate to strong positive relationship with SAT scores, stakeholders' responses did not indicate a clear understanding of the nature and use of the CAT4 reports. Leaders were the

only participants who valued the aptitude factor over the attainment and attitudes toward learning factors. This was reflected in their reasons and experience. Similar previous findings pointed to the need to provide teachers with professional development to effectively use aptitude assessment reports (Arens et al., 2017; Gonzalez, 2015). Leaders, teachers, and students looked at the MAP as a tool that benchmarks students' subject knowledge and skills and as a reflection tool that helps in setting goals and enhancing students' metacognitive awareness.

One of the common practices highlighted in the study was the use of the MAP goal-setting sheet, which involves a process of reflection on current achievement, setting an action plan to achieve the new projected growth automatically assigned by the MAP, then monitoring the progress toward that target after the next MAP assessment. The whole process when combined with the use of the CAT4 report to understand students' learning strengths, weaknesses, and needs implicates reflection and self-regulation skills that are proven to develop students' metacognitive awareness (Collins, 2011; Davis, 2003; Hennessey, 1999; Nelson, 1992; Schraw & Dennison, 1994; Wiezbicki-Stevens, 2009). It is important to consider that engaging students in metacognitive thinking requires teachers' understanding and clear guidance on the use of assessment and the ability to be metacognitively aware (Abdul Hadi, 2014; Ku & Ho, 2010; Rahman, 2011).

The study findings regarding students' attitudes toward learning factors support the literature. As shown in the tables above, perceived learning capability, learner self-regard, confidence in learning, and response to curriculum demands are the only common PASS factors that have a positive relationship with students' achievement in both SAT-Math and SAT-English. When looking at the nine PASS factors that contribute to students' attitudes toward learning and their achievement in SAT, there was a variation in the relationship between each factor and students' achievement in SAT-Math and SAT-English. The findings concluded a positive relationship

between perceived learning capability, learner self-regard, confidence in learning, response to curriculum and both SAT-English and SAT-Math; students' preparedness for learning had a small positive relationship with SAT-Math. Attitudes toward teachers and general work ethic were common in having no correlation with achievement in both SAT-Math and SAT-English. Feelings about school and attitudes to attendance have a small negative correlation with SAT-English and no correlation with SAT-Math. Self-regard was the only factor that had moderate positive correlations with both SAT-English and SAT-Math. Students with a positive attitude towards self and school tend to be self-regulated learners who have perceived learning capabilities, positive self-regard, utilise different learning strategies, monitor and control learning processes, and closely monitor their own progress (Christian, 2017; Schunk, 2001; Zimmerman, 2001).

Teachers, students, and parents supported the role of students' attitudes toward learning in their achievement in SAT. A positive attitude has been considered the key to enhancing learners' self-regard, feelings about school, and response to curriculum demands. Adding to the previous factors, leaders highlighted the importance of preparedness for learning and confidence in learning. Although the participants considered attitudes toward learning as having the most impact on students' SAT scores, the analysis of the assessment data indicated that MAP and CAT4 had stronger positive correlations than PASS. The literature showed studies which supported the participants' point of view (Lipnevich, Preckel & Krumm, 2016) due to the role of students' attitudes toward the subject affecting the level of engagement and performance (Lipnevich et al., 2011). Previous studies highlighted the same findings where educators argued the long-term impact of affective factors on academic achievement; thus, those studies have prioritised cognitive factors (Gal & Ginsburg, 1994; Vaessen et al., 2017; Zieffler, Garfield & Fry, 2018).

As shown in Tables (7.1) and (7.2) above, the two formulated prediction equations of SAT-English and SAT-Math illustrate the contribution of the predictors. CAT4, MAP-Math, and learner self-regard had the highest contribution to predict SAT-Math with regression coefficient of 7.258, 1.021, and 0.381 respectively. Although the overall prediction size of SAT-Math by MAP, CAT4, and PASS is 0.808, only MAP-Math had a small effect size (0.072) while the rest of the predictors' effect sizes are below 0.02. On the other hand, MAP-Reading, MAP-Language Usage, and confidence in learning had the highest contribution to predict SAT-English with regression coefficient of 0.641, 0.400, and 0.330 respectively. The overall prediction size of SAT-English by predictors is 0.751 where MAP-Reading and confidence in learning had small effect sizes of 0.023 and 0.015 respectively.

The commonality between the two equations is that students' current MAP attainment in math, reading and language usage had a high contribution to predict students' SAT achievement in the questions related to that subject within the SAT. Specially that students' language usage skills and reasoning skills are crucial in understanding the SAT questions. MAP-Language Usage was found to be one of the factors that contributed to SAT-Math prediction ($B = 0.201$, $f^2 = 0.002$) and SAT-English prediction ($B = 0.400$, $f^2 = 0.008$), especially when answering contextual and problem-solving questions. The concluded results are aligned with the findings from the stakeholders' perception questionnaires and interviews where they all had strong relative agreement with the impact of MAP scores and reports on students' understanding of their strengths and weaknesses, improving their subject knowledge and skills, helping students monitor their progress, and enhance performance in SAT in general.

By looking at the other predictors of SAT in the equations, students' aptitude level along with learner self-regard, followed by feelings about school within the PASS factors had the highest contribution toward predicting SAT-Math scores, while confidence in learning had the highest

contribution toward predicting SAT-English scores. There was a variation in levels of agreement with those factors by stakeholders. For instance, leaders and students had higher relative agreement than teachers regarding the impact of aptitude level on SAT scores. At the same time, learner self-regard and confidence in learning were highlighted by stakeholders. It is also important to highlight that all stakeholders referred to students' motivation and aspiration to learn and to reach targets as predictors of students' achievement in SAT. However, this factor, which represents the general work ethic, was proven to significantly predict SAT scores, although negatively. Moreover, the stakeholders' perceptions highlighted other factors such as attitudes toward teachers, feelings about school, and response to curriculum demand, which were not proven to be predictor of SAT scores.

The study findings reflect the debate in literature about the most influential factors in students' achievement. Throughout the literature, students' achievement, aptitude, and attitude towards learning appear to be interrelated. The literature concludes that the more variables and factors related to academic achievement the research investigates, the more accurate and deep information the findings' conclusions will be (Gonzalez, 2015; Thum, 2011). By looking at the factors compiled from the assessment data and stakeholders' perceptions, the relationship between the different cognitive and affective factors can be looked at from different dimensions within the educational context.

The SCLT (Schunk, 2012) shed light on the relationship between the different factors of students' attitudes toward learning, where each student has different characteristics and learning experiences that affect their self-regard, confidence in learning, perceived learning capabilities, and preparedness for learning, which impact their self-efficacy for self-regulation and academic performance (Christian, 2017; O'Neal, 2019; Stajkovic et al., 2018; Viljaranta

et al., 2014). Accordingly, those factors affect their feelings about school and teachers, general work ethic, and response to curriculum demands (Polychroni, Hatzichristou & Sideridis, 2012). The practice of using MAP goal sheets that involve reflection and learning strategies within the self-regulation framework (Mayer, 1998; Pintrich, 2000; Zimmerman, 2001) enhances students' metacognitive awareness and skills (Banks, 2020).

Learners' aptitude levels represent verbal, quantitative, and non-verbal reasoning, along with spatial ability that reflect students' responses to different stimuli that trigger their memory, mental activities, and reasoning skills (Gonzalez, 2015; Mayes et al., 2014; Moore, Carlson & Oehrtman, 2009). The effective assessment process provides students with consistent, constructive feedback and enhances reflection to help students learn from their mistakes, set new targets, and develop self-regulated skills (Garcia & Lang, 2018; McTighe & Ferrara, 2021). The whole process is defined by the Metacognitive Learning Theory (Schraw & Moshman, 1995), Information Processing Theory (Mayer, 1996; Schunk, 2012), and Goal Setting Theory (Locke & Latham, 2002), where students' developed learning skills and metacognitive awareness play the main role as a mediator variable in the effect of aptitude and attitude towards learning on students' academic achievement (Christian, 2017; Schwinger et al., 2009).

7.2 Implications and Contribution

The study findings shed more light on the use of implemented assessments from a data perspective and stakeholders' perceptions. First, the study developed two regression models and prediction equations that predict students' scores in SAT-Math and SAT-English using their current MAP-Math, MAP-Reading, MAP-Language Usage, CAT4, and PASS scores. The equations help in predicting students' SAT scores as early as the MAP, CAT4, and PASS

scores, especially as the students starting from Grade 3 take MAP three times per year, and CAT4 and PASS every two years. Accordingly, predicting students' SAT scores can start as early as the data is available to follow up on students' progress if the students are on track to achieve the required target in SAT. The more accurate and early schools can predict how a student will perform on future assessment, the more intervention and enrichment plans can be implemented based on students' achievement level before the summative achievement assessment at the end of the school year.

Predicting students' academic achievement helps teachers to plan intervention plans for both underachieving and outperforming students, to provide feedback regarding the curriculum, assessment, teaching and learning processes, and to identify cognitive and affective factors that contribute to students' performance. One of the highlighted practices in the current study is the use of metacognitive tasks that are based on students' reflection and goal setting. Including explicit metacognitive activities in instructional programmes is well supported in literature. Schraw and Moshman (1995) highlighted the importance of including the justification for the significance of metacognitive theorising and giving explicit examples/models that reflect the metacognitive theories in practice. As concluded from teachers' and students' self-reporting statements and interviews, experience of the process of taking assessments and using metacognitive strategies helped teachers and students reflect on their performance and how they can plan to achieve their goals. This process helped in understanding students' learning needs, their attitudes toward learning, and how teachers can support underachieving and outperforming students academically and psychologically.

The study helped in understanding the relationship between different factors that play a main role in students' academic achievement. Understanding the relationship between the obtained information from different types of assessment and students' predicted scores can help schools

when developing their school self-evaluation process and improvement plans. As schools in the UAE are expected to implement specific attainment, aptitude, and attitude assessments (UAE Government, 2019), finding a systematic method that can help school leaders utilise the data from those assessments is crucial. Utilising different assessment scores by comparing students' attainment and progress data to internal and external assessment benchmarks and triangulating attainment, aptitude, and attitude data are part of the school inspection framework in the UAE. The study implicated that school improvement plans should be targeting students' academic, cognitive, and social development based on the influential factors identified in the study.

The study also developed three valid and reliable self-reporting tools that could be used to collect leaders', teachers' and students' perceptions about the different types of assessment implemented in the school. Using these self-reporting tools provides schools and policymakers with information about stakeholders' perceptions about the assessments, the use of assessment data, and reports and the practices that can enhance the use of assessment information. Information collected from stakeholders' perceptions can be triangulated with assessment data analysis to provide feedback for school improvement plans and guide the review process of curriculum and assessment policies. The collected feedback from stakeholders helps the school to identify the stakeholders' needs for professional development and training to understand the assessment characteristics, to effectively use the different assessments, and to monitor the use of assessment information in the classroom.

The study results reflected the misalignment between teachers' and leaders' understanding about the assessments. Moreover, leaders' relative agreement on the role of students' attainment, aptitude, and attitudes toward learning in academic achievement was higher than the teachers. The teachers' responses indicated the need for clear communication of

assessment policies, expectation about the use of assessment data, and importance of communicating the purpose and feedback from assessments with stakeholders. The literature showed that teachers have a significant impact on teaching and learning processes and, consequently, the quality of education (Johnson, 2016). So, as stated earlier, this means that the designed curriculum and implemented assessment processes should include explicit, clear teaching and learning strategies that include teachers' positive, constructive feedback and students' reflection.

The findings highlighted the importance of exploring students' perceptions about factors that might affect their performance. Accordingly, the study helps bridge the potential discrepancies between learners' perceptions and implicit theories to develop proper intervention plans (Christian, 2017). Moreover, there is a need to develop students' and parents' understanding of the nature of the assessments and their use. This finding points to the important role of counselling and induction/orientation that can help both parents and teachers understand the purpose and use of each type of assessment and report. This is highlighted by the literature, which indicated the importance of educational counselling to support parents and teachers (Rindermann, Baumeister & Groper, 2014). Students and parents confirmed during the interview that if they knew the benefit of each assessment earlier, they would have taken it more seriously and utilised it in a different way.

7.3 Limitations

The limitations of the current study will be discussed to shed light on aspects that can be considered in future research. Although the sample size was proven to be statically adequate, the study limitation related to sample size is highlighted for the following three reasons. First, the sampling was not random because the purpose of the study was to investigate the role of the implemented specific assessments (MAP, CAT4, and PASS) in students' achievement in

SAT. Therefore, only schools and students who participated in those assessments specifically were purposefully part of the study which limited the number of participating schools. Accordingly, the researcher targeted all the schools implementing MAP, CAT4, PASS, and SAT assessments without any exclusions. Second, based on the targeted schools, the concluded prediction equations for SAT-English and SAT-Math using MAP, CAT4, and PASS can be generalised only in any school implementing those assessments and cannot be generalised to all US-curriculum schools. Third, another limitation is related to the great difference in sample size between the number of students who took the SAT-English and SAT-Math, as students took another English proficiency test instead of SAT-English. Having a higher number of participants in SAT-English will increase the reliability of the study findings related to that.

The results from the focus group research cannot be considered representative of any population segment or a point of view of a specific target audience due to purposive sampling having been employed and the small sample sizes (Plummer-D'Amato, 2008). Furthermore, the non-random method of recruitment and the small size of the sample do not permit this type of generalisability. However, the results of the focus groups reported in the present study can provide a great deal of rich insight into the relevant aspects of the topics discussed and should be used accordingly (Fraenkel, Wallen & Hyun, 2015). At the same time, the sampling of parents and students who participated in the interview was supposed to be selected based on criteria to form the focus group. However, due to the restriction during the COVID-19 pandemic, the researcher had to change the sampling to a convenient one.

The last limitation is related to the focus of the questionnaires on a specific subject. The questionnaires consisted of 30 self-reporting items categorised under three factors, namely academic attainment, aptitude, and attitudes toward learning within academic, cognitive, and affective domains. Targeting a specific subject in the questionnaires' items might add depth

and cover the study from a different perspective, especially since each subject has its own characteristics which might affect the stakeholders' perceptions about their performance and attitude related to this subject.

7.4 Recommendations for Future Research

The main purpose of the study was to investigate the relationship between the different types of assessment carried out in US-curriculum schools in the UAE to create prediction equations for students' SAT-Math and SAT-English scores. The study explored the stakeholders' perceptions about the role of each assessment on students' academic achievement in SAT. The recommendations cover points related to the implementation and practices in schools and areas that require future research.

For instance, in the current study, students' attainment, aptitude, and attitudes toward learning varied in the percentages (44.7%, 42.9%) that explained the variance in SAT-Math and SAT-English scores with effect sizes of 0.808 and 0.751 respectively. This means that around 55% of the variance in students' SAT scores can be explained by other factors. Moreover, although the overall effect size of factors combined is considered large, the effect size of each variable individually within the main factors was small to medium or below, according to Cohen (1988). Only MAP-Math had medium effect size on SAT-Math, while MAP-Reading and confidence in learning had small effect size on SAT-English. Accordingly, the above findings point to the recommendation to investigate different variables within each factor to shed more light on their effect size on students' academic achievement. Moreover, conducting similar studies using different academic, cognitive, and affective factors in different subjects will add more depth to the impact and use of each assessment across different subjects. The shifts in the role of different types of assessment implemented in schools have significant impacts on changing the

school improvement plans to enhance learning. Consequently, the findings will help in developing school self-evaluation plans and to provide feedback regarding progress for school improvement plans, especially since the predictability of subject-specific academic achievement based on the combination of students' current attainment in specific subject, aptitude, and attitude towards that subject is not fully established in literature.

There are a considerable number of studies exploring teachers' and students' perceptions and views about their attitudes towards assessments (Brown, 2008; Dutro & Selland, 2012; Harris, 2015; Harris & Brown, 2009, Harris, Harnett & Brown, 2009; Hirschfeld & Brown, 2009; Klinger & Rogers, 2011; Remesal, 2011), however, parents' perceptions are only occasionally explored. Conducting studies that collect quantitative and qualitative data about parents' perceptions will help in addressing their needs for training and to provide feedback to understand the aim behind assessments and how to support their children. The recommendation is to enhance communication among stakeholders about the purpose and results of different types of assessment to maximise the benefits, to gain stakeholders' buy-in and accountability (Popham, 2016).

The goal and value of assessments are gained when assessments' purposes and results are communicated clearly with stakeholders. Simultaneously, when assessments' purposes do not match the types to enable taking the right decisions and to provide feedback to policy makers and educational reforms, they are considered off-target assessments (Popham, 2016). The stakeholders' questionnaires and interview findings indicate that stakeholders' perceptions, including leaders, teachers, parents, and students, conclude that leaders believe that different types of assessment are beneficial to impact their schools' improvement plans; teachers report that assessment is utilised for differentiation, instructional strategies, and schools' administrative reasons; parents and students favour the assessments that provide students with

feedback to improve learning and they highlight the need for support to understand the purpose and use of each assessment. The study recommends having a systematic process in schools that explores stakeholders' perceptions to identify the need for training for each stakeholder group. A continuous engagement session for parents and clear communication are recommended to keep parents informed in order to support their children. Other training should take place for leaders and teachers.

Teachers are generally more confident about administering assessments than interpreting assessment data and communicating it with stakeholders. The role of data coaches in schools is crucial to support teachers' understanding of assessment and to improve students' performance. Therefore, data coaching and forming data teams to support data-driven decisions are recommended to ensure the alignment between curriculum, assessment, and instruction.

One of the study objectives was developing prediction equations for students' SAT scores. Since the study followed the explanatory mixed-method research design, generalisation was not a target of the study. Therefore, repeating the study on a bigger scale would be beneficial to generalise the study findings.

Hattie (2015) highlighted the effect size of feedback and reflection on maximising the impact on learning. Since metacognitive awareness underpins the assessment processes, investigating students' learning skills and attitudes toward learning by investigating and exploring teaching and learning strategies, classroom observations, and implemented programmes in the school that can help in developing students' self-regulation skills and positive attitudes toward learning are recommended for further research.

References

- Abdul Hadi, L. (2014). *Investigating Metacognitive Awareness and Self-Efficacy of High School Students through Prompted Reflections in Mathematics and science*. MEd. Dissertation. British University in Dubai.
- Abu Dhabi Department of Education and Knowledge (ADEK). (2012). Abu Dhabi Education Reform: The Road to 2030 [online]. Abu Dhabi: ADEK [Accessed 20 March 2019]. Available at: https://centres.insead.edu/innovation-policy/events/policy-breakfasts/documents/ad_edu_ref_pres-2012april.pdf.
- Abu Dhabi Department of Education and Knowledge (ADEK). (2020). *Abu Dhabi: ADEK*. Retrieved from <https://www.adek.gov.ae>
- Abu Dhabi Statistics Centre. (2019). Social Statistics – Education: Schools, Classrooms, Pupils, Teachers and Administrators in Government and Private Education. Abu Dhabi: Government of Abu Dhabi. Retrieved from: <https://www.scad.gov.ae/ar/pages/statistics.aspx?topicid=23#>
- Aeby, V., Manning, B., Thycr, B. & Carpenter-Aeby, T. (1999). Comparing outcomes of an alternative school program offered with and without intensive family involvement. *School Community Journal*, vol.9, pp. 17-32.
- Agus, M, Pennaa, M.P., Però-Cebollerob, M., Guàrdia-Olmosb, J. & Pessac, E. (2016). Investigating the probabilistic reasoning in verbal–numerical and graphical–pictorial formats in relation to cognitive and non-cognitive dimensions: The proposal of a model. *Personality and Individual Differences*, vol. 94, pp. 44-53
- Ai, X. (2002). Gender differences in growth in mathematics achievement: Three-level longitudinal and multilevel analyses of individual, home, and school influences. *Mathematical Thinking and Learning*, vol.4(1), pp. 1-22.
- Aiken, L. R. (1980). “Attitudes measurement” research," in D.A Payne (ed). *Recent developments in affective measurement*. San Francisco: Jossey-Bass, pp. 1-24.
- Al-Alwan, I. A. (2009). Association between scores in high school, aptitude and achievement exams and early performance in health science college. *Saudi Journal of Kidney Diseases and Transplantation*, vol.20(3), p. 448.
- Alonazi, A. (2018). *Psychological, Academic and Demographic Variables Affecting Students’ Academic Achievement among First Year College Students in Saudi Arabia*. EdD. Dissertation. University of the Pacific Stockton, California

- Alshamsi, A., Zahavich, A. & El-Farra, S. (2021). Why Graded Assessment for Undergraduates during the COVID-19 Lockdown? An Experience Introspection. *IAFOR Journal of Education*, vol.9(2), pp. 55-75
- Althoff, J. (2016). *An Investigation of the Link between Nonverbal Aptitude and Academic Achievement*. EdD. Dissertation. Florida International University.
- Anderson, S., Medrich, E., & Fowler, D. (2007). Which achievement gap? *Phi Delta Kappan*, vol.7, pp. 547-550.
- Angoff, W. & Johnson, E. (1990). The differential impact of curriculum on aptitude test scores. *Journal of Educational Measurements*, vol. 27, pp. 291-305.
- Arens, A. & Jansen, M. (2016). Self-concepts in reading, writing, listening, and speaking: A multidimensional and hierarchical structure and its generalizability across native and foreign languages. *Journal of Educational Psychology*, vol. 108(5), pp. 646-664.
- Arens, A., Marsh, H., Pekrun, R., Lichtenfeld, S., Murayama, K. & von Hofe, R. (2017). Math self-concept, grades, and achievement test scores: Long-term reciprocal effects across five waves and three achievement tracks. *Journal of Educational Psychology*, vol. 109(5), pp.621-634.
- Atkinson, R. C., & Shiffrin, R. M. (1971). The control of short-term memory. *Scientific American*, vol.225(2), pp.82–90.
- Baadte, C. & Schnotz, W. (2014). Feedback effects on performance, motivation and mood: Are they moderated by the learner's self-concept? *Scandinavian Journal of Educational Research*, vol. 58(5), pp. 570-591.
- Bacon, D.R. & Bean, B. (2006). GPA in research studies: An invaluable but neglected opportunity. *Journal of Marketing Education*, vol.28, pp.35-42. <http://dx.doi.org/10.1177/0273475305284638>.
- Baker, R. S. & Yacef, K. (2009). The state of educational data mining in 2009: A review and future visions. *Journal of Educational Data Mining*, vol.1(1), pp. 3-17.
- Balboni, G., Naglieri, J. A. & Cubelli, R. (2010). Concurrent and predictive validity of the Raven Progressive Matrices and the Naglieri Nonverbal Ability Test. *Journal of Psychoeducational Assessment*, vol.28, pp. 222-235. doi:10.1177/0734282909343763
- Balcikanli, C. (2011). Metacognitive Awareness Inventory for Teachers (MAIT). *Education & Psychology*, vol.9(23), pp. 1309-1332.

Bandura, A. (1986). *Social foundation of thought and action*. Upper Saddle River, NJ: Prentice Hall.

Bandura, A. (1997). *Self-efficacy: the exercise of control*. New York: W.H. Freeman.

Bandura, A. (1999). A social cognitive theory of personality. In L. Pervin & O. John (eds). *Handbook of personality*. New York, Guildford Publications, pp. 154-196. *Psychological review*, vol.106(4), p.676.

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review of Psychology*, vol.52, Pp. 1-26. doi: 10.1146/annurev.psych.52.1.1

Banks, B.K. (2020). *Examining the Relationship between Resiliency Factors and Academic Achievement in High School Graduates*. PhD Thesis. Hampton University.

Barber, T.D. (2017). *The relationship between MAP assessment and PASS results for eighth grade students*. DEd. Dissertation. Walden University, ProQuest Dissertations Publishing.

Barker, C., Pistrang, N. & Elliott, R. (2002). Foundations of qualitative methods. *Research Methods in Clinical Psychology: An Introduction for Students and Practitioners*. 3rd edn, pp. 73-95.

Bassey, S., Umoren, G. & Udida, L.A. (2013). Cognitive Styles, Secondary School Students' Attitude and Academic Performance in Chemistry in Akwa Ibom State-Nigeria. *Global Journal of Interdisciplinary Social Sciences*, vol. 4(3), pp. 39-43.

Baumeister, R. F., Campbell, J. D., Kruegger, J. I. & Vohs, K. D. (2003). Does high self-esteem cause better performance, interpersonal success, happiness, or healthier lifestyles? *Psychological Science in the Public Interest*, vol.4(1), p. 144.

Beaujean, A. A., Parkin, J. & Parker, S. (2014). Comparing Cattell–Horn–Carroll factor models: Differences between bifactor and higher order factor models in predicting language achievement. *Psychological Assessment*, vol.26, pp. 789-805. <http://dx.doi.org/10.1037/a0036745>.

Becker, M., Neumann, M., Tetzner, J., Bose, S., Knoppick, H., Maaz, K., Baumert, J. & Lehmann, R. (2014). Is early ability grouping good for high-achieving students' psychosocial development? Effects of the transition into academically selective schools. *Journal of Educational Psychology*, vol. 2, p. 555.

Beesley, A., Clark, T., Dempsey, K. & Tweed, A. (2018). Enhancing formative assessment practice and encouraging middle school mathematics engagement and persistence. *School Science and Mathematics*, vol. 118(1-2), pp. 4-16.

- Bender, S. L., Roth, R., Zielenski, A., Longo, Z. & Chermak, A. (2018). Prevalence of mindfulness literature in school psychology journals from 2006-2016. *Psychology in the Schools*, vol. 55(4), pp. 680-692. doi:10.1002/pits.22132
- Berkowitz M. & Stern, E. (2018). Which Cognitive Abilities Make the Difference? Predicting Academic Achievements in Advanced STEM Studies. *Journal of Intelligence*, vol. 6(4), p.48.
- Bernacki, M. L., Byrnes, J. P. & Cromley, J. G. (2012). The effects of achievement goals and self-regulated learning behaviors on reading comprehension in technology-enhanced learning environments. *Contemporary Educational Psychology*, vol. 37(2), pp. 148-161.
- Bernacki, M. L., Nokes-Malach, T. J. & Aleven, V. (2015). Examining self-efficacy during learning: variability and relations to behavior, performance, and learning. *Metacognition and Learning*, vol.10(1), pp. 99-117.
- Bernacki, M. L. (2018). *Examining the Cyclical, Loosely Sequenced, and Contingent Features of Self-Regulated Learning: Trace Data and Their Analysis*. In P.A. Alexandar, D. H. Schunk & J. A. Greene (2017). *Handbook of Self-Regulation of Learning and Performance*. *Developmental Review*, vol.29(3), pp. 180–200.
- Best, J. R. & Miller, P. H. (2010). A developmental perspective on executive function. *Child Development*, vol.81(6), pp.1641-1660.
- Best, J. R., Miller, P. H. & Naglieri, J. A. (2011). Relations between executive function and academic achievement from ages 5 to 17 in a large, representative national sample. *Learning and Individual Differences*, vol.21(4), pp. 327-336.
- Binet, A. & Simon, T. (1916). *The development of cognitive ability in children: The Binet–Simon Scale* (No. 11). Williams & Wilkins Company. <http://dx.doi.org/10.1037/11069-000>.
- Bobowski, K. (2016). Make Assessment Work for All Students: Multiple Measures Matter. NWEA: Gallup Inc. <https://www.nwea.org/blog/2016/what-do-parents-think-about-assessment/>
- Bollen, A. K. & Long, J. S. (1993), *Testing structural equation models*. Newbury Park, CA: Sage.
- Bong, M. (2001). Role of self-efficacy and task-value in predicting college students' course performance and future enrolment intentions. *Contemporary educational psychology*, vol.26(4), pp. 553-570.
- Bong, M., Cho, C., Ahn, H. S. & Kim, H. J. (2012). Comparison of self-beliefs for predicting student motivation and achievement. *The Journal of Educational Research*, vol. 105(5), pp. 336-352.

Bouyamourn, A. & Malek, C. 2016. *Leaders Chart New Strategic Roadmap for the UAE After Oil* [online]. Abu Dhabi: The National [Accessed 9 March 2019]. Available at: <https://www.thenational.ae/uae/leaders-chart-new-strategic-roadmap-for-the-uae-after-oil-1.193589>

Bowen, P., Rose, R. & Pilkington, A. (2017). Mixed methods- theory and practice: Sequential, explanatory approach. *International Journal of Quantitative and Qualitative Research Methods*, vol. 5(2), pp. 10-27.

Bowles, S. & Gintis, H. (1976). *Schooling in Capitalist America: Educational Reform and the Contradictions of Economic Life*. New York: Basic Books.

Bowles, S. & Gintis, H. (2002). Schooling in capitalist America revisited. *Sociology of Education*, vol.75, pp.1-18.

Brody, N. (1992). *Intelligence*. San Diego, CA: Academic Press.

Broekkamp, H. & Van Hout-Wolters, B.H.A.M. (2007). Students' adaptation of study strategies when preparing for classroom tests. *Educational Psychology Review*, vol.19, pp. 401-428.

Brown, G. T. L. (2008). *Conceptions of Assessment: Understanding What Assessment Means to Teachers and Students*. New York: Nova Science Publishers.

Brown, J. (2014). *Investigating the Validity of Using NWEA's MAP Results to Predict PSAT and ACT Results*. PhD. Thesis. University of Illinois.

Brunner, M. (2008). No g in education? *Learning and Individual Differences*, vol.18, pp. 152-165. <http://dx.doi.org/10.1016/j.lindif.2007.08.005>.

Brunner, M., Gogol, K. M., Sonnleitner, P., Keller, U., Krauss, S. & Preckel, F. (2013). Gender differences in the mean level, variability, and profile shape of student achievement: Results from 41 countries. *Intelligence*, vol.41, pp.378-395. <http://dx.doi.org/10.1016/j.intell.2013.05.009>.

Brunner, M., Ludtke, O. & Trautwein, U. (2008). The internal/external frame of reference model revisited: Incorporating general cognitive ability and general academic self-concept. *Multivariate Behavioral Research*, vol. 43, pp. 137-172.

Burney, V.H. (2008). Applications of Social Cognitive Theory to Gifted Education. *Roeper Review*, vol.30(2), pp.243-250.

Burton, N., Welsh, C., Kostin, I. & VanEssen T. (2009). *Toward a Definition of Verbal Reasoning in Higher Education*. Research Report. ETS, Princeton, New Jersey. Educational Testing Service.

Butler, D. L. & Cartier, S. C. (2018). Advancing Research and Practice about Self-Regulated Learning: The Promise of In-Depth Case Study Methodologies. In D. H. Schunk & J. A. Greene (eds). *Handbook of self-regulation of learning and performance*, 2nd edn, pp. 352-369. New York: Cambridge University Press.

Byat, A. & Sultan O. (2014). The United Arab Emirates: Fostering a Unique Innovation Ecosystem for a Knowledge-Based Economy, pp.101-111, in *The Global Innovation Index 2014. The Human Factor in Innovation*. The World Intellectual Property Organization (WIPO). Geneva, Switzerland.

California Department of Education (CDE) (2022). All Curriculum Frameworks [online]. California: US. [Accessed 15 May 2022]. Available at: <https://www.cde.ca.gov/ci/cr/cf/allfwks.asp>

Calero, F., Dalley, C., Fernandez, N., Davenport-Dalley, T., Morote, E. & Tatum, S. (2014). A model of academic self-concept for high school Hispanic students in New York. *Journal of Latinos and Education*, vol. 13(1), pp. 33-43.

Calvin, C. M., Fernandes, C., Smith, P., Visscher, P. M. & Deary, I. J. (2010). Sex, intelligence and educational achievement in a national cohort of over 175,000 11-year-old schoolchildren in England. *Intelligence*, 38, pp. 424-432. <http://dx.doi.org/10.1016/j.intell.2010.04.005>.

Caprara, G. V., Fida, R., Vecchione, M., Del Bove, G., Vecchio, G. M., Barbaranelli, C. & Bandura, A (2008). Longitudinal analysis of the role of perceived self-efficacy for self-regulated learning in academic continuance and achievement. *Journal of Educational Psychology*, vol.100, p.525.

Cardelle-Elawar, M. (1992). Effects of teaching metacognitive skills to students with low mathematics ability. *Teaching and Teacher Education*, vol.8(2), pp.109-121.

Carlson, M., Jacobs, S., Coe, E., Larsen, S. & Hsu, E. (2002). Applying covariational reasoning while modeling dynamic events: A framework and a study. *Journal for Research in Mathematics Education*, vol. 33, pp. 352-378.

Carver, C. S. & Scheier, M. F (2009). Action, affect, multitasking, and layers of control. In J. P. Forgas, R. F. Baumeister & D. M. Tice (eds). *Psychology of self-regulation: Cognition, affective and motivational processes*, pp.109-126. New York, NY: Psychology Press.

Cassidy, S. (2012). Exploring individual differences as determining factors in student academic achievement in higher education. *Studies in Higher Education*, 37(7), pp. 793-810.

Chen, W-C. & Whitehead, R. (2009). Understanding physics in relation to working memory. *Research in Science & Technological Education*, vol.27(2), pp.151-160.

Chen, S.K., Hwang, F.M., Yeh, Y.C. & Lin, S. (2012). Cognitive ability, academic achievement and academic self-concept: extending the internal/external frame of reference model. *British Journal of Educational Psychology*, vol. 82(2), pp. 308-326.

Chen, B., Chiu, W. & Wang, C. (2015). The relationship among academic self-concept, learning strategies, and academic achievement: A case study of national vocational college students in Taiwan via sem. *Asia-Pacific Education Researcher (Springer Science & Business Media B.V.)*, vol. 24(2), pp. 419-431.

Chiesi, F. & Primi, C. (2009a). A model of achievement in the quantitative subjects of psychology students. *Italian Journal of Psychology*, vol.36(1), pp. 161-184.

Chiesi, F. & Primi, C. (2009b). Assessing statistics attitudes among college students: Psychometric properties of the Italian version of the Survey of Attitudes toward Statistics (SATS). *Learning and Individual Differences*, vol.19(2), pp. 309-313.

Chingos M. M., Whitehurst G. J. R., & Lindquist K. M. (2014). *School superintendents: Vital or irrelevant?* Washington, DC: Brookings. <https://www.brookings.edu/wp-content/uploads/2016/06/SuperintendentsBrown-Center9314.pdf>

Christian, M. (2017). *Modelling the Relationship between Students' Self-Perceptions, Goals, and Achievement Motivation*. PhD Thesis. University of California Riverside.

Cizek, G. J. & Gierl, M. J., (eds). (2016). *The eighteenth mental measurements yearbook*. Lincoln, NE: Buros Center for Testing.

Cohen, J (1988). *Statistical Power Analysis for the Behavioral Sciences*. 2nd edn. Hillsdale, NJ: Lawrence Erlbaum Associates.

Cohen, L., Manion, L. & Morrison, K. (2018). *Research methods in education*. 8th edn. London: Routledge.

Coleman J., Campbell E., Hobson C., Partland F., Mood A., Weinfeld M. & York R. (1966). *Equality of Educational Opportunity*. Washington, DC: Government Printing Office.

College Board. (2018). SAT Understanding Scores.
<https://collegereadiness.collegeboard.org/sat/scores/understanding-scores>

Common Core K-12 Standards Draft Appendix A. (2010). Retrieved from <http://www.corestandards.org/the-standards>

Common Core State Standards Initiative (2017). *Preparing America's students for success*. Retrieved from <http://www.corestandards.org/>

Cooper, M.M., Caballero, M.D., Ebert-May, D., Fata-Hartley, C.L., Jardeleza, S.E., Krajcik, J.S., Lavery, J.T., Matz, R.L., Posey, L.A. & Underwood, S.M. (2015). Challenge faculty to transform STEM learning. *Science*, vol. 350(6258), pp. 281-282.

Corbin, J. & Strauss, A. (2008). *Basics of qualitative research: techniques and procedures for developing grounded theory*. 3rd edn. Thousand Oaks, CA: Sage.

Cordray, D., Pion, G., Brandt, C. & Molefe, A. (2013). The Impact of the Measures of Academic Progress (MAP) Program on Student Reading Achievement. *Society for Research on Educational effectiveness* [online]. SREE Spring 2013: Washington, DC [Accessed 25 October 2019]. Available at: <https://files.eric.ed.gov/fulltext/ED564093.pdf>

Cordray, D., Pion, G., Brandt, C., Molefe, A. & Toby, M. (2012). *The Impact of the measures of academic progress (MAP) program on student reading achievement*. Final Report. NCEE pp. 2013-4000. National Center for Education Evaluation and Regional Assistance.

Council of International Schools (2017). CIS International Accreditation: The framework for the Evaluation & International Accreditation of Schools.

Covington, M. V. (2000). Goal theory, motivation, and school achievement: An integrative review. *Annual Review of Psychology*, vol.51, pp. 171-200.

Coyle, T. R. (2014). Predictive validity of non-g residuals of tests: More than g. *Intelligence*, vol.2, pp. 21-25. <http://dx.doi.org/10.3390/jintelligence2010021>.

Coyle, T. R., Purcell, J. M., Snyder, A. C. & Richmond, M. C. (2014). Ability tilt on the SAT and ACT predicts specific abilities and college majors. *Intelligence*, vol.46, pp. 18-24. <http://dx.doi.org/10.1016/j.intell.2014.04.008>.

Coyle, T. R., Snyder, A. C., Richmond, M. C. & Little, M. (2015). SAT non-g residuals predict course specific GPAs: Support for investment theory. *Intelligence*, vol.51, pp.57-66. <http://dx.doi.org/10.1016/j.intell.2015.05.003>.

Cragg, L. & Gilmore, C. (2014). Skills underlying mathematics: The role of executive function in the development of mathematics proficiency. *Trends in Neuroscience and Education*, vol.3(2), pp.63-68.

Crano W. D., Kenny D. A. & Campbell D. T. (1972). Does intelligence cause achievement? A cross-lagged panel analysis. *Journal of Educational Psychology*, vol. 63, pp. 258-275.

Crawford, L., Tindal, G. & Stieber, S. (2001). Using oral reading rate to predict student performance on state wide achievement test. *Educational Assessment*, vol. 7, pp. 303-323.

Creamer, E. G. (2018). *An Introduction to Fully Integrated Mixed Methods Research*. London, SAGE Publications.

Credé, M. & Phillips, L.A. (2011). A meta-analytic review of the Motivated Strategies for Learning Questionnaire. *Learning and Individual Differences*, vol.21, pp. 337-346.

Credé, M., Tynan, M. C. & Harms, P. D. (2017). Much ado about grit: A meta-analytic synthesis of the grit literature. *Journal of Personality and Social Psychology*, vol.113(3), pp. 492-511.

CTB/McGraw-Hill. (2014). *Missouri Assessment Program Technical Support*. Monterey, CA: Author.

Creswell, J.W. (2014). *Research Design: Qualitative, Quantitative & Mixed Methods Approaches*. 4th edn. Thousand Oaks, CA: Sage.

Creswell, J. W. & Plano Clark, V. (2011). *Designing and conducting mixed methods research* 2nd edn. Thousand Oaks, CA: Sage.

Creswell, J. W. & Plano Clark, V. L. (2018). *Designing and conducting mixed methods Research*. Thousand Oaks, CA: Sage.

Cronin, J., Kingsbury, G. G., Dahlin, M., Adkins, D. & Bowe, B. (2007). *Alternate methodologies for estimating state standards on a widely-used computerized adaptive test*. Chicago, IL: Paper presented at the National Council on Measurement in Education.

Culbertson, L. D. & Jalongo, M. R. (1999). “But What’s Wrong with Letter Grades?” Responding to Parents’ Questions about Alternative Assessment. *Childhood Education*, vol.75(3), 130-135. doi: 10.1080/00094056.1999.10521999

Cullen, M. J., Hardison, C. M. & Sackett, P. R. (2004). Using SAT-Grade and Ability-Job Performance Relationships to Test Predictions Derived from Stereotype Threat Theory. *Journal of Applied Psychology*, vol. 89(2), pp. 220-230.

Cunha, F. & Heckman, J., (2007). The Technology of Skill Formation. *American Economic Review*, vol. 97, pp. 31-47.

Cunha, F., Heckman, J. J. & Schennach, S. M. (2010). Estimating the technology of cognitive and noncognitive skill formation. *Econometrica*, vol.78(3), pp. 883-931.

Dale, S. & Kruger A. (2011). Estimating the return to college selectivity over the career using administrative earnings data. *The National Bureau of Economic Research*, Paper 17159.

Dang, N. V., Chiang, J. C., Brown, H. M. & McDonald, K. K. (2018). Curricular activities that promote metacognitive skills impact lower-performing students in an introductory biology course. *Journal of Microbiology & Biology Education*, vol.19(1), pp. 1-9.

Daniel, M. & Wahlstrom, D. (2019). Raw-score equivalence of computer-assisted and paper versions of WISC-V. *Psychological Services*, vol.16(2), pp. 213-220. <https://doi.org/10.1037/ser0000295>

Darling-Hammond, L. (2011). "Policy frameworks for new assessments", in P. Griffin, B. McGaw & E.Care (eds). *Assessment and teaching 21st century skills*. Springer, Heidelberg.

Das, S., Alsalhanie, K.M., Nauhria, S., Joshi, V.R., Khan, S. & Surender, V. (2017). Impact of formative assessment on the outcome of summative assessment - a feedback based cross sectional study conducted among basic science medical students enrolled in MD program. *Asian Journal of Medical Sciences*, vol. 8(4), pp. 38-43.

Deary, I. J., Strand, S., Smith, P. & Fernandes, C. (2007). Intelligence and educational achievement. *Intelligence*, vol.35, pp.13-21. <http://dx.doi.org/10.1016/j.intell.2006.02.001>.

Dejaeger, K., Goethals, F., Giangreco, A., Mola, L. & Baesens, B. (2012). Gaining insight into student satisfaction using comprehensive data mining techniques. *European Journal of Operational Research*, vol.218(2), pp.548-562.

Demo, D. H., & Parker, K. D. (1988). Academic achievement and self-esteem among black and white college students. *The Journal of Social Psychology*, vol.127, pp. 345-355.

Department of Education and Knowledge (ADEK) (2019). [online]. Abu Dhabi Government: ADEK. [Accessed 15 September 2019] Available at: <https://www.adek.gov.ae>

Department of Education and Knowledge (ADEK) (2020). [online]. Curriculum: ADEK. [Accessed 15 September 2019] Available at: <https://www.adek.gov.ae/Education-System/Private-Schools/Curriculum>

Detterman, D. (2016). Education and Intelligence: Pity the poor teacher because student characteristics are more significant than teachers or schools. *The Spanish Journal of Psychology*, vol.19, pp. 1-11.

De Ridder, D.T., Lensvelt-Mulders, G., Finkenauer, C., Stok, F.M. & Baumeister, R.F. (2012). Taking stock of self-control: A meta-analysis of how trait self-control relates to a wide range of behaviors. *Personality and Social Psychology Review*, vol.16, pp.76-99. <http://dx.doi.org/10.1177/1088868311418749>.

Dewey, J. (1998). *The Essential Dewey: Pragmatism, Education, Democracy*. Indiana University Press.

Didier, T., Kreiter, C., Buri, R. & Solow, C. (2006). Investigating the utility of a GPA institutional adjustment index. *Advances in Health Sciences Education*, vol.11, pp. 145–153. [http:// dx.doi.org/10.1007/s10459-005-0390-0](http://dx.doi.org/10.1007/s10459-005-0390-0).

Donati, G., Meaburn, E. & Dumontheil, I. (2019). The specificity of associations between cognition and attainment in English, maths and science during adolescence. *Learning and Individual Differences*, vol.69, pp. 84-93.

Downey, M. (2011). Math by any other name will still be harder than math of old. *The Atlanta Journal-Constitution*. Retrieved from <http://archive.fo/V0kt>

Dubai Statistics Centre (2019). Students by education type and nationality-Emirate of Dubai. Dubai: Government of Dubai. Retrieved from: <https://www.dsc.gov.ae/en-us/Pages?education.aspx>

Duckworth, A.L. & Kern, M.L. (2011). A meta-analysis of the convergent validity of self-control measures. *Journal of Research in Personality*, vol.45, pp.259-268. <http://dx.doi.org/10.1016/j.jrp.2011.02.004>.

Duckworth, A.L., Peterson, C., Matthews, M.D. & Kelly, D.R. (2007). Grit: Perseverance and passion for long-term goals. *Journal of Personality and Social Psychology*, vol.92(6), pp. 1087-1101.

Duckworth, A.L. & Quinn, P.D. (2009). Development and validation of the Short Grit Scale (Grit-S). *Journal of Personality Assessment*, vol.91(2), pp. 166-174.

Duckworth, A. L., & Seligman, M. E. P. (2005). Self-discipline outdoes IQ in predicting academic performance of adolescents. *Psychological Science*, vol.16, pp.939-944 [http://dx. doi.org/10.1111/j.1467-9280.2005.01641.x](http://dx.doi.org/10.1111/j.1467-9280.2005.01641.x).

Duckworth, A. L. & Yeager, D. S. (2015). Measurement matters: Assessing personal qualities other than cognitive ability for educational purposes.

Educational Researcher, vol.44, pp. 237-251.

<http://dx.doi.org/10.3102/0013189X15584327>.

Dutro, E. & Selland, M. (2012). "I Like to Read, but I Know I'm Not Good at It": Children's Perspectives on High-Stakes Testing in a High-Poverty School. *Curriculum Inquiry*, vol. 42(3), pp.340-367.

Dye, K.M. & Stanton, J.D. (2017). Metacognition in upper-division biology students: Awareness does not always lead to control. *CBE-Life Sciences Education*, 16, ar31.

Eccles, J. S. & Roeser, R. W (2011) Schools as developmental contexts during adolescence. *Journal of Research on Adolescence*, 21(1), pp. 225-241. Doi:10.1111/j.1532-7795.2010.00725.x

Elliot, A. J. & Dweck, C. S. (eds.). (2005). *Handbook of competence and motivation*. New York: Guilford Press.

Elphinstone, B., Whitehead, R., Tinker, S. P. & Bates, G. (2019). The academic benefits of 'letting go': The contribution of mindfulness and nonattachment to adaptability, engagement, and grades. *Educational Psychology*, 39(6), pp. 784-796. doi:10.1080/01443410.2019.1588228

Ercikan, K., McCreith, T. & Lapointe, V. (2005). Factors associated with mathematics achievement and participation in advanced mathematics courses: An examination of gender differences from an international perspective. *School Science and Mathematics*, vol. 105(1), pp. 5-14.

Evans, J. S. B. T., Thompson, V. & Over, D. E. (2015). Uncertain deduction and conditional reasoning. *Frontiers in Psychology*, vol. 6. <http://dx.doi.org/10.3389/fpsyg.2015.00398>

Farkas, G. (2003). Cognitive skills and noncognitive traits and behaviors in stratification process. *Annual Review of Sociology*, vol. 29, pp. 541-562.

Feinberg, F. & Halprin, S. (1978), "Affective and cognitive correlates of course performance in introductory statistics," *Journal of Experimental Education*, vol. 46, pp. 11-18.

Field, A. (2009). *Discovering Statistics Using SPSS*. 3rd edn. California. Sage Publications Inc.

Finn, J. D. (1989). Withdrawing from school. *Review of Educational Research*, vol. 59, pp. 117-142.

Ginsburg, G. S. & Bronstein, P. (1993). Family factors related to children's intrinsic/ extrinsic motivational orientation and academic performance. *Child Development*, vol.64, pp. 1461-1474.

Finn, A., Kraft, M., West, M., Gabrieli, C. & Gabrieli, J. (2014). Cognitive Skills, Student Achievement Tests, and Schools. *Psychological Science*, vol. 25(3), pp.736-744.

Fives, A., Russell, D., Kearns, N., Lyons, R., Eaton, P., Canavan, J. & O'Brien, A. (2014). The association between academic self-beliefs and reading achievement among children at risk of reading failure. *Journal of Research in Reading*, vol. 37(2), pp. 215-232.

Flavell, J. H. (1976). MC aspects of problem-solving. In: Resnick, L. (edn.), *The Nature of Intelligence* (pp. 231 – 235). Hillsdale, NJ: Erlbaum Assoc.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive developmental inquiry. *American Psychologist*, vol.34, pp.906-911.

Flavell, J. H. (1992). Cognitive development: Past, present, and future. *Developmental Psychology*, vol.28(6), pp.998-1012.

Formazin, M., Schroeders, U., Köller, O., Wilhelm, O. & Westmeyer, H. (2015). Student selection in the subject of psychology. *Psychological Review*, vol.62(4); pp.221-236.

Fraenkel, J. & Wallen, N. (2012). *How to design and evaluate research in education*. 8th edn. Boston: McGraw Hill.

Fraenkel, J., Wallen, N. & Hyun, H.H. (2015). *How to design and evaluate research in Education*. 9th edn. Boston: McGraw-Hill.

Friedman, N. & Miyake, A. (2017). Unity and diversity of executive functions: Individual differences as a window on cognitive structure. *Cortex*, vol. 86, pp. 186-204.

Friedman, N. P., Miyake, A., Altamirano, L. J., Corley, R. P., Young, S. E., Rhea, S. A. & Hewitt, J. K. (2016). Stability and change in executive function abilities from late adolescence to early adulthood: A longitudinal twin study. *Developmental Psychology*, 52(2), pp. 326-340.

Friedman, N. P., Miyake, A., Corley, R., Young, S., Defries, J. & Hewitt, J. (2006). Not all executive functions are related to intelligence. *Psychological Science*, vol.17(2), pp. 172-179.

Fremer, J. & Wall, J. E. (2004). 'Why use tests and assessments? Questions and answers', in J. E. Wall & G. R. Walz (eds). *Measuring up: Assessment issues for teachers, counsellors, and administrators*, pp. 3-19. Austin, TX: PRO-ED.

Frey, M. C. & Detterman, D. K. (2004). Scholastic assessment or g? The relationship between the scholastic assessment test and general cognitive ability. *Psychological Science*, vol. 15, pp.373-378. <http://dx.doi.org/10.1111/j.0956-7976.2004.00687.x>

Frosch, C. A. & Johnson-Laird, P. N. (2011). Is everyday causation deterministic or probabilistic? *Acta Psychologica*, vol.137(3), pp. 280–291.

Fuchs, L.S., Fuchs, D., Hosp, M. & Jenkins, J.R. (2001). Oral reading fluency as an indicator of reading competencies: A theoretical, and historical analysis. *Scientific Studies of Reading*, vol. 5, pp. 239-256.

Furinghetti, F. & Morselli, F. (2009). Every unsuccessful problem solver is unsuccessful in his or her own way: Affective and cognitive factors in proving. *Educational Studies in Mathematics*, vol. 70, pp. 7190.

Gal, L. B. & Ginsburg, L. (1994). The rule of beliefs and attitude in learning statistics: toward an assessment framework. *Journal of Statistics Education* [online], 2(2). www2.amstat.org/publications/jse/v2n2/gal.html.

Galagedera, D. (1998). Is remedial mathematics a real remedy? Evidence from learning statistics at tertiary level. *International Journal of Mathematics Education, Sciences and Technology*, vol. 29, pp. 475-480.

Galagedera, D., Woodward, G. & Degamboda, S. (2000). An investigation of how perceptions of mathematics ability can affect elementary statistics performance. *International Journal of Mathematics Education, Sciences and Technology*, vol. 31, pp. 679-689.

Gallagher, K. (2019). *Education in the United Arab Emirates: Innovation and Transformation*. Springer.

Gamoran, A. & Long, D. (2006). "Equality of educational opportunity: A 40-year retrospective." (WCER Working Paper No. 2006–9) [online]. Madison, WI: University of Wisconsin Madison, Wisconsin Center for Education Research. [Accessed 25 October 2019]. Available at: <http://www.wcer.wisc.edu/publications/workingPapers/papers.php>

Garcia, G.E. & Lang, M.G. (2018). The link between standards and dual language teacher's Spanish literacy instruction and use of formative assessment. *Bilingual Research Journal*, vol.41(2), pp.167-186.

Garden, R.A. (1997). *Mathematics and science performance in middle primary school: Results from New Zealand's participation in the Third International Mathematics and Science Study*. Wellington: Research and International Section, Ministry of Education.

Gardner, R. C., Lalonde, R. N. & Pierson, R. (1983). The socio-educational model of second language acquisition: An investigation using causal modelling. *Journal of Language and Social Psychology*, vol.2(1), pp. 1-15.

Gardner, J. (2010). *Developing teacher assessment: an Introduction*. In: Gardner J, Harlen W, Hayward L, Stobart G & Montgomery M (eds.) *Developing Teacher Assessment*. Maidenhead, England: McGraw Hill/Open University Press, pp. 1-11.

Glaser, R. (1963). Instructional technology and the measurement of learning outcomes: Some questions. *American Psychologist*, vol. 18, pp. 519-521.

GL Assessment. (2012). Cognitive Abilities Test Technical Information [online]. Vantage London: GL-Assessment. [Accessed 12 November 2018] Available at: https://www.glassessment.co.uk/media/1343/cat4_extended_technical_information.pdf

GL Assessment. (2017). Cognitive abilities Tests (CAT4) [online]. Vantage London: GL-Assessment. [Accessed 12 March 2019] Available at: <https://www.glassessment.co.uk/products/cognitive-abilities-test-cat4/>

GL Assessment. (2017). Pupil Attitude towards School and Self (PASS). [online]. Vantage London: GL-Assessment. [Accessed 12 September 2019]. Available at: <https://www.glassessment.co.uk/products/pupil-attitudes-to-self-and-school-pass/>

GL Assessment. (2019). *Cognitive Ability Test (CAT4): Group report for teachers*. Vantage London: GL Assessment Limited.

Glesne, C. (2011). *Becoming qualitative researchers: An introduction*. 3rd edn. Boston: Pearson.

Gollwitzer, P. M. (1999). Implementation intentions: Strong effects of simple plans. *American Psychologist*, vol.54(7), pp. 493-503. doi:10.1037/0003-066X.54.7.493

Gonzalez, J. (2015). *Predictive Relationships among Assessments, Academic Growth, Student Cognitive Ability and Achievement*. A Dissertation Proposal submitted for Doctor of Education. ProQuest.

- Gorard, S. (2015). Rethinking 'quantitative' methods and the development of new researchers. *Review of Education*, vol. 3(1), pp. 72-96
- Gorard, S. & Gorard, J. (2016). What to do instead of significance testing? Calculating the 'number of counterfactual cases needed to disturb a finding'. *International Journal of Social Research Methodology*, vol. 19(4), pp.481-490.
- Green, M. & Piel, J. (2009). *Theories of human development: A comparative approach*. 2nd edn. Prentice-Hall, Inc.
- Gresalfi, M. S. & Cobb, P. (2006). Cultivating students' discipline-specific dispositions as a critical goal for pedagogy and equity. *Pedagogies: An International Journal*, vol.1(1), pp. 49-57.
- Griffin, P., Care, E. & McGaw, B. (2011). "The changing role of education and schools", in P. Griffin, B. McGaw & E. Care (eds). *Assessment and teaching 21st century skills*. Springer, Heidelberg.
- Griffin, P., Wiley, J. & Salas, C. (2013). Supporting Effective Self-Regulated Learning: The Critical Role of Monitoring. In R. Azevedo and V. Aleven (2013) (eds.), *International Handbook of Metacognition and Learning Technologies* (pp.19-34). New York: Springer.
- Grootenboer, P. & Hemmings, B. (2007). Mathematics performance and the role played by affective and background factors. *Mathematics Education Research Journal*, vol.19(3), pp. 3-20.
- Guo, B., Perron, B. & Gillespie, D. (2009). A Systematic Review of Structural Equation Modelling in Social Work Research. *The British Journal of Social Work*, vol.39(8), pp.1556-1574.
- Guo, J., Parker, P., Marsh, H. & Morin, A. (2015). Achievement, motivation, and educational choices: A longitudinal study of expectancy and value using a multiplicative perspective. *Developmental Psychology*, vol. 51(8), p. 1163.
- Guruler, H., Istanbulu, A. & Karahasan, M. (2010). A new student performance analysing system using knowledge discovery in higher educational databases. *Computers & Education*, 55(1), 247-254.
- Haahr, J. H. (2005). *Explaining student performance: Evidence from the international. PISA, TIMSS, & PIRLS surveys*. The Danish Technological Institute.
- Haladyna, T., Shaughnessy, J. & Shaughnessy, M. (1983). A Casual Analysis of Attitude toward Mathematics. *The National Council of Teachers of Mathematics*, vol.14(1). pp. 19-29.

- Hamaideh, S. H. & Hamdan-Mansour, A. M. (2014). Psychological, cognitive, and personal variables that predict college academic achievement among health sciences students. *Nurse Education Today*, vol.34(5), pp. 703-708.
- Hanushek, E. & Woessmann, L. (2010). Sample selectivity and the validity of international students' achievement tests in economic research. *CESifo Working Papers*, no.3007.
- Harlen, W. & Gardner, J. (2010). "Assessment to support learning", in J. Gardner, W. Harlen, L. Hayward, G. Stobart & M. Montgomery. (eds). *Developing Teacher Assessment*, pp. 15-28. New York, NY: Open University Press.
- Harris, L. R. (2015). Reviewing Research on Parent Attitudes towards School Assessment: Implications for Classroom Assessment Practices. Conference: American Educational Research Association Annual Meeting at Chicago, Illinois.
- Harris, L. R. & Brown, G. T. L. (2009). The complexity of teachers' conceptions of assessment: Tensions between the needs of schools and students. *Assessment in Education: Principles, Policy, & Practice*, vol.16(3), pp. 365-381.
- Harris, L. R. & Brown, G. T. L. (2013). Opportunities and obstacles to consider when using peer- and self-assessment to improve student learning: Case studies into teachers' implementation. *Teaching and Teacher Education*, vol.36(0), pp.101-111.
- Harris, L. R., Harnett, J. A. & Brown, G. T. L. (2009). "Drawing" out student conceptions: Using pupils' pictures to examine their understandings of assessment. In D. M. McInerney, G. T. L. Brown & G. A. D. Liem (eds). *Student perspectives on assessment: What students can tell us about improving school outcomes*, Vol. IX, pp. 53-83. Charlotte, NC: Information Age Publishing.
- Harter, S. (1985a). "Process underlying self-concept formation in children", in J. Suls & E. Greenald (eds). *Psychological perspectives on the self*, vol. 3, pp. 137-181. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
- Harter, S. (1985b). Competence as a dimension of self-evaluation: Toward a comprehensive model of self-worth. In R. L. Leahy (ed). *The development of the self*, pp. 55-121. New York: Academic Press.
- Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses related to achievement*. London: Routledge, Taylor and Francis Group.
- Heaven, P. & Ciarrochi, J. (2012). When IQ is not everything: Intelligence, personality and academic performance at school. *Personality and Individual Differences*, vol. 53(4), pp. 518-522.
- Hell, B., Trapmann, S. & Schuler, H. (2008). Synopsis of the Hohenheim Meta-analysis on the Predictability of Study Success and Implications for Selection and Counselling Practice. University of Konstanz.

Hidi, S. & Harackiewicz, J. M. (2000). Motivating the academically unmotivated: A critical issue for the 21st century. *Review of Educational Research*, vol.70(2), pp.151-179.
doi:10.3102/00346543070002151

Hirschfeld, G. H. F. & Brown, G. T. L. (2009). Students' Conceptions of Assessment. *European Journal of Psychological Assessment*, vol.25(1), pp.30-38.

Hong, W. (2018). *Exploring Relations Between Motivation, Metacognition, and Academic Achievement Through Variable-Centered, Person-Centered and Learning Analytic Methodologies*. PhD. Thesis. University of Nevada, Las Vegas.

Hora, M. T. & Oleson, A. K. (2017). Examining study habits in undergraduate STEM courses from a situative perspective. *International Journal of STEM Education*, vol.4(1), pp.1-19.

Horn, P., Jansen, A. & Yu, D. (2011). Factors explaining the academic success of second year economics students: an exploratory analysis. *South African Journal of Economics*, vol. 79(2), pp. 202-210.

Hu, J., Chen, C., Chen, C. & Wang, C. (2015). A study on the influence of self-concept, social support and academic achievement on occupational choice intention. *The Asia-Pacific Education Researcher*, vol. 24(1), pp. 1-11.

Hulleman, C. S., Schrager, S. M., Bodmann, S. M. & Harackiewicz, J. M. (2010). A meta-analytic review of achievement goal measures: Different labels for the same constructs or different constructs with similar labels? *Psychological bulletin*, vol.136(3), pp. 422-449.

Hyman, J. (2017). ACT foe all: The effect of mandatory college entrance exams on postsecondary attainment and choice. *Education, Finance & Policy*, vol.12(3), pp.281-311.

Jackson, D. N. & Rushton, J. P. (2006). Males have greater g: Sex differences in general mental ability from 100,000 17- to 18-year-olds on the Scholastic Assessment Test. *Intelligence*, vol.34, pp. 479-486. <http://dx.doi.org/10.1016/j.intell.2006.03.005>.

Jacobs, J. E. & Bleeker, M. M. (2004). Achievement in Math and Science: Do Mothers' Beliefs Matter 12 Years Later? *Journal of Educational Psychology*, vol.96(1), pp. 97-109.

James, W. (1910). *Pragmatism, a new name for some old ways of thinking: Popular lectures on philosophy*. New York, NY: Longmans, Green.

Jax, J., Ahn, J. & Lin-Siegler, X. (2019). Using contrasting cases to improve self-assessment in physics learning. *Educational Psychology*, 39(6), pp. 815-838.
doi:10.1080/01443410.2019.1577360

Jayaprakash, S. M., Moody, E. W., Lauría, E. J., Regan, J. R. & Baron, J. D. (2014). Early alert of academically at-risk students: An open source analytics initiative. *Journal of Learning Analytics*, 1(1), pp. 6-47.

Jensen, A. R. (1998). *The g factor: The science of mental ability*. Westport, CT: Praeger.

Johnson A. (2016). Learning, the brain, and the teacher. Retrieved from <https://ucarecdn.com/a74e2d4a-7111-4de5-af5b-31227cc64a74/>

Johnson, R. B. & Christensen, L. (2020). *Educational Research: Quantitative, Qualitative, and Mixed Approaches*. 7th edn. London: Sage Publications.

Johnson, R. B., Onwuegbuzie, A. J., Tucker, S. & Icenogle, M. L. (2014). *Conducting mixed methods research using dialectical pluralism and social psychological strategies*. In P. Leavy (ed). *The Oxford handbook of qualitative research*, pp. 557-580. New York, NY: Oxford University Press.

Johnson, R. B., Onwuegbuzie, A. J., de Waal, C., Stefurak, T. & Hildebrand, D. (2017). Unpacking pragmatism for mixed methods research: The philosophies of Peirce, James, Dewey, and Rorty. In *The BERA/SAGE Handbook of Educational Research*, pp. 259-279. London, England: Sage.

Johnson, V.E. (2003). *Grade inflation: A crisis in college education*. New York, NY: Springer-Verlag.

Jones, S. L. (2015). *Predicting performance on the Georgia Criterion Referenced Competency Test based on the measures of academic progress in mathematics and reading*. Doctoral Dissertation, Capella University.

Joshi, S. & Srivastava, R. (2014). An explanation of rural and urban adolescents' academic self-concept and academic achievement in different type of schools. *Social Science International*, vol. 30(1), p.77.

Kamal, K. & Trines, S. (2018). Education System Profiles: Education in the United Arab Emirates. World Education Services (2021). <https://wenr.wes.org/2018/08/education-in-the-united-arab-emirates>

Katsperski, R., Shany, M. & Katzir, T. (2016). The role of RAN and reading rate in predicting reading self-concept. *Reading and Writing*, vol. 29(1), pp. 117-136.

Kaufman, S., Reynolds, M., Liu, X. & McGrew, K.S. (2012). Are cognitive g and academic achievement g one and the same g? An exploration on the Woodcock-Johnson and Kaufman tests. *Intelligence*, vol. 40, pp. 123-138.

Kelly, D.L., Centurino, Victoria, Martin, M.O. & Mullis, I.V.S. (eds.). (2020). *TIMSS 2019 Encyclopaedia: Education Policy and Curriculum in Mathematics and Science*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: <https://timssandpirls.bc.edu/timss2019/encyclopedia/>

Kilminster, S., Cottrell, D., Grant, J. & Brian, J. (2007). Effective educational and clinical supervision. *Medical Teacher*, 29(1), pp.2-19.

Kim, K. R. & Seo, E. H. (2018). The relationship between teacher efficacy and students' academic achievement: A meta-analysis. *Social Behavior and Personality: An international journal*, vol.46(4), pp. 529-540.

Klinger, D. A. & Rogers, W. T. (2011). Teachers' Perceptions of Large-Scale Assessment Programs within Low-Stakes Accountability Frameworks. *International Journal of Testing*, vol.11(2), pp.122-143.

Knowledge and Human Development Authority. (2015). [online]. Dubai: KHDA. [Accessed 10 October 2019]. Available at: https://www.khda.gov.ae/CMS/WebParts/TextEditor/Documents/Final_035_KHDA-ENGLISH.pdf

Knowledge and Human Development Authority. (2017). 'School Inspection Supplement: Dubai Schools Inspection Bureau' [online]. Dubai: KHDA. [Accessed 20 October 2019]. Available at: https://www.khda.gov.ae/Areas/Administration/Content/FileUploads/Publication/Documents/English/20170716151230_20170716144744_School_Inspection_Supplement_En.pdf

Knowledge and Human Development Authority. (2017). 'Dubai Student Wellbeing Census' [online]. Dubai: KHDA. [Accessed 21 October 2019]. Available at: <https://www.khda.gov.ae/en/dswc>

Knowledge and Human Development Authority. (2017). 'Learning From Each Other: Key Messages 2016-2017' [online]. Dubai: KHDA. [Accessed 26 October 2018]. Available at: https://www.khda.gov.ae/Areas/Administration/Content/FileUploads/Publication/Documents/English/20170516132050_KF2017_En.pdf.

Knowledge and Human Development Authority. (2019). 'KHDA's Open Data' [online]. Dubai: KHDA. [Accessed 21 May 2021].

Knowledge and Human Development Authority. (2019). *Statistics for private schools in Dubai 2019/2020*. Dubai: Government of Dubai. Retrieved from https://www.khda.gov.ae/en/directory?isSearched=1&islight=_islight&school=&textFilter=&rating=&curriculum=&grade=&fee=&location=&isNewSchool=0&tab=tab-school&year=

Knowledge and Human Development Authority. (2019). 'Dubai School Inspection Reports' [online]. Dubai: KHDA. [Accessed 21 October 2019]. Available at: https://www.khda.gov.ae/en/directory?isSearched=1&islight=_islight&school=&textFilter=&rating=100&curriculum=American&grade=GRADE_12&fee=&location=&isNewSchool=0&tab=tab-

Knowledge and Human Development Authority (KHDA). (2020). *TIMSS 2019 School Report. Dubai: KHDA*. Retrieved from <https://www.khda.gov.ae/en/publications/article?id=10263>

Knowledge and Human Development Authority (KHDA). (2020). *KHDA: UAE National Agenda Parameter (NAP) Guidelines 2020-2021*. Dubai: KHDA.

Knowledge and Human Development Authority (KHDA). (2021). *Dubai: KHDA*. Retrieved from <http://www.khda.gov.ae/en/>

Komarraju, M. & Nadler, D. (2013). Self-efficacy and academic achievement: Why do implicit beliefs, goals, and effort regulation matter? *Learning and Individual Differences*, vol.25, pp.67-72. <http://dx.doi.org/10.1016/j.lindif.2013.01.005>.

Krishnaswamy, K.N., Sivakumar, A.L. & Mathirajan, M. (2006). *Management Research Methodology: Integration of Principles, Methods and Techniques*. 1st edn. India: Pearson Education.

Krumrei-Mancuso, E. J., Newton, F. B., Kim, E. & Wilcox, D. (2013). Psychosocial factors predicting first-year college student success. *Journal of College Student Development*, vol.54(3), pp. 247-266.

Kuhfeld, M., Tarasawa, B., Johnson, A., Ruzek, E. & Lewis, K. (2020). *Learning during Covid-19: Initial findings on students' reading and math achievement and growth NWEA*. <https://www.nwea.org/research/publication/learning-during-covid-19-initial-findings-on-students-reading-and-math-achievement-and-growth/>

Kuo, E., Hull, M., Gupta, A. & Elby, A. (2013). How students blend conceptual and formal mathematical reasoning in solving physics problems. *Science Education*, vol.97(1), pp.32-57.

Kyttala, M., Kanerva, K., Munter, I. & Bjorn, P. M. (2019). Working memory resources in children: Stability and relation to subsequent academic skills. *Educational Psychology*, 39(6), pp. 709-728. doi:10.1080/ 01443410.2018.1562046

Lakin, J. M. (2012). Assessing the cognitive abilities of culturally and linguistically diverse students: Predicting validity of verbal, quantitative, and nonverbal tests. *Psychology in the Schools*, vol.49, pp.756-769.

Lalonde, R. N. & Gardner, R. C. (1993). Statistics as a second language: Predicting performance of psychology students. *Canadian Journal of Behavioral Science*, vol.25, pp. 108-125.

Lambros, N. (2018). Global perspectives: Pupil Attitudes Where Should We Begin. GL Education Group.

Latzman, R. D., Elkovitch, N., Young, J. & Clark, L. A. (2010). The contribution of executive functioning to academic achievement among male adolescents. *Journal of Clinical and Experimental Neuropsychology*, 32(5), pp. 455-462.

Leder, G. C. & Forgasz, H. J. (2006). "Affect and mathematics education: PME perspectives", in A. Gutiérrez & P. Boero (eds). *Handbook of Research on the Psychology of Mathematics Education: Past, Present and Future*, pp. 403-427.

Lee, J. (2009). Universals and specifics of math self-concept, math self-efficacy, and math anxiety across 41 PISA 2003 participating countries. *Learning and Individual Differences*, vol.19, pp. 355-365.

Lee, J. & Shute, V. J. (2010). Personal and social-contextual factors in K-12 academic performance: An integrative perspective on student learning. *Educational Psychologist*, vol.45, pp. 185-202.

Lee, K., Bull, R. & Ho, R. M. H. (2013). Developmental changes in executive functioning. *Child Development*, 84(6), pp. 1933-1953.

Lee, J. & Shute, V. J. (2010). Personal and social-contextual factors in K-12 academic performance: An integrative perspective on student learning. *Educational Psychologist*, 45(3), pp. 185-202.

Lee, J. & Stankov, L. (2016). *Non-cognitive psychological processes and academic achievement*. London: UK: Routledge.

Leech, N.L. & Onwuegbuzie, A.J. (2007). An Array of Qualitative Data Analysis Tools: A Call for Data Analysis Triangulation. *School Psychology Quarterly*, vol.22(4), pp.557-584.

Lehto, J. E., Juujärvi, P., Kooistra, L. & Pulkkinen, L. (2003). Dimensions of executive functioning: Evidence from children. *British Journal of Developmental Psychology*, 21(1), pp. 59-80.

Lewis, K. & Kuhfeld, M. (2021). *Learning during COVID-19: An update on student achievement and growth at the start of the 2021-22 school year*. Center for School and Student Progress. Portland, OR: Northwest Evaluation Association.

- Leithwood, K., Mascal, B. & Strauss, L. (2008). Collective leadership effects on student achievement. *Educational Administration Quarterly*, vol. 44, pp. 529-561.
- Liem, G. (2019). Academic performance and assessment, *Educational Psychology*, vol.39(6), pp.705-708.
- Liem, G. A. D. & McInerney, D. M. (eds.). (2018). *Big theories revisited 2*. Charlotte, NC: Information Age Publishing.
- Liem, G. A. D. & Tan, S. H. (eds.). (2019). *Asian education miracles: In search of sociocultural and psychological explanations*. New York: Routledge.
- Linnenbrink-Garcia, L. & Patall, E.A. (2015). Motivation. In E.M. Anderman and L. Corno (eds). *Handbook of Educational Psychology*. 3rd edn, pp. 91-103. New York: Routledge.
- Liou, P. (2014). Investigation of the big-fish-little-pond effect on students' self-concept of learning mathematics and science in Taiwan: Results from TIMSS 2011. *Asia-Pacific Education Researcher*, vol. 23(3), pp. 769-778.
- Lipnevich, A., McCann, C., Krumm, S., Burrus, J. & Roberts, R. (2011). Mathematics attitudes and mathematics outcomes of U.S. and Belarusian middle school students. *Journal of Educational Psychology*, vol. 103(1), pp. 105-118.
- Lipnevich, A., Preckel, F. & Krumm, S. (2016). Mathematics attitudes and their unique contribution to achievement: Going over and above cognitive ability and personality. *Learning and Individual Differences*, vol. 47, pp. 70-79.
- Locke, E. A. & Latham, G. P. (2002). *Building a practically useful theory of goal setting and task motivation: A 35-year odyssey*. *American Psychologist*, vol. 57, pp. 705-717.
- Locke, E. A. & Latham, G. P. (2019). The Development of Goal Setting Theory: A Half Century Retrospective. *American Psychological Association*, vol.5(2), pp.93-105.
- Lohman, D. F. (2005). Review of Naglieri and Ford (2003): Does the Naglieri Nonverbal Ability Test identify equal proportions of high scoring White, Black, and Hispanic students? *The Gifted Child Quarterly*, vol.49, pp.19-29.
- Lone, P. A. & Lone, T. A. (2016). A study on relation between self-concept and academic achievement among secondary school students of Jammu district. *Journal of Education and Practice*, vol.7(31), pp.19-23.
- Luna, B., Padmanabhan, A. & O'Hearn, K (2010). What has fMRI told us about the development of cognitive control through adolescence? *Brain and Cognition*, vol.72, pp.101-113.

Luna, B., Marek, S., Larsen, B., Tervo-Clemmens, B. & Chahal, R. (2015). An Integrative model of the maturation of cognitive control. *Annual Review of Neuro Science*, vol.8 (38), pp.151-170.

Lynn, R. & Mikk, J. (2007). National differences in intelligence and educational attainment. *Intelligence*, vol. 35, pp. 115-121.

Marsh, H. W. (2007). *Self-concept theory, measurement and research into practice: The role of self-concept in educational psychology*. Leicester, UK: British Psychological Society.

Marsh, H. W., Hau, K. T., Artelt, C., Baumert, J. & Peschar, J. L. (2006). OECD's brief self-report measure of educational psychology's most useful affective constructs: Cross-cultural, psychometric comparisons across 25 countries. *International Journal of Testing*, vol.6, pp. 311-360.

Marsh, H. & Martin, A. (2011). Academic self-concept and academic achievement: relations and casual ordering. *British journal of Educational Psychology*, vol.81, pp. 59-77.

Marsh, H., Pekrun, R., Lichtenfeld, S., Guo, J., Arens, A. & Murayama, K. (2016). Breaking the double-edged sword of effort/trying hard: Developmental equilibrium and longitudinal relations among effort, achievement, and academic self-concept. *Developmental Psychology*, vol. 52(8), pp. 1273-1290.

Marsh, H., Pekrun, R., Murayama, K., Arens, A., Parker, P., Guo, J. & Dicke, T. (2018). An integrated model of academic self-concept development: Academic self-concept, grades, test scores, and tracking over 6 years. *Developmental Psychology*, vol. 54(2), pp. 263-280.

Marshall, J., Smart, J. & Alston, D. (2017). Inquiry-based instruction: A possible solution to improving student learning of both science concepts and scientific practices. *International Journal of Science and Mathematics Education*, vol. 15(5), pp. 777-796.

Martin, A. J. (2007). Examining a multidimensional model of student motivation and engagement using a construct validation approach. *British Journal of Educational Psychology*, 77, pp. 413-440.

Martin, A. J. (2009). Motivation and engagement across the academic life span. *Educational and Psychological Measurement*, vol.69, pp. 794-824.

Matsumoto, A. (2019). Literature Review on Education Reform in the UAE. *International Journal of Educational Reform*, vol. 28(1), pp. 4-23.

Mayer, R. E. (1996). *Learners as information processors: Legacies and limitations of educational psychology's second metaphor*. *Educational Psychologist*, vol. 31, pp. 151-161.

Mayer, R. E. (1998). Cognitive, metacognitive, and motivational aspects of problem solving. *Instructional Science*, vol.26, pp. 49-63.

Mayes, R.L., Forrester, J.H., Christus, J.S., Peterson, F.I., Bonilla, R. & Yestness, N. (2014). Quantitative reasoning in Environmental Science: A learning Progression. *International Journal of Science Education*, vol. 36(4), pp. 635-658.

McDonald, A. S., Newton, P. E., Whetton, C. & Benefield, P. (2001) Aptitude testing for university entrance: A literature review. *The Sutton Trust*. Retrieved from http://www.nfer.ac.uk/publications/APL01/APL01_home.cfm

McGeown, S., Johnston, R., Walker, J., Howatson, K., Stockburn, A. & Dufton, P. (2015). The relationship between young children's enjoyment of learning to read, reading attitudes, confidence and attainment. *Educational Research*, vol. 57(4), pp.389-402.

McLeod, D.B. (1992). "Research on affect in mathematics education: a reconceptualization", in D.Grows (ed). *Handbook of Research on Mathematics Teaching and Learning*, pp. 575-596. New York: McMillan.

McInerney, D., Cheng, R., Mok, M. & Lam, A. (2012). Academic self-concept and learning strategies: Direction of effect on student academic achievement. *Journal of Advanced Academics*, vol. 23(3), pp. 249-269.

McMillan, J. H. & Schumacher, S. (2010). *Research in education: evidence-based inquiry*. 7th edn. Pearson Education, Inc.

McTighe, J. & Ferrara, S. (2021). *Assessing Student Learning by Design: Principles and Practices for Teachers and School Leaders in the Classroom*. Teacher College Press, Columbia University.

Medford, R. S. (2014). *An Analysis of Teachers' Classroom Instructional Activities Based on NWEA" Measures of Academic Progress"(MAP) Data*. Gardner-Webb University.

Merino, K. & Beckman, T.O. (2010). Using reading Curriculum-Based Measurements as Predictor for the Measure Academic Progress (MAP) Standardized Test in Nebraska. *International Journal of Psychology: A Biopsychosocial Approach*, vol. 6, pp. 85-98.

Merriam, S. B. (2002). "Introduction to qualitative research", in S. B. Merriam & Associates (eds). *Qualitative research in practice: Examples for discussion and analysis*. San Francisco, CA: Jossey-Bass.

Mertens, D. & Hesse-Biber, S. (2012). Triangulation and Mixed Methods Research: Provocative Positions. *Journal of Mixed Methods Research*, vol.6(2), pp. 75-79.

Midgley, C., Kaplan, A., Middleton, M., Urdan, T., Maehr, M. L., Hicks, L. & Roeser, R.W. (1998). Development and validation of scales assessing students' achievement goal orientation. *Contemporary Educational Psychology*, vol.23, pp. 113-131. doi: 10.1006/ceps.1998.0965

Ministry of Education United Arab Emirates – MOE. (2014). *United Arab Emirates: School Inspection Framework*. Retrieved from <https://www.moe.gov.ae/ar/importantlinks/inspection/publishingimages/frameworkbooken.pdf>

Ministry of Education United Arab Emirates - MOE (2019). UAE. Retrieved from <https://www.moe.gov.ae/en/pages/home.aspx>

Moakler, M. W. & Kim, M. M. (2014). College major choice in STEM: Revisiting confidence and demographic factors. *The Career Development Quarterly*, 62(2), pp. 128-142.

MoE.Gov. (2019). Open Data [online]. [Accessed 20 May 2021]. Available at: <https://www.moe.gov.ae/En/OpenData/pages/home.aspx>

Moonesar, I. Mourtada, R. Shaer, S., Al-Eisawi, D. & Elomari, L. (2015). *Persistence in the Abu Dhabi STEM Pipeline. Preparing Emirati Youth for Science and Technology Careers in The Innovation Economy*. Mohamed Bin Rashid School of Government. Dubai, United Arab Emirates.

Moore, K.C., Carlson, M.P. & Oehrtman, M. (2009). *The role of quantitative reasoning in solving applied precalculus problems*. Conference on research in undergraduate mathematics education (CRUME). Raleigh, NC.

Moore, K.C. (2010). *The role of quantitative reasoning in precalculus students learning central concepts of trigonometry*. PhD. Thesis. Arizona State University.

Mosing M., Madison G., Pedersen N., Kuja-Halkola R. & Ullén F. (2014). Practice does not make perfect: No causal effect of music practice on music ability. *Psychological Science*, vol. 25, pp. 1795-1803.

Muis, K. R. & Edwards, O. (2009). Examining the stability of achievement goal orientation. *Contemporary Educational Psychology*, 34(4), pp. 265-277. doi:10.1016/j.cedpsych.2009.06.003

Musa, D. & Smuel, I. (2019). Influence of cognitive Styles and Gender on Upper Basic III Mathematics Students' Achievement in Keffi, Nasarawa State, Nigeria. *International Journal of Scientific and Research Publications*, vol. 9(8), pp. 566-576.

Mushtaq, S. N. K. (2012). Factors affecting students' academic performance. *Global Journal of Management and Business Research*, 12(9), pp. 17-22.

Nasser, F. (1999). "Prediction of statistics achievement," in *Proceedings of the International Statistical Institute 52nd Conference*, Helsinki, Finland, (3), pp. 7-8.

Nasser, F. (2004). Structural model of the effects of cognitive and affective factors on the achievement of Arabic-speaking pre-service teachers in introductory statistics. *Journal of Statistics Education*. Retrieved from <http://www.amstat.org/publications/JSE/v12n1/nasser.html>.

National Association of School Psychologists. (2020c). Telehealth: Virtual Service Delivery Updated Recommendations. National Association of School Psychologists. Retrieved from <https://www.nasponline.org/resources-and-publications/resources-and-podcasts/covid-19-resource-center/special-education-resources/telehealth-virtual-service-delivery-updated-recommendations>

National Research Council. (2001). Classroom assessment and the National Science Education Standards. Washington, DC: National Academies Press. Retrieved from <http://www.nap.edu/catalog/9847/classroom-assessment-and-the-national-scienceeducation-standards>.

National Research Council. (2003). Assessment in support of instruction and learning: bridging the gap between large-scale and classroom assessment. Workshop Report. Washington, DC: National Academies Press.

National Research Council. (2011b). *Assessing 21st century skills*. Washington, DC: National Academies Press.

Naglieri, J. A. & Ronning, M. E. (2000). The relationship between general ability using the Naglieri Nonverbal ability test (NNAT) and Stanford Achievement Test (SAT) Reading Achievement. *Journal of Psychoeducational Assessment*, vol.18, pp. 230-239. doi:10.1177/073428290001800303

New England Association of Schools and Colleges (NEASC). (2017). *ACE learning Eco-System Foundation Standards Learning Principles Reflections*. NEASC-Commission on International Education (V3.0).

Nelson, T. O. (1996). Consciousness and metacognition. *American Psychologist*, vol. 51, pp. 102-116.

Ng, T.W., Eby, L.T., Sorensen, K.L. & Feldman, D.C. (2005). Predictors of objective and subjective career success: A meta-analysis. *Personnel Psychology*, vol.58, pp. 367-408. <http://dx.doi.org/10.1111/j.1744-6570.2005.00515.x>.

Northwest Evaluation Association. (2004). Reliability and validity estimates: NWEA achievement level tests and Measure of Academic Progress [online]. [Accessed 30 November 2019]. Available at: <http://www.nwea.org>.

Northwest Evaluation Association. (2005). *NWEA reliability and validity estimates: Achievement level tests and measures of academic progress*. Lake Oswego, OR: Author

Northwest Evaluation Association NWEA. (2007b). *Research based accuracy*. Portland, OR: Northwest Evaluation Association.

Northwest Evaluation Association NWEA. (2011). *Technical manual for MAP and MPG*. Portland, OR: Northwest Evaluation Association.

Northwest Evaluation Association. (2012). *Glossary of terms*. Portland, OR: NWEA.

Northwest Evaluation Association. (2012). *Measures of academic progress (MAP): basics overview*. Portland, OR: Northwest Evaluation Association.

Northwest Evaluation Association NWEA. (2013). *Normative Data & RIT Scores: NWEA achievement level tests and measures of academic progress* [online]. US: NWEA. [Accessed 21 October 2019]. Available at: <https://www.nwea.org/normative-data-rit-scores/>

Northwest Evaluation Association NWEA. (2014). 'Measures for Academic Progress MAP: Interim Assessments for Grades K-12. How MAP Enables teachers and School Leaders to Make a Difference' [online]. US: NWEA. [Accessed 21 October 2019]. Available at: <https://www.nwea.org/content/uploads/2014/10/MAP-Overview-for-Teachers-and-School-Leaders.pdf>

Northwest Evaluation Association. (2017). *NWEA: Linking the Smarter Balanced assessments to NWEA MAP Growth tests*. Portland, OR: Author.

Northwest Evaluation Association NWEA (2019). *MAP Growth™ Technical Report*. Portland, OR: Northwest Evaluation Association.

Northwest Evaluation Association. (2020). *NWEA: MAP Growth: Class Report* [online] <https://teach.mapnwea.org/impl/maphelp/Content/Data/SampleReports/ClassReport.html>.

Nowicki, B., Sullivan-Watts, B., Shim, M., Young, B. & Pockalny, R. (2012). Factors Influencing Science Content Accuracy in Elementary Inquiry Science Lessons. *Research in Science Education*, vol. 43 (3), pp. 1135-1154.

Newton, S., Smith, L., Moore, G. & Magnan, M. (2007). Predicting early academic achievement in Baccalaureate nursing program. *Journal of Professional Nursing*, vol.23(3), pp. 144-149.

Oettingen, G. & Gollwitzer, P. M. (2009). "Making goal pursuit effective: Expectancy-dependent goal setting and planned goal striving", in J. P. Forgas, R. F. Baumeister & D. M. Tice (eds). *Psychology of self-regulation: Cognitive, affective, and motivational processes*, pp 127-146. New York, NY: Psychology Press.

Olani, A. (2009). Predicting first-year university students' academic success. *Electronic Journal of Research in Educational Psychology*, vol.7(3), pp. 1053-1072.

Olivier, E., Archambault, I., De Clercq, M. & Galand, B. (2019). Student Self-Efficacy, Classroom Engagement, and Academic Achievement: Comparing Three Theoretical Frameworks. *Journal of Youth Adolescence*, vol.48, pp. 326-340 (2019).

Olson, J. M. & Zanna, M. P. (1993), "Attitude and attitude change." *Annual Review of Psychology*, vol.44, pp. 117-154.

O'Neal, J. (2019). *Examining the Relationship between Academic Self-Concept and Academic Achievement for Early Elementary Students*. PhD Thesis. Grand Canyon University: Phoenix, Arizona.

Onwuegbuzie, A.J. (1998). Statistics anxiety: A function of learning style? *Research in Schools*, vol.5, pp 43-52.

Onwuegbuzie, A.J. (2000). Statistics anxiety and the role of self-perception. *Journal of Educational Research*, vol. 93, pp. 323-330.

Onwuegbuzie A.J. (2003). Modeling Statistics Achievement among Graduate Students. *Educational and Psychological Measurement*, 63(6), pp. 1020-1038.

Onwuegbuzie, A.J. & Collins, K. (2007). A typology of mixed methods sampling designs in social science research. *The Qualitative Report*, vol. 12(2), pp. 281-316.

Onwuegbuzie, A.J. & Johnson, R.B. (2006). The Validity Issue in Mixed Research. *Research in the Schools*, vol. 13(1), pp. 48-63.

Onwuegbuzie, A.J. & Leech, N. (2005). On becoming a pragmatic researcher: The importance of combining quantitative and qualitative research methodologies. *International Journal of Social Research Methodology*, vol. 8(5), pp. 375-387.

Organization for Economic Co-operation and Development OECD. (2003). *Student engagement at school: A sense of belonging and participation*. Results from PISA 2000. Paris: Author.

Organization for Economic Co-operation and Development OECD. (2004a). *Learning for tomorrow's world. First results from PISA 2003*. Paris: Author.

Organization for Economic Co-operation and Development OECD. (2004b). *Problem solving for tomorrow's world first measures of cross-curricular competencies from PISA 2003*. Paris: Author.

Organization for Economic Co-operation and Development OECD. (2010). *PISA 2009 results. Learning to Learn*. Paris: Author.

Organization for Economic Co-operation and Development OECD. (2011). *PISA in focus: How do some students overcome their socio-economic background?* OECD Publishing.

Organization for Economic Co-operation and Development OECD. (2012). *PISA 2009 technical report*. PISA, OECD Publishing. <http://dx.doi.org/10.1787/9789264167872-en>.

Organization for Economic Co-operation and Development OECD. (2015a). *PISA in focus: How confident are students in their ability to solve mathematics problems?* OECD Publishing.

Organization for Economic Co-operation and Development OECD. (2015b). *Better Skills, Better Jobs, Better Lives: A Strategic Approach to Education and Skills Policies for the United Arab Emirates*. OECD Publishing.

Organization for Economic Co-operation and Development OECD. (2016). *PISA 2015 Technical Report*. Paris: PISA, OECD Publishing.

Organization for Economic Co-operation and Development OECD. (2017a). 'PISA 2015 Assessment and Analytical Framework Science, Reading, Mathematics, Financial Literacy and Collaborative Problem Solving' [online]. [Accessed 10 October 2019]. Available at: <https://www.oecd.org/publications/pisa-2015-assessment-and-analytical-framework-9789264281820-en.html>.

Organization for Economic Co-operation and Development OECD. (2017b). *PISA for Development Assessment and Analytical framework: Reading, Mathematics and Science, Preliminary Version*, Paris: OECD Publishing.

Organization for Economic Co-operation and Development OECD. (2018a). 'PISA: Programme for International Assessment for Schools' [online]. [Accessed 10 October 2019]. Available at: <http://www.oecd.org/pisa/aboutpisa/pisa-based-test-for-schools-faq.htm>

Organization for Economic Co-operation and Development OECD. (2018b). 'PISA 2015: PISA Results in focus' [online]. [Accessed 10 March 2019]. Available at: <https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf>

The above two a and b?

Organization for Economic Co-operation and Development OECD. (2018c). Learners Assessment for learning Formative Assessment. OECD/CERI: International Conference on Learning in the 21st Century-Research, Innovation and Policy. [online]. Center for Educational Research and Innovation. [Accessed 30 April 2022]. Available at: <https://www.oecd.org/site/educeri21st/40600533.pdf>

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research*, vol.66, pp. 543-578.

Pajares, F. D. H. (2002). "Self and self-belief in psychology and education: A historical perspective", in J. Aronson & D. Cordova (eds). *Improving academic achievement: Impact of psychological factors on education*, pp. 3-21. New York: Academic Press.

Pan, W., Liu, C., Q., Gu, Y., Yin, S. & Chen, A. (2016). The neural basis of trait self-esteem revealed by the amplitude of low-frequency fluctuations and resting state functional connectivity. *Social Cognitive and Affective Neuroscience*, vol. 11(3), pp. 367-376.

Patton, M. Q. (2002). *Qualitative Research and Evaluation Methods*. 3rd edn. Thousand Oaks, CA: Sage.

Paul, F. (2015). ADNOC Elementary Schools MAP Data Overview. Education Data Specialist. <https://www.adnoc.sch.ae/Documents/ADNOC%20Elementary%20Schools%20MAP%20Data%20Overview.Fall%202015.pdf>

Peirce, C. S. (1934). "Some Consequences of Four Incapacities" in Hartshorne, Charles and Weiss, Paul (eds). *Collected papers of Charles Sanders Peirce, Volume 5: Pragmatism and Pragmaticism*. Cambridge, Mass.: Harvard University Press.

Pennington, R. (2017). New Exam Awaits Grade 12 Pupils across the country, Minister Says [online]. Abu Dhabi: The National. [Accessed 9 March 2019]. Available at: <https://www.thenational.ae/uae/new-exam-awaits-grade-12-pupils-across-the-country-minister-says-1.33009>

Perry, R.P., Hladkyj, S., Pekrun, R.H. & Pelletier, S.T. (2001). Academic control and action control in the achievement of college students: A longitudinal field study. *Journal of Educational Psychology*, 93(4), pp. 776-789.

- Perry, R.P., Hladkyj, S., Pekrun, R.H., Clifton, R.A. & Chipperfield, J.G. (2005). Perceived academic control and failure in college students: a three-year study of scholastic attainment. *Research in Higher Education*, 46(5), pp. 535-569.
- Pesu, L., Aunola, K., Viljaranta, J. & Nurmi, J.E. (2016). The Development of Adolescents' Self-concept of Ability through Grades 7-9 and the Role of Parental Beliefs. *Frontline Learning Research*, 4(3), pp. 92-109.
- Petty, T. (2014). Motivating first-generation students to academic success and college completion. *College Student Journal*, 48(2), pp. 257-264.
- Phan, H. (2014). Self-efficacy, reflection, and achievement: A short-term longitudinal examination. *Journal of Educational Research*, vol. 107(2), pp. 90-1-2.
- Phillips, J. M. & Gully, S. M. (1997). Role of goal orientation, ability, need for achievement, and locus of control in the self-efficacy and goal-setting process. *Journal of Applied Psychology*, 82(5), p. 792.
- Pieschl, S. (2009). Metacognitive calibration-an extended conceptualisation and potential applications. *Metacognition and Learning*, vol. 4(1), pp. 3-31.
- Pintrich, P.R., and De Groot, E.V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, vol.82, pp. 33-40.
- Pintrich, P. R. (2000a). Multiple goals, multiple pathways: The role of goal orientation in learning and achievement. *Journal of Educational Psychology*, vol. 92, pp. 544-555.
- Pintrich, P. R. (2000b). An achievement goal theory perspective on issues in motivation terminology, theory, and research. *Contemporary Educational Psychology*, vol.25, pp. 92-104.
- Pintrich, P. R. & Schunk, D. H. (1996). *Motivation in education theory: Research and application*. Englewood Cliffs, NJ: Prentice Hall Merrill.
- Pinxten, M., de Fraine, B., Van Damme, J. & D'Haenens, E. (2013). Student achievement and academic self-concept among secondary students in Flanders: Gender and change over time. *Irish Educational Studies*, vol. 32(2), p.157.
- Pistilli, M. D., Willis, J. E. & Campbell, J. P. (2014). "Analytics through an institutional lens: Definition, theory, design and impact", in J. A. Larusson & B. White (eds). *Learning analytics: From research to practice*, pp. 79-102. New York: Springer.

Plucker, J. A., Burroughs, N. & Song, R. (2010). *Mind the (other) gap! The growing excellence gap in K-12 Education*. Center for Evaluation and Education Policy, Bloomington, IN: Indiana University.

Polychroni, F., Hatzichristou, C. & Sideridis, G. (2012). The role of goal orientations and goal structures in explaining classroom social and affective characteristics. *Learning and Individual Differences*, vol.22, pp. 207-217. doi:10.1016/j.lindif.2011.10.005

Popham, W.J. (2016). Standardized Tests: Purpose is the Point. *Educational Leadership*, vol.73(7), pp.44-49.

Potter, J. (2000). Post cognitivist psychology. *Theory and Psychology*, vol. 10, pp. 31-37.

Prashanti, E. & Ramnarayan, K. (2019). Ten maxims of formative assessment. *Advances in Physiology Education*, vol. 43(2), pp. 99-102.

Prince, D. & Nurius, P. (2014). The role of positive academic self-concept in promoting school success. *Children and Youth Services Review*, vol. 43, pp. 145-152.

Pritchard, M. E. & Wilson, G. S. (2003). Using emotional and social factors to predict student success. *Journal of college student development*, 44(1), pp. 18-28.

Quinn-Nilas, C., Kennett, D. & Maki, K. E. (2019). Examining explanatory style for failure of direct entry and transfer students using structural equation modelling. *Educational Psychology*, vol.39(6), pp.749-767.

Radel, R., Sarrazin, P., Legrain, P. & Wild, T. C. (2010). Social contagion of motivation between teacher and student: Analysing underlying processes. *Journal of Educational Psychology*, vol.102, pp. 577-587.

Radhwan, M. (2019). Investigating the Impact of Applying Different Strategies of Formative Assessments on Students' Learning Outcomes in Summative Assessments in a Private School in Sharjah, UAE. *Journal for Researching Education Practice and Theory*, vol. 2(1), pp. 57-79.

Ramsden, P. (2003). *Learning to teach in higher education*. London: Routledge Falmer.

Reichardt, C.S. & Rallis, S.F. (1994). Qualitative and quantitative inquiries are not incompatible: A call for a new partnership. *The Qualitative –Quantitative Debate: New Perspectives*, vol. 61, pp. 5-11.

Reggianini, F. (2017). *Measuring Academic and Cognitive Processes in Mathematics Assessment: A Content Analysis of The Mathematics Programme For International Student Assessment*. St. John's University, ProQuest Dissertation Publishing.

- Remesal, A. (2011). Primary and secondary teachers' conceptions of assessment: A qualitative study. *Teaching and Teacher Education*, vol.27(2), pp.472-482.
- Rickinson, B. & Rutherford, D. (1996). Systematic monitoring of the adjustment to university of undergraduates: A strategy for reducing withdrawal rates. *British Journal of Guidance and Counselling*, 24(2), pp. 213-225.
- Richardson, M., Abraham, C. & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychological Bulletin*, vol.138, pp. 353-387.
- Riley, N. & Ahlberg, M. (2004). Investigating the use of ICT-based concept mapping techniques on creativity in literacy tasks. *Journal of Computer Assisted Learning*, vol. 20, pp. 244-256.
- Rindermann, Baumeister & Groper (2014). Cognitive Abilities of Emirati and German Engineering University Students. Cambridge University Press, vol. 46, pp. 199-213.
- Rhodes, S. M., Booth, J. N., Campbell, L. E., Blythe, R. A., Wheate, N. J. & Delibegovic, M. (2014). Evidence for a role of executive functions in learning biology: Executive functions and science. *Infant and Child Development*, 23(1), pp. 67-83.
- Rhodes, S. M., Booth, J. N., Palmer, L. E., Blythe, R. A., Delibegovic, M. & Wheate, N. J. (2016). Executive functions predict conceptual learning of science. *British Journal of Developmental Psychology*, 34(2), pp. 261-275.
- Rohde, T. & Thompson, L. (2007). Predicting academic achievement with cognitive ability. *Intelligence*, vol.35, pp. 83-92.
- Rosenberg, M. (2015). Society and the Adolescent Self Image In *Society and the Adolescent Self Image*. Princeton University Press.
- Rosman, T. & Mayer, A. (2015). Intelligence, academic self-concept, and information literacy: The role of adequate perceptions of academic ability in the acquisition of knowledge about information searching. *Information Research*, vol.20(1).
Retrieved from <http://www.informationr.net/ir/20-1/isic2/isic34.html#.V2gARmgrK70>
- Roth, B., Becker, N., Romeyke, S., Schäfer, S., Domnick, F. & Spinath, F. M. (2015). Intelligence and school grades: A meta-analysis. *Intelligence*, vol.53, pp. 118-137.
<http://dx.doi.org/10.1016/j.intell.2015.09.002>.
- Rudloff, R. (2009). *The connexions project data wise: a step to using assessment results to improve teaching and learning*. Cambridge, MA: Harvard Education Press.

Saadat, M., Ghasemzadeh, A. & Soleimani, M. (2012). Self-esteem in Iranian university students and its relationship with academic achievement. *Procedia-Social and Behavioral Sciences*, vol.31, pp. 10-14.

Sackett, P. R., Kuncel, N. R., Arneson, J. J., Cooper, S. R. & Waters, S. D. (2009). Socioeconomic status and the relationship between the SAT® and freshman GPA: An analysis of data from 41 colleges and universities. The College Board. Research Report 2009-1. New- York: The College Board. Retrieved from <http://research.collegeboard.org/sites/default/files/publications/2012/9/researchreport-2009-1-socioeconomic-status-sat-freshman-gpa-analysis-data.pdf>

Sadler, P.M., Sonnert, G., Hazari, Z. & Tai, R. (2012). Stability and volatility of STEM career interest in high school: A gender study. *Science in Education*, vol. 96(3), pp. 411-427.

Salimabarkat, A. & Anjum, A. (2017). Intelligence as a Determinant of Academic Achievement: A Comparative Study of High Achievers and Underachievers. *International Journal of Humanities and Social Sciences (IJHSS)*, vol. 6(6), pp. 79-88. Available at SSRN: <https://ssrn.com/abstract=3092593>

Salimirad, F. & Srimathi, N. L. (2016). The relationship between psychological wellbeing and occupational self-efficacy among teachers in the city of Mysore, India. *The International Journal of Indian Psychology*, 3(2), pp. 14-21.

Saunders, M., Lewis, P. & Thornhill, A. (2009). *Research Methods for Business Students*. 5th edn. Harlow, Pearson Education.

Sawalha, A.M. & Sawalha, M. (2018). Academic Procrastination and its Relationship with the Academic Self-Concept in a Sample of Irbid National University Students. *Journal of Al-Quds Open University for Educational & Psychological Research & Studies*, vol.9(26), pp. 161-175.

Savin-Baden, M. & Major, C. H. (2013). *Qualitative Research: The Essential Guide to Theory and Practice*. Abingon, UK: Routledge.

Schau, C., Stevens, J., Dauphinee, T. & Del Vecchio, A. (1995). The development and validation of the Survey of Attitude toward Statistics. *Educational and Psychological Measurement*, vol.55, pp. 868-875.

Schmidt, I., Brunner, M., Keller, L., Scherrer, V., Wollschlager, R., Baudson, T. & Preckel, F. (2017). Profile formation of academic self-concept in elementary school students in grades 1 to 4. *Plos ONE*, vol. 12(5), pp.1-27.

Schraw, G. (1998). Promoting general metacognitive awareness. *Instructional Science*, vol.26, pp. 113-125.

Schraw, G., Crippen, K.J. & Hartley, K. (2006). Promoting self-regulation in science education: Metacognition as part of a broader perspective on learning. *Research in Science Education*, vol.36, pp. 111-139.

Schraw, G. & Dennison, R. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology*, vol. 19(4), pp. 460-475.

Schraw, G. & Moshman, D. (1995). Metacognitive theories. *Educational Psychology Review*, vol. 7(4), pp. 351-373.

Schult, J. & Sparfeldt, J.R. (2016). Do non-g factors of cognitive ability tests align with specific academic achievements? A combined bifactor modelling approach. *Intelligence*, vol. 59, pp. 96-102.

Schunk, D. H. (1991). Self-efficacy and academic motivation. *Educational Psychologist*, vol.26, pp. 207-231.

Schunk, D. H. (2001). Self-regulation through goal setting. ERIC/CASS Digest ED462671.

Schunk, D. H. (2012). *Learning Theories: An Educational Perspective*. 6th edn. Boston, MA: Pearson.

Schunk, D. H. (2020). *Learning Theories: An Educational Perspective*. 8th edn. New York, NY: Pearson.

Schunk, D. H. & DiBenedetto, M. K. (2014). "Academic self-efficacy", in M. J. Furlong, R. Gilman & E. S. Huebner (eds). *Handbook of Positive Psychology in the Schools*. 2nd edn, pp. 115-130. New York, NY: Routledge.

Schunk, D. H. & Mullen, C.A. (2012). "Self-efficacy as an engaged learner", in S.L. Christenson, A.L. Reschly & C. Wylie (eds). *Handbook of Research on Student Engagement*. pp.219-235. New York, NY: Springer.

Schunk, D. H. & Pajares, F. (2009). "Self-efficacy theory", in K.R. Wentzel & A. Wigfield (eds). *Handbook of motivation at school*, pp. 35-53. New York: Routledge.

Seligman, M. E. (2012). *Flourish: A Visionary New Understanding of Happiness and Wellbeing*. New York, NY: Simon and Schuster.

Senko, C. & Harackiewicz, J. M. (2005). Achievement goals, task performance, and interest: Why perceived goal difficulty matters. *Personality and Social Psychology Bulletin*, vol. 3, pp. 1739-1753.

Shannon-Baker, P. (2015). Making paradigms meaningful in mixed methods research. *Journal of Mixed Methods Research*, vol. 10(4).

Shepard, L. & Penuel, W. (2017). *Using Learning and Motivation Theories to Coherently Link Formative Assessment, Grading Practices, and Large-Scale Assessment*. Paper presented for discussion in “Book Club” session at the NCME Special Conference on Classroom Assessment and Large-Scale Psychometrics: *The Twain Shall Meet*, September 12-14, 2017, Lawrence, KS.

Shogren, K. A., Garnier Villarreal, M., Lang, K. & Seo, H. (2017). Mediating role of self-determination constructs in explaining the relationship between school factors and postschool outcomes. *Exceptional Children*, vol.83(2), pp. 165-180.

Simon, M. (2011). *Dissertation and Scholarly Research: Recipes for Success* (edn). Seattle, WA: Dissertation Success, LLC.

Singh, K., Granville, M. & Dika, S. (2002). Mathematics and science achievement: Effects of motivation, interest, and academic engagement. *The Journal of Educational Research*, vol. 95(6), pp. 323-332.

Sitzmann, T. & Ely, K. (2011). A meta-analysis of self-regulated learning in work-related training and educational attainment: What we know and where we need to go. *Psychological Bulletin*, vol.137(3), pp. 421-442.

Skinner, E., Furrer, C., Marchand, G. & Kindermann, T. (2008). Engagement and disaffection in the classroom: Part of a larger motivational dynamic? *Journal of Educational Psychology*, vol.100(4), pp. 765-781.

Smith, W. (2014). The Global Transformation toward Testing for Accountability. *Education Policy Analysis Archives*, vol. 22(116), pp.1-34.

Soni, A. & Kumari, S. (2017). The Role of Parental Math Anxiety and Math Attitude in Their Children’s Math Achievement. *International Journal of Science and Mathematics Education*, vol.15(2), pp. 331-347.

Sorge, C. & Schau, C. (2002). Impact of engineering students' attitudes on achievement in statistics: A structural model. *Annual meeting of the American Educational Research Association*, New Orleans.

Soric, I. & Palecic, M. (2009). The role of students' interests in self-regulated learning: The relationship between students' interests, learning strategies and causal attributions. *European Journal of Psychology of Education*, XXIV, pp. 545-565.

Srinivasan R. & Lohith C.P. (2017). Pilot Study-Assessment of Validity and Reliability. In: Strategic Marketing and Innovation for Indian MSMEs. *India Studies in Business and Economics*. Springer, Singapore.

Stadler, M., Austa, M., Beckerb, N., Niepela, C. & Greiffa, S. (2016). Choosing between what you want now and what you want most: Self-control explains academic achievement beyond cognitive ability. *Personality and Individual Differences*, vol.94, pp.168-172.

Stadler, M.J., Becker, N., Greiff, S. & Spinath, F.M. (2015). The complex route to success: Complex problem-solving skills in the prediction of academic achievement. *Higher Education Research and Development*, pp. 1-15.
<http://dx.doi.org/10.1080/07294360.2015.1087387>.

Stajkovic, A., Bandura, A., Locke, E., Lee, D. & Sargent, K. (2018). Test of three conceptual models of influence of the big five personality traits and self-efficacy on academic performance: A meta-analytic path-analysis. *Personality and Individual Differences*, vol. 120, pp. 238-245.

Stankov, L. (2013). Non cognitive predictors of intelligence and academic achievement: An important role of confidence. *Personality and Individual Differences*, 55(7), pp. 727-732.

Stankov, L. & Lee, J. (2014). Quest for the best non-cognitive predictor of academic achievement. *Educational Psychology*, vol.34(1), pp. 1-8.

Stankov, L. & Lee, J. (2015). "Confidence and self-efficacy: Are they different?" in F. Guay, D. McInerney, R. Craven & H. Marsh (eds). *Self-concept, motivation and identity: Underpinning success with research and practice*, pp. 225-248. Charlotte, NC: Information Age Publishing.

Stankov, L., Lee, J., Luo, W. & Hogan, D. J. (2012). Confidence: A better predictor of academic achievement than self-efficacy, self-concept and anxiety? *Learning and Individual Differences*, 22(6), pp. 747-758.

Stankov, L., Morony, S. & Lee, Y. P. (2014). Confidence: The best non-cognitive predictor of academic achievement. *Educational Psychology*, vol. 34(1), pp. 9-28.

Stanton, J. D., Neider, X. N., Gallegos, I. J. & Clark, N. C. (2015). Differences in metacognitive regulation in introductory biology students: When prompts are not enough. *CBE-Life Sciences Education*, vol.14(2).

Struyven, K., Dochy, F. & Janssens, S. (2005). Students' perceptions about evaluation and assessment in higher education: A review. *Assessment & Evaluation in Higher Education*, vol. 30(4), pp. 325-41.

Stupnisky, R. H., Perry, R. P., Hall, N. C. & Guay, F. (2012). Examining perceived control level and instability as predictors of first-year college students' academic achievement. *Contemporary Educational Psychology*, 37(2), pp. 81-90.

Stupnisky, R. H., Renaud, R. D., Perry, R. P., Ruthig, J. C., Haynes, T. L. & Clifton, R. A. (2007). Comparing self-esteem and perceived control as predictors of first-year college students' academic achievement. *Social Psychology of Education*, vol.10, pp. 303-330.

Tarka, P. (2018). An overview of structural equation modelling: its beginnings, historical development, usefulness and controversies in the social sciences. *Quality & Quantity: International Journal of Methodology*, vol.52(1), pp.313-354.

Tashakkori, A. & Teddlie, C. (2010). *Handbook of mixed methods in social and behavioral research*. 2nd edn. Thousand Oaks, CA: Sage.

Thompson, P. W. (1994d). "The development of the concept of spend and its relationship to concepts of rate", in G. Harel & J. Confrey (eds). *The development of multiplicative reasoning in the learning of mathematics*, pp. 179-234. Albany, NY: SUNY Press.

Thompson, P. W. (2011). "Quantitative reasoning and mathematical modelling", in L. L. Hatfield, S. Chamberlain & S. Belbase (eds). *New perspectives and directions for collaborative research in mathematics education*. WISDOMe Monographs, vol. 1, pp. 33-57. Laramie, WY: University of Wyoming.

Thompson, V. A. & Johnson, S. C. (2014). Conflict, metacognition, and analytic thinking. *Thinking and Reasoning*, 20(2), pp. 215-244.
<http://dx.doi.org/10.1080/13546783.2013.869763>.

Thompson, V. A., Turner, J. A. P. & Pennycook, G. (2011). Intuition, reason, and metacognition. *Cognitive Psychology*, vol.63(3), pp. 107-140.
<http://dx.doi.org/10.1016/j.cogpsych.2011.06.001>.

Thum, Y. M. (2011). *Measuring Student Growth and Achievement against College Readiness Benchmarks and the ACT*. Technical White Paper. Grand Rapids, MI: National Charter School Institute.

Thum, Y.M. & Hauser, C.H. (2015). *NWEA 2015 MAP norms for student and school achievement status and growth*. NWEA Research Report. Portland, OR: NWEA.

- Thum, Y.M. & Kuhfeld, M. (2020). *NWEA 2020 MAP Growth: Achievement Status and Growth Norms for Students and Schools*. NWEA Research Report. Portland, OR: NWEA.
- Thum Y. M. & Matta, T. (2015). *MAP College Readiness Benchmarks: A Research Brief*. NWEA Research Report. Portland, OR: NWEA.
- Tremblay, P. F., Gardner, R. C. & Heipel, G. (2000). A model of the relationships among measures of affect, aptitude, and performance in introductory statistics. *Canadian Journal of Behavioural Science*, vol. 321, pp. 40-48. <http://dx.doi.org/10.1037/h0087099>.
- UAE Government. (2018). '*Information and services: Equalizing High School Certificate*' [online]. Abu Dhabi: Information and e-Government. [Accessed 17 March 2019]. Available at: <https://government.ae/en/information-and-services/education/school-education-k-12/joining-k-12-education/equalising-high-school-certificates>
- UAE Government. (2019). '*UAE Centennial 2071*' [online]. Abu Dhabi: Government.ae [Accessed 30 September 2019]. Available at: <https://government.ae/en/about-the-uae/strategies-initiatives-and-awards/federal-governments-strategies-and-plans/uae-centennial-2071>
- UAE Vision 2021. (2018). '*Enrolment Rate in Foundation Year: First rate Education System*' [online]. Dubai: Vision2021. [Accessed 12 March 2019]. Available at: <https://www.vision2021.ae/en/national-agenda-2021/list/card/enrollment-rate-in-foundation-year>
- Uerz, D., Dekkers, H. & Beguin, A. A. (2004). Mathematics and language skills and the choice of science subjects in secondary education. *Educational Research and Evaluation*, vol. 10(2), pp. 163-182.
- Unicef. (2021). '*Education Disrupted: The second year of the Covid-19 pandemic and school closures*' [online]. Unicef for every child. [Accessed March 2022]. Available at: <https://data.unicef.org/resources/education-disrupted/>
- United Nations Educational, Scientific and Cultural Organization- International Bureau of Education (UNESCO-IBE) (2013). '*IBE Glossary of Curriculum Terminology*' [Online] UNESCO International Bureau of Education [Accessed April 2022]. Available at: <http://www.ibe.unesco.org/sites/default/files/resources/ibe-glossary-curriculum.pdf>
- Vaessen, B., Beemt, A., Watering, G., Meeuwen, L., Lemmens, L. & Brok, P. (2017). Students' perception of frequent assessments and its relation to motivation and grades in a statistics course: a pilot study. *Assessment & Evaluation in Higher Education*, vol. 42(6), pp. 872-886.
- Valerius, S. & Sparfeldt, J. R. (2014). Consistent g- as well as consistent verbal-, numerical-

and figural-factors in nested factor models? Confirmatory factor analyses using three test batteries. *Intelligence*, vol.44, pp. 120-133. <http://dx.doi.org/10.1016/j.intell.2014.04.003>.

Vandavelde, S., Van Keer, H. & Rosseel, Y. (2013). Measuring the complexity of upper primary school children's self-regulated learning: A multi-component approach. *Contemporary Educational Psychology*, vol.38, pp. 407-425.

Van Lancker, W. & Parolin, Z. (2020). COVID-19, school closures, and child poverty: A social crisis in the making. *The Lancet Public Health*, vol.5(5), pp.e243-e244.

Veenman, M. (2012). "Metacognition in science education: definitions, constituents, and their intricate relation with cognition", in A.Zohar & Y. Dori (eds). *Metacognition in Science Education: Trends in Current Research*. Berkeley, CA: Springer, Ch2.

Veenman, M. V. J. & Spaans, M. A. (2005). Relation between intellectual and metacognitive skills: Age and task differences. *Learning and Individual Differences*, vol.15(2), pp. 159-176.

Veenman, M., Van Hout-Wolters, B. & Afflerbach, P. (2006). Metacognition and learning: conceptual and methodological considerations. *Metacognition Learning*, vol.1, pp. 3-14.

Viljaranta, J., Tolvanen, A., Aunola, K. & Nurmi, J. (2014). The developmental dynamics between interest, self-concept of ability, and academic performance. *Scandinavian Journal of Educational Research*, vol. 58(6), pp. 734-756.

Viner, R. M., Russell, S. J., Croker, H., Packer, J., Ward, J., Stansfield, C., Mytton, O., Bonell, C. & Booy, R. (2020). School closure and management practices during corona virus outbreaks including COVID-19: A rapid systematic review. *The Lancet Child & Adolescent Health*, vol.4(5), pp.397-404.

Vizoso, C., Arias, O. & Rodriguez Perez, C. (2019). Exploring coping and optimism as predictors of academic burnout and performance among university students. *Educational Psychology*, vol.39(6), pp. 768-783. doi:10.1080/ 01443410.2018.1545996

Voelkl, K. E. (1997). Identification with school. *American Journal of Education*, vol.105, pp. 294-318.

Volpe, F. (2016). *The Role of Academic Achievement Motivation in Predicting Performance on the Northwest Evaluation Association's Measure of Academic Progress. Mindsets: Incremental vs. Entity Beliefs about Intelligence*. The University of New Mexico, ProQuest Dissertation Publishing.

Wai, J., Brown, M. & Chabris, C. (2018). Using Standardized Test Scores to Include General Cognitive Ability in Education Research and Policy. *Journal of Intelligence*, vol. 6(37), pp.1-16.

Wang, X. (2013). Why students choose STEM majors: Motivation, high school learning, and postsecondary context of support. *American Educational Research Journal*, 50(5), pp. 1081-1121.

Wang, Y., Kretschmer, R. & Hartman, M. (2010). Teacher as researcher: theory into practice. *American Annals of the Deaf*, vol. 155 (2), pp. 105-109.

Wäschle, K., Allgaier, A., Lachner, A., Fink, S. & Nückles, M. (2014). Procrastination and self-efficacy: Tracing vicious and virtuous circles in self-regulated learning. *Learning and Instruction*, vol.29, pp. 103-114.

Watkins M. W., Lei P-W. & Canivez G. L. (2007). Psychometric intelligence and achievement: A cross lagged panel analysis. *Intelligence*, vol. 35, pp. 59-68.

Wells, B. H., Sanchez, H. A. & Attridge, J. M. (2009). *Modeling student interest in science, technology, engineering and mathematics*. Waltham, MA: Raytheon Company. Retrieved from http://www.raytheon.com/responsibility/rtnwcm/groups/public/documents/content/rtn_stem_whpaper.pdf

Wentzel, K. R. (1992). “Motivation and achievement in adolescence: A multiple goals perspective”, in D. H. Schunk & J.L. Meece (eds). *Student perceptions in the classroom*, pp. 287-306. Hillsdale, NJ: Erlbaum.

Whitham S., Sterling L., Lin C.E., Wood J.J. (2013). “Social Cognitive Learning Theory”, in F.R. Volkmar (eds). *Encyclopaedia of Autism Spectrum Disorders*. Springer, New York, NY. https://doi.org/10.1007/978-1-4419-1698-3_484

Wiggins, G. & McTighe, J. (2005). *Understanding by Design*. 2nd edn. Alexandria, VA: Association for Supervision and curriculum Development ASCD.

Williams, G. Whittome, B. & Watts, P. (2005). “Attitude Measurement to Bridge the Post-16 Gap”, in Y. Hillier & A. Thompson (eds). *Readings in Post-Compulsory Education*. London: Continuum International Publishing Group.

Wince, M. H. & Borden, V. M. H. (1995). When does student satisfaction matter? (ERIC Document Reproduction Services No. ED 386 990). MA: Association for Institutional Research.

Winne, P. H. (2005). Key issues in modelling and applying research on self-regulated learning. *Applied psychology: an international review*, vol. 54(2), pp. 232–238.

Winne, P. H. (2010). Bootstrapping learner's self-regulated learning. *Psychological Test and Assessment Modeling*, vol. 52(4), pp. 472-490.

Winne, P. H. (2011). "A cognitive and metacognitive analysis of self-regulated learning", in B. J. Zimmerman & D. H. Schunk (eds). *Handbook of self-regulation of learning and performance*, pp. 15-32. New York: Routledge.

Winne, P. H. (2018). "Cognition and metacognition within self-regulated learning", in D. H. Schunk & J. A. Greene (eds). *Handbook of self-regulation of learning and performance*, 2nd edn, pp. 15-32. New York: Routledge.

Winne, P. H. & Hadwin, A. F. (1998). Studying as self-regulated learning. *Metacognition in educational theory and practice*, vol.93, pp.27-30.

Wintre, M. G., Dilouya, B., Pancer, S. M., Pratt, M. W., Birnie-Lefcovitch, S., Polivy, J. & Adams, G. (2011). Academic achievement in first-year university: Who maintains their high school average? *Higher Education*, 62(4), pp. 467-481.

Wise, S. L. (2017). Rapid-guessing behavior: Its identification, interpretations, and implications. *Educational Measurement: Issues and Practice*, vol. 36(4), pp. 52-61.

Wise, S. L. & Kingsbury, G. G. (2016). Modeling student test-taking motivation in the context of an adaptive achievement test. *Journal of Educational Measurement*, vol. 53, pp. 86-105.

Wise, S. L. & Ma, L. (2012). *Setting response time thresholds for a CAT item pool: The normative threshold method*. In annual meeting of the National Council on Measurement in Education, Vancouver, Canada.

Wisnabaker, J. M. & Scott, J. S. (1997). *Modeling aspects of students' attitude and achievement in introductory statistics course*. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago, IL.

Wisnabaker, J., Nasser, F. & Scott, J. (1998). *A multicultural exploration of the interrelation among attitude about and achievement in introductory statistics*. Paper presented at the Annual Meeting of the International Conference of Teaching Statistics, Singapore.

Wisnabaker, J., Scott, J. & Nasser, F. (2000). *Structural equation models relating attitude about and achievement in introductory statistics courses: a comparison of results from US and Israel*. Paper presented at the Annual Meeting of the International Group for the Psychology of Mathematics Education, Akito, Japan.

Wolters, C.A. & Hussain, M. (2015). Investigating grit and its relations with college students' self-regulated learning and academic achievement. *Metacognition and Learning*, 10(3), pp. 293-311.

Wooten, C. T. (1998). Factors influencing student learning in introductory accounting classes: A comparison of traditional and non-traditional students. *Issues Accounting Education*, vol.13, pp. 357-373.

Wouters, S., Germeijs, V., Colpin, H. & Verschueren, K. (2011). Academic self-concept in high school: Predictors and effects on adjustment in higher education. *Scandinavian Journal of Psychology*, vol. 52(6), pp. 586-594.

Yildiz, E., Akpinar, E., Tatar, N. & Ergin, O. (2009). Exploratory and confirmatory factor analysis of the metacognition scale for primary school students. *Kurman ve Uygulamada Egitim Bilimleri*, vol. 9(3), pp. 1591-1604.

Yorke, M. (2011). Analysing existing datasets: some considerations arising from practical experience. *International Journal of Research and Method in Education*, vol. 34(3), pp. 255-267.

Zakaria, E., Zain N.M., Ahmad, N.A. & Erlina, A. (2012). Mathematics Anxiety and Achievement among Secondary School Students. *American Journal of Applied Sciences*, vol.9(11), pp.1828-1832.

Zajacova, A., Lynch, S. M. & Espenshade, T. J. (2005). Self-efficacy, stress, and academic success in college. *Research in Higher Education*, 46(6), pp. 677-706.

Zan, R., Brown, L., Evans, J. & Hannula, M. (2006). Affect in mathematics education: An introduction. *Educational Studies in Mathematics*, 63(2), pp. 113-121.

Zieffler A., Garfield J. & Fry E. (2018). "What Is Statistics Education?" in D. Ben-Zvi, K. Makar & J. Garfield (eds). *International Handbook of Research in Statistics Education*. Springer International Handbooks of Education. Springer, Cham.
https://doi.org/10.1007/978-3-319-66195-7_2

Zimmerman, B.J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology*, 81(3), pp. 329-339.

Zimmerman, B.J. (1990a). Self-regulating academic learning and achievement: The emergence of a social cognitive perspective. *Educational Psychology Review*, 2(2), pp. 173-201.

Zimmerman, B.J. (2000a). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology*, vol. 25(1), pp. 82-91.

Zimmerman, B.J. (2001). “Achieving academic excellence: A self-regulatory perspective”, in M. Ferrari (ed). *The pursuit of excellence through education*, pp. 85-110. Mahwah, NJ: Erlbaum.

Zimmerman, B.J. (2001). “Theories of self-regulated learning and academic achievement: An overview and analysis”, in B. J. Zimmerman & D. H. Schunk (eds). *Self-regulated learning and academic achievement: Theoretical perspectives*, pp. 1-39. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice*, vol. 41(2), pp. 64-70.

Zimmerman, B. J. (2008). “Goal setting: A key proactive source of academic self-regulation”, in D. H. Schunk & B. J. Zimmerman (eds). *Motivation and self-regulated learning: Theory, research, and applications*, pp. 267-295. New York: Taylor & Francis.

Zimmerman, B. J. (2008). Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American Educational Research Journal*, vol. 45(1), pp. 166-183.

Zwick, R. (2007). College admission testing. Retrieved from the National Association for College Admission Counselling
<http://stage.nacacnet.org/research/PublicationsResources/Marketplace/Documents/TestingWhitePaper.pdf>

Appendices

Appendix A- National Agenda Parameters

Mandatory components for all schools
Benchmark tests time frames and required scores (KHDA, 2020)

UAE National Agenda Parameter (NAP) Guidelines 2020-2021

Recommended Components

1. Potential to learn - CAT4
2. Progress towards improved performance in PISA – PbTS
3. Academic achievement - GLPT, MAP, ISA, ASSET
4. Readiness to learn – PASS. This assessment will help to identify, for individual students and groups of students, the perceived learning capability, self-regard, preparedness for learning, confidence in learning, response to curriculum demand and other aspects. In the 2020-21 academic year, PASS will be offered to schools free of charge for **all grades that take CAT4** as a part of the NAP (For more details, please see GL-education.com).

The data from these assessments should provide schools with a three-dimensional view of each student and help to triangulate internal and other external data for validating attainment and progress outcomes.

Table 1: Recommended components for all schools

The National Agenda Parameter 2020 -21 components		Requirements	
		Suggested grades	Number of students
1	GL Cognitive ability test – CAT 4	G5, 7, 9, 11 (UK curriculum schools Y6, 8, 10, 12)	- All students in the suggested grades (students who sat the test last academic year need not repeat it this year) - All new students who have joined the schools and do not have any CAT 4 data.
2	PISA based Test for Schools (PbTS)	Details later	- Details later
3	One benchmark assessment in Mathematics, Science and English (Mathematics, Science and Arabic for MOE-private schools) listed in Table B and specific to each curriculum.	All grades from G3 – G9 (UK curriculum schools: all years from Y4 – Y10)	- All students in the suggested grades

Table 2: Benchmark tests available according to the curriculum

Curriculum	Recommended assessment (choose one from this list)	Suggested grades	Comments	Number of students
UK	☐ GL (PTE, PTS and PTM) ☐ ACER (ISA)	Years 4, 5, 6, 7, 8, 9 and 10 (Grades 3, 4, 5, 6, 7, 8 and 9)	- For schools using the GL PT tests, the PTS (Progress Test in Science) is not available for Y7 - For schools administering ASSET or ACER (ISA), only the online version can be used	All students in the suggested grades
US	☐ NWEA MAP	Grades 3, 4, 5, 6, 7, 8 and 9	- NWEA MAP should be used for the grades that follow a US curriculum. For other grades, schools can choose any appropriate test from Table B (including, if appropriate, MAP)	
MoE	☐ EmSAT for all available grades and subjects. ☐ IBT (Arabic version) for all remaining available grades.	More details about available grades for EmSAT will be provided by the MoE.	- All information on the EmSAT and graduation requirements will be provided by the MoE.	
Indian (CBSE, CISCE, KSB)	☐ ASSET ☐ ACER (ISA)	Grades 3, 4, 5, 6, 7, 8, and 9	- For schools administering ASSET or ACER (ISA), only the online version can be used	All students in the suggested grades
IB	☐ ACER (ISA) ☐ NWEA MAP ☐ GL (PTE, PTS, PTM) ☐ ASSET	Grades 3, 4, 5, 6, 7, 8, and 9		
Others: Pakistani, Canadian, Philippines, and schools with English as language of instruction.	☐ ACER (ISA) ☐ NWEA MAP ☐ GL (PTE, PTS, PTM) ☐ ASSET	Grades 3, 4, 5, 6, 7, 8, and 9		

TABLE 3. Recommended component

1	GL PASS	Suggested for the same grades as CAT 4: Grades 5, 7, 9, 11 (Years 6, 8, 10, 12)	All students who will take CAT4 test as a part of N.A.P.
---	---------	--	---

TABLE 4: National Agenda Parameter Test Dates 2020-21

Test name	Format	Testing window		
GL CAT 4 www.gl-education.com email: international@gl-education.com	Online	Please communicate with the test provider for the updated dates.		
GL PASS	Online	October 1 – November 12, 2020		
GL PTS, PTM, PTE Revised dates from 2019/20 Academic Year	Online	Please communicate with the test provider for the updated dates. Using this assessment in September-October 2020 means that you will need to have your students sit the level they would have taken at the end of last year , i.e. a Year 6 student in September will take the assessment they would have taken in Year 5.		
GL PTS, PTM, PTE Spring 2021 session	Online	May 2 – June 17, 2021		
ACER ISA Revised dates from 2019/20 Academic Year https://www.acer.org/au/isa	Online	September 27 – October 15, 2020		
ACER ISA Spring 2021 session	Online	February 1 – February 19, 2021		
ACER IBT Spring 2021 (Arabic version for MoE schools only)	Online	November 16 – December 10, 2020		
ASSET https://www.ei-india.com/asset Email: savitri@sageuae.com (M) 0566744513	Online	January 10 – March 4, 2021		
NWEA MAP https://www.nwea.org/map-growth/ https://community.nwea.org/ Support: techsupport@nwea.org	Online	It is suggested that the test is administered a minimum of three times within an academic year: Fall, Winter and Spring . The three testing windows are as follows: (allowing for at least 8 weeks of instruction between test administrations). Students tested in Fall must be tested again in Winter and Spring.		
		<table> <tr> <td>Fall August 30 – November 28, 2020</td> <td>Winter December 2 – February 28, 2021</td> <td>Spring March 1 – June 25, 2021</td> </tr> </table>	Fall August 30 – November 28, 2020	Winter December 2 – February 28, 2021
Fall August 30 – November 28, 2020	Winter December 2 – February 28, 2021	Spring March 1 – June 25, 2021		
EmSAT		The MoE will inform eligible schools of the dates, targeted grades and targeted group of students. This information will be communicated at a later stage.		
PBTS – PISA based test for schools		The details will be provided later.		

Attainment in the National Agenda Parameter should be measured according to the table provided below. This is fully aligned to UAE Framework in Attainment 1.1.2

2019-2020 NAP standards.

Column A	Column B	Column C
International Benchmark Assessments	In line with international standards (minimum expectation) Attainment is Acceptable if at least 75% of students are attaining at or above the international standards stated in this column (Column B)	Level above international standards Attainment is Good: If at least 50% of the students are at or above the international standards stated in this column (Column C) Very Good If at least 61% of the students are at or above the international standards stated in this column (Column C) Outstanding If at least 75% of the students are at or above the international standards stated in this column (Column C)
MAP	41 st international percentile	61 st international percentile
GL PT (PTS, PTM, PTE)	Stanine 5	Stanine 6
IBT and Arabic version of IBT	41 st international percentile	61 st international percentile
ASSET	Stanine 5	Stanine 6
ISA	International mean minus half of standard deviation: $\mu - 0.75\sigma$	International mean: $\mu - 0.25\sigma$

August 18, 2020

To whom it may concern

This is to certify that **Mrs. Lames Abdul Hadi** with student ID number **20170124** is a registered part-time student on the **Doctor of Education** programme at **The British University in Dubai** since **September 2017**.

Mrs. Abdul Hadi has successfully completed the taught modules and is currently working on her thesis titled **“Investigating the Impact of Students’ Attainment, Aptitude, and Attitude on SAT Achievement: The Case of US-Curriculum Schools in the UAE”**.

She needs your support in conducting surveys, interviews and data assessment to complete the research.

This letter is issued on student’s request.

Yours sincerely,



Amer Alaya
Head of Student Administration

Appendix C- Research Consent Form for Participation in the Study



Research Consent Form

Title of Thesis: Investigating the Impact of Students' Attainment, Aptitude, and Attitude on SAT Achievement: The Case of US-Curriculum Schools in the UAE

September 6th, 2020

Dear Respected School Leaders,

My name is Lames Abdul Hadi, I am a PhD student in Education at The British University in Dubai. I am writing to request your permission to visit your school to collect data for my study.

I am conducting a study that aims to:

- ☐ Investigate the impact of students' attainment in MAP, aptitude level, and attitude towards learning on SAT achievement.
- ☐ Develop an equation to predict student's SAT score based on CAT4, MAP and PASS scores.
- ☐ Explore the stakeholders' perceptions about the impact of MAP, CAT4 and PASS on SAT achievement.

The international and national literature highlight a gap in clear indicators that can predict students' performance in US-curriculum schools exit exam. The intended outcome of the study is to develop an equation that predict performance in SAT using attainment, aptitude, and attitude assessment data. The study findings will contribute to the body of knowledge about the educational data driven decisions in curriculum, assessment, teaching and learning. Findings can help in improving students' attainment and progress in US-curriculum schools by taking early intervention plans and enhancing the stakeholders' role.

The data collection procedure will include:

- ☐ Assessment data collected from the school assessment records that include the MAP, CAT4, PASS, and SAT scores.
- ☐ Questionnaire consists of close-ended and open-ended questions. Two types of questionnaires will be used, one for grades 9-12 students and the other one for their teachers and leadership team.
- ☐ Interview with a focus group, which will be conducted after analyzing and interpreting the assessment data and questionnaires. The three focus groups are leadership team and teachers, students, and parents.

Please be assured with anonymity and confidentiality of the faculty members, students and the school itself. Also, faculty members and students' participation in the data collection process is totally voluntary and that they can withdraw at any time without any penalty or any social, financial or psychological harm. On the other hand, the researcher will present the data obtained objectively without any interference or manipulation.

Please sign the consent form attached to indicate your approval of participating in the study. Kindly, provide me with a suitable period – if any – where you think I should conduct the data collection procedure.

Thank you for your time and consideration.

School Approval

Principal Investigator: Lames Abdul Hadi

PHD student in Education, The British University in Dubai

Email ID: 20170124@student.buid.ac.ae

Research Consent Form

Title of Thesis: Investigating the Impact of Students' Attainment, Aptitude, and Attitude on SAT Achievement: The Case of US-Curriculum Schools in the UAE
October 15th, 2020

Dear Dr. [REDACTED]
Director of [REDACTED] The UAE

My name is Lames Abdul Hadi, I am a PHD student in Education at The British University in Dubai. I am writing to request your permission to visit your school to collect data for my study.

I am conducting a study that aims to:

- Investigate the impact of students' attainment in MAP, aptitude level, and attitude towards learning on SAT achievement;
- Develop an equation to predict student's SAT score based on CAT4, MAP and PASS scores.
- Explore the stakeholders' perceptions about the impact of MAP, CAT4 and PASS on SAT achievement.

The international and national literature highlight a gap in clear indicators that can predict students' performance in US-curriculum schools exit exam. The intended outcome of the study is to develop an equation that predict performance in SAT using attainment, aptitude, and attitude assessment data. The study findings will contribute to the body of knowledge about the educational data driven decisions in curriculum, assessment, teaching and learning. Findings can help in improving students' attainment and progress in US-curriculum schools by taking early intervention plans and enhancing the stakeholders' role.

The data collection procedure will include:

- Assessment data collected from the school assessment records that include the MAP, CAT4, PASS, and SAT scores.
- Questionnaire consists of close-ended and open-ended questions. Two types of questionnaires will be used, one for grades 11 and 12 students and the other one for their teachers and leadership team.
- Interview with focus group, which will be conducted after analyzing and interpreting the assessment data and questionnaires. The three focus groups are leadership and teachers, students, and parents.

Please be assured with anonymity and confidentiality of the faculty members, students and the school itself. Also, that faculty members and students' participation in the data collection process is totally voluntary and that they can withdraw at any time without any penalty, or any social, financial or psychological harm. On the other hand, the researcher will present the data obtained in an objective manner without any interference or manipulation.

Please sign the consent form attached to indicate your approval of visiting your school. Kindly, provide me with a suitable period – if any – where you think it is best for me to visit your university and conduct the data collection procedure.

Thank you for your time and consideration.
Principal Investigator: Lames Abdul Hadi
PHD student in Education, The British University in Dubai
Mobile: +971508470920.
Email ID: 20170124@student.buid.ac.ae



Tel: [REDACTED]

1

Appendix D- Leadership's Questionnaire



Investigating the Role of Students' Attainment, Aptitude, and Attitude Assessments in Predicting SAT Achievement: The Case of US-Curriculum Schools in the UAE Leadership's Questionnaire (Non-Teaching Positions)

The purpose of the study is to:

- Investigate the role of students' attainment in MAP, cognitive ability/ aptitude level (CAT4), and attitude towards learning (PASS) in SAT achievement.
- Develop an equation to predict student's SAT score based on CAT4, MAP and PASS scores.
- Explore the stakeholders' perceptions about the role of MAP, CAT4 and PASS in SAT achievement.

The study findings will contribute to the body of knowledge about the educational data-driven decisions in curriculum, assessment, teaching and learning. Findings can help in improving students' attainment and progress in US-curriculum schools by taking early intervention plans and enhancing the stakeholders' role.

If you decide to participate, please provide your signature as indicated below. Your signature indicates that you have read, considered, and understood the information provided above and that you have decided to participate. Please note that your participation is totally voluntary and that you can withdraw at any time. There are no foreseeable risks associated with the current study. In fact, the study will provide you with the opportunity to reflect on the practices implemented at the school. All information collected in this questionnaire will be handled with confidentiality and anonymity.

Thank you for your participation. Your effort and time are highly appreciated.

Do you consent to participate in the current study?

☐ Yes.

☐ No

Signature

--

Part A: Demographic Information

Nationality			
First Language (Mother Tongue)		Second Language	
Gender	☐ Female	☐ Male	
Highest Degree	☐ Bachelor	☐ Master	☐ PhD/Doctorate
Overall Years of Experience	☐ 1-3 ☐ 4-7	☐ 8-11 ☐ 12-15	☐ Over 15
Years of Experience in the Current School	☐ 1-3 ☐ 4-7	☐ 8-11 ☐ Over 11	

Current Role:

- Director-General
- Deputy Director
- Principal/
Superintendent/
Assistant/Vice Principal
- Academic Advisor
- Wellbeing Coordinator
- Social/Career Counsellor
- Curriculum (Director/HoD/Coordinator)
- Assessment (Director/HoD/Coordinator)
- Head of Department/Coordinator
- Head/Coordinator of Inclusion (Special Educational Needs)
- Others

Specialization:

- English
- Science
- ICT
- Math
- Humanities
- Others

Grade Level:

- Kindergarten
- Grades 1-5
- Grades 6-8
- Grades 9-12

Part B: Leadership's Perception

I) Academic Factors:

This section investigates the relationship between Measures of Academic Progress (MAP) test and student's academic achievement in SAT.

MAP is a test that measures students' progress in Reading, Language Usage, Mathematics, and Science.

How much experience do you have using MAP Tests?

- ☐ 1-3 ☐ 4-6 ☐ More than 7 years

Please read the following statements carefully then decide to what extent you agree or disagree with them. It is simply asking for your perception.

1= Strongly Disagree 2= Disagree 3=Neutral 4= Agree 5= Strongly Agree

SN	Statement	1	2	3	4	5
A) Academic Factor						
Academic Attainment (Measures of Academic Progress - MAP)						
1	I am aware of the strengths and weaknesses in the student's academic level based on MAP reports.					
2	I believe that training students on using MAP test report helps them improve their learning.					
3	I encourage students to use the information in MAP report to improve their academic knowledge and skills.					
4	I advise students to adjust their plans for learning based on the results they get from the MAP test or MAP "Student Goal Setting Worksheet".					
5	I think that monitoring students' academic progress should be based on their progress in MAP test.					
6	I recommend using MAP Goals or MAP "Student Goal Setting Worksheet" frequently to reflect with students on their achievement.					
Measures of Academic Progress (MAP) and SAT Achievement:						
7	I think MAP scores are important in predicting students' SAT scores.					
8	I think MAP tests are helpful to improve students' scores in SAT.					
9	I believe that students should connect what they learn from MAP to their SAT target.					
10	I think that setting students' SAT goals should be based on current MAP-RIT score or percentile.					

Do you think that MAP can help in predicting students' SAT scores?

- ☐ Yes. ☐ No

Explain, why?

II) Cognitive Factor:

This section investigates the relationship between Cognitive Abilities Test (CAT4) and student's academic achievement in SAT.

CAT4 assesses students reasoning abilities in thinking with "words", "shapes", "numbers", and "shapes and space".

How much experience do you have using CAT4 Test?

- ☐ 1-3 ☐ 4-6 ☐ More than 7 years

Please read the following statements carefully then decide to what extent you agree or disagree with them. It is simply asking for your opinion.

1= Strongly Disagree 2= Disagree 3=Neutral 4= Agree 5= Strongly Agree

SN	Statement	1	2	3	4	5
B) Cognitive Factor						
Aptitude (Cognitive Ability Test - CAT4)						
1	I am aware of the strengths and weaknesses in the student's cognitive ability level based on CAT4 reports.					
2	I believe that training students on using CAT4 report should help them improving their learning.					
3	I encourage students to use the information in CAT4 report to improve their academic knowledge and skills.					
4	I advise students to adjust their plans for learning based on the recommendation they get from the CAT4 test results and report.					
5	I think monitoring students' progress during a learning task should be done using the advice they got from their CAT4 reports.					
6	I recommend using CAT4 report and recommendation frequently to improve students' learning strategies and skills.					
Cognitive Ability Test (CAT4) and SAT Achievement						
7	I think cognitive abilities' level are important in predicting students' SAT scores.					
8	I think students' cognitive abilities (verbal, quantitative, non-verbal reasoning, and spatial ability) are helpful to improve their scores in SAT.					
9	I believe that students should connect what they learn about their cognitive abilities from CAT4 report to achieve their SAT target					
10	I think that setting students' SAT goals should be based on their current cognitive ability- CAT4 level.					

Do you think that CAT4 can help in predicting students' SAT scores?

- ☐ Yes. ☐ No

Explain, why?

III) Affective Factor:

This section investigates the relationship between Pupil Attitudes to Self and School (PASS) test and student's academic achievement in SAT.

PASS Test investigates students' attitudes towards self, learning, teachers, and school.

How much experience do you have in using tool to measure student's attitude towards learning?

- ☐ 1-3 ☐ 4-6 ☐ More than 7 years

Please read the following statements carefully then decide to what extent you agree or disagree with them. There are no right or wrong answers. It is simply asking for your opinion. Thank you very much for your participation.

1= Strongly Disagree 2= Disagree 3=Neutral 4= Agree 5= Strongly Agree

SN	Statement	1	2	3	4	5
C) Affective Factor						
Attitude (Attitude towards learning - PASS)						
27	I am aware that student's attitude towards school affect their performance in assessments.					
28	I am satisfied with students' performance.					
33	I think that students' attitude towards their teacher is important in affecting their academic achievement.					
29	Our students have a clear vision and goals to achieve in their learning.					
30	I think that our students believe in their capability of thinking independently and dealing with challenges to achieve their goal.					
31	I believe that students communication and collaboration in learning will improve their performance.					
Attitude towards Learning (PASS) and SAT Achievement						
32	I understand that students improve their attitude towards preparing for SAT test in order to achieve their goal.					
33	I think students' attitudes towards learning are important in affecting their SAT scores.					
34	I think that students' attitude towards the subject affect their performance in SAT tests.					
35	I think students' self-confidence in the subject is important in predicting their SAT scores.					

Do you think that students' attitude towards learning can help in predicting students' SAT scores?

- ☐ Yes. ☐ No

Explain, why?

Appendix E- Teachers' Questionnaire



Investigating the Role of Students' Attainment, Aptitude, and Attitude Assessments in Predicting SAT Achievement: The Case of US-Curriculum Schools in the UAE Teacher's Questionnaire (Teaching Positions)

The purpose of the study is to:

- Investigate the role of students' attainment in MAP, cognitive ability/ aptitude level (CAT4), and attitude towards learning (PASS) in SAT achievement.
- Develop an equation to predict student's SAT score based on CAT4, MAP and PASS scores.
- Explore the stakeholders' perceptions about the role of MAP, CAT4 and PASS in SAT achievement.

The study findings will contribute to the body of knowledge about the educational data-driven decisions in curriculum, assessment, teaching and learning. Findings can help in improving students' attainment and progress in US-curriculum schools by taking early intervention plans and enhancing the stakeholders' role.

If you decide to participate, please provide your signature as indicated below. Your signature indicates that you have read, considered, and understood the information provided above and that you have decided to participate. Please note that your participation is totally voluntary and that you can withdraw at any time. There are no foreseeable risks associated with the current study. In fact, the study will provide you with the opportunity to reflect on the practices implemented at the school. All information collected in this questionnaire will be handled with confidentiality and anonymity.

Thank you for your participation. Your effort and time are highly appreciated.

Do you consent to participate in the current study?

☐ Yes.

☐ No

Signature

--

Part A: Demographic Information

Nationality			
First Language (Mother Tongue)		Second Language	
Gender	☐ Female	☐ Male	
Highest Degree	☐ Bachelor	☐ Master	☐ PhD/Doctorate
Overall Years of Experience	☐ 1-3 ☐ 4-7	☐ 8-11 ☐ 12-15	☐ Over 15
Years of Experience in the Current School	☐ 1-3 ☐ 4-7	☐ 8-11 ☐ Over 11	

Current Role:

- ☐ Head of Department/Coordinator
- ☐ Coach
- ☐ Lead Teacher
- ☐ Teacher
- ☐ Others

Specialization:

- ☐ English
- ☐ Science
- ☐ ICT
- ☐ Math
- ☐ Humanities
- ☐ Others

Grade Level:

- ☐ Grade 9
- ☐ Grade 10
- ☐ Grade 11
- ☐ Grade 12

Part B: Teacher's Perception

I) Academic Factor:

This section investigates the relationship between Measures of Academic Progress (MAP) test and student's academic achievement in SAT.

MAP is a test that measures students' progress in Reading, Language Usage, Mathematics, and Science.

How much experience do you have using MAP Tests?

- ☐ 1-3 ☐ 4-6 ☐ More than 7 years

Please read the following statements carefully then decide to what extent you agree or disagree with them. It is simply asking for your perception.

1= Strongly Disagree 2= Disagree 3=Neutral 4= Agree 5= Strongly Agree

SN	Statement	1	2	3	4	5
A) Academic Factor						
Academic Attainment (Measures of Academic Progress - MAP)						
1	I am aware of the strengths and weaknesses in the student's academic level based on MAP reports.					
2	I train my students on using MAP test report to help them improve their learning.					
3	I encourage my students to use the information in MAP report to improve their academic knowledge and skills.					
4	I help my students to adjust their plans for learning based on the results they get from the MAP test or MAP "Student Goal Setting Worksheet".					
5	I monitor students' academic progress based on their progress in MAP test.					
6	I use MAP Goals or "Student Goal Setting Worksheet" frequently to reflect with students on their achievement					
Measures of Academic Progress (MAP) and SAT Achievement:						
7	I think MAP scores are important in predicting students' SAT scores					
8	I think MAP tests are helpful to improve students' scores in SAT.					
9	I help students to connect what they learn from MAP to their SAT target.					
10	I try to set students' SAT goals based on current MAP-RIT score or percentile.					

Do you think that MAP can help in predicting students' SAT scores?

- ☐ Yes. ☐ No

Explain, why?

II) Cognitive Factor:

This section investigates the relationship between Cognitive Abilities Test (CAT4) and student's academic achievement in SAT.

CAT4 assesses students reasoning abilities in thinking with "words", "shapes", "numbers", and "shapes and space".

How much experience do you have using CAT4 Test?

- ☐ 1-3 ☐ 4-6 ☐ More than 7 years

Please read the following statements carefully then decide to what extent you agree or disagree with them. There are no right or wrong answers. It is simply asking for your opinion. Thank you very much for your participation.

1= Strongly Disagree 2= Disagree 3=Neutral 4= Agree 5= Strongly Agree

SN	Statement	1	2	3	4	5
B) Cognitive Factor						
Aptitude (Cognitive Ability Test - CAT4)						
1	I am aware of the strengths and weaknesses in the student's cognitive ability level based on CAT4 reports.					
2	I train my students on using CAT4 report to help them improve their learning.					
3	I encourage my students to use the information in CAT4 report to improve their academic knowledge and skills					
4	I help my students to adjust their plans for learning based on the recommendation they get from the CAT4 test results and report.					
5	I monitor students' progress during a learning task using the advice I got from their CAT4 reports.					
6	I use CAT4 report and recommendation frequently to improve my students' learning strategies and skills.					
Cognitive Ability Test (CAT4) and SAT Achievement						
7	I think cognitive abilities' level are important in predicting students' SAT scores.					
8	I think students' cognitive abilities (verbal, quantitative, non-verbal reasoning, and spatial ability) are helpful to improve their scores in SAT.					
9	I believe that students should connect what they learn about their cognitive abilities from CAT4 report to achieve their SAT target					
10	I think that setting students' SAT goals should be based on their current cognitive ability- CAT4 level.					

Do you think that CAT4 can help in predicting students' SAT scores?

- ☐ Yes. ☐ No

Explain, why?

III) Affective Factor:

This section investigates the relationship between Pupil Attitudes to Self and School (PASS) test and student's academic achievement in SAT.

PASS Test investigates students' attitudes towards self, learning, teachers, and school.

How much experience do you have in using tool to measure student's attitude towards learning?

- ☐ 1-3 ☐ 4-6 ☐ More than 7 years

Please read the following statements carefully then decide to what extent you agree or disagree with them. There are no right or wrong answers. It is simply asking for your opinion. Thank you very much for your participation.

1= Strongly Disagree 2= Disagree 3=Neutral 4= Agree 5= Strongly Agree

SN	Statement	1	2	3	4	5
C) Affective Factor						
Attitude (Attitude towards learning - PASS)						
1	I understand that my students' attitude towards school affect their performance in assessments.					
2	I am satisfied with students' performance.					
3	I think my students' attitude towards their teacher is important in affecting their academic achievement.					
4	My students have a clear vision and goals to achieve in their learning.					
5	I believe that my students believe in their capability of thinking independently and dealing with challenges to achieve their goal.					
6	I believe that students communication and collaboration in learning will improve their performance					
Attitude towards Learning (PASS) and SAT Achievement						
7	I understand that students improve their attitude towards preparing for SAT test in order to achieve their goal.					
8	I think students' attitude towards learning are important in affecting their SAT scores.					
9	I think that students' attitude towards the subject affect their performance in SAT tests					
10	I think students' self-confidence in the subject is important in predicting their SAT scores					

Do you think that students' attitude towards learning can help in predicting students' SAT scores?

- ☐ Yes. ☐ No

Explain, why?

Appendix F- Students' Questionnaire



Investigating the Role of Students' Attainment, Aptitude, and Attitude Assessments in Predicting SAT Achievement: The Case of US-Curriculum Schools in the UAE Student's Questionnaire

The purpose of the study is to:

- Investigate the role of students' attainment in MAP, cognitive ability/ aptitude level (CAT4), and attitude towards learning (PASS) in SAT achievement
- Develop an equation to predict student's SAT score based on CAT4, MAP and PASS scores.
- Explore the stakeholders' perceptions about the role of MAP, CAT4 and PASS in SAT achievement.

Please note that your participation is totally voluntary and that you can withdraw at any time. There are no foreseeable risks associated with the current study. In fact, the study will provide you with the opportunity to reflect on the practices implemented at the school. All information collected in this questionnaire will be handled with confidentiality and anonymity. Thank you for your participation.

Do you consent to participate in the current study? *

☐ Yes. ☐ No

Part A: Demographic Information

Nationality				
First Language (Mother Tongue)		Second Language		
Age				
Gender	☐ Female	☐ Male		
Grade Level	☐ 9	☐ 10	☐ 11	☐ 12
Highest Degree	☐ Bachelor	☐ Master	☐ PhD/Doctorate	

Part B: Student's Perception

I) Academic Factor:

This section investigates the relationship between Measures of Academic Progress (MAP) test and student's academic achievement in SAT.

MAP is a test that measures student's progress in Reading, Language Usage, Mathematics, and Science.

How many years have you been taking the MAP test?

- ☐ 1-3 ☐ 4-6 ☐ More than 7 years

Please read the following statements carefully then decide to what extent you agree or disagree with them. There are no right or wrong answers. It is simply asking for your opinion. Thank you very much for your participation.

1= Strongly Disagree 2= Disagree 3=Neutral 4= Agree 5= Strongly Agree

SN	Statement	1	2	3	4	5
A) Academic Factor						
Academic Attainment (Measures of Academic Progress - MAP)						
1	I am aware of my strengths and weaknesses in subject based on MAP reports.					
2	I am aware of how to use MAP test to help me improve my learning.					
3	I know I can use the information in MAP report to master the mathematical skills.					
4	I adjust my plans for learning based on the results I get from the MAP test and MAP Goal Sheets.					
5	I check my progress in Math based on my progress in MAP test.					
6	I use MAP goal sheet frequently to reflect on my achievement.					
Measures of Academic Progress (MAP) and SAT Achievement:						
7	I seek to connect what I learn from MAP to achieve my SAT target.					
8	I think MAP tests are helpful to improve my scores in SAT.					
9	I think my MAP score is important in predicting my SAT scores.					
10	I try to set my SAT goals based on my current MAP-RIT score or percentile.					

Do you think that MAP can help you in predicting your SAT scores?

- ☐ Yes. ☐ No

Explain, why?

II) Cognitive Factor:

This section investigates the relationship between Cognitive Abilities Test (CAT4) and student's academic achievement in SAT.

CAT4 assesses students reasoning abilities in thinking with "words", "shapes", "numbers", and "shapes and space".

How many years have you been taking the Cognitive Ability Test – CAT4?

- ☐ 1-3 ☐ 4-6 ☐ More than 7 years

Please read the following statements carefully then decide to what extent you agree or disagree with them. There are no right or wrong answers. It is simply asking for your opinion. Thank you very much for your participation.

1= Strongly Disagree 2= Disagree 3=Neutral 4= Agree 5= Strongly Agree

SN	Statement	1	2	3	4	5
B) Cognitive Factor						
Aptitude (Cognitive Ability Test - CAT4)						
1	I am aware of my strengths and weaknesses in subject based on CAT4 reports.					
2	I am aware of how to use CAT4 report to help me improve my learning.					
3	I know I can use the information in my CAT4 report to master the mathematical skills.					
4	I adjust my plans for learning based on the recommendation I get from the CAT4 test results and report.					
5	I check my progress during a learning task using the advice I got from CAT4.					
6	I use CAT4 report and recommendation frequently to improve my learning strategies and skills.					
Cognitive Ability Test (CAT4) and SAT Achievement						
7	I seek to connect what I learn about my cognitive abilities from CAT4 report to achieve my SAT target.					
8	I think my cognitive ability (verbal, quantitative, non-verbal reasoning, and spatial ability) level is helpful to improve my scores in SAT.					
9	I think my cognitive ability level is important in predicting my SAT scores.					
10	I try to set my SAT goals based on my current cognitive ability-CAT4 level.					

Do you think that CAT4 can help you in predicting your SAT scores?

- ☐ Yes. ☐ No

Explain, why?

III) Affective Factor:

This section investigates the relationship between Pupil Attitudes to Self and School (PASS) test and student's academic achievement in SAT.

PASS Test investigates students' attitudes towards self, learning, teachers, and school.

How many years have you been taking the Pupil Attitudes to Self and School Test (PASS)?

- ☐ 1-3 ☐ 4-6 ☐ More than 7 years

Please read the following statements carefully then decide to what extent you agree or disagree with them. There are no right or wrong answers. It is simply asking for your opinion. Thank you very much for your participation.

1= Strongly Disagree 2= Disagree 3=Neutral 4= Agree 5= Strongly Agree

SN	Statement	1	2	3	4	5
C) Affective Factor						
Attitude (Attitude towards learning - PASS)						
1	I understand that my attitude towards school affect my performance in assessments.					
2	I am satisfied with my performance.					
3	I think my attitude towards my teacher is important in affecting my academic achievement.					
4	I have a clear vision and goals to achieve in my learning.					
5	I believe that I am capable of thinking independently and dealing with challenges to achieve my goal.					
6	I believe that my communication and collaboration in learning will improve my performance.					
Attitude towards Learning (PASS) and SAT Achievement						
7	I seek to improve my attitude towards preparing for SAT to achieve my goal.					
8	I think my attitude towards learning is important in affecting my SAT scores.					
9	I think that my attitude towards the subject affects my performance in SAT tests.					
10	I think my self-confidence in the subject is important in predicting my SAT scores.					

Do you think that your attitude towards learning can help you in predicting your SAT scores?

- ☐ Yes ☐ No

Explain, why?

Appendix G– Interview- (1) Leadership Team Focus Group (Non-Teaching Roles)

Brief description about the study: The study aims to understand the stakeholders' perceptions about the role of attainment in MAP, aptitude level (CAT4) and students' attitude towards self and school in SAT achievement.

Please note that your participation is totally voluntary and that you can withdraw at any time. All information collected in this interview will be handled with confidentiality and anonymity.

Section 1: Participants Demographic Information

Participants Demographic Information	Interviewee (1)	Interviewee (2)	Interviewee (3)	Interviewee (4)	Interviewee (5)
Name					
School					
Gender	Male () Female ()	Male () Female ()	Male () Female ()	Male () Female ()	Male () Female ()
Academic qualification	B. A/B.SC () M.A./M.Sc. () M.Phil. () Ph.D. ()	B. A/B.SC () M.A./M.Sc. () M.Phil. () Ph.D. ()	B. A/B.SC () M.A./M.Sc. () M.Phil. () Ph.D. ()	B. A/B.SC () M.A./M.Sc. () M.Phil. () Ph.D. ()	B. A/B.SC () M.A./M.Sc. () M.Phil. () Ph.D. ()
Professional qualification	B.Ed. () TD. /PGCE () M.Ed. () Ph.D. ()	B.Ed. () TD. /PGCE () M.Ed. () Ph.D. ()	B.Ed. () TD. /PGCE () M.Ed. () Ph.D. ()	B.Ed. () TD. /PGCE () M.Ed. () Ph.D. ()	B.Ed. () TD. /PGCE () M.Ed. () Ph.D. ()
Role					
Total years of leadership/teaching experience	0-5 () 6-10 () 11-15 () > 16 ()	0-5 () 6-10 () 11-15 () > 16 ()	0-5 () 6-10 () 11-15 () > 16 ()	0-5 () 6-10 () 11-15 () > 16 ()	0-5 () 6-10 () 11-15 () > 16 ()

Section 2- Stakeholders' perceptions about the role of attainment in MAP, aptitude level (CAT4) and students' attitude towards learning (PASS) in SAT achievement.

1. What are your views about the SAT? How does it differ than MAP or Internal Assessment?
2. What are your thoughts about the MAP test?
3. What are your thoughts about the CAT4 test?
4. What are your thoughts about the PASS test?
5. In your opinion, what are the main challenges in achieving the required scores in SAT?
6. Is there any changes in school plan to use CAT4, MAP and PASS to predict SAT?
7. Which one of the following tests is accurate in predicting SAT?
8. Is there any feedback or recommendation you would like to add?

Appendix H– Interview- (2) Teachers Focus Group (Teaching Roles)

Brief description about the study: The study aims to understand the stakeholders' perceptions about the role of attainment in MAP, aptitude level (CAT4) and students' attitude towards self and school in SAT achievement.

Please note that your participation is totally voluntary and that you can withdraw at any time. All information collected in this interview will be handled with confidentiality and anonymity.

Section 1: Participants Demographic Information

Participants Demographic Information	Interviewee (1)	Interviewee (2)	Interviewee (3)	Interviewee (4)	Interviewee (5)
Name					
School					
Gender	Male () Female ()	Male () Female ()	Male () Female ()	Male () Female ()	Male () Female ()
Academic qualification	B. A/B.SC () M.A./M.Sc. () M.Phil. () Ph.D. ()	B. A/B.SC () M.A./M.Sc. () M.Phil. () Ph.D. ()	B. A/B.SC () M.A./M.Sc. () M.Phil. () Ph.D. ()	B. A/B.SC () M.A./M.Sc. () M.Phil. () Ph.D. ()	B. A/B.SC () M.A./M.Sc. () M.Phil. () Ph.D. ()
Professional qualification	B.Ed. () TD. /PGCE () M.Ed. () Ph.D. ()	B.Ed. () TD. /PGCE () M.Ed. () Ph.D. ()	B.Ed. () TD. /PGCE () M.Ed. () Ph.D. ()	B.Ed. () TD. /PGCE () M.Ed. () Ph.D. ()	B.Ed. () TD. /PGCE () M.Ed. () Ph.D. ()
Role/Subject taught					
Total years of leadership/teaching experience	0-5 () 6-10 () 11-15 () > 16 ()	0-5 () 6-10 () 11-15 () > 16 ()	0-5 () 6-10 () 11-15 () > 16 ()	0-5 () 6-10 () 11-15 () > 16 ()	0-5 () 6-10 () 11-15 () > 16 ()

Section 2- Stakeholders' perceptions about the role of attainment in MAP, aptitude level (CAT4) and students' attitude towards learning (PASS) in SAT achievement.

- 1.What are your views about the SAT? How does it differ than MAP or Internal Assessment?
2. What are your thoughts about the MAP test?
3. What are your thoughts about the CAT4 test?
4. What are your thoughts about the PASS test?
5. In your opinion, what are the main challenges in achieving the required scores in SAT?
6. Is there any changes in school plan to use CAT4, MAP and PASS to predict SAT?
7. Which one of the following tests is accurate in predicting SAT?
8. Is there any feedback or recommendation you would like to add?

Appendix I- Interview- (3) Students Focus Group

Brief description about the study: The study aims to understand the stakeholders' perceptions about the role of attainment in MAP, aptitude level (CAT4) and students' attitude towards self and school in SAT achievement.

Please note that your participation is totally voluntary and that you can withdraw at any time. All information collected in this interview will be handled with confidentiality and anonymity.

Section 1: Participants Demographic Information

School Name				
Participants Demographic Information	Interviewee (1)	Interviewee (2)	Interviewee (3)	Interviewee (4)
Student's Name				
Grade Level				
Gender	Male () Female ()	Male () Female ()	Male () Female ()	Male () Female ()
Participants Demographic Information	Interviewee (5)	Interviewee (6)	Interviewee (7)	Interviewee (8)
Student's Name				
Grade Level				
Gender	Male () Female ()	Male () Female ()	Male () Female ()	Male () Female ()

Section 2- Stakeholders' perceptions about the role of attainment in MAP, aptitude level (CAT4) and students' attitude towards learning (PASS) in SAT achievement.

1. What are your views about the SAT? How does it differ than MAP or Internal Assessment?
2. What are your thoughts about the MAP test? Did you use the MAP report? How did you use it?
3. What are your thoughts about the CAT4 test? Did you use the CAT4 report? How did you use it?
4. What are your thoughts about the PASS test? To what extent your attitude can affect your academic performance? elaborate
5. In your opinion, what are the main challenges in achieving the required scores in SAT?
6. Did you use any of the CAT4, MAP and attitude towards learning scores to set goals for SAT?
7. If any, which one of the tests you think is accurate in predicting SAT?
8. Is there any feedback or recommendation you would like to add?

Appendix J: Interview (4) Parents Focus Group

Interview Protocol

Brief description about the study: The study aims to understand the stakeholders' perceptions about the role of attainment in MAP, aptitude level (CAT4) and students' attitude towards self and school in SAT achievement.

Please note that your participation is totally voluntary and that you can withdraw at any time.

All information collected in this interview will be handled with confidentiality and anonymity.

Section 1: Participants Demographic Information

School Name				
Participants Demographic Information	Interviewee (1)	Interviewee (2)	Interviewee (3)	Interviewee (4)
Name				
Son/Daughter Grade Level				
Gender	Male () Female ()	Male () Female ()	Male () Female ()	Male () Female ()
Participants Demographic Information	Interviewee (5)	Interviewee (6)	Interviewee (7)	Interviewee (8)
Name				
Son/Daughter Grade Level				
Gender	Male () Female ()	Male () Female ()	Male () Female ()	Male () Female ()

Section 2- Stakeholders' perceptions about the role of attainment in MAP, aptitude level (CAT4) and students' attitude towards learning (PASS) in SAT achievement.

1. What are your views about the SAT? How does it differ than MAP or Internal Assessment?
2. What are your thoughts about the MAP test? Do you receive the MAP results? Do you discuss the results with your son/daughter?
3. What are your thoughts about the CAT4 test? Do you receive the MAP results? Do you discuss the results with your son/daughter?
4. What are your thoughts about your son/daughter attitude towards learning (PASS test)?
5. In your opinion, what are the main challenges in achieving the required scores in SAT?
6. Is there any communication from school that use students' CAT4, MAP and attitude towards learning to predict SAT?
7. Which one of the tests is accurate in predicting SAT?
8. Is there any feedback or recommendation you would like to add?

Appendix K: Pilot Study – Pearson Correlation Coefficients

Correlations																															
Pearson Correlation		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1																															
2	0.36																														
3	0.37	0.73																													
4	0.50	0.67	0.73																												
5	0.42	0.49	0.34	0.65																											
6	0.61	0.56	0.55	0.76	0.82																										
7	0.36	0.50	0.36	0.76	0.75	0.70																									
8	0.54	0.62	0.62	0.75	0.65	0.74	0.76																								
9	0.45	0.45	0.42	0.79	0.68	0.70	0.87	0.78																							
10	0.55	0.50	0.44	0.77	0.79	0.82	0.85	0.80	0.85																						
11	0.48	0.27	0.36	0.29	0.48	0.42	0.34	0.38	0.38	0.49																					
12	0.59	0.49	0.55	0.59	0.60	0.69	0.65	0.75	0.63	0.75	0.81																				
13	0.56	0.70	0.74	0.74	0.68	0.77	0.64	0.78	0.55	0.69	0.61	0.81																			
14	0.50	0.58	0.56	0.73	0.75	0.74	0.79	0.71	0.69	0.82	0.70	0.86	0.88																		
15	0.51	0.45	0.43	0.62	0.75	0.76	0.72	0.66	0.72	0.79	0.78	0.86	0.77	0.91																	
16	0.50	0.50	0.46	0.66	0.79	0.82	0.74	0.67	0.69	0.78	0.74	0.85	0.83	0.92	0.98																
17	0.53	0.45	0.63	0.72	0.71	0.79	0.70	0.73	0.72	0.78	0.66	0.83	0.86	0.90	0.87	0.88															
18	0.37	0.42	0.51	0.47	0.54	0.48	0.52	0.65	0.56	0.58	0.61	0.79	0.70	0.73	0.65	0.62	0.77														
19	0.41	0.60	0.62	0.56	0.54	0.64	0.56	0.71	0.55	0.58	0.59	0.82	0.81	0.73	0.71	0.73	0.75	0.85													
20	0.58	0.49	0.57	0.72	0.74	0.81	0.73	0.72	0.73	0.83	0.72	0.89	0.84	0.94	0.93	0.92	0.94	0.77	0.77												
21	0.31	0.54	0.34	0.40	0.51	0.33	0.37	0.35	0.34	0.41	0.49	0.41	0.53	0.58	0.46	0.49	0.52	0.53	0.51	0.51											
22	-0.13	0.50	0.26	0.38	0.34	0.30	0.48	0.39	0.55	0.34	0.13	0.30	0.29	0.40	0.42	0.43	0.29	0.35	0.43	0.37	0.24										
23	-0.10	0.54	0.26	0.36	0.36	0.25	0.45	0.24	0.46	0.36	0.01	0.14	0.16	0.28	0.18	0.20	0.20	0.27	0.18	0.24	0.36	0.66									
24	0.15	0.70	0.46	0.41	0.28	0.27	0.34	0.36	0.36	0.24	0.28	0.34	0.53	0.41	0.36	0.39	0.37	0.52	0.64	0.37	0.61	0.56	0.53								
25	-0.02	0.59	0.37	0.34	0.20	0.12	0.43	0.42	0.35	0.16	0.03	0.20	0.39	0.29	0.15	0.18	0.23	0.44	0.51	0.20	0.43	0.52	0.45	0.70							
26	-0.01	0.46	0.45	0.17	0.01	0.10	0.14	0.26	0.28	0.07	0.01	0.11	0.10	0.01	0.06	0.04	0.11	0.25	0.34	0.09	0.18	0.48	0.54	0.55	0.47						
27	0.02	0.37	0.16	0.15	0.34	0.18	0.29	0.26	0.20	0.24	0.15	0.20	0.19	0.17	0.24	0.19	0.08	0.36	0.42	0.17	0.31	0.27	0.32	0.51	0.42	0.51					
28	0.47	0.51	0.46	0.44	0.37	0.31	0.41	0.51	0.40	0.31	0.27	0.31	0.44	0.29	0.22	0.25	0.27	0.34	0.43	0.26	0.44	0.13	0.23	0.47	0.61	0.45	0.52				
29	0.20	0.62	0.28	0.38	0.34	0.38	0.34	0.54	0.28	0.36	0.03	0.32	0.43	0.28	0.24	0.26	0.19	0.33	0.54	0.24	0.40	0.34	0.32	0.54	0.53	0.33	0.54	0.44			
30	0.27	0.62	0.24	0.23	0.33	0.37	0.20	0.29	0.09	0.26	0.32	0.35	0.40	0.32	0.35	0.37	0.14	0.19	0.43	0.26	0.48	0.29	0.26	0.53	0.35	0.27	0.58	0.42	0.74		

Appendix L: Correlational Analysis Results for all the Variables

SAT-Math and SAT-English:

- There is a strong positive correlation between SAT-Math and SAT-English, $r = 0.754$.

MAP-Math and MAP-English:

- There is a strong positive correlation between MAP-Math and MAP-Reading, $r = 0.695$.
- There is a strong positive correlation between MAP-Math and MAP-Language, $r = 0.727$.
- There is a strong positive correlation between MAP-Reading and MAP-Language, $r = 0.817$.

MAP-Math and PASS:

- There is a small positive correlation between MAP-Math and PASS-2 (Perceived Learning Capability), $r = 0.222$.
- There is a moderate positive correlation between MAP-Math and PASS-3 (Learner Self Regard), $r = 0.352$.
- There is a small positive correlation between MAP-Math and PASS-4 (Preparedness for Learning), $r = 0.222$.
- There is a small positive correlation between MAP-Math and PASS6 (General Work Ethics), $r = 0.147$.
- There is a small positive correlation between MAP-Math and PASS-7 (Confidence in Learning), $r = 0.116$.
- There is a moderate positive correlation between MAP-Math and PASS-9 (Response to Curriculum), $r = 0.342$.

MAP- Reading and PASS:

- There is a small positive correlation between MAP- Reading and PASS-2 (Perceived Learning Capability), $r = 0.278$.
- There is a moderate positive correlation between MAP- Reading and PASS-3 (Learner Self Regard), $r = 0.319$.
- There is a small positive correlation between MAP- Reading and PASS-4 (Preparedness for Learning), $r = 0.289$.
- There is a small positive correlation between MAP- Reading and PASS6 (General Work Ethic), $r = 0.095$.
- There is a small positive correlation between MAP- Reading and PASS7 (Confidence in Learning), $r = 0.133$.
- There is a moderate positive correlation between MAP- Reading and PASS9 (Response to Curriculum), $r = 0.301$.

MAP-Language and PASS:

- There is a small positive correlation between MAP-Language and PASS-2 (Perceived Learning Capabilities), $r = 0.263$.

- There is a small positive correlation between MAP-Language and PASS-3 (Learner Self Regard), $r = 0.298$.
- There is a small positive correlation between MAP-Language and PASS-4 (Preparedness for Learning), $r = 0.240$.
- There is a small positive correlation between MAP-Language and PASS-6 (General Work Ethic), $r = 0.081$.
- There is a small positive correlation between MAP-Language and PASS-7 (Confidence in Learning), $r = 0.110$.
- There is a small positive correlation between MAP-Language and PASS-9 (Response to Curriculum), $r = 0.288$.

CAT4 and PASS:

- There is a small positive correlation between CAT4 and PASS 2 (Perceived Learning Capability), $r = 0.211$.
- There is a moderate positive correlation between CAT4 and PASS 3 (Learner Self Regard), $r = 0.346$.
- There is a small positive correlation between CAT4 and PASS 4 (Preparedness for Learning), $r = 0.181$.
- There is a small positive correlation between CAT4 and PASS 6 (General Work Ethic), $r = 0.122$.
- There is a small positive correlation between CAT4 and PASS 7 (Confidence in Learning), $r = 0.114$.
- There is a small positive correlation between CAT4 and PASS 9 (Response to Curriculum), $r = 0.289$.

CAT4 and MAP:

- There is a strong positive correlation between MAP- Reading and CAT4, $r = 0.646$.
- There is a strong positive correlation between MAP-Language and CAT4, $r = 0.678$.
- There is a strong positive correlation between MAP-Math and CAT4, $r = 0.660$.

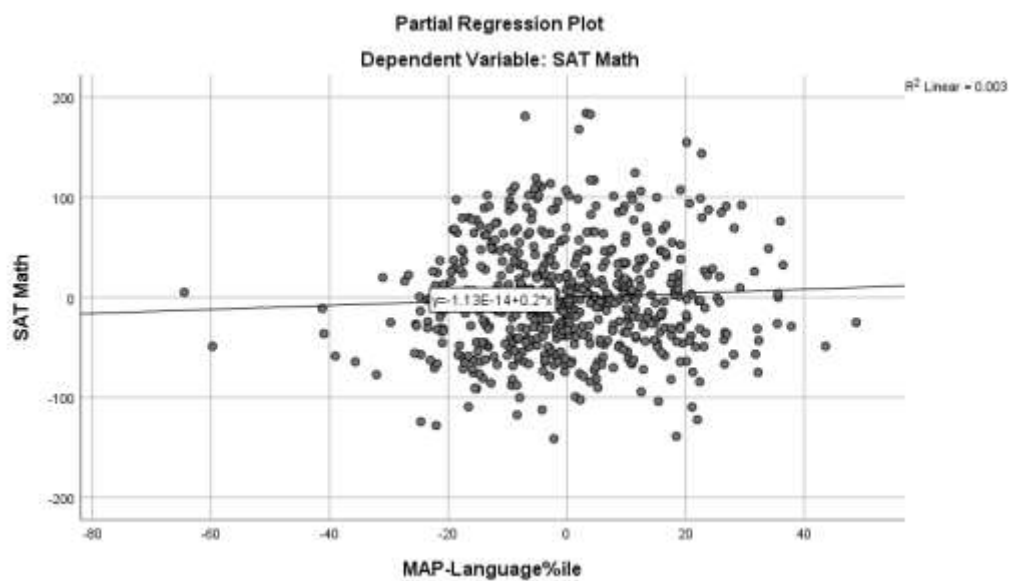
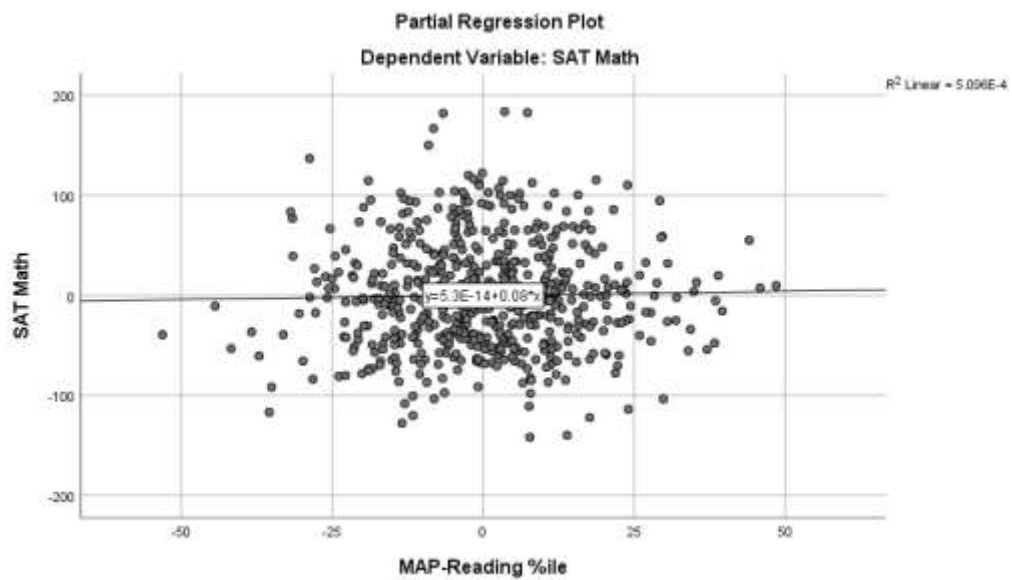
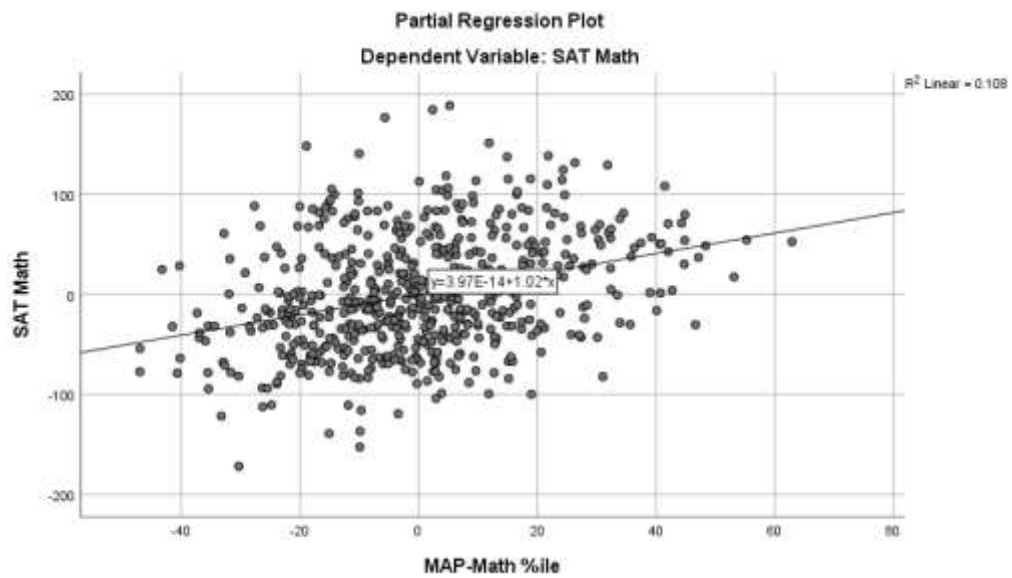
PASS Factors:

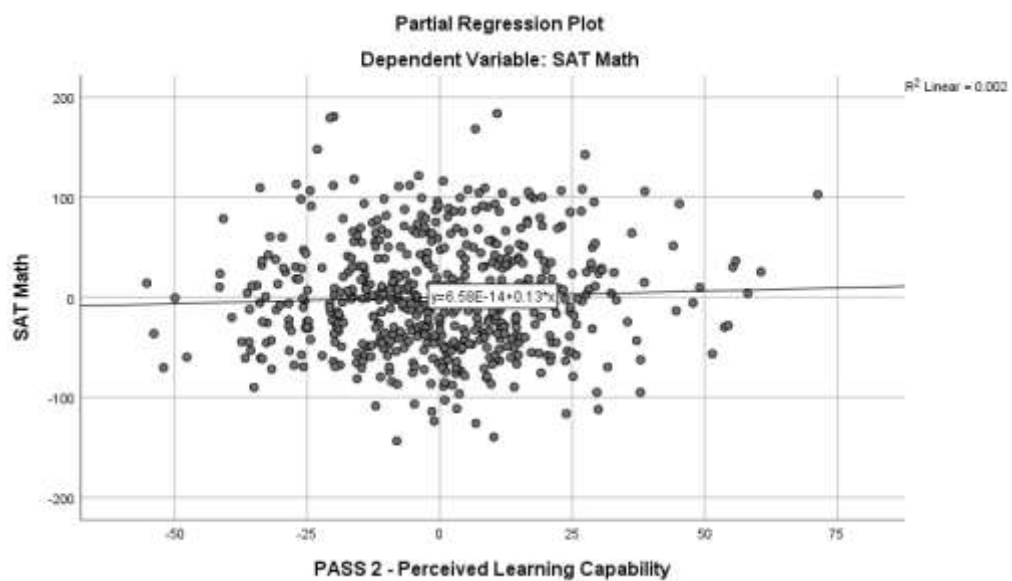
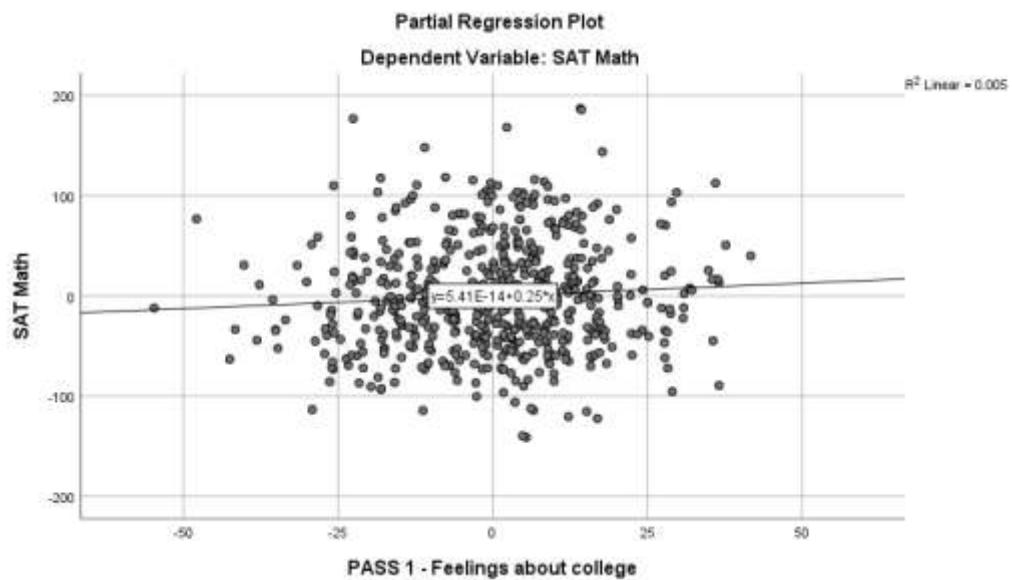
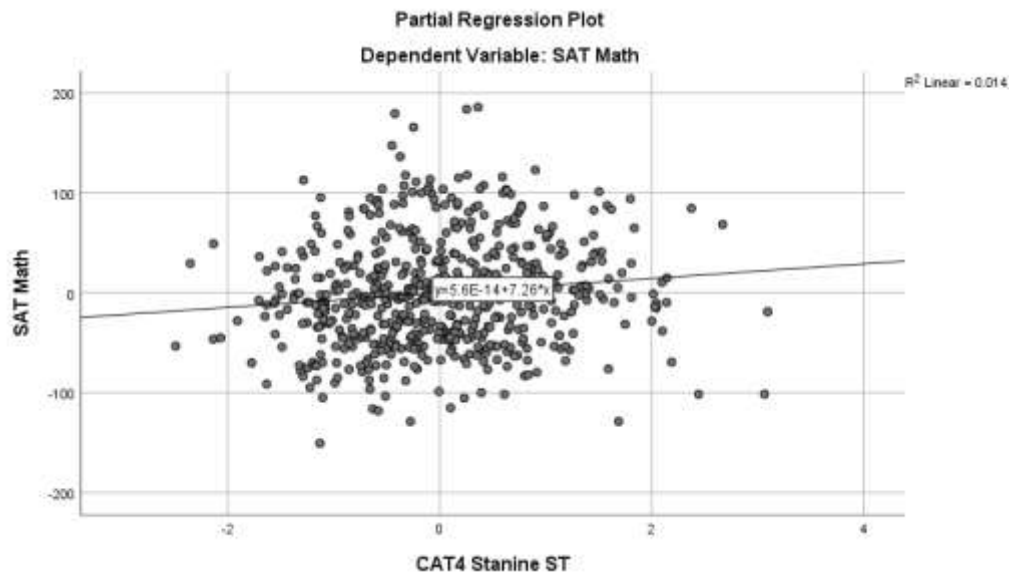
- There is a positive correlation between all PASS factors. Where r value ranges between 0.134-0.800.
- The highest/strongest positive correlation occurred between PASS-1 (Feelings about School) & PASS-8 (Attitude to Attendance), $r = 0.800$.
- The lowest positive correlation occurred between PASS-3 (Learner Self Regard) & PASS-5 (Attitude to Teachers); $r = 0.134$.
- There is a positive correlation between PASS-1 (Feelings about School) and PASS-2 (Perceived Learning Capability), $r = 0.497$.
- There is a positive correlation between PASS-1 (Feelings about School) and PASS-3 (Learner Self Regard), $r = 0.266$.

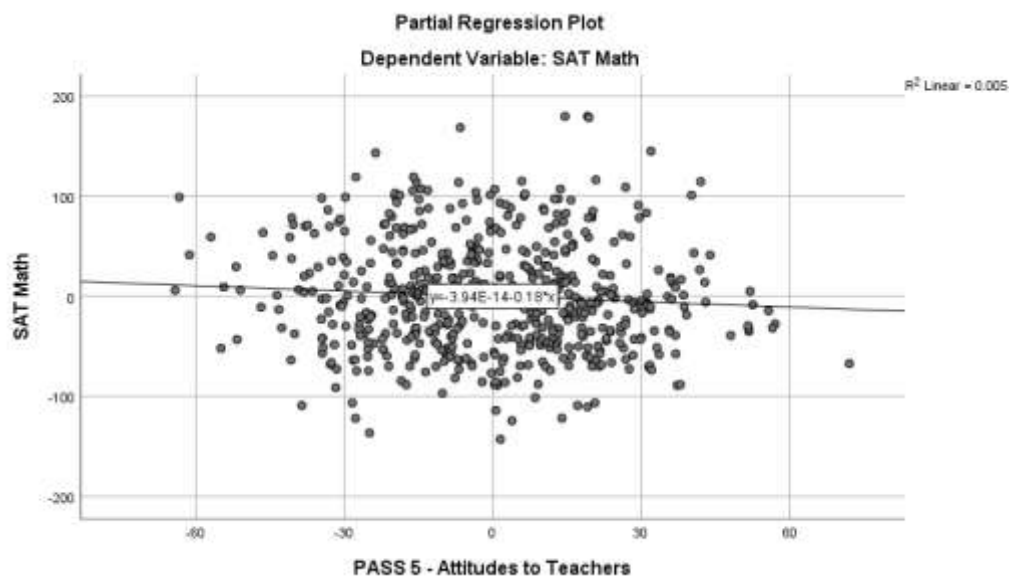
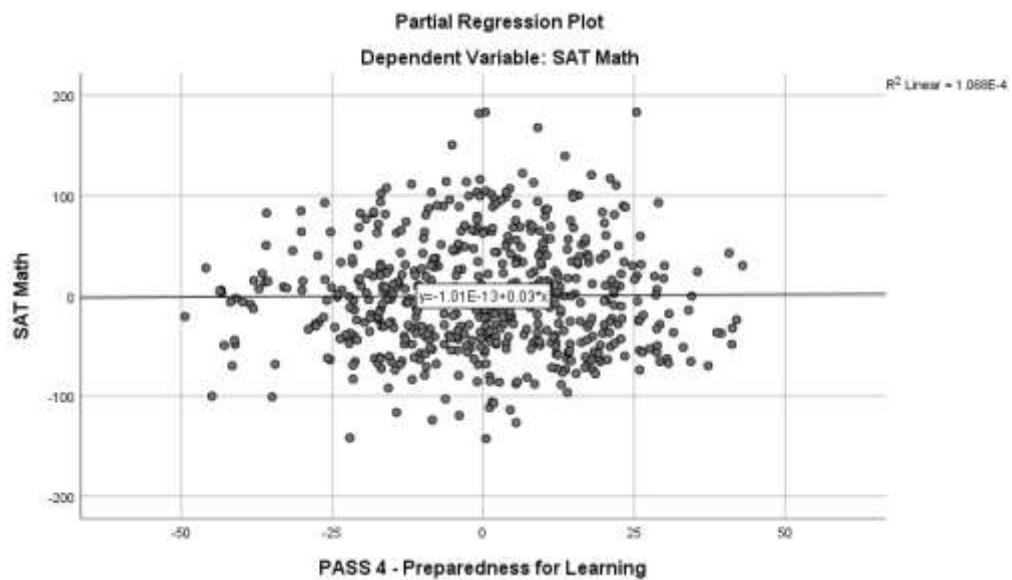
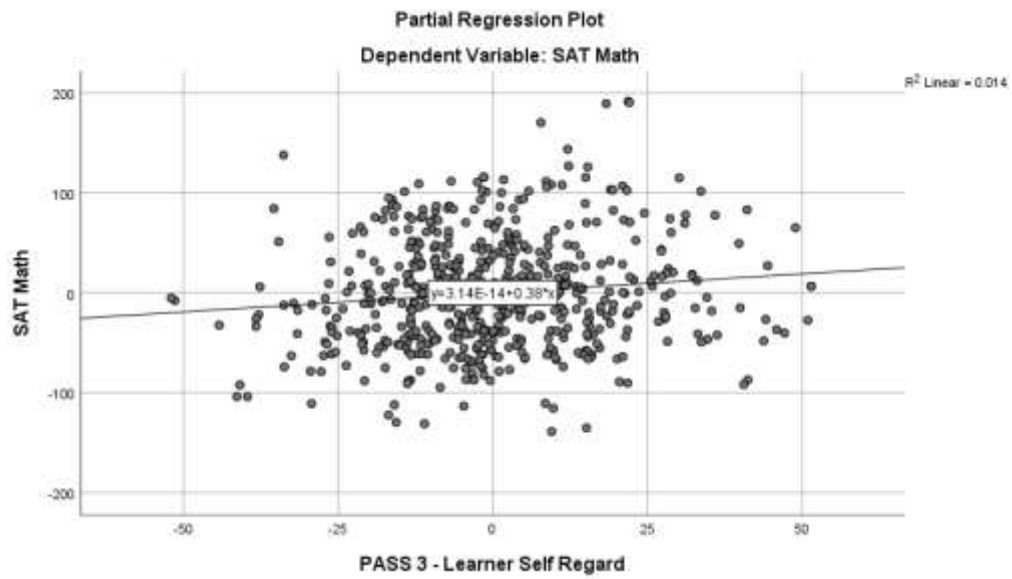
- There is a positive correlation between PASS-1 (Feelings about School) and PASS-4 (Preparedness for Learning), $r = 0.667$.
- There is a positive correlation between PASS-1 (Feelings about School) and PASS-5 (Attitudes to Teachers), $r = 0.619$.
- There is a positive correlation between PASS-1 (Feelings about School) and PASS-6 (General Work Ethics), $r = 0.460$.
- There is a positive correlation between PASS-1 (Feelings about School) and PASS-7 (Confidence in Learning), $r = 0.444$.
- There is a positive correlation between PASS-1 (Feelings about School) and PASS-8 (Attitudes to Attendance), $r = 0.800$.
- There is a positive correlation between PASS-1 (Feelings about School) and PASS-9 (Response to Curriculum), $r = 0.271$.
- There is a positive correlation between PASS-2 (Perceived Learning Capability) and PASS-3 (Learner Self Regard), $r = 0.386$.
- There is a positive correlation between PASS-2 (Perceived Learning Capability) and PASS-4 (Preparedness for Learning), $r = 0.658$.
- There is a positive correlation between PASS-2 (Perceived Learning Capability) and PASS-5 (Attitudes to Teachers), $r = 0.462$.
- There is a positive correlation between PASS-2 (Perceived Learning Capability) and PASS-6 (General Work Ethics), $r = 0.413$.
- There is a positive correlation between PASS-2 (Perceived Learning Capability) and PASS-7 (Confidence in Learning), $r = 0.660$.
- There is a positive correlation between PASS-2 (Perceived Learning Capability) and PASS-8 (Attitudes to Attendance), $r = 0.424$.
- There is a positive correlation between PASS-2 (Perceived Learning Capability) and PASS-9 (Response to Curriculum), $r = 0.293$.
- There is a positive correlation between PASS-3 (Learner Self Regard) and PASS-4 (Preparedness for Learning), $r = 0.357$.
- There is a positive correlation between PASS-3 (Learner Self Regard) and PASS-5 (Attitudes to Teachers), $r = 0.134$.
- There is a positive correlation between PASS-3 (Learner Self Regard) and PASS-6 (General Work Ethics), $r = 0.381$.
- There is a positive correlation between PASS-3 (Learner Self Regard) and PASS-7 (Confidence in Learning), $r = 0.286$.
- There is a positive correlation between PASS-3 (Learner Self Regard) and PASS-8 (Attitudes to Attendance), $r = 0.366$.
- There is a positive correlation between PASS-3 (Learner Self Regard) and PASS-9 (Response to Curriculum), $r = 0.795$.
- There is a positive correlation between PASS-4 (Preparedness for Learning) and PASS-5 (Attitudes to Teachers), $r = 0.574$.
- There is a positive correlation between PASS-4 (Preparedness for Learning) and PASS-6 (General Work Ethic), $r = 0.449$.

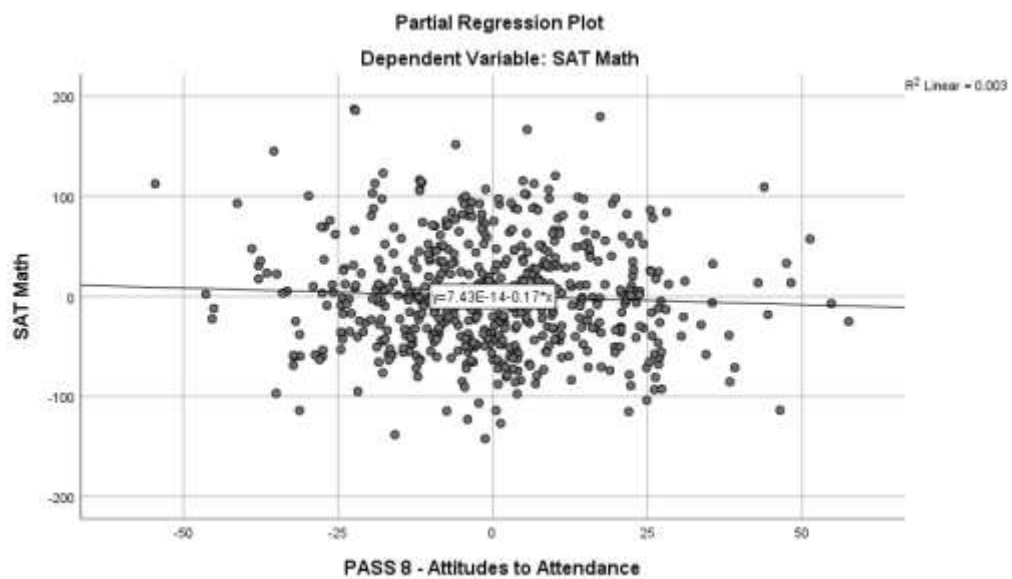
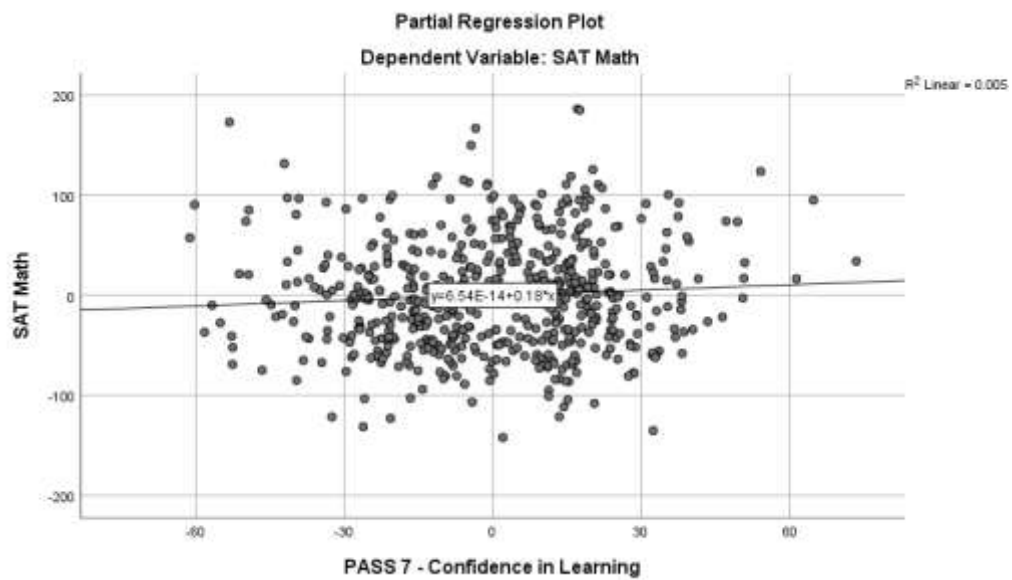
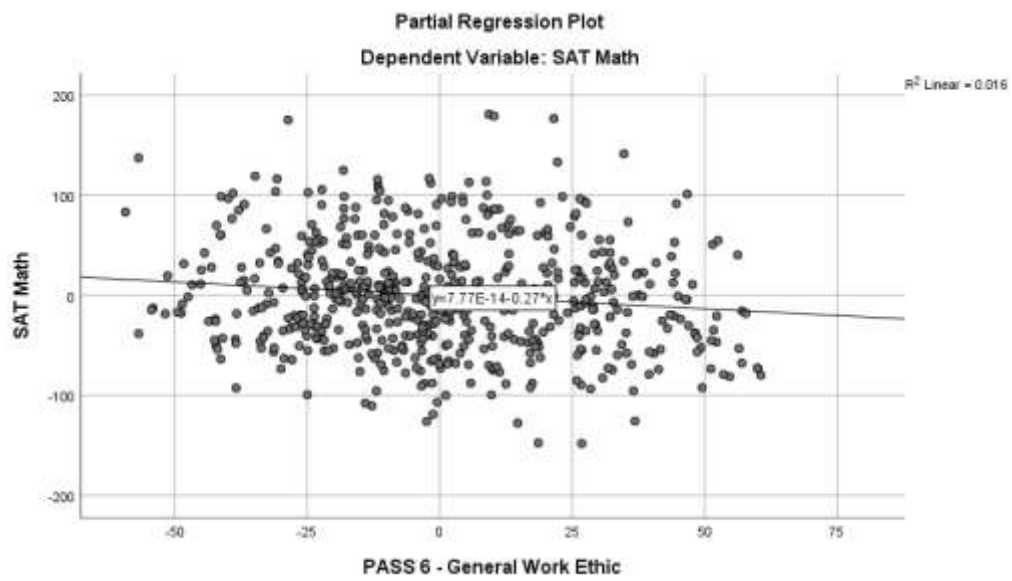
- There is a positive correlation between PASS-4 (Preparedness for Learning) and PASS-7 (Confidence in Learning), $r = 0.527$.
- There is a positive correlation between PASS-4 (Preparedness for Learning) and PASS-8 (Attitudes to Attendance), $r = 0.528$.
- There is a positive correlation between PASS-4 (Preparedness for Learning) and PASS-9 (Response to Curriculum), $r = 0.528$.
- There is a positive correlation between PASS-5 (Attitudes to Teachers) and PASS-6 (General Work Ethic), $r = 0.442$.
- There is a positive correlation between PASS-5 (Attitudes to Teachers) and PASS-7 (Confidence in Learning), $r = 0.369$.
- There is a positive correlation between PASS-5 (Attitudes to Teachers) and PASS-8 (Attitudes to Attendance), $r = 0.454$.
- There is a positive correlation between PASS-5 (Attitudes to Teachers) and PASS-9 (Response to Curriculum), $r = 0.169$.
- There is a positive correlation between PASS-6 (General Work Ethic) and PASS-7 (Confidence in Learning), $r = 0.342$.
- There is a positive correlation between PASS-6 (General Work Ethic) and PASS-8 (Attitudes to Attendance), $r = 0.405$.
- There is a positive correlation between PASS-6 (General Work Ethic) and PASS-9 (Response to Curriculum), $r = 0.367$.
- There is a positive correlation between PASS-7 (Confidence in Learning) and PASS-8 (Attitudes to Attendance), $r = 0.428$.
- There is a positive correlation between PASS-7 (Confidence in Learning) and PASS-9 (Response to Curriculum), $r = 0.428$.
- There is a positive correlation between PASS-8 (Attitudes to Attendance) and PASS-9 (Response to Curriculum), $r = 0.294$.

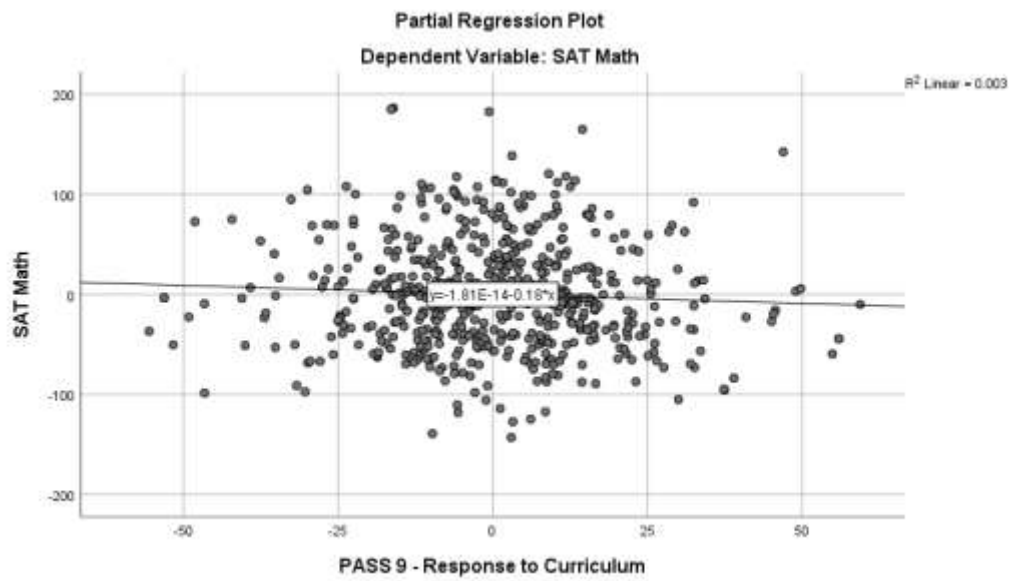
Appendix M: Partial Regression Plots for Model 1



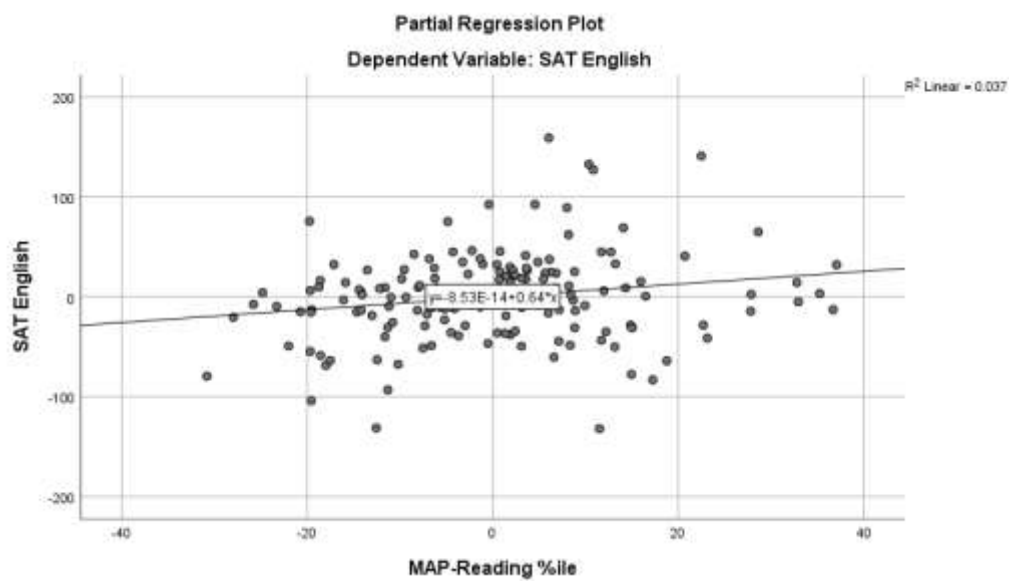
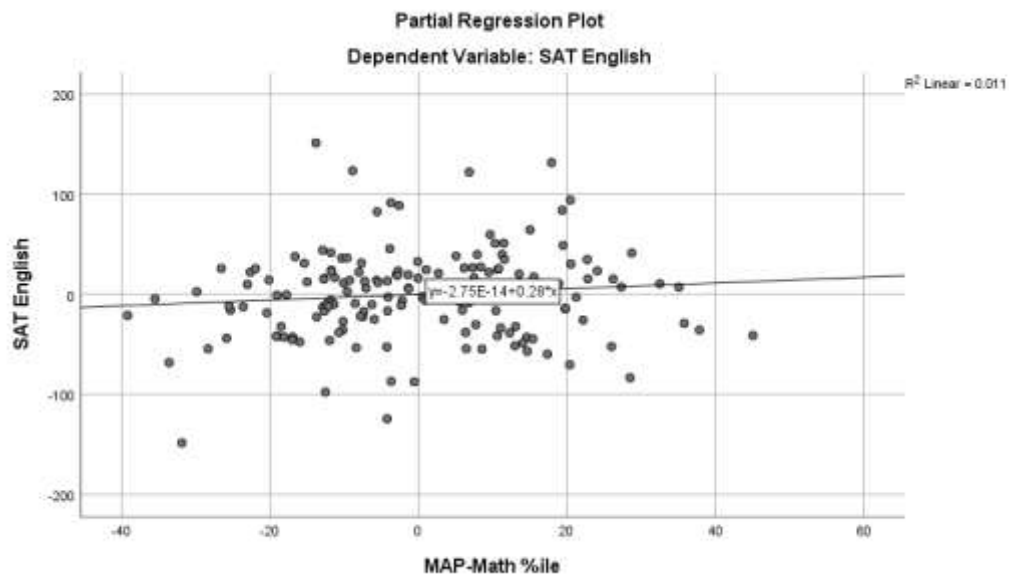


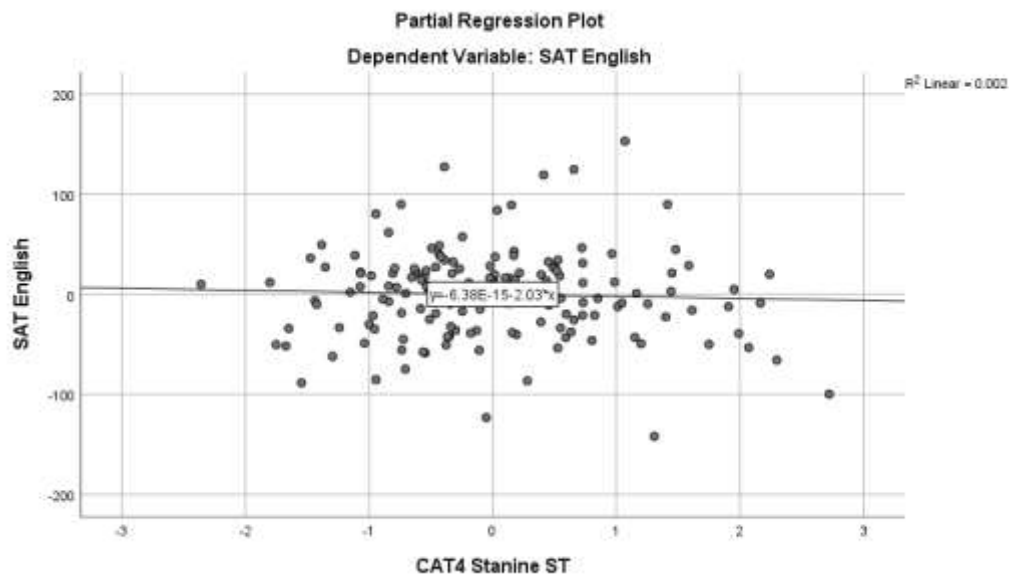
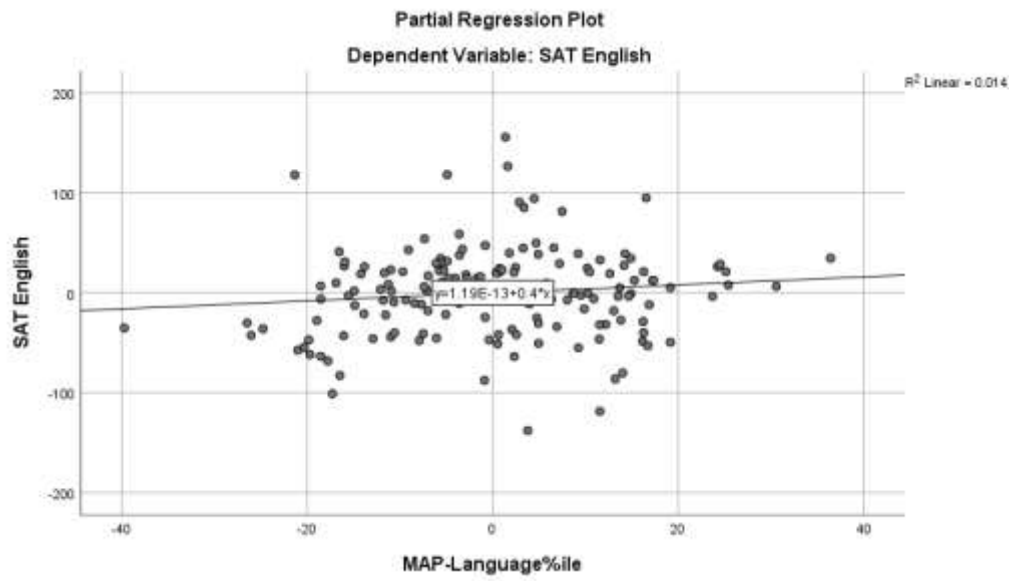


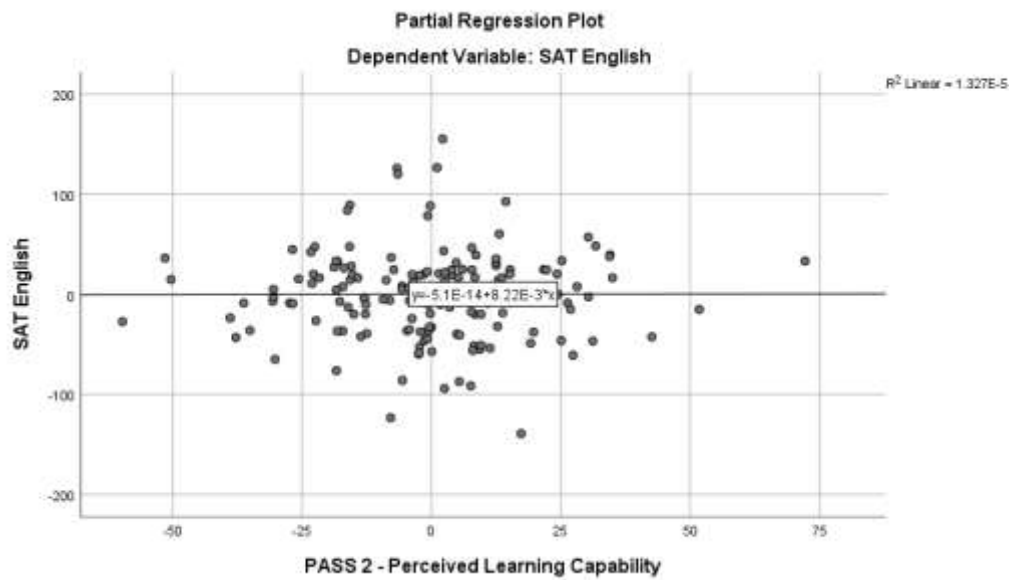
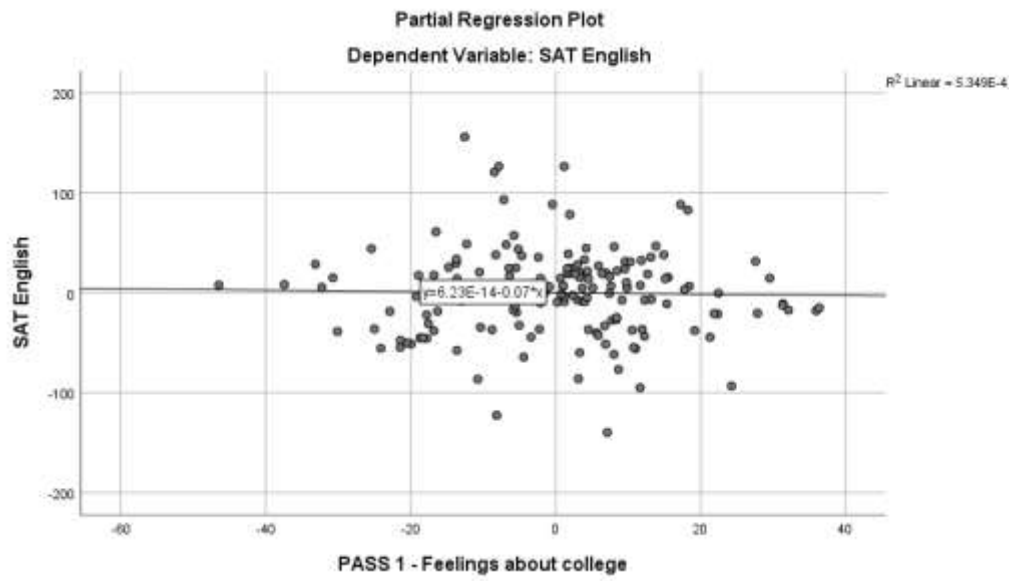


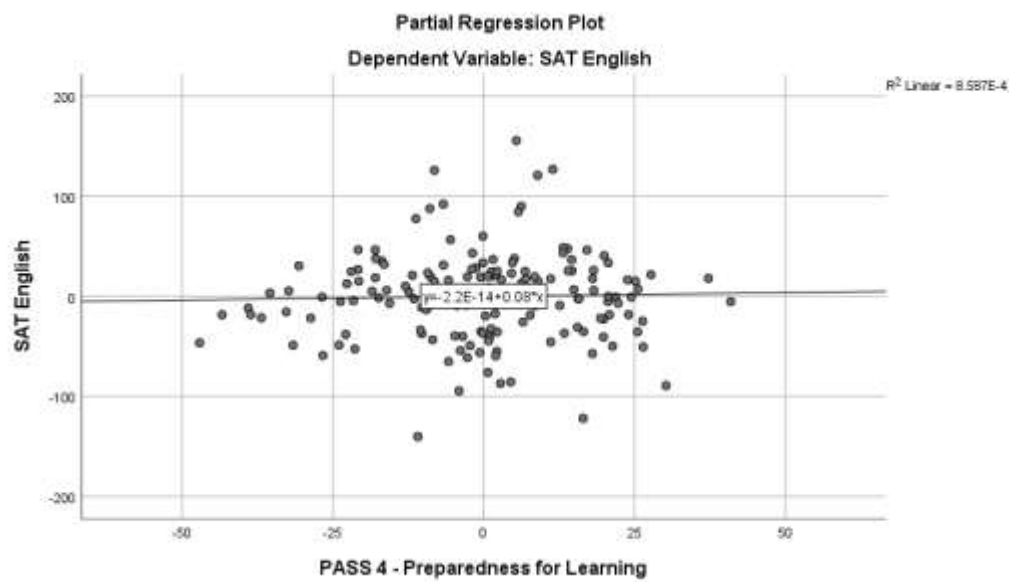
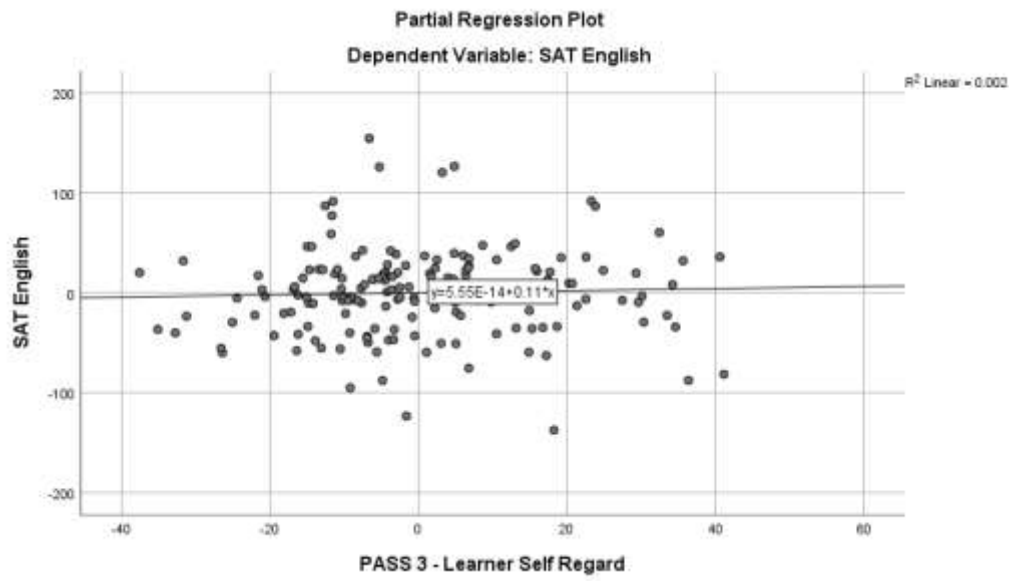


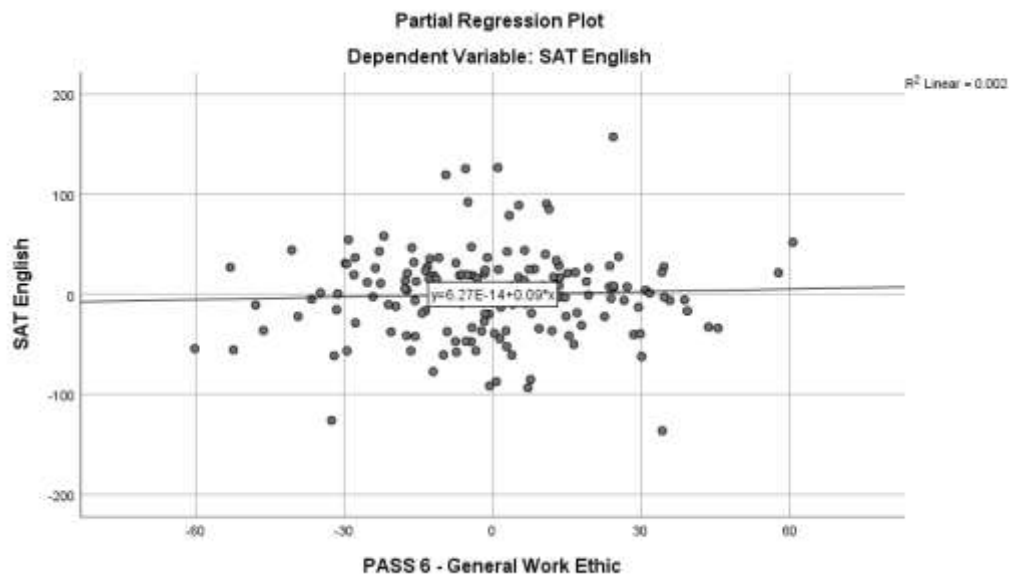
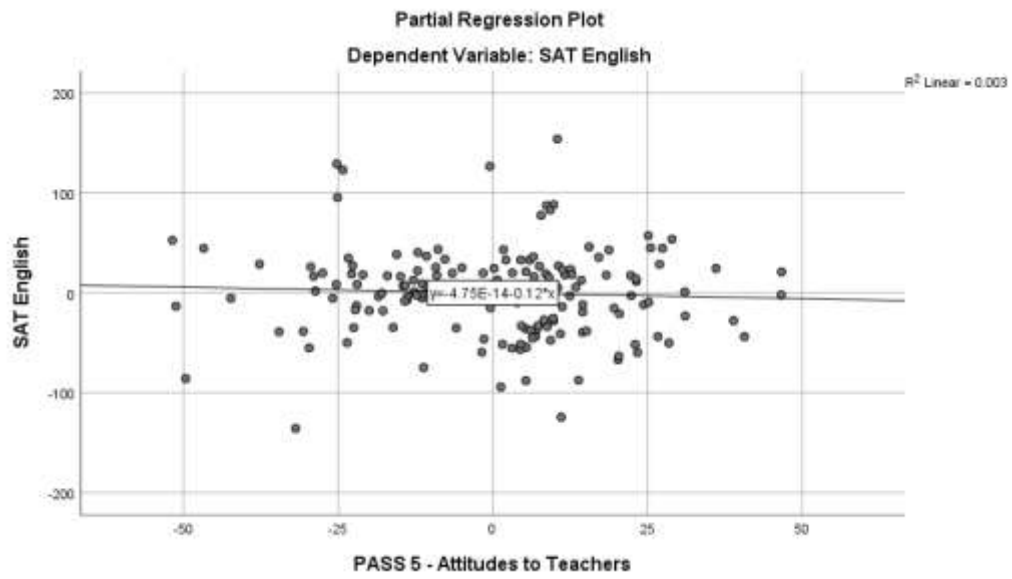
Appendix N: Partial Regression Plots for Model 2

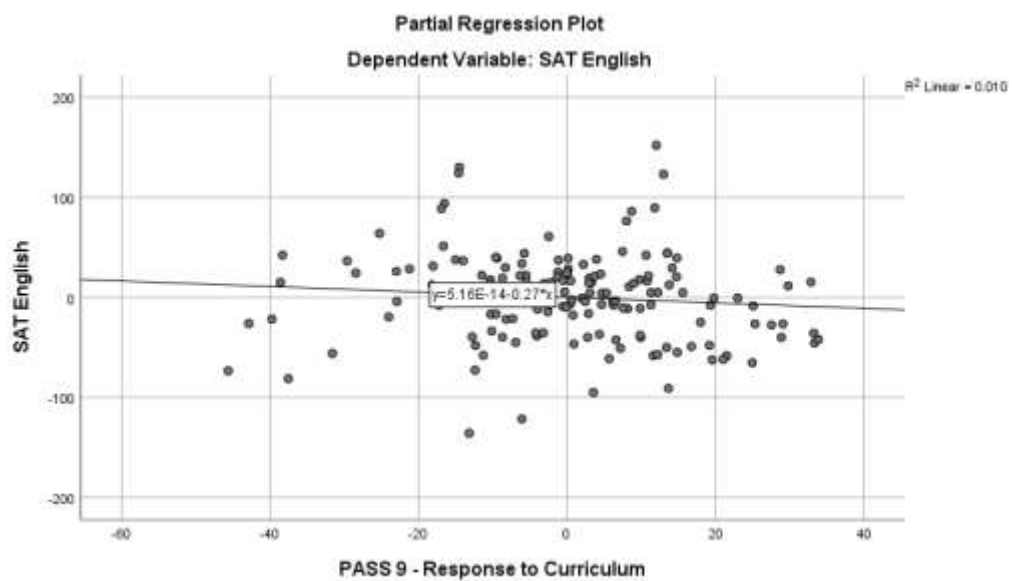
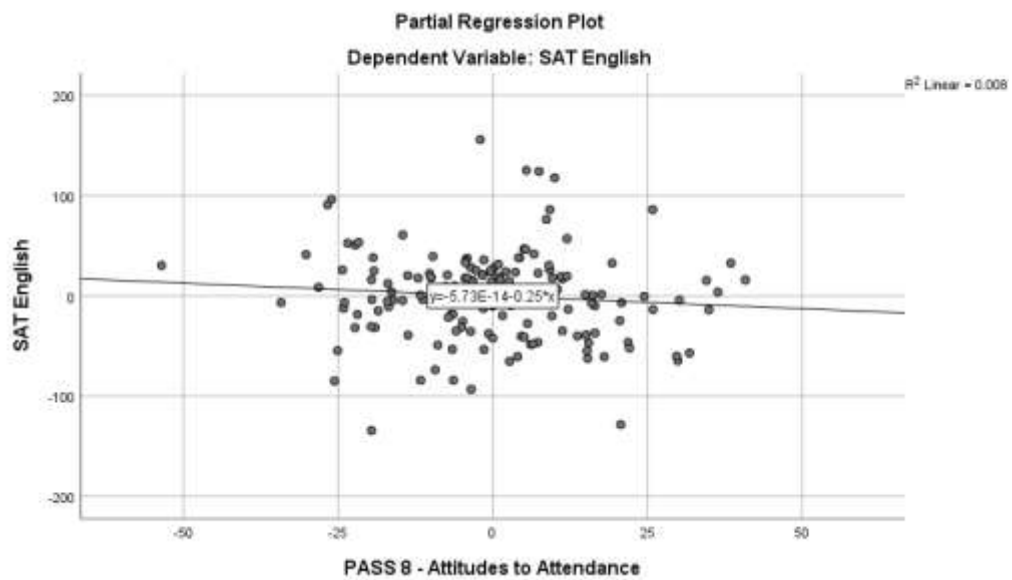
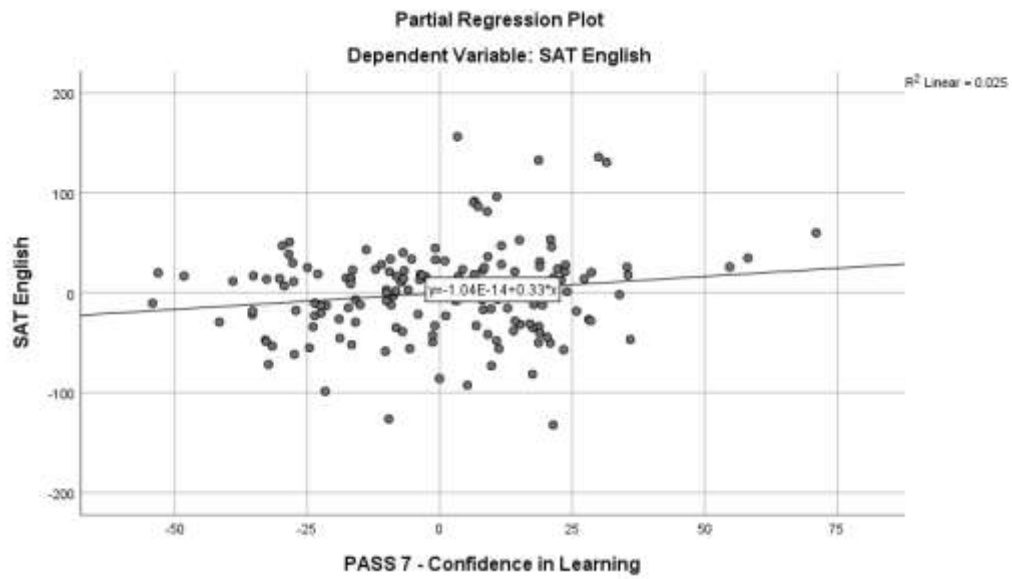












Appendix O: Regression Analysis Output (SAT-Math)

Model 1- Regression Analysis (SPSS Output)

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.668 ^a	.447	.434	54.230	1.618
a. Predictors: (Constant), PASS 9 - Response to Curriculum, PASS 5 - Attitudes to Teachers, MAP-Language %ile, PASS 7 - Confidence in Learning, PASS 6 - General Work Ethic, PASS 8 - Attitudes to Attendance, CAT4 Stanine ST, PASS 4 - Preparedness for Learning, MAP-Math %ile, PASS 2 - Perceived Learning Capability, PASS 3 - Learner Self Regard, MAP-Reading %ile, PASS 1 - Feelings about college					
b. Dependent Variable: SAT Math					

ANOVA ^a					
Model		Sum of Squares	df	Mean Square	F
1	Regression	1385874.529	13	106605.733	36.249
	Residual	1717502.604	584	2940.929	
	Total	3103377.132	597		
a. Dependent Variable: SAT Math					
b. Predictors: (Constant), PASS 9 - Response to Curriculum, PASS 5 - Attitudes to Teachers, MAP-Language %ile, PASS 7 - Confidence in Learning, PASS 6 - General Work Ethic, PASS 8 - Attitudes to Attendance, CAT4 Stanine ST, PASS 4 - Preparedness for Learning, MAP-Math %ile, PASS 2 - Perceived Learning Capability, PASS 3 - Learner Self Regard, MAP-Reading %ile, PASS 1 - Feelings about college					

Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	95.0% Confidence Interval for B		Correlations	
		B	Std. Error	Beta	Lower Bound	Upper Bound	Zero-order	Partial
1	(Constant)	335.877	8.414		319.351	352.403		
	CAT4 Stanine ST	7.258	2.481	.134	2.385	12.131	.525	.120
	MAP-Math %ile	1.021	.121	.412	.782	1.259	.619	.329
	MAP-Reading %ile	.083	.152	.031	-.215	.381	.515	.023
	MAP-Language %ile	.201	.153	.078	-.100	.502	.538	.054
	PASS 1 - Feelings about college	.254	.147	.109	-.036	.543	.062	.071
	PASS 2 -Perceived Learning Capability	.126	.118	.052	-.105	.357	.240	.044
	PASS 3 - Learner Self-regard	.381	.131	.165	.123	.639	.325	.119
	PASS 4 - Preparedness for Learning	.032	.129	.013	-.221	.285	.205	.010
	PASS 5 - Attitudes to Teachers	-.178	.100	-.076	-.374	.018	-.011	-.074
	PASS 6 - General Work Ethic	-.268	.088	-.116	-.440	-.095	.043	-.125
	PASS 7 - Confidence in Learning	.176	.101	.074	-.022	.374	.173	.072
	PASS 8 - Attitudes to Attendance	-.166	.132	-.069	-.425	.092	.031	-.052
	PASS 9 - Response to Curriculum	-.180	.128	-.074	-.431	.071	.254	-.058
a. Dependent Variable: SAT Math								

Appendix P: Regression Analysis Output (SAT-English)

Model 2- Regression Analysis (SPSS Output)

Model Summary ^b					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
2	.655 ^a	.429	.380	45.173	1.678
a. Predictors: (Constant), PASS 9 - Response to Curriculum, PASS 1 - Feelings about college, MAP-Language%ile, PASS 7 - Confidence in Learning, PASS 6 - General Work Ethic, CAT4 Stanine ST, PASS 4 - Preparedness for Learning, PASS 2 - Perceived Learning Capability, PASS 5 - Attitudes to Teachers, PASS 8 - Attitudes to Attendance, MAP-Math %ile, PASS 3 - Learner Self Regard, MAP-Reading %ile					
b. Dependent Variable: SAT English					

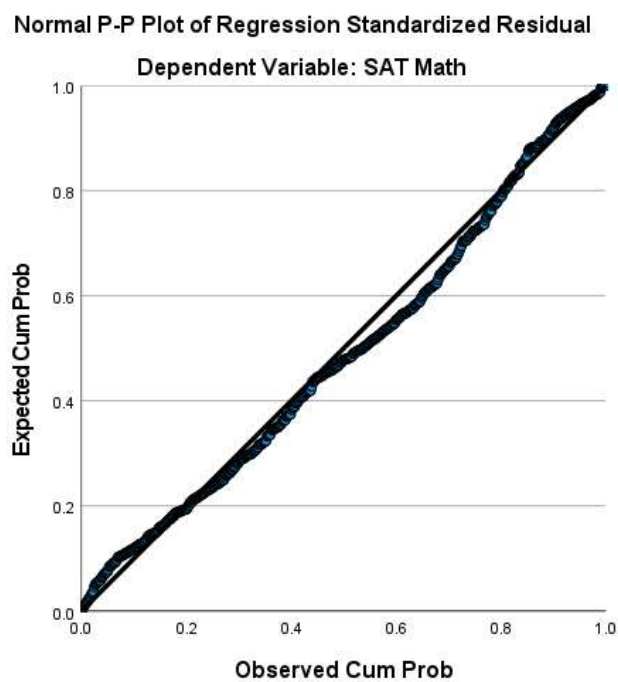
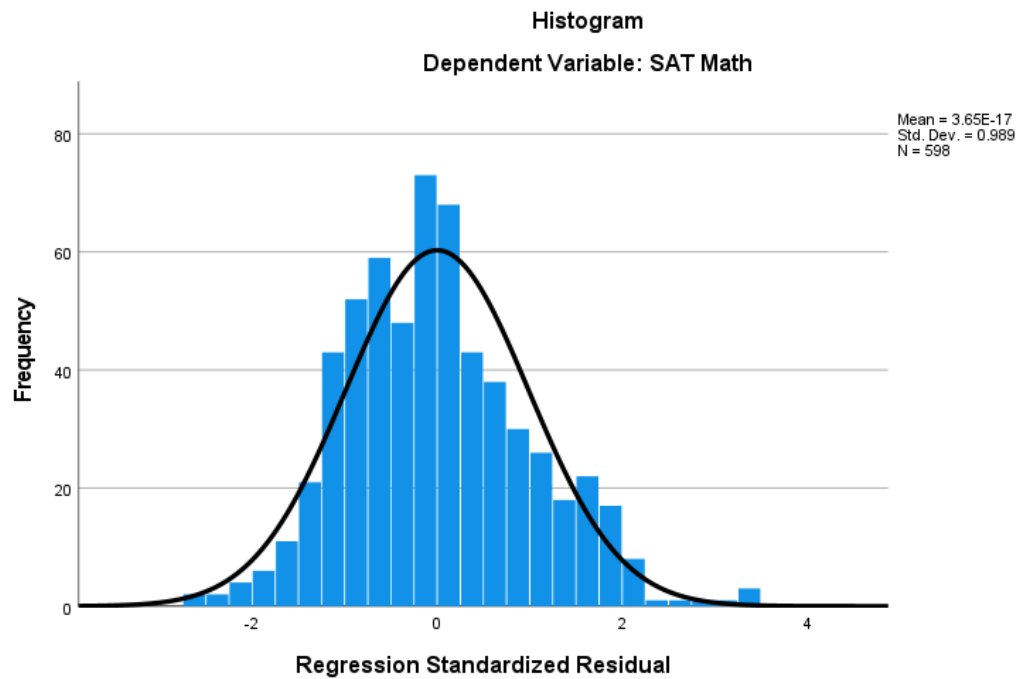
ANOVA ^a					
Model		Sum of Squares	df	Mean Square	F
1	Regression	232672.382	13	17897.876	8.771
	Residual	310176.563	152	2040.635	
	Total	542848.946	165		
a. Dependent Variable: SAT English					
b. Predictors: (Constant), PASS 9 - Response to Curriculum, PASS 1 - Feelings about college, MAP-Language%ile, PASS 7 - Confidence in Learning, PASS 6 - General Work Ethic, CAT4 Stanine ST, PASS 4 - Preparedness for Learning, PASS 2 - Perceived Learning Capability, PASS 5 - Attitudes to Teachers, PASS 8 - Attitudes to Attendance, MAP-Math %ile, PASS 3 - Learner Self Regard, MAP-Reading %ile					

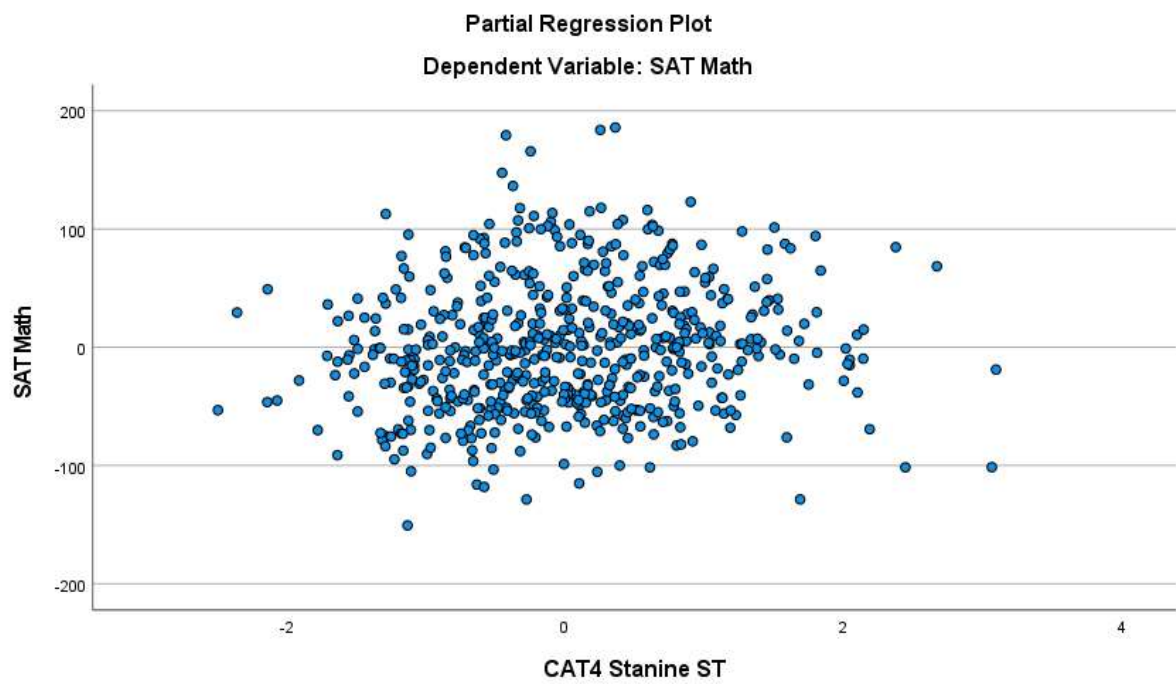
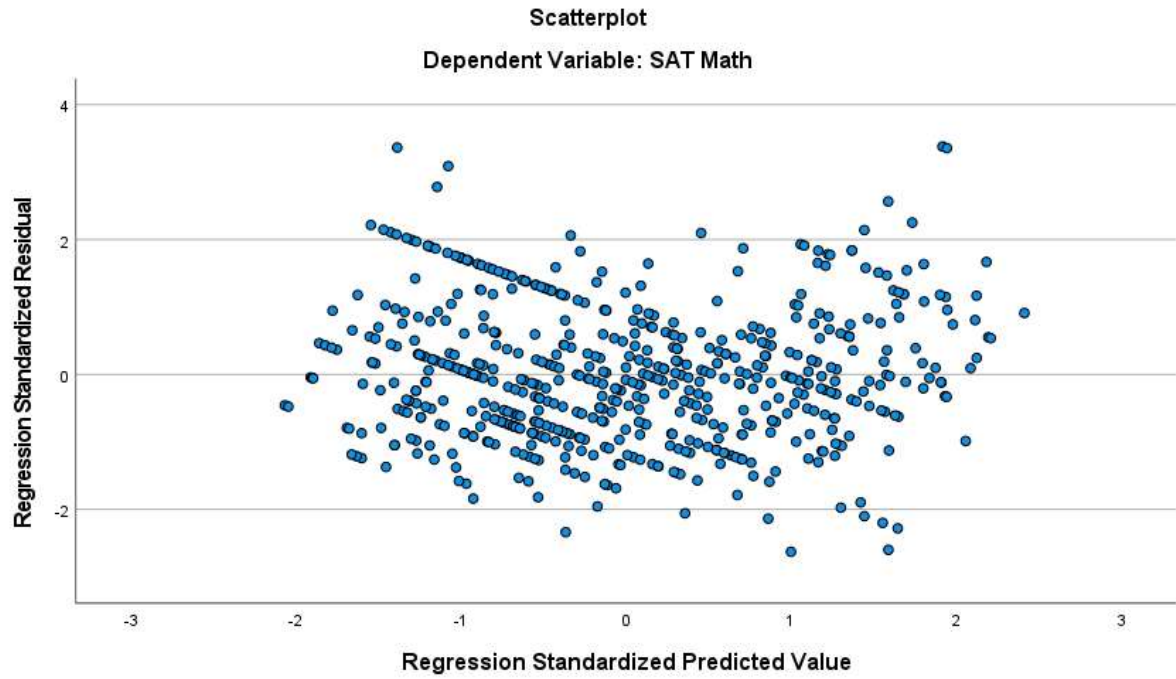
Coefficients ^a									
Model		Unstandardized Coefficients		Standardized Coefficients	95.0% Confidence Interval for B		Correlations		
		B	Std. Error	Beta	Lower Bound	Upper Bound	Zero-order	Partial	Part
2	(Constant)	404.116	13.835		376.783	431.450			
	CAT4 Stanine ST	-2.031	3.799	-.051	-9.537	5.476	.457	-.043	-.033
	MAP-Math %ile	.284	.219	.155	-.149	.717	.548	.105	.080
	MAP-Reading %ile	.641	.264	.318	.119	1.163	.597	.193	.149
	MAP-Language %ile	.400	.277	.208	-.147	.947	.592	.116	.089
	PASS 1 - Feelings about college	-.068	.239	-.038	-.540	.404	-.139	-.023	-.017
	PASS 2 - Perceived Learning Capability	.008	.183	.004	-.354	.370	.120	.004	.003
	PASS 3 - Learner Self Regard	.106	.220	.059	-.328	.540	.150	.039	.030
	PASS 4 -Preparedness for Learning	.076	.210	.037	-.339	.490	.088	.029	.022
	PASS 5 - Attitudes to Teachers	-.115	.182	-.062	-.475	.244	.000	-.051	-.039
	PASS 6 - General Work Ethic	.088	.162	.048	-.232	.408	.055	.044	.033
	PASS 7 - Confidence in Learning	.330	.166	.178	.002	.657	.152	.159	.122
	PASS 8 - Attitudes to Attendance	-.255	.225	-.138	-.700	.190	-.160	-.091	-.069
	PASS 9 - Response to Curriculum	-.273	.224	-.141	-.716	.170	.110	-.098	-.075
a. Dependent Variable: SAT English									

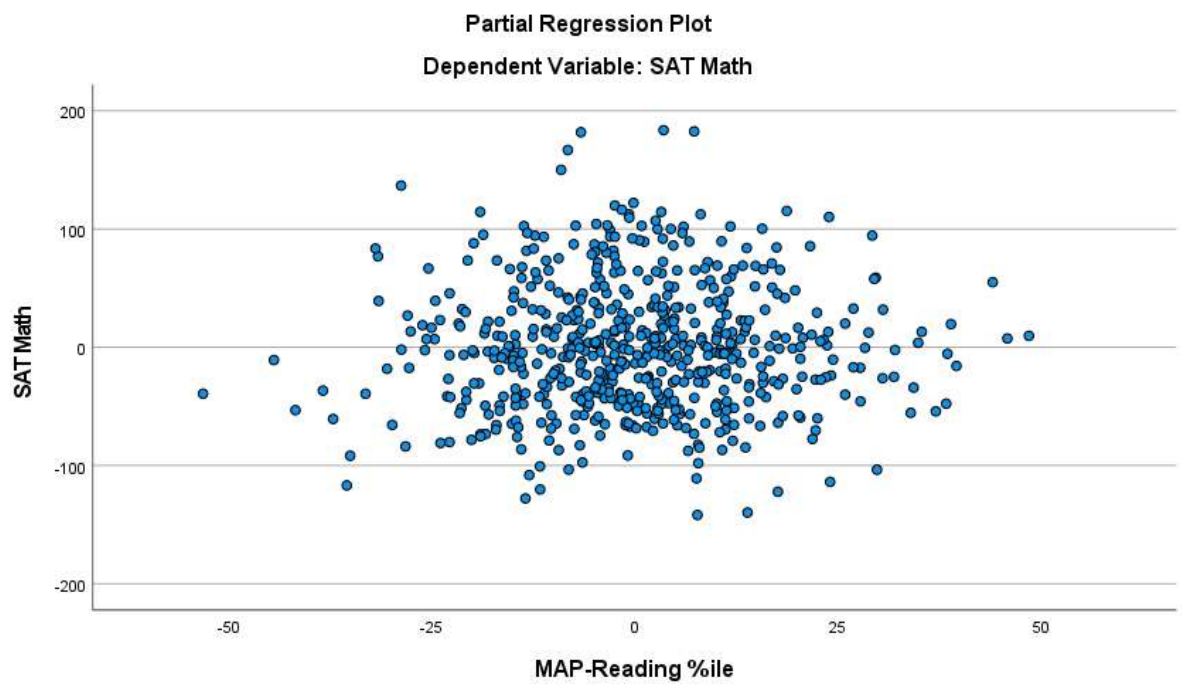
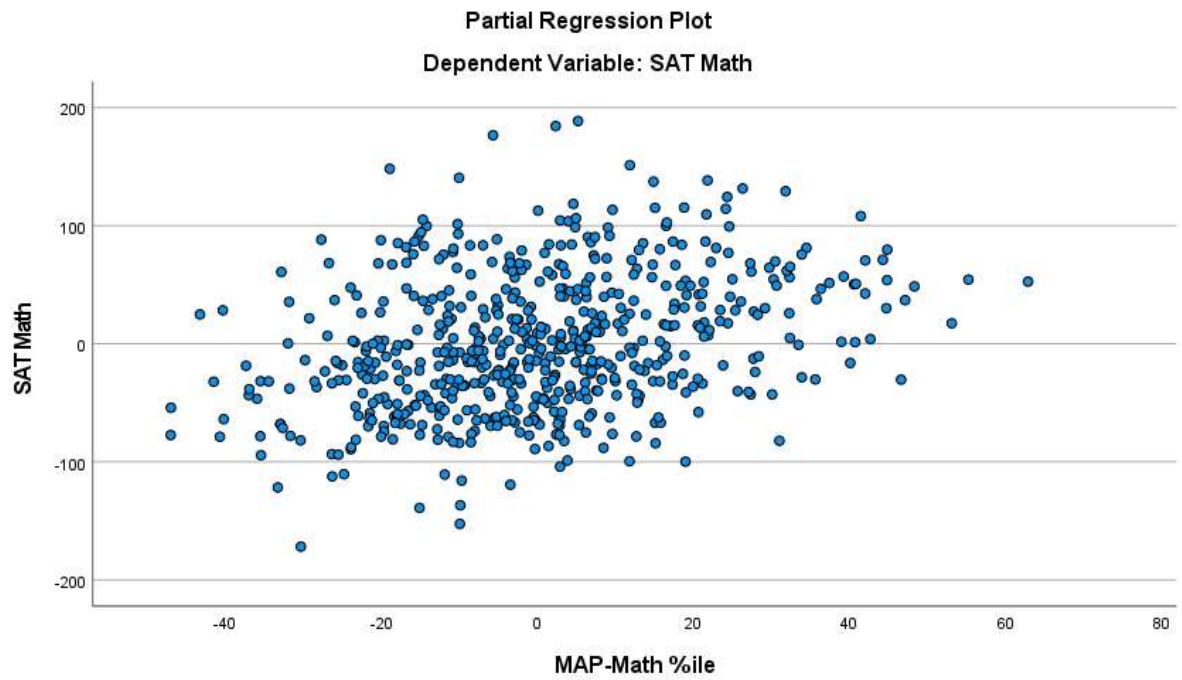
Appendix Q: Homoscedasticity Plots, Residuals Plot & Histograms

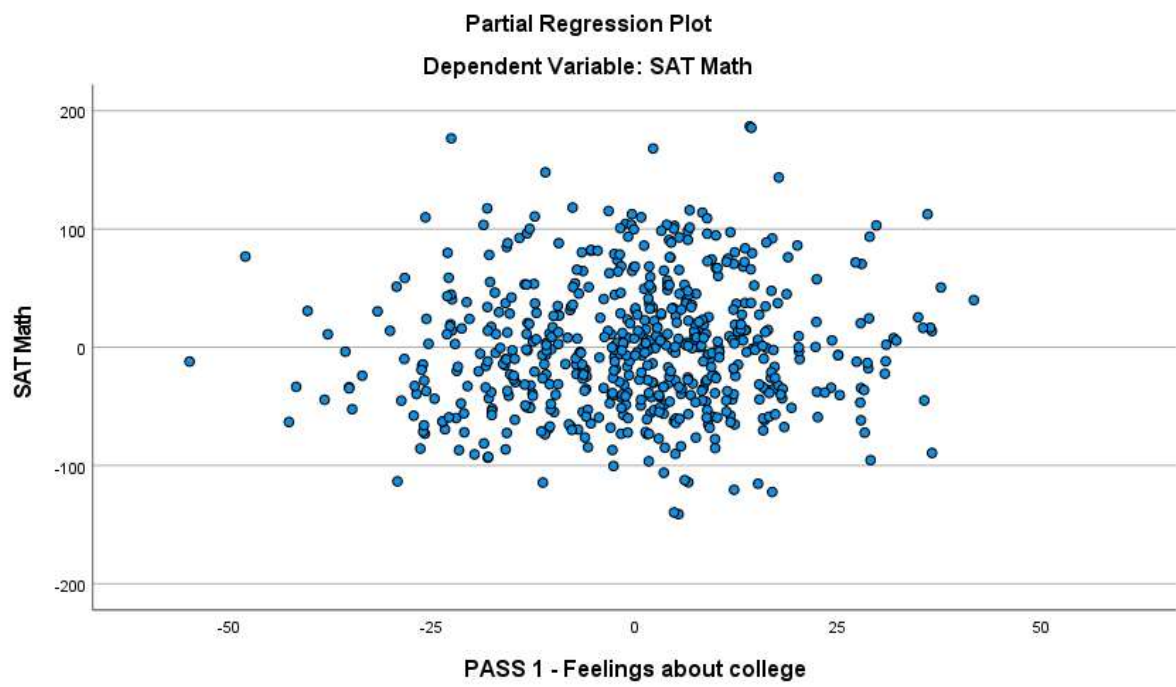
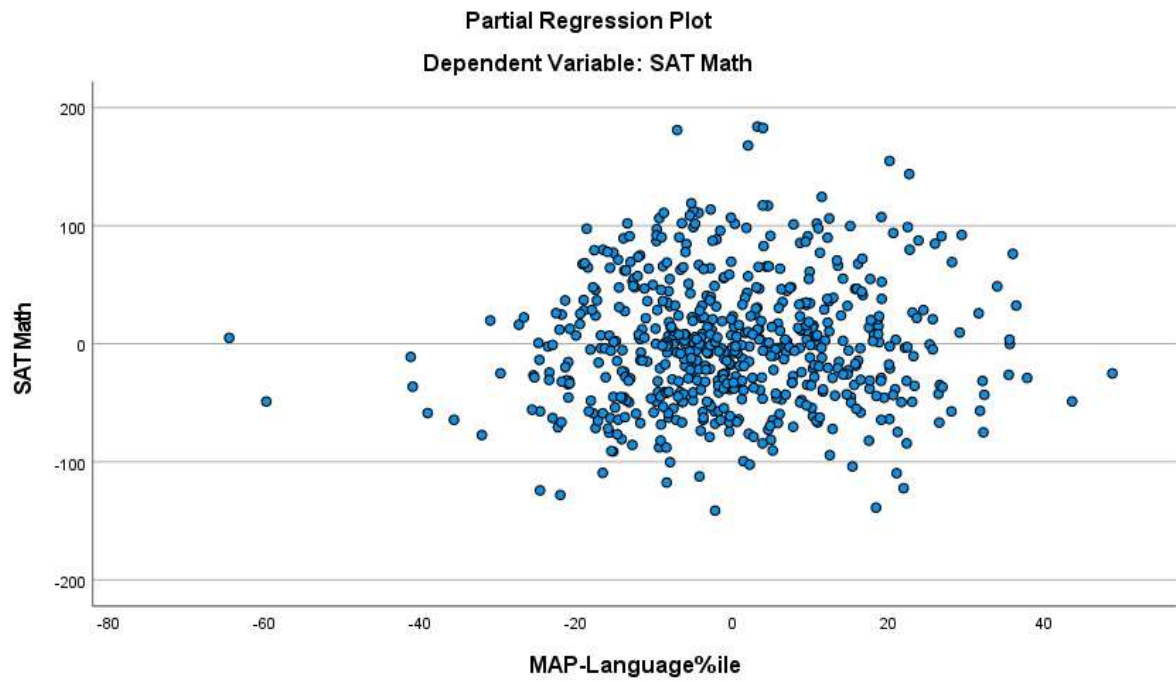
Charts

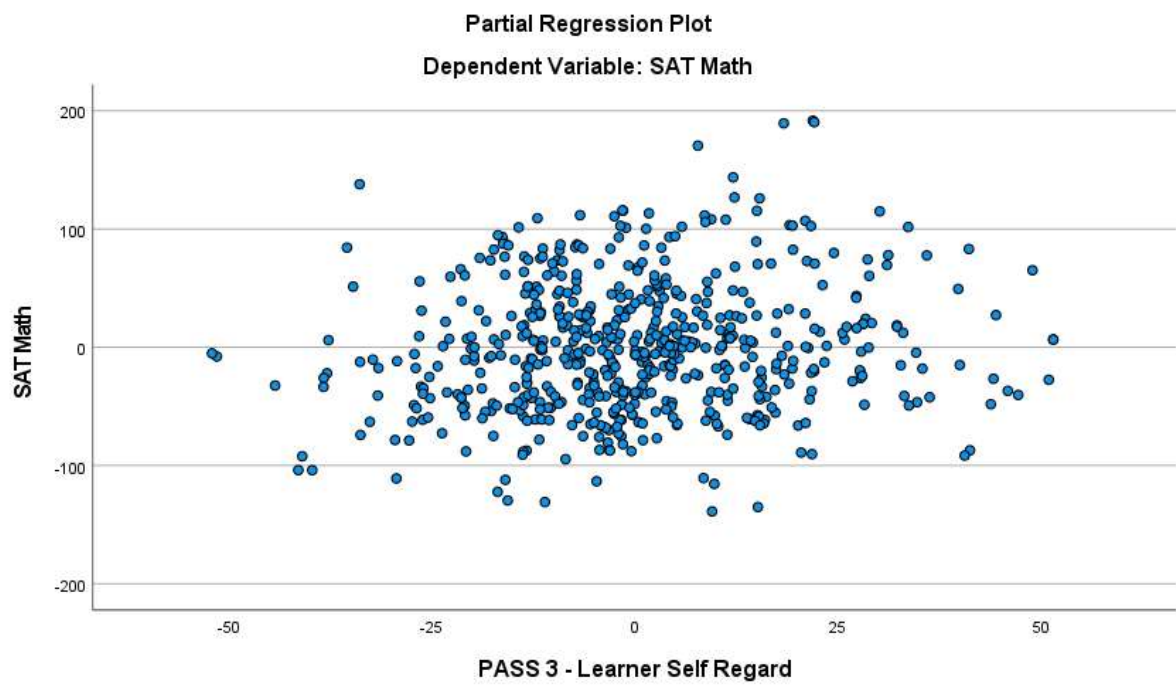
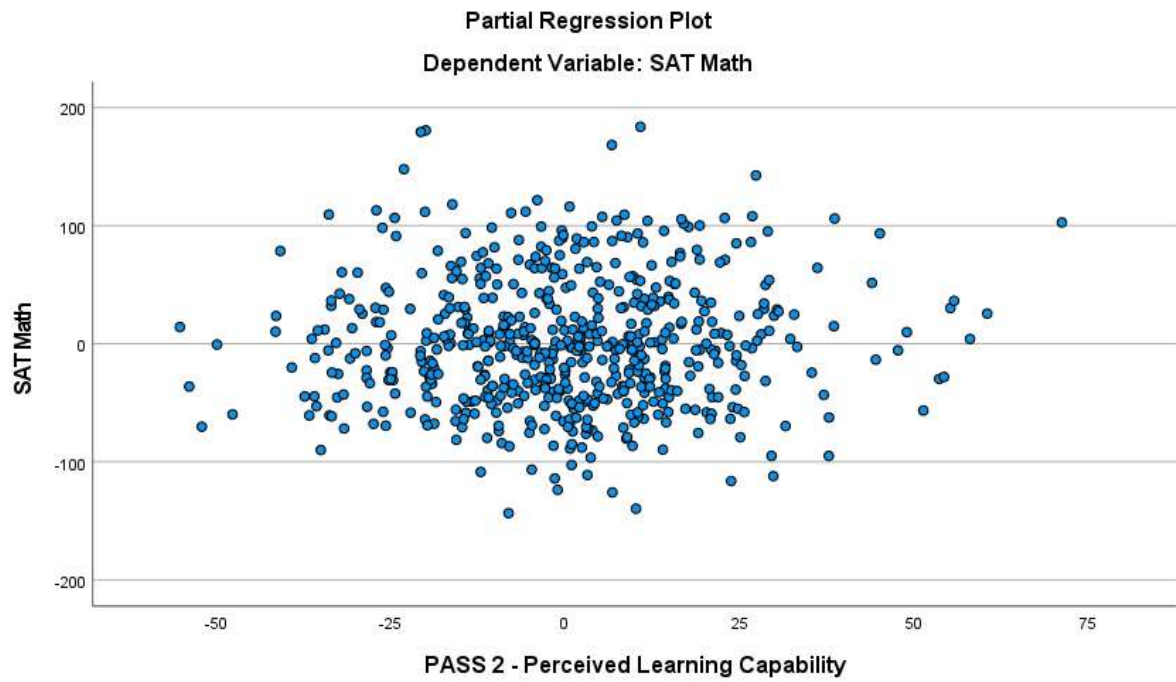
1) SAT-Math

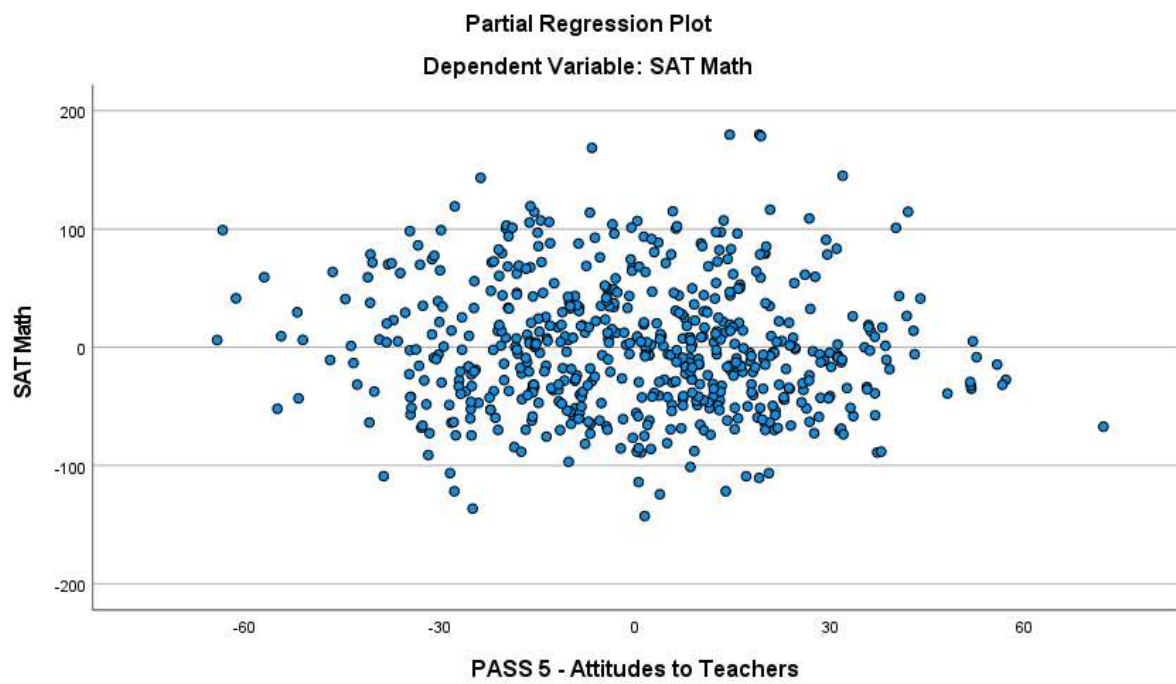
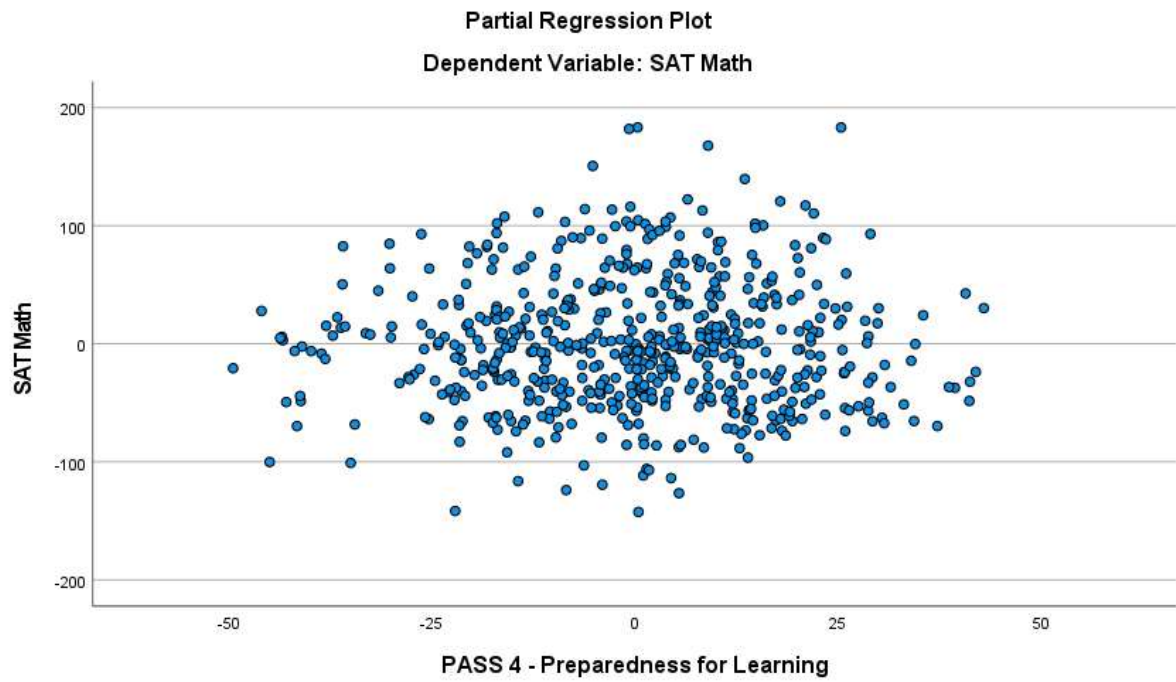


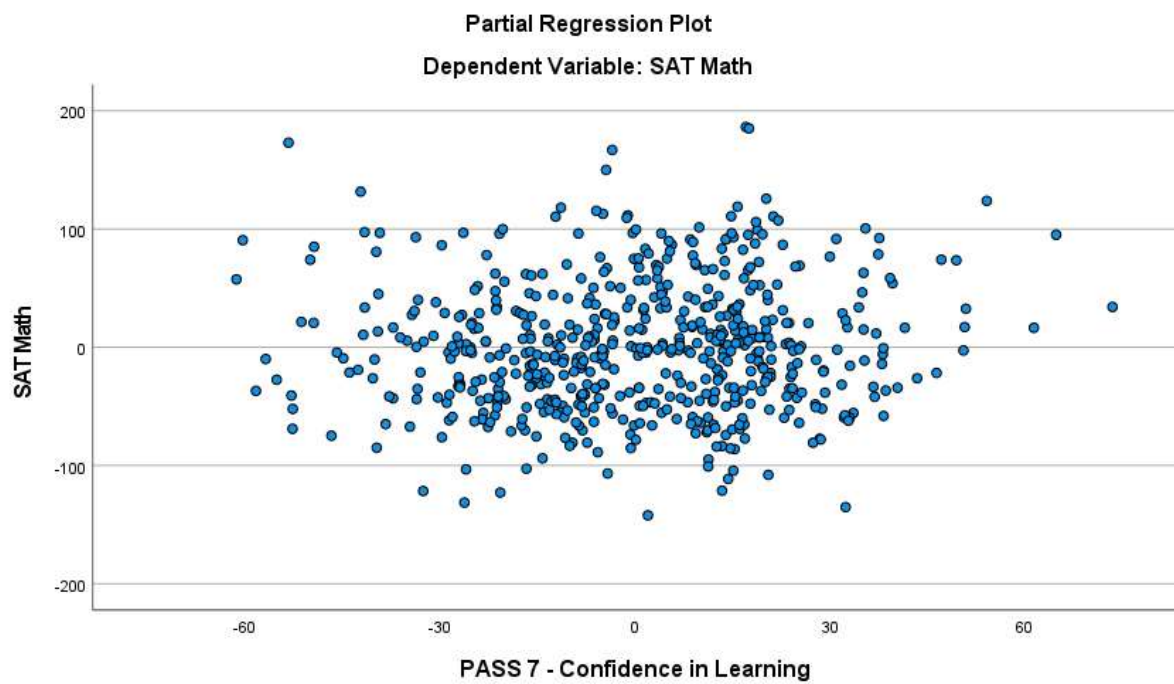
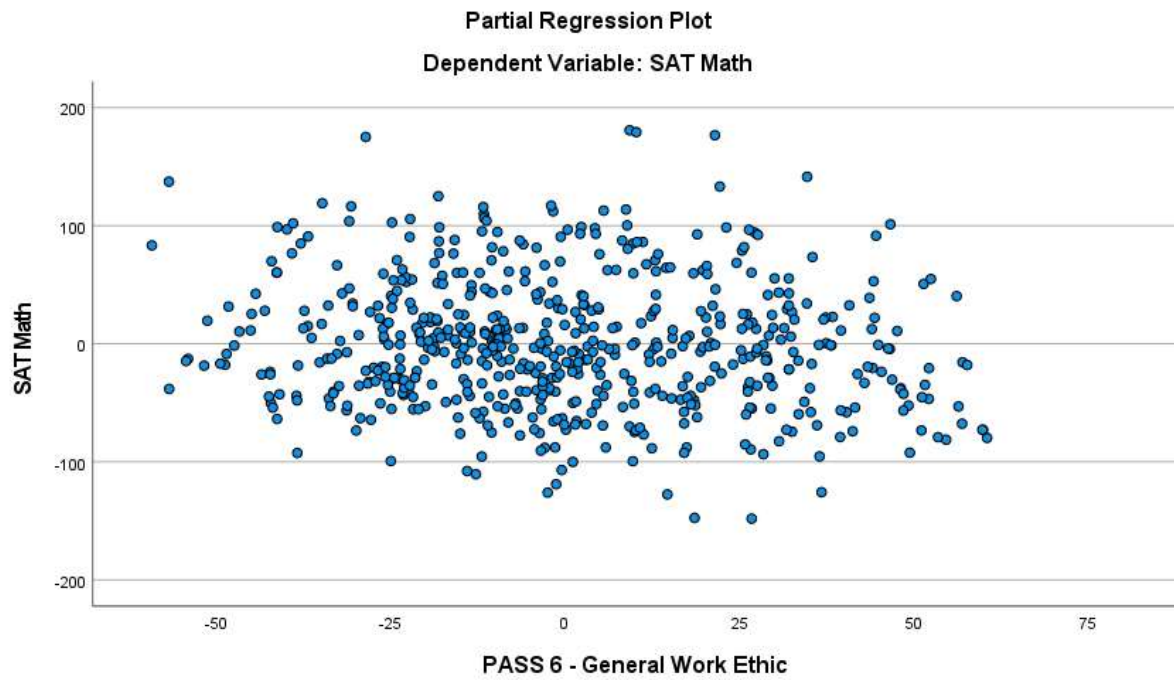


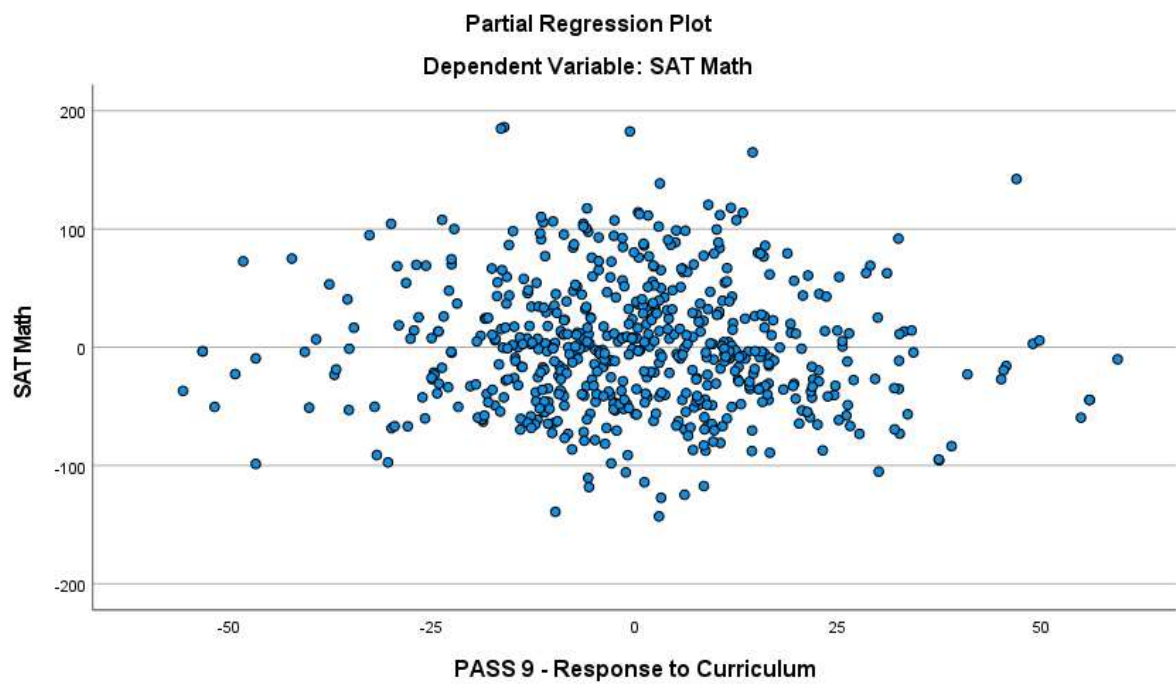
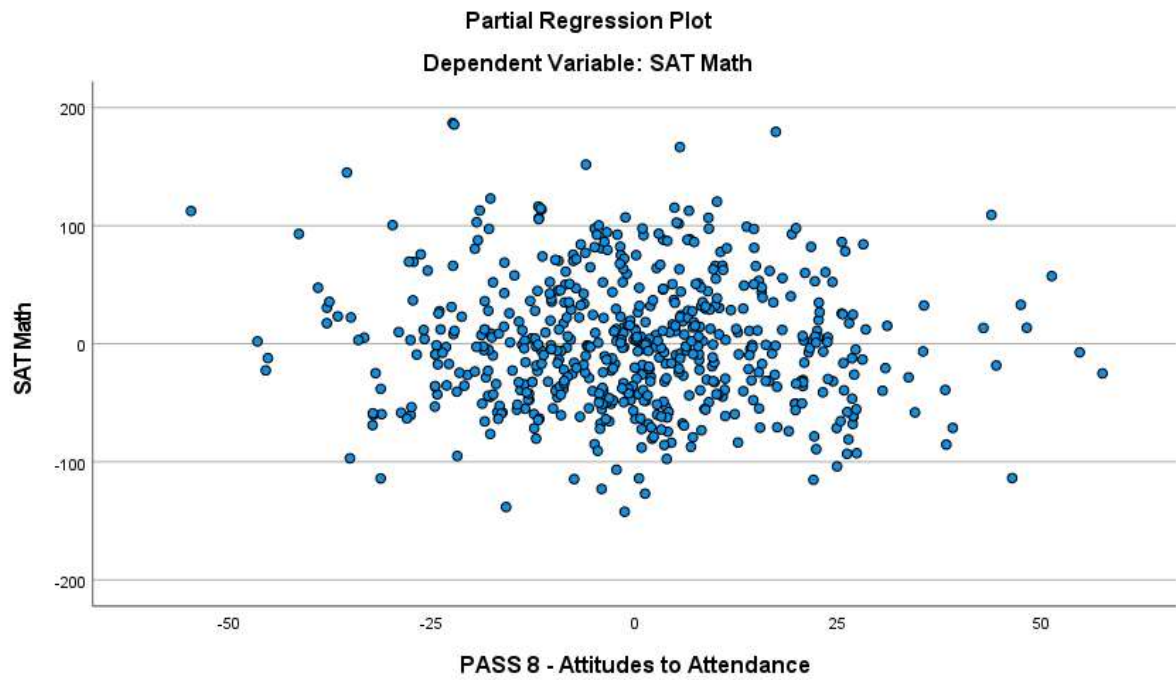




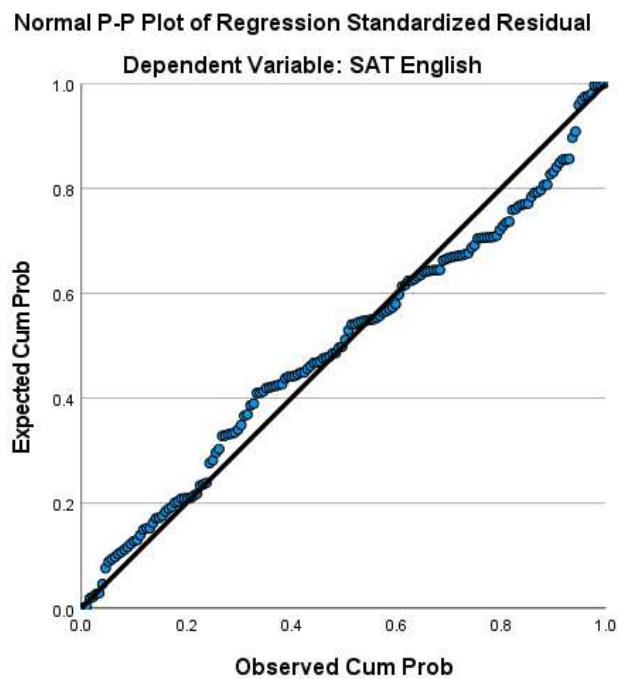
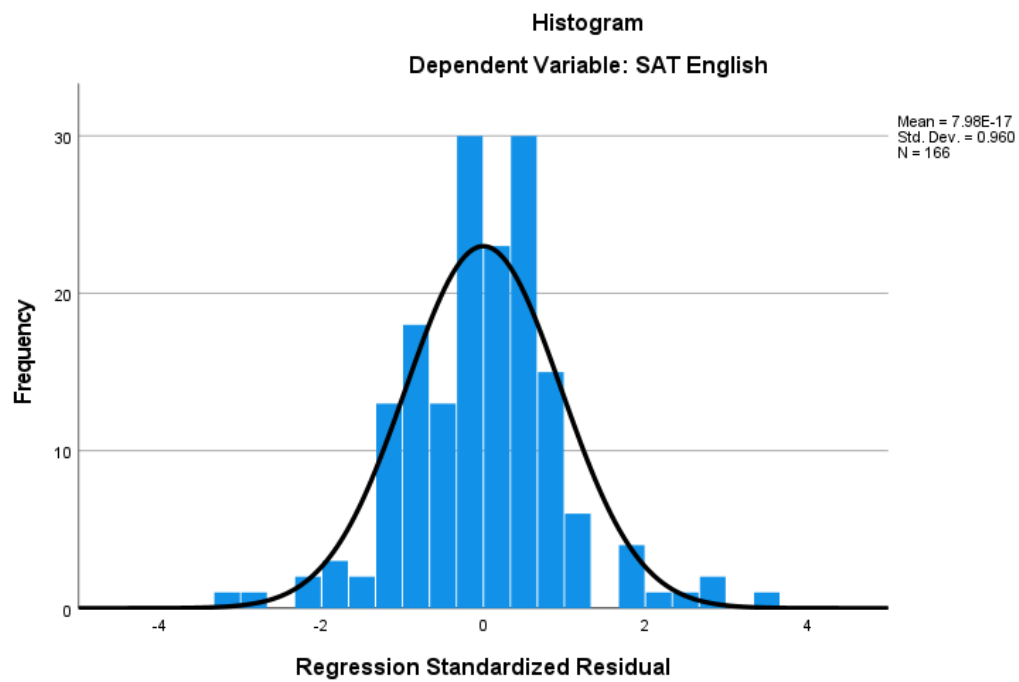


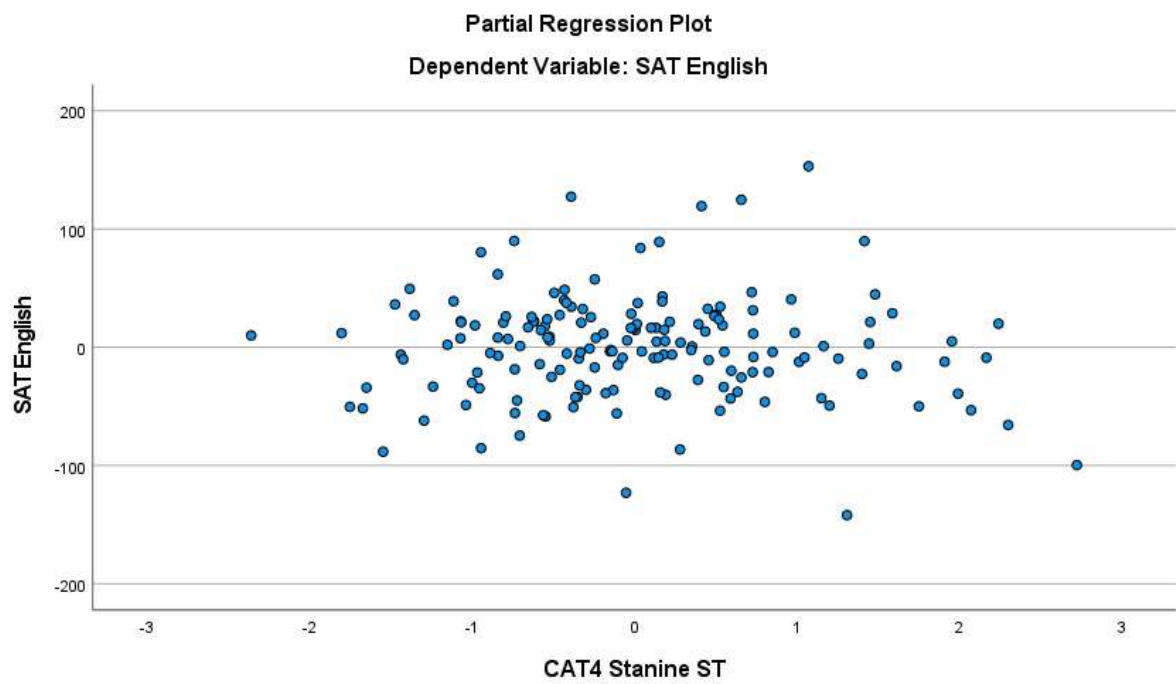
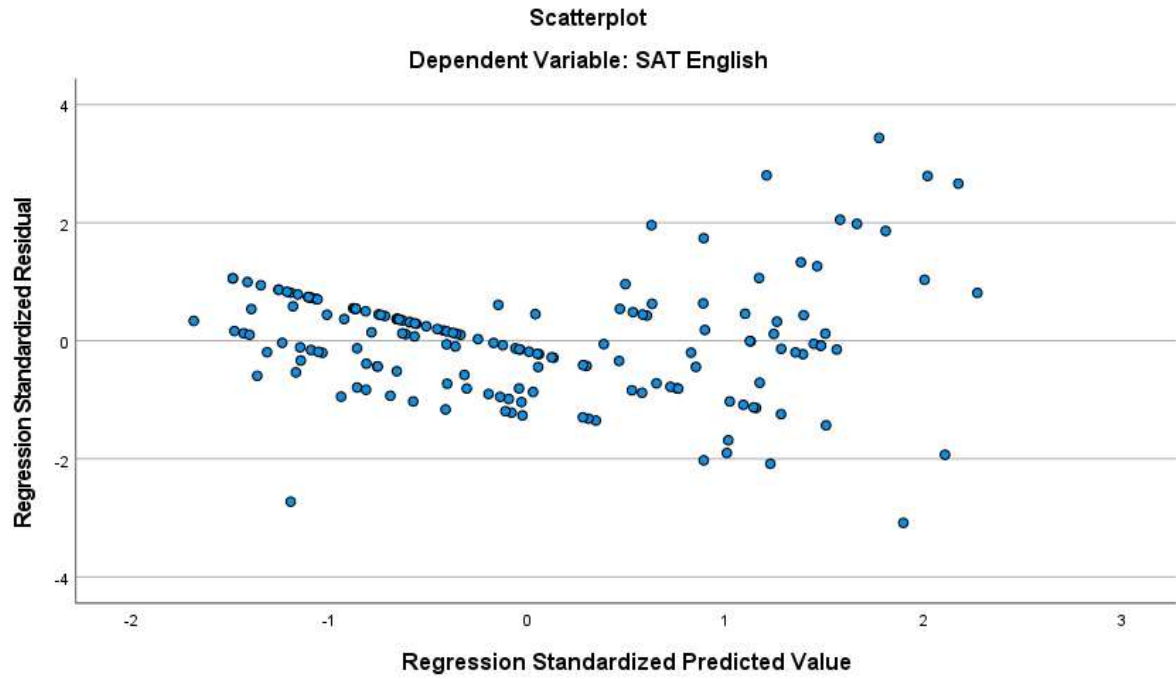


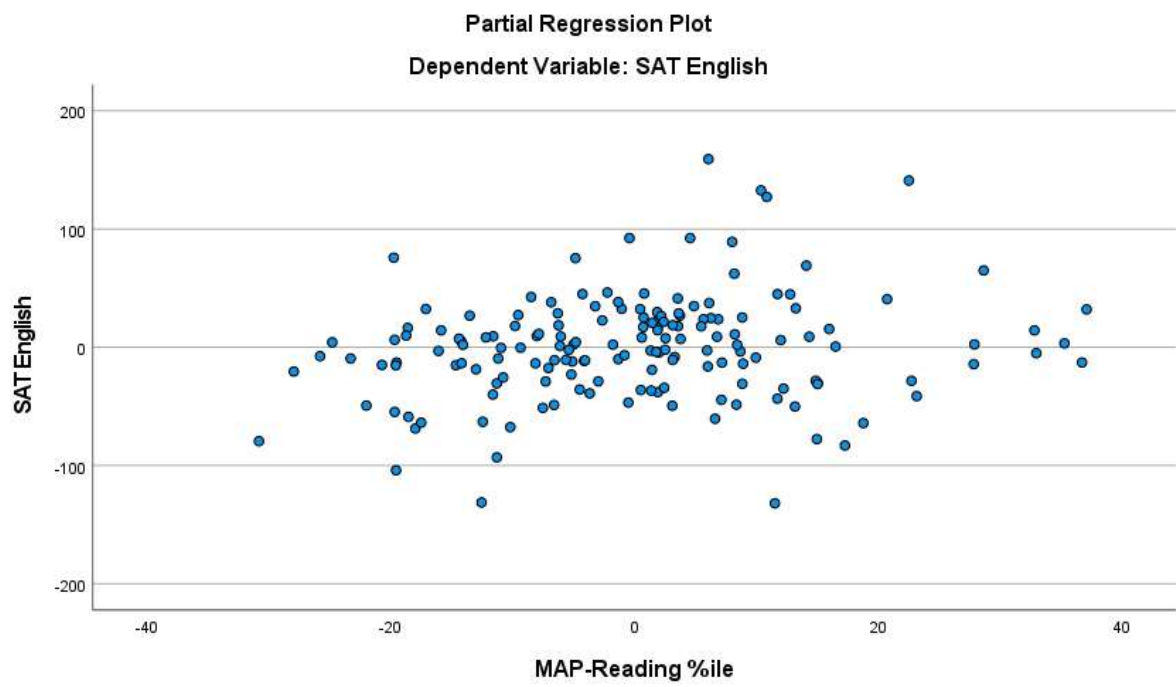
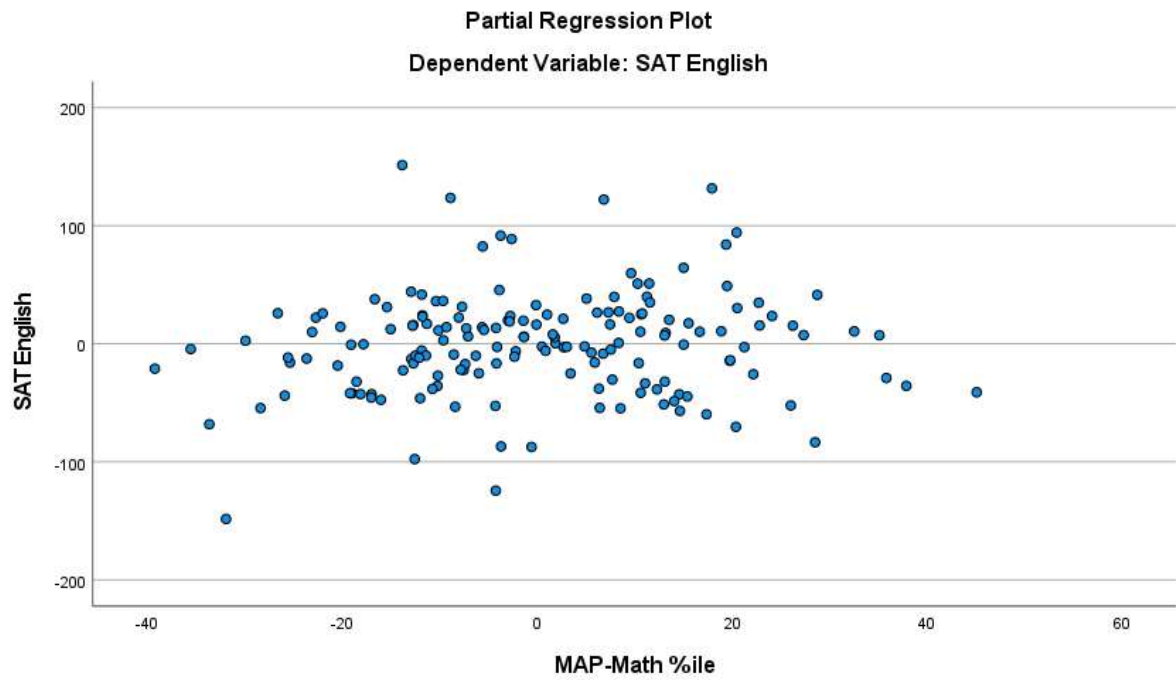


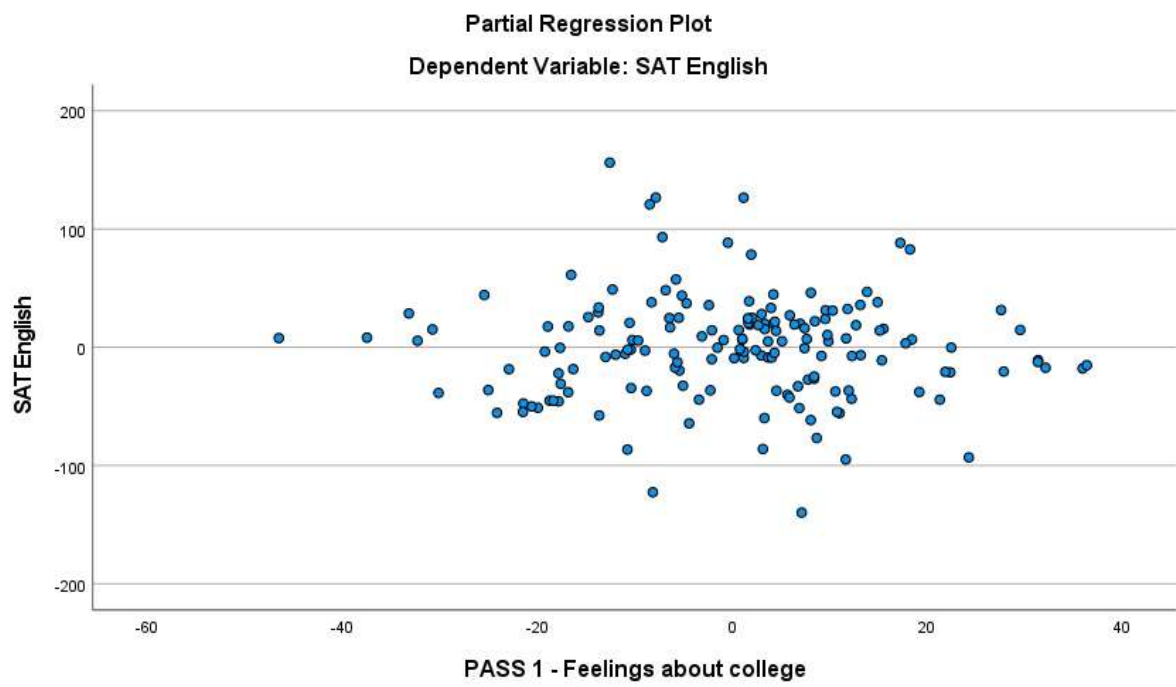
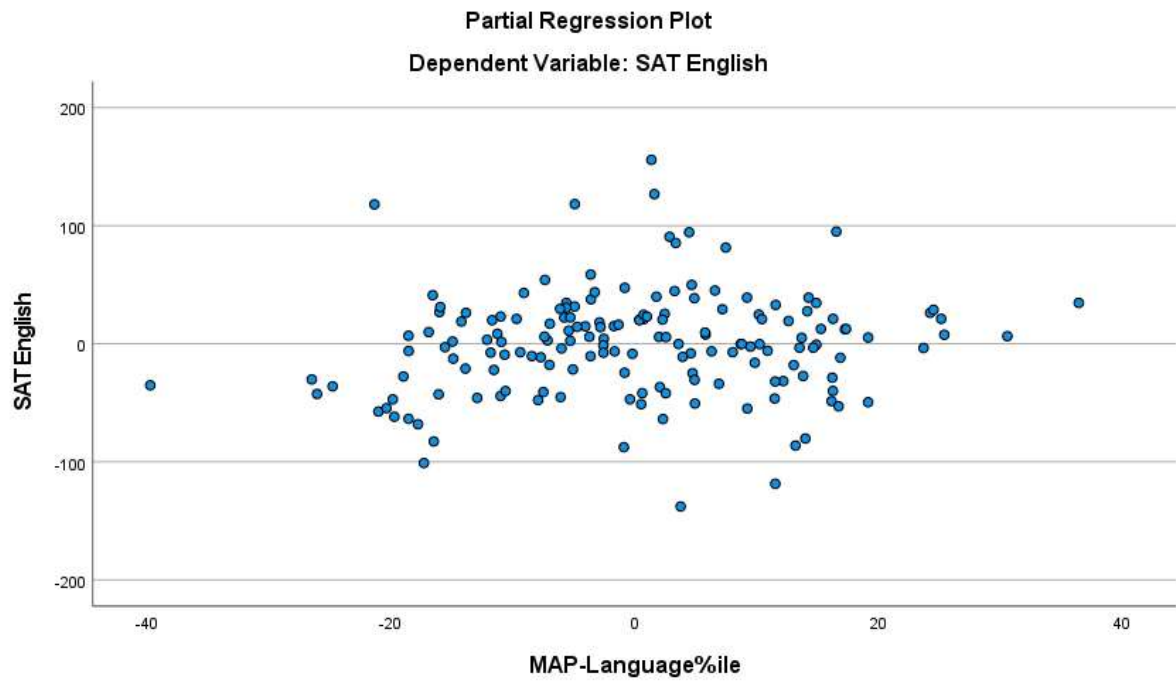


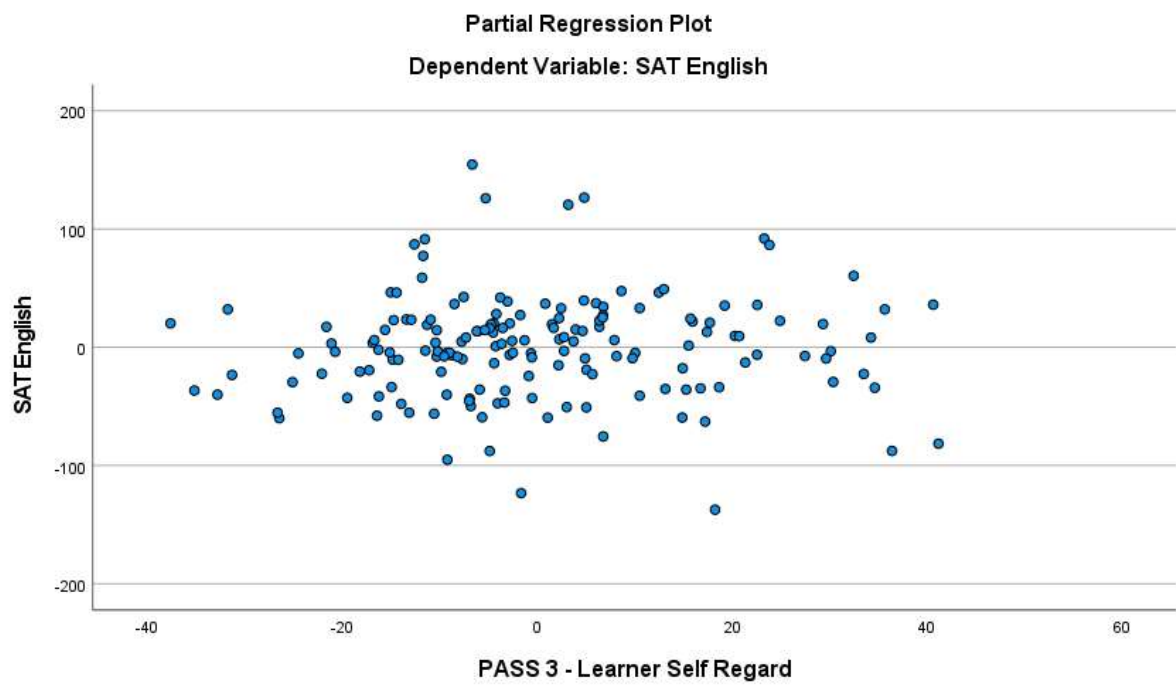
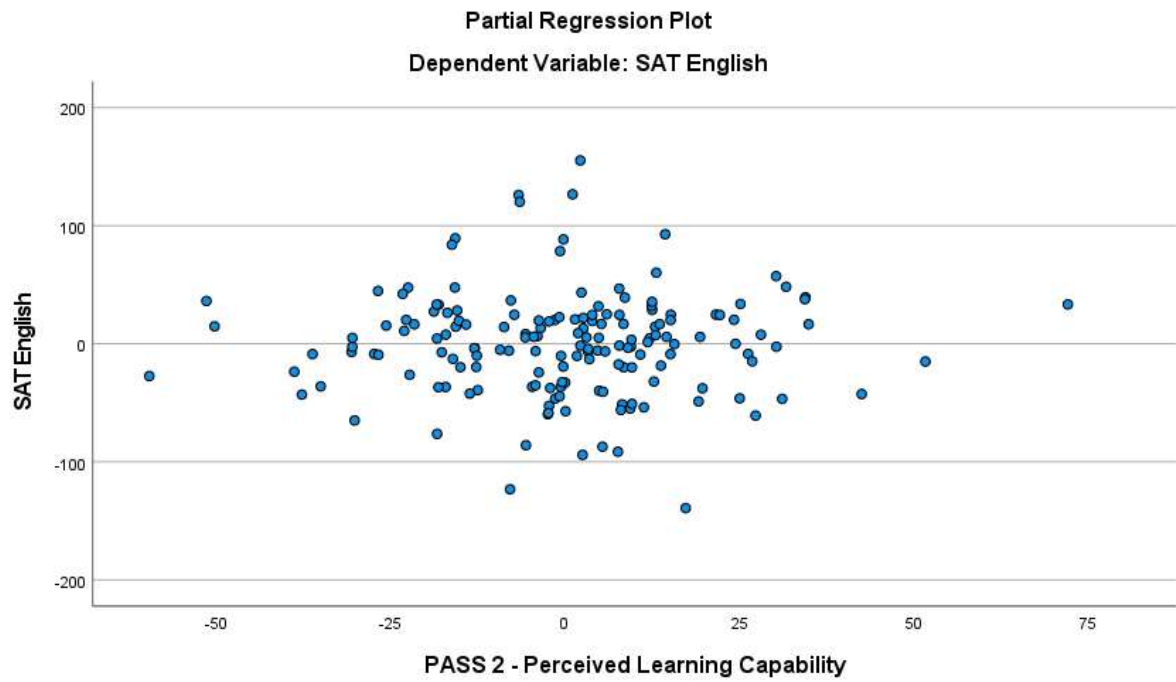
2) SAT-English

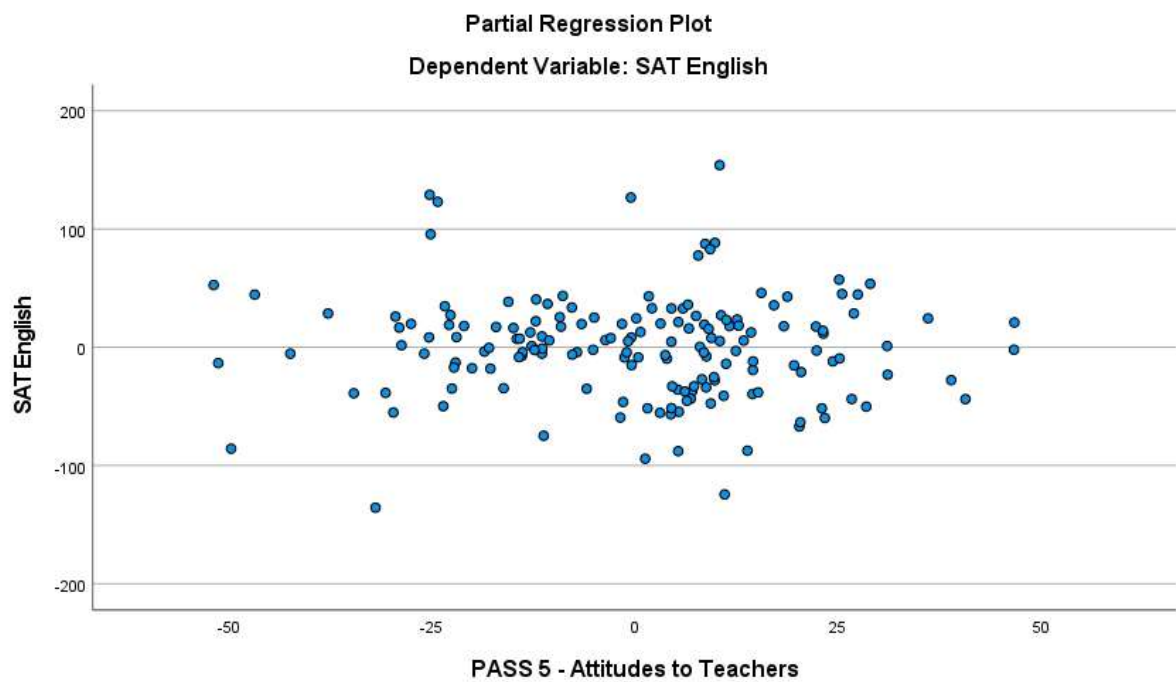
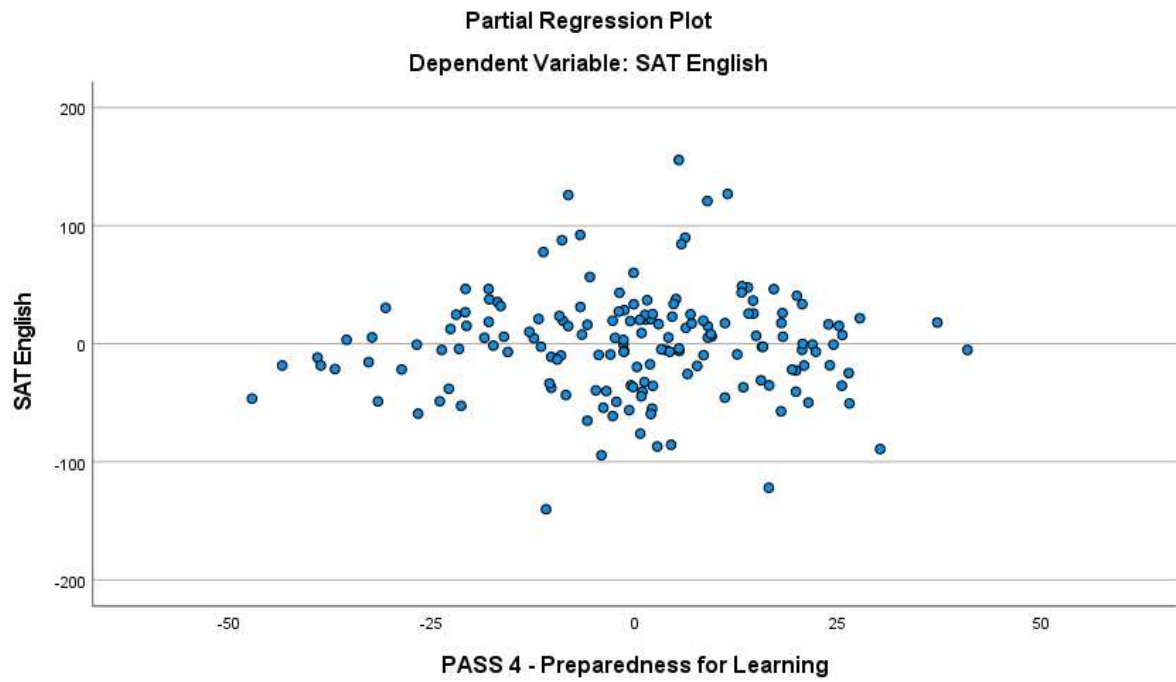


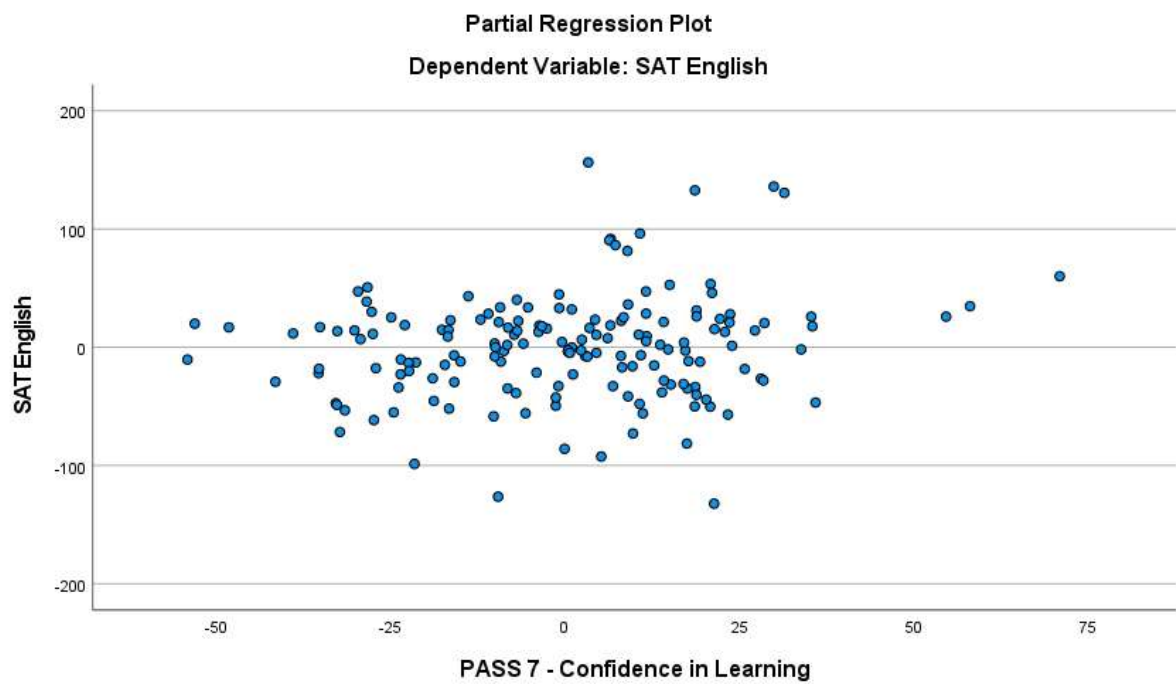
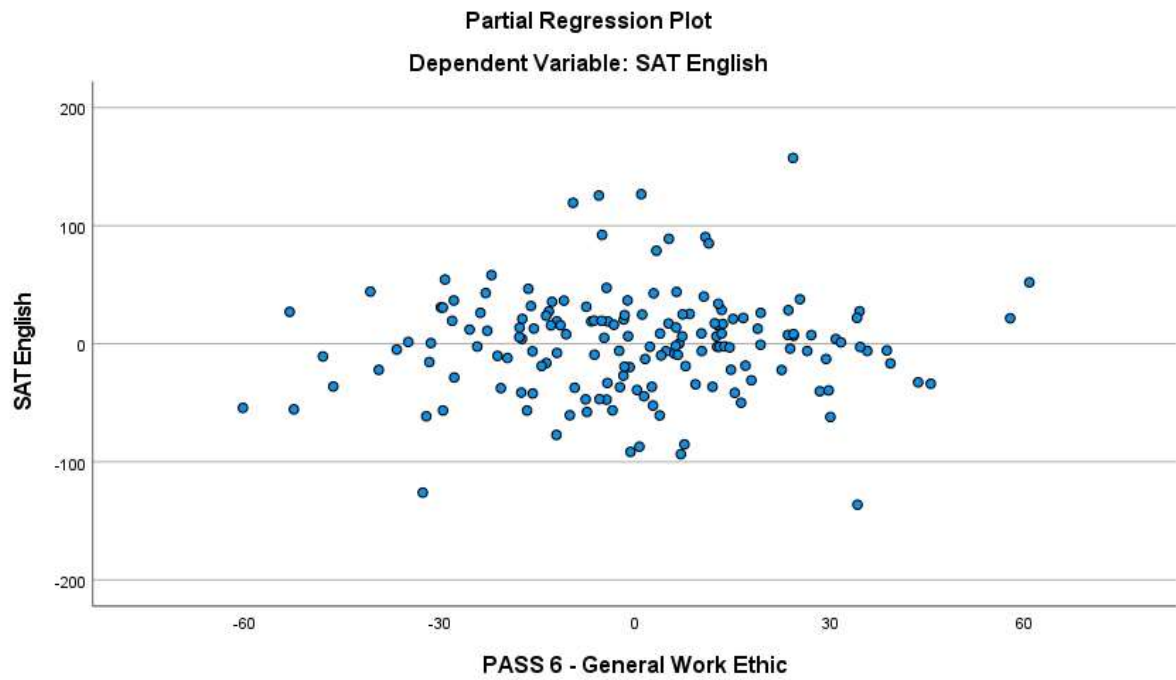


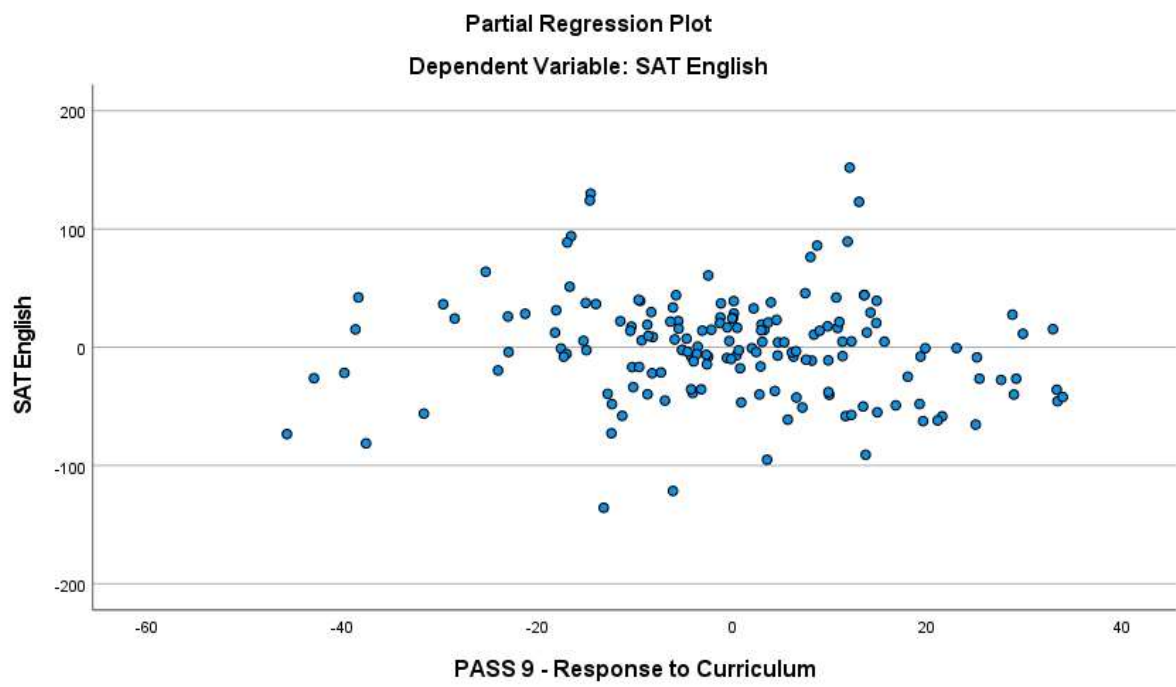
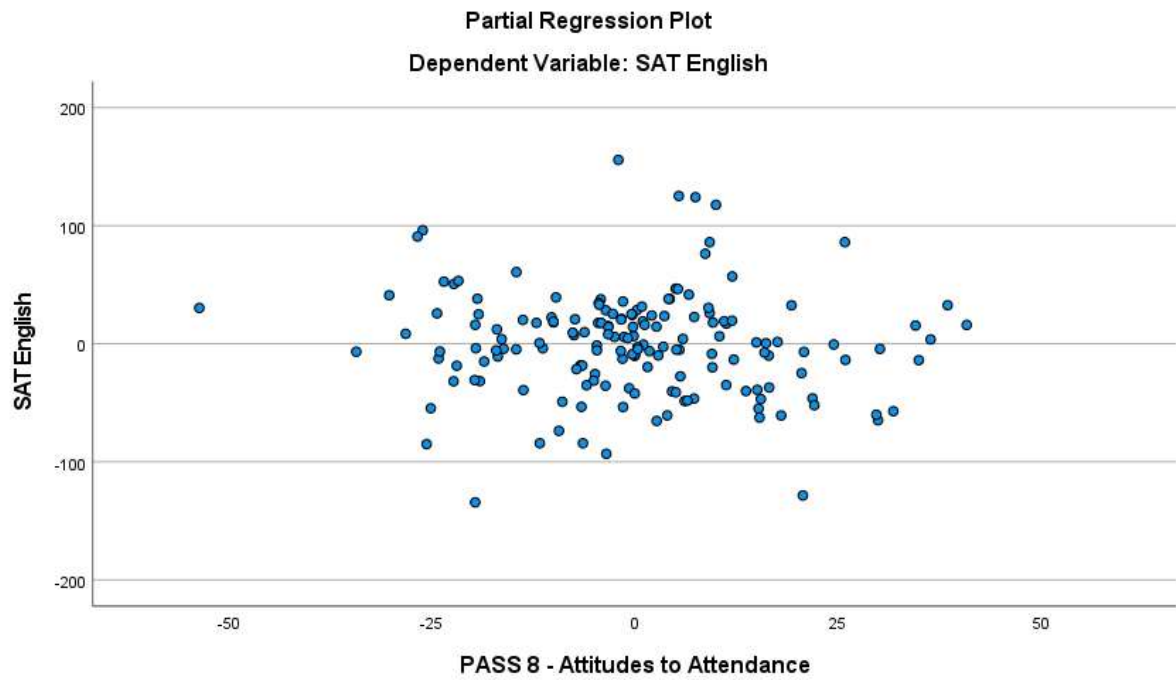












Appendix R - Correlation Matrix of Leaders and Teachers Questionnaire Items (Pearson's r Correlation Coefficients)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	1																													
2	.54	1																												
3	.55	.73	1																											
4	.44	.59	.71	1																										
5	.45	.32	.35	.38	1																									
6	.57	.42	.40	.49	.39	1																								
7	.44	.34	.33	.41	.45	.49	1																							
8	.43	.36	.32	.23	.42	.40	.71	1																						
9	.36	.31	.25	.26	.27	.43	.59	.63	1																					
10	.30	.22	.16	.21	.35	.42	.57	.58	.86	1																				
11	.62	.48	.38	.23	.47	.51	.49	.51	.41	.42	1																			
12	.35	.39	.30	.35	.40	.37	.28	.22	.34	.39	.49	1																		
13	.37	.44	.42	.49	.42	.39	.29	.38	.41	.30	.39	.73	1																	
14	.33	.35	.32	.35	.36	.37	.24	.29	.41	.32	.43	.66	.85	1																
15	.29	.31	.29	.33	.52	.34	.30	.37	.34	.48	.39	.48	.52	.54	1															
16	.46	.39	.32	.38	.42	.39	.35	.51	.48	.54	.44	.59	.51	.49	.62	1														
17	.31	.25	.15	.21	.34	.39	.48	.32	.50	.54	.36	.56	.48	.44	.45	.52	1													
18	.22	.23	.15	.25	.29	.36	.50	.39	.55	.59	.19	.36	.34	.34	.48	.51	.73	1												
19	.20	.20	.03	.18	.16	.30	.37	.23	.56	.60	.17	.52	.40	.41	.48	.48	.71	.72	1											
20	.07	.07	-.05	.12	.28	.20	.41	.26	.55	.70	.16	.48	.32	.32	.55	.46	.60	.70	.79	1										
21	.24	.10	.33	.17	.24	.06	.13	.26	.25	.29	.16	.22	.15	.18	.35	.36	.16	.29	.25	.19	1									
22	.14	.08	.18	.09	-.15	.05	.09	.02	.25	.16	.05	.03	.13	.13	-.08	.00	.14	-.03	.12	.04	-.16	1								
23	.15	.08	.31	.26	.19	.06	.13	.22	.19	.18	.22	.22	.23	.28	.32	.32	.16	.33	.17	.10	.58	-.10	1							
24	.05	.07	.17	.08	-.08	.10	.16	.08	.16	.07	.03	.03	.26	.33	.01	.09	.29	.21	.14	.13	-.09	.59	-.04	1						
25	-.06	-.06	-.03	.00	-.08	-.11	-.06	-.20	-.05	-.08	-.09	.01	.09	.29	.00	.04	.16	.10	.09	.15	-.05	.26	-.02	.64	1					
26	.30	.20	.32	.04	.04	.02	.14	.33	.32	.31	.28	.15	.16	.13	.25	.26	.13	.17	.04	.06	.48	.02	.41	-.02	-.03	1				
27	.19	.22	.17	.08	.18	.14	.13	.29	.33	.33	.33	.20	.21	.27	.36	.33	.29	.27	.20	.16	.37	.05	.38	.15	.05	.54	1			
28	.14	.35	.36	.37	.26	.08	.10	.08	.00	.03	.17	.28	.22	.17	.27	.16	.23	.40	.13	.17	.18	-.23	.36	-.02	-.04	.24	.31	1		
29	.26	.23	.32	.28	.42	.18	.23	.19	.18	.21	.32	.28	.27	.35	.36	.19	.27	.36	.21	.19	.28	-.16	.46	-.06	.01	.33	.39	.69	1	
30	.15	.19	.29	.13	.37	.15	.25	.24	.20	.25	.16	.21	.20	.16	.38	.13	.28	.36	.13	.20	.15	-.12	.23	.00	-.01	.34	.23	.47	.55	1

Appendix S - Convergent Validity Estimates from CFA on Leaders' and Teachers' Questionnaires

Standardized Factor Loadings, Cronbach's Alpha (α), Composite Reliability (CR), and Average Variance Explained (AVE)

Factors & Indicators		Factor Loading
Academic Factors - Attainment ($\alpha = .882$, CR = .872, AVE = .407)		
1	I am aware of the strengths and weaknesses in the student's academic level based on MAP reports.	.616
2	I believe that training students on using MAP test report helps them improving their learning.	.642
3	I encourage students to use the information in MAP report to improve their academic knowledge and skills.	.546
4	I advise students to adjust their plans for learning based on the results they get from the MAP test or MAP "Student Goal Setting Worksheet".	.597
5	I think that monitoring students' academic progress should be based on their progress in MAP test.	.569
6	I recommend using MAP Goals or MAP "Student Goal Setting Worksheet" frequently to reflect with students on their achievement	.705
7	I think MAP scores are important in predicting students' SAT scores.	.708
8	I think MAP tests are helpful to improve students' scores in SAT.	.631
9	I believe that students should connect what they learn from MAP to their SAT target.	.665
10	I think that setting students' SAT goals should be based on current MAP-RIT score or percentile.	.682
Cognitive Factors – Aptitude ($\alpha = .907$, CR = .912, AVE = .510)		
1	I am aware of the strengths and weaknesses in the student's cognitive ability level based on CAT4 reports.	.552
2	I believe that training students on using CAT4 report should help them improving their learning.	.829
3	I encourage students to use the information in CAT4 report to improve their academic knowledge and skills.	.696
4	I advise students to adjust their plans for learning based on the recommendation they get from the CAT4 test results and report.	.661
5	I think monitoring students' progress during a learning task should be done using the advice they got from their CAT4 reports.	.692
6	I recommend using CAT4 report and recommendation frequently to improve students' learning strategies and skills.	.713
7	I think cognitive abilities' level are important in predicting students' SAT scores.	.755
8	I think students' cognitive abilities (verbal, quantitative, non-verbal reasoning, and spatial ability) are helpful to improve their scores in SAT.	.798
9	I believe that students should connect what they learn about their cognitive abilities from CAT4 report to achieve their SAT target	.726
10	I think that setting students' SAT goals should be based on their current cognitive ability- CAT4 level.	.684

<u>Affective Factors - Attitude ($\alpha = .664$, CR = .794, AVE = .504)</u>		
1	~~I am aware that students' attitude towards school affect their performance in assessments.~~	Dropped
2	~~I am satisfied with students' performance.~~	Dropped
3	I think that students' attitude towards their teacher is important in affecting their academic achievement.	.481
4	~~Our students have a clear vision and goals to achieve in their learning.~~	Dropped
5	~~I think that our students believe in their capability of thinking independently and dealing with challenges to achieve their goal.~~	Dropped
6	~~I believe that students communication and collaboration in learning will improve their performance.~~	Dropped
7	~~I understand that students improve their attitude towards preparing for SAT test in order to achieve their goal.~~	Dropped
8	I think students' attitudes towards learning are important in affecting their SAT scores.	.752
9	I think that students' attitude towards the subject affect their performance in SAT tests.	.915
10	I think students' self-confidence in the subject is important in predicting their SAT scores.	.618

Appendix T - Correlation Matrix of Students Questionnaire Items

(Pearson's r Correlation Coefficients)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	1																													
2	.37	1																												
3	.36	.51	1																											
4	.35	.45	.49	1																										
5	.31	.34	.35	.42	1																									
6	.25	.33	.37	.50	.49	1																								
7	.26	.36	.38	.47	.37	.47	1																							
8	.27	.43	.40	.38	.36	.33	.52	1																						
9	.24	.36	.36	.43	.45	.44	.52	.55	1																					
10	.25	.30	.36	.46	.44	.49	.53	.45	.55	1																				
11	.25	.36	.36	.35	.35	.38	.37	.32	.35	.38	1																			
12	.26	.38	.37	.35	.35	.40	.37	.37	.38	.40	.62	1																		
13	.27	.42	.43	.45	.34	.41	.41	.44	.45	.38	.59	.66	1																	
14	.26	.33	.35	.43	.36	.44	.42	.35	.43	.42	.59	.62	.63	1																
15	.24	.35	.39	.40	.40	.48	.43	.37	.44	.39	.54	.61	.61	.64	1															
16	.21	.30	.33	.41	.35	.48	.39	.31	.42	.44	.51	.58	.57	.60	.68	1														
17	.25	.33	.33	.41	.39	.41	.46	.41	.47	.48	.51	.59	.63	.61	.59	.64	1													
18	.17	.30	.33	.30	.29	.32	.38	.40	.38	.37	.42	.53	.49	.51	.51	.50	.57	1												
19	.18	.34	.36	.36	.33	.38	.40	.42	.45	.43	.48	.51	.56	.54	.53	.51	.63	.63	1											
20	.20	.30	.30	.37	.36	.42	.45	.38	.47	.48	.51	.53	.56	.60	.62	.60	.65	.52	.60	1										
21	.24	.20	.24	.21	.20	.24	.24	.27	.23	.20	.32	.32	.29	.30	.26	.31	.32	.38	.34	.30	1									
22	.19	.21	.23	.24	.16	.24	.23	.21	.25	.24	.25	.31	.29	.30	.26	.34	.32	.34	.33	.30	.53	1								
23	.16	.13	.18	.17	.14	.19	.17	.21	.22	.17	.21	.27	.26	.29	.26	.28	.28	.32	.33	.23	.61	.60	1							
24	.17	.16	.26	.19	.15	.25	.25	.24	.26	.20	.25	.31	.31	.27	.31	.31	.33	.35	.36	.29	.57	.59	.67	1						
25	.13	.19	.20	.16	.12	.20	.20	.23	.22	.18	.22	.21	.25	.27	.27	.26	.29	.33	.32	.21	.55	.59	.68	.67	1					
26	.20	.14	.22	.13	.16	.16	.18	.23	.23	.15	.21	.26	.23	.24	.25	.23	.28	.33	.31	.22	.59	.57	.70	.65	.66	1				
27	.19	.18	.27	.20	.21	.23	.27	.32	.28	.24	.27	.27	.31	.29	.31	.29	.34	.33	.38	.29	.61	.51	.62	.63	.63	.65	1			
28	.23	.19	.28	.21	.21	.28	.27	.32	.32	.27	.29	.32	.31	.30	.31	.28	.33	.36	.37	.28	.59	.53	.57	.60	.61	.62	.69	1		
29	.12	.19	.26	.19	.19	.24	.24	.27	.25	.23	.25	.31	.30	.29	.28	.25	.29	.36	.35	.26	.57	.51	.62	.61	.60	.62	.65	.70	1	
30	.18	.17	.26	.20	.21	.27	.23	.25	.23	.26	.22	.25	.25	.30	.30	.31	.29	.33	.34	.30	.55	.55	.61	.60	.58	.62	.63	.66	.66	1

Appendix U - Convergent Validity Estimates from CFA on Students' Questionnaire
Standardized Factor Loadings, Cronbach's Alpha (α), Composite Reliability (CR), and Average Variance Explained (AVE)

Factors & Indicators		Factor Loading
<u>Academic Factors- Attainment ($\alpha = .872$, CR = .867, AVE = .401)</u>		
1	I am aware of my strengths and weaknesses in Math based on MAP reports.	.383
2	I am aware of how to use MAP test to help me improve my learning.	.520
3	I know I can use the information in MAP report to master the mathematical skills.	.552
4	I adjust my plans for learning based on the results I get from the MAP test and MAP Goal sheets.	.647
5	I check my progress in Math based on my progress in MAP test.	.622
6	I use MAP goal sheet frequently to reflect on my achievement.	.688
7	I seek to connect what I learn from MAP to achieve my SAT target.	.721
8	I think MAP tests are helpful to improve my scores in SAT.	.673
9	I think my MAP score is important in predicting my SAT scores.	.723
10	I try to set my SAT goals based on my current MAP-RIT score or percentile.	.717
<u>Cognitive Factors- Aptitude ($\alpha = .931$, CR = .928, AVE = .563)</u>		
1	I am aware of my strengths and weaknesses in Math based on CAT4 reports.	.657
2	I am aware of how to use CAT4 report to help me improve my learning.	.731
3	I know I can use the information in my CAT4 report to master the mathematical skills.	.770
4	I adjust my plans for learning based on the recommendation I get from the CAT4 test results and report.	.779
5	I check my progress during a learning task using the advice I got from CAT4.	.799
6	I use CAT4 report and recommendation frequently to improve my learning strategies and skills.	.759
7	I seek to connect what I learn about my cognitive abilities from CAT4 report to achieve my SAT target.	.824
8	I think my cognitive ability (verbal, quantitative, non-verbal reasoning, and spatial ability) level is helpful to improve my scores in SAT.	.663
9	I think my cognitive ability level is important in predicting my SAT scores.	.726
10	I try to set my SAT goals based on my current cognitive ability- CAT4 level.	.777

Factors & Indicators		Factor Loading
<u>Affective Factors - Attitude ($\alpha = .940$, CR = .940, AVE = .609)</u>		
1	I understand that my attitude towards school affect my performance in assessments.	.735
2	I am satisfied with my performance.	.717
3	I think my attitude towards my teacher is important in affecting my academic achievement.	.826
4	I have a clear vision and goals to achieve in my learning.	.800
5	I believe that I am capable of thinking independently and dealing with challenges to achieve my goal.	.798
6	I believe that my communication and collaboration in learning will improve my performance.	.811
7	I seek to improve my attitude towards preparing for SAT to achieve my goal.	.805
8	I think my attitude towards learning is important in affecting my SAT scores.	.785
9	I think that my attitude towards Math affects my performance in SAT tests.	.762
10	I think my self-confidence in Math is important in predicting my SAT scores.	.757