Educational Leaders' Perceptions of the Implementation of Formative Assessment Strategies on Enhancing Students' Results in the MAP Exams in American Private Schools in the United Arab Emirates

تصورات القادة التربويين حول كيفية تنفيذ استراتيجيات التقييم التكويني الهادف لتحسين نتائج الطلبة في امتحانات مقياس التقدم الأكاديمي في المدارس الخاصة الأمريكية في دولة الإمارات العربية المتحدة

by

MINA RADHWAN

A thesis submitted in fulfilment

of the requirements for the degree of

DOCTOR OF PHILOSOPHY IN EDUCATION

at

The British University in Dubai

June 2020

Educational Leaders' Perceptions of the Implementation of Formative Assessment Strategies on Enhancing Students' Results in the MAP Exams in American Private Schools in the United Arab Emirates

تصورات القادة التربويين حول كيفية تنفيذ استراتيجيات التقييم التكويني الهادف لتحسين نتائج الطلبة في امتحانات مقياس التقدم الأكاديمي في المدارس الخاصة الأمريكية في دولة الإمارات العربية المتحدة

By Mina Radhwan

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

September 2020

Thesis Supervisor

Professor Sufian A. Forawi

Approved for award:

_____	_____
Name	Name
Designation	Designation
_____	_____
Name	Name
Designation	Designation

Date: _____

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that the content of this research is the direct result of my own work and that any use made in it of published or unpublished copyright material falls within the limits permitted by international copyright conventions.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

Signature

Mina Radhwan

COPYRIGHT AND INFORMATION TO USERS

Abstract

Assessments are considered as a significant component in the process of improving education all over the world. Formative assessment helps teachers to enhance students' learning skills and develop their academic progress. Nowadays, for educational accountability, countries, schools and teachers are evaluated based on students' progress results in various types of assessments. Benchmark tests and specifically the Measure of Academic Progress (MAP) is one of the external benchmark assessments in which students are not performing well according to the required targets of the UAE National Agenda 2021. Therefore, the purpose of the current study is fourfold (1) to investigate teachers' perceptions about the implemented formative assessment strategies, (2) to investigate teachers' perceptions about the effect of using formative assessment strategies on enhancing students' skills, (3) to explain grade eight students' progress in science MAP exams in the light of formative assessment strategies implemented, (4) to explore science leaders' beliefs about how grade eight teachers implement formative assessment strategies in preparing students for the MAP exams. Guided by the perspectives of Vygotsky's social constructivist theory, constructive alignment theory, self-determination theory, and depth of knowledge model. An explanatory sequential mixed method design was used in this research study. Teachers' questionnaires, document analysis of students' results in the MAP exams and science leader's interviews were administered in this study. The participants included 163 teachers who implement formative assessment strategies in their daily lesson plans, 250 grade eight science students from both genders and 10 science leaders. The findings revealed many important results: 1) most of the teachers are knowledgeable and aware regarding the importance of using formative assessment strategies in their science classes 2) Think-Pair-Share, Problem-Based Learning, Self-assessment, Exit-Card, Feedback and questioning strategies are the most effective strategies that can help students to improve their results in science benchmark exams 3) according to the use of various formative assessment strategies, students' results in the MAP science exam in the fall 2019 were better than in the fall 2018. These results indicated that using formative assessment strategies may have a positive effect on enhancing students' results in the MAP exams.

Key Words: Formative Assessment Strategies - MAP exam - Students' Skills - Students' Results

الخلاصة

تعتبر التقييمات عنصرا هاما في عملية تحسين التعليم في جميع انحاء العالم. يساعد التقييم التكويني المعلمين على تحسين مهارات تعلم الطلاب وتطوير تقدمهم الأكاديمي. في الوقت الحاضر للمسائلة التعليمية ، يتم تقييم البلدان والمدارس والمعلمين بناءً على نتائج تقدم الطلاب في أنواع مختلفة من التقييمات. تعد اختبارات الأداء المعياري وبالتحديد مقياس التقدم الأكاديمي (MAP) أحد التقييمات القياسية الخارجية حيث لا يؤدي الطلاب أداءً جيدًا وفقًا للأجندة الوطنية لدولة الإمارات العربية المتحدة لسنة 2021.
لذلك، فإن الغرض من هذه الدراسة يشتمل على أربعة أهداف (1) دراسة تصورات المعلمين حول استراتيجيات التقييم التكويني المنفذة ، (2) استكشاف معتقدات المعلمين حول تأثير استخدام استراتيجيات التقييم التكويني في تعزيز مهارات الطلاب ، (3) استكشاف تقدم طلاب الصف الثامن في امتحانات MAP العلمية في ضوء استراتيجيات التقييم التكويني المنفذة ، (4) استكشاف وجهات نظر قادة العلوم حول كيفية تنفيذ معلمي الصف الثامن لاستراتيجيات التقييم التكويني في إعداد الطلاب لامتحانات مقياس التقدم الأكاديمي MAP. مسترشدة بوجهات نظر نظرية البنائية الاجتماعية لفيجوتسكي ، ونظرية المحاذاة البناءة ، ونظرية التحديد الذاتي ، ونموذج عمق المعرفة. تم استخدام طريقة الخلط متعددة المراحل لغرض تحقيق أهداف هذه الدراسة البحثية من خلال تنفيذ استبيان للمعلمين ، وتحليل المستندات لنتائج الطلاب في امتحانات مقياس التقدم الأكاديمي MAP ، أضافة الى اجراء مقابلات مع قادة العلوم في المدارس المشاركة في هذه الدراسة. تضمن المشاركون 163 مدرسًا يقومون بتنفيذ استراتيجيات التقييم التكويني في خطط الدروس اليومية ، و 250 من طلاب العلوم في الصف الثامن من كلا الجنسين ، و 10 من قادة العلوم.
كشفت الدراسة عن العديد من النتائج المهمة: 1) أن معظم المعلمين على دراية بأهمية استخدام استراتيجيات التقييم التكويني في فصولهم العلمية 2) التفكير القائم على المشاركة والتعلم القائم على حل المشكلات والتقييم الذاتي وبطاقة الخروج والتغذية الراجعة واستراتيجيات الأسئلة هي الاستراتيجيات الأكثر فاعلية التي يمكن أن تساعد الطلاب على تحسين نتائجهم في امتحانات العلوم الخارجية 3) وفقًا لاستخدام استراتيجيات التقييم التكويني المختلفة ، كانت نتائج الطلاب في امتحانات مقياس التقدم الأكاديمي MAP في مادة العلوم في خريف عام 2019 أفضل من خريف عام 2018. أشارت النتائج إلى أن استخدام استراتيجيات التقييم التكويني المختلفة قد يكون له تأثير إيجابي على تحسين النتائج الأكاديمية للطلاب في امتحانات مقياس التقدم الأكاديمي MAP.

الكلمات والعبارات الرئيسية: استراتيجيات التقييم التكويني - اختبار مقياس التقدم الأكاديمي MAP – مهارات تعلم الطلاب - نتائج الطلاب الأكاديمية.

DEDICATION

The completion of my dissertation is one of the hardest challenges that I have had to face. I dedicate this thesis to my family and friends. I could never have done this without your faith and constant encouragement. I wish to acknowledge the amazing support received from you.

To my parents who encouraged me through their motivational words. Thank you for teaching me to believe in myself and in my dreams. A special feeling of gratitude is to my husband Ammar who supported me and inspired me to do the best I can in my life. Thank you for understanding my frustration and stressful deadlines. To my children, Yoser, Omar, and Adnan for always making me smile and for understanding the time I took to complete my study instead of spending time with them. Thank you for all the warm and supportive hugs that I received from you in my hard times. I owe you the greatest degree of gratitude.

I also dedicate this work to my best friends and colleagues who supported me with their inspirational words during the years of my study.

ACKNOWLEDGMENT

Foremost, I would like to express my sincere gratitude to my Prof. Sufian Forawi for the continuous support of my PhD study and research, for his patience, motivation, and immense knowledge. It was a great honor to finish this thesis under his supervision and guidance in all the time of research and writing of this thesis.

Besides my supervisor, I would like to express my deep appreciation to the committee members who were more than generous with their expertise and precious time. The insights and encouragement offered by them are invaluable to this work. Moreover, I would like to extend my thanks to the staff and all the faculty members of the British University in Dubai.

I am deeply indebted to my respected colleagues and friends for their invaluable help in collecting the thesis data. Without their contribution and valuable support, it would not be possible to complete this research. Thank you for assisting me in my difficult times.

I owe a lot to my parents, my sister Dr. Dalia, and my brother Radhwan who encouraged me at every stage of this academic journey and believed in my abilities to see this achievement come true. A special thanks to my husband Ammar who was patient for many years to provide me with great support in order to achieve my dream. My heartfelt gratitude to my loving children, Yoser, Omar and Adnan, for supporting me spiritually throughout the journey of writing this thesis and my life in general.

Above all, I owe it all to Almighty God for granting me the wisdom, health and strength to undertake this research task and enabling me to its completion.

I hope that the insights offered here might drive policies that will advance the good work being done by this research.

Table of Contents

List of Figures

List of Tables

Chapter One: Introduction

1.1 Introduction

At the present time, education is considered as one of the most successful ways to develop individuals' competencies with the aim of preparing them to be successful citizens in society. Nowadays, there is clear competition between countries regarding development in various fields, and the educational field is one of them (Nakhaee and Arab Nasrabadi, 2019). One of the most important factors that the progress of any country depends on is the quality of individual's performance and skills in coping with the 21st century requirements (Jamhari and Sipahutar, 2018).

Education is categorized as one of the most significant aspects that can influence the national vision of every country (Retnawati, Djidu, Apino, and Anazifa, 2018). In order to reach a higher level towards a better future, successful accomplishment in the educational field is the key to achieve this target. All the school stakeholders must participate with the aim of effective and positive implementation to achieve the goal of the nation (Retnawati et al., 2018).

According to the Ministry of Education (MOE) in the UAE considers that one of the most significant targets in the educational field at present is to support the current and future generations to be able to contribute efficiently in the world generally and the future of the UAE specifically (MOE, 2019). Developing countries, and specifically the United Arab Emirates, where the country's mission is focused on developing an innovative Education System for knowledge and a global competitive society, that includes all age groups to meet future labor market demand, by ensuring quality of the ministry of education outputs, and the provision of the best services for internal and external customers (MOE, 2019). Moreover, in various developing countries, several technological and innovative improvements have occurred. Individuals' everyday lives have turned out to be increasingly complex in addition to numerous types of unexpected difficulties, which might face the country in the future. Hence, in order to live in a dynamic country, individuals are required to build their abilities to become viable and effective residents. At the present time, schools have a big responsibility towards all students because they have to teach them all the essential skills that could empower them to be effective leaders and enable them to take part in the upcoming knowledge economy of the country (UAE Ministry of Education 2015).

Both the government and the policymakers have fundamental responsibility toward preparing the suitable path in the direction of educational progress through providing constructive education for all learners (Quamruzzaman, Rodríguez, Heymann, Kaufman, and Nandi, 2014). In addition to that, teachers have the main role within the government in attaining this aim because they are able and responsible for applying all types of policies and guidelines through the use of classroom strategies that have to be suitable for all levels of learners. At the start, teachers must focus on the effective quality of their educational implementation before they concentrate on their planning. Government, principals, school leaders and experts, teachers, and other stakeholders have to work collaboratively to achieve a better academic future for all students. This can take place by improving the teaching professionalism, evaluating the process of teaching and its results, setting new regulations, and updating the curriculum according to learners' need (Purnomo, 2017).

A variety of research indicates the vital role of teachers in enhancing the quality of education which imparts the development of an ideal human society (Gil-Flores, Rodríguez-Santero, & TorresGordillo, 2017; Hu, Fan, Yang, & Neitzel, 2017; Maba, Perdata, Astawa, and Mantra, 2018). Consequently, the ability of teachers in implementing an effective educational policy is considered as one of the main factors to have a strong influence on the quality of education. Moreover, teachers should have adequate capability in addition to being highly knowledgeable in their specialist subject (Mantra, 2018).

There is a strong relationship between improving the quality of education and the requirements of 21st century skills that need to move through many challenges (Scott, 2017). These skills can be classified into three crucial frameworks which include firstly, the learning and innovation skills that are related to collaboration, communication, creativity and critical thinking skills (4CS). The second structure is about students' life and career skills which are connected to self-direction, social abilities, accountability and flexibility. The third framework is linked to the skills that have an association with information and technology (Scott, 2017). In addition to other important skills such as the learner's skills and their relation to metacognition (Bialik, 2015). The last two authors Bialik (2015) and Scott (2017) categorized the skills of the 21st century into two key components which involve learners' thinking skills and their ability to work collaboratively.

The current contemporary world has a need to develop a high level of skill to be able to deal with new quickly changing conditions and the expanding requests of the modern technological society

(Guadu & Boersma, 2018). Stimulating the higher order thinking for all learners from different academic levels is the principle target of all educational curricula. A lot of results from previous research specifically in science education have confirmed the importance of using effective teaching strategies as an essential element towards enhancing students' academic skills (Saido, Siraj, Nordin, and Al-Amedy, 2017).

As stated by Dewey (1933) who is considered as one of the most significant educational reformers whose thoughts have been influential in the field of education, he indicated that learning is not related to doing something but it is associated with the way of thinking about how to do it.
Dewey claims that thought comes to fruition only through communication and that its realization is most complete when we think together in "face-to-face relationships by means of direct give and take", or dialogue (1991b, p. 218). In science subjects, students' high order thinking abilities represent as a fundamental component to enhance the learning process and the building blocks for science instructions (Avargil, Herscovitz, & Dori, 2012). Furthermore, moving from the traditional way of teaching called (teacher-centered approach) which leads to a low level of students' thinking skills to the (student-centered approach) that leads to students with high-order thinking skills and is considered as one of the essential components that is used in the current reformation in teaching the science subjects (Avargil et al., 2012; Constantinou & Kuys, 2013; Karami, Pakmehr, & Aghili, 2012; Rotgans & Schmidt, 2011; Thitima & Sumalee, 2012). These types of skills which are connected to high order cognitive skills will be stimulated when learners experience unfamiliar problems or dilemmas. It is essential to move from the teacher-centered approach where the teacher presents information to the students, who are expected to passively receive the knowledge being presented to a student-centered approach where the teacher's role is a facilitator as students embrace a more active and collaborative role in their own learning. Effective applications of the aptitudes in the classes of science bring about clarifications, performances and right choices that are active within the setting of accessible knowledge and practice that support constant development in these and other intellectual abilities (Saido et al., 2017).
Furthermore, several studies indicated that working collaboratively, which can be implemented positively using various teaching strategies will lead students to achieve a higher level in their academic results. Effective strategies can be considered as an important way of assessment that can assist all learners from different academic levels to aim for better learning. This type of

assessment can be utilized to repair the process of learning. Consequently, instructors must use assessment and particularly formative assessment (FA) that highlights the needed feedback towards improving the quality of learning (Pradana, Sujadi, and Pramudya, 2017).

According to the study of the National Research Council on promoting high order thinking skills for all levels of students where it specified that teachers play a crucial role in creating the right educational environment where their students can feel comfortable and confident in sharing their own thoughts and inventions (Yao, 2012). Additionally, science teachers must use the required strategies that enhance learners' participation through generating thinking questions, demonstrating their understanding, solving questions with different levels of complexity and re-building their own thinking (Albaaly, 2012; Panasan and Nuangchalerm, 2010; Şimşek and Kabapınar, 2010). In this case and through the discussions and the different levels of class activities that the students have to participate in, they will be able to develop their cognitive skills which will assist them to be more confident in making decisions and being problem solvers in their everyday life.

Moreover, an expanding collection of research has concentrated on the connection between the utilization of effective teaching strategies and learners' cognitive abilities (Constantinou & Kuys, 2013; Karami et al., 2012; Rotgans & Schmidt, 2011; Thitima & Sumalee, 2012). Furthermore, results from previous research underlined that teaching strategies are influenced by certain elements for instance, gender and students' thinking skills (Bülent, Mehmet, and Nuran, 2014; Hamzeh, 2014). Consequently, teachers have to support the idea of using effective teaching strategies that will transfer students to a development level of both knowledge and skills regardless of their future role in society (Saido, Siraj, Nordin, and Al-Amedy, 2017).

In, recent times, a great deal of attention is focused on assessment in education because of its positive role in helping educators with improving the quality and the nature of learning (Widiastuti, Mukminatien, Prayogo, & Irawati, 2020). For that reason, researchers and specialists have attempted to find suitable and effective assessment strategies that can measure and monitor the learning progress of all students in the local and global context. In order to achieve the assigned educational target of each student, teachers need to have the baseline information that can help in

enhancing students' learning. This information includes identifying the level of success of the learning process and the students' skills which can be collected through the use of assessment (Pantiwati, & Husamah, 2017).

Students' assessment is considered as one of the essential components to complete the process of successful education appropriately as it energizes the learning of students (Shepard, 2019). An assessment is considered as one of the strongest instruments that the teacher can depend upon. For that reason, it needs careful consideration (Evans, Zeun & Stanier, 2014). The assessment demonstrates a pivotal role in the field of education. It is important due to its great impact on the process of successful learning (Baleni, 2015). Effective assessments can deliver a positive and focal commitment to instruction (Wilson, 2018). Especially if these assessments are connected to measure more than one aspect such as, thinking skills, social abilities and students' capabilities to work cooperatively with others. These aspects have a direct association with learners' positive academic outcomes (Tsay, and Brady, 2010).

Assessment represents an essential part in the process of teaching and learning. Teachers use various types of assessments in order to determine the level of both the knowledge and skills of students. It can also help in identifying their learning outcomes accompanied by their strengths and weaknesses. As a result of that, teachers will be able to choose the appropriate tasks that can motivate students and improve their capabilities according to their academic level (Box, Skoog, & Dabbs, 2015). Furthermore, the collected information about students' learning through using assessment can inform the strategies and methods to assist teachers in enhancing the quality of learning (Ashraf, & Zolfaghari, 2018).

There are two types of assessment, which are formative assessment (FA) and summative assessment. The difference between them were identified in the 1960s. FA is the process towards assessing the understanding of students on daily basis. It is used to provide better effective instructional and practical strategies for all levels of learners (Miller, 2019). On the other hand, summative assessment provides some measures that can assist in the final draft effectiveness. It evaluates student learning at the end of an instructional unit by comparing it against some standard or benchmark.

FA is defined as “activities undertaken by teachers and by their students in assessing themselves that provide information to be used as feedback to modify teaching and learning activities” as stated by (Black & Wiliam, 2010, p. 82). As a result, FA contains various tools that can provide feedback to both the teacher and the students toward helping students to learn in an effective way (Dixson and Worrell, 2016). Summative assessments can be defined as “cumulative assessments ... that intend to capture what a student has learned, or the quality of the learning, and judge performance against some standards” (National Research Council, p. 25). This type of assessment can provide teachers and students with specific information about the learning level that the students reached and achieved in a specific period of time (Dixson and Worrell, 2016).
Moreover, informal assessment may be a part of FA and depends upon teacher-student interaction appeared as one of the best ways to predict students’ intrinsic motivation as well as their positive attitudes toward learning. This type of assessment can promote the learning process for each student and it has been mightily upheld by the present international educational research and policy (Gan, He, and Liu, 2019).

One of the crucial subjects that has a direct relationship with building learners’ significant skills is the subject of science. It can improve the students’ cognitive and meta-cognitive capabilities as stated by Hanauer & Bauerle (2012). Thus, enhancing the teaching strategies in science and using effective types of assessment would elevate students to experience and develop different types of skills such as, critical thinking and problem solving which can empower them to handle future difficulties that they might face (Harrison, 2014). Therefore, all educators have to participate in implementing strong assessment by using various FA strategies with the purpose of gathering all the related evidence about the students’ performance and their results in their daily teaching and learning process. This will help lead clear and positive perspectives and constructive feedback for further development (Clark, 2012).

The up-to-date learning objectives can empower learners to realize what they will learn and why they need to learn it, with the intention of becoming active learners (Heritage, 2008). It is significant for learners to discuss their aims, criteria and necessities together to get noticeable outcomes (Lombard and Schneider, 2013). From the earliest starting point of the school session, students have to be self-directed by taking the obligation for their own learning, allowing all students to make their own insight into the subject, cooperating with their instructors as well as

peers, and extending their plan along with advancing on the way to more multifaceted knowledge and understanding (Ritchhart, Church, and Morrison, 2011). In the meantime, school leaders are continuously challenged to generate the skills of students in the 21st century. These students must be curious, critical thinkers with specific targets. They should experience the appropriate ways of incorporating logical reasoning during the procedures of solving problems. They should be able to find answers for critical thinking and reasoning questions accompanied by related evidence. In addition to their ability in being effective innovators and creators in the society (Conklin, 2011).

As stated by His Highness Sheikh Zayed Bin Sultan Al Nahyan, Founding Father of the UAE "The education of our people is a great wealth. We are proud of our educated nation because through knowledge and science we will open the horizons of a glorious future."

In 2014, in the UAE, H.H. Sheik Mohammed Bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, launched the UAE National Agenda (NA) as an expansion to accomplish the UAE Vision 2021. The NA included the ambition to have the UAE become a main supplier of world-class education as well as to empower the UAE learners to rank among the best in the world in reading, mathematics, and science. Thus, the UAE Vision 2021 NA highlights the improvement of a top-notch instruction framework, which will require a total change of the present education framework and educating techniques. In addition, the NA will intend to guarantee that 100% of schools have a high quality of educators that know how to utilize their strategies towards achieving the level of the most astounding students' performance in the international and benchmark tests among the world through challenging, critical thinking questions, formative assessment and other methods.

According to the UAE, the NA 2021 plan should be achieved in a short period of time. However, this NA falls under the new National agenda of 2031 launched in April 2018. The aim of the NA 2031 is to support the current objectives of the UAE National Agenda of 2021 in order to effectively generate solutions for the upcoming challenges. On the other hand, the UAE cabinet launched a new plan (the five-decade government plan) that is called the "UAE Centennial 2071". The main target of this plan focuses on making the UAE the best country in the whole world by 2071. The UAE Centennial 2071 concentrates on four main pillars, education is the second pillar

that the UAE is giving a great deal of attention to (UAE Centennial Vision 2071). The UAE plan concentrates on building the essential knowledge and skills in future generations in order to make the UAE the best country in the world. This aim should be achieved by the next centennial in 2071.

The four pillars of the UAE Centennial 2071 include the following:

The first pillar is called (Future-focused government) which concentrates on establishing the best government in the world through an inspirational leadership. The second pillar entitled (Excellent Education) which highlights the significance of achieving an outstanding quality of education in various specializations. For example, the areas that are related to advanced science and technology, space science, engineering, innovation and health sciences. In addition to additional educational measures that are linked with teaching students. The third pillar known as (A diversified knowledge economy) which targets the UAE to be one of the top economies globally. The fourth and last pillar is titled **(**A happy and cohesive society**)** which highlights the importance of developing the UAE community by concentrating on humans' happiness and their positive lifestyle. The achievement of these pillars will lead the UAE to become one of the best places in the whole world. This represents the target of the UAE in their National Agenda.

H.H. Sheik Mohammed Bin Rashid Al Maktoum stated that the UAE has several plans that should be completed by 2021 but with the UAE Centennial vision 2071, there will be an updated vision for the coming generations. The five decade plan has clear targets that should be achieved through the hard work and the participations of all individuals (UAE Centennial Vision 2071). The UAE concentrates on creating positive and quick changes in all areas and specifically in education in order to develop the country to be the best country in the world. Sheik Mohammed indicated that "Rapid changes requires us to prepare future generations with new tools and knowledge, and different skills that enable them to succeed in a world that we will be very different from the times we live in today," (UAE Centennial Vision 2071).

1.2 Research Background

In order to improve the quality of education, one of the central requirements in teaching and learning is the need to balance between students' knowledge, their skills and assessments with the end goal of keeping up the process of learning in the right way (Freeman and Lewis, 1998; Palmer, 2016). Therefore, various FA strategies must be implemented by the subject teachers in order to gain the needed knowledge and skills that can help students to achieve the required targets in their assessments and to enhance their performance to guarantee the accomplishment of them (Warner, 2017). For instance, peer assessments (Thuraisingam, Chiew, & Singh, 2019), participating in various discussions between small or large groups in order to build and develop students' critical thinking skills (Mat Daud, Nur Shidrah, Gilmore, Alison & Mayo, Helen, 2013) and to gain deeper knowledge (Cassidy, 2006). As a result, students can become more capable (Papinczak, Young, Groves, & Haynes, 2007) and autonomous (Maarof, Yamat, & Lili, 2011) which can help them to attain better results in their assessments.

FA targets obtaining insights into the process of learning. This might have the ability to be utilized in the direction of supporting learning through appropriate instruction, strategies, and addressed feedback (Heitink, Van der Kleij, Veldkamp, Schildkamp & Kippers, 2016). Educational stakeholders and investigators are progressively intrigued by using FA strategies as they mirror and bolster the learning of students (Wiliam, 2011). Furthermore, it also supports the teachers of the school in both the teaching instructions and the assessment pedagogies (Wylie, Bauer, Bailey, and Heritage, 2018) specifically in science education (Alicia, 2018).

FA is considered as one of the most effective approaches to be used at a large variety of schools (Altman, Lazarus, Quenemoen, Kearns, Quenemoen, & Thurlow, 2010). This type of assessment ought to not only be done to school learners; rather, it ought to likewise improve the academic level of the pupils as well as to guide and upgrade their learning (National Council of Teachers of Mathematics, 2000).

According to some researchers (Amelia, 2018; Catarina & Torulf, 2017; Gikandi, Morrow & Davis, 2011) FA is identified as the repetition procedures of finding out what, how much plus how well learners are learning. In addition to connecting that to the objectives of learning accompanied by the anticipated results with the aim of informing tailored formative constructive feedback as

well as promoting further learning, a pedagogical strategy that is increasingly useful when the job is shared among the educator, peers and the individual students.

The FA strategies alert instructors about the academic level of the school learners. In addition to an indicator qualification that has the ability to support the school teachers in planning for the forthcoming lessons (Wuest and Fisette, 2012). This can be achieved by creating effective classroom discussions, questions, activities, and tasks that offer the right type of evidence of how students are progressing to the espoused learning goals.

FA alludes to not just methodically gathering information about the students of the school, and what individuals ordinarily consider when they hear the concept of assessment, yet in addition to deciphering and following up on data about the performance and the understanding of the students in connection to educational objectives (Bennett, 2011).

FA represents a strategy of “assessment for learning” as opposed to "assessment of learning." By giving input and direction to school learners, FA effectively affects learning and achievement. It is a basic component of self-directed learning as well as knowledgeable self-assessment. At this point, when done attentively, it tends to be an impetus for development and improvement, diminishing uncertainty and prompting more engaged and proficient gains in ability and knowledge (Konopasek, Norcini and Krupat, 2016).

Assessment is progressively viewed as an instrument to outfit learners with a mixture of both cognitive and metacognitive strategies in order to increase the number of more successful and effective students who can self-manage their learning (Box, 2019; Clark, 2012). Accordingly, FA offers students an appropriate environment filled with rich learning in which they can assume liability for their very own learning and build up a scope of strategies that consist of cognitive and metacognitive methodologies to accomplish this.

Specifically, the valuable effect of Assessment for Learning on a scope of features of pupil learning has been a form of motivation for many scholars (Black and Wiliam, 1998a; Wiliam, Lee, Harrison, and Black, 2004; Suskie, 2018; Wiliam and Thompson, 2017). Furthermore, it is the way towards gathering data about learners’ knowledge from a wide assortment of assessment practices and utilizing this information to alter the process of teaching and learning with the end goal to more readily address the needs of learners (Wiliam, 2011). While instructors take an important responsibility in the procedure of assessment, a definitive objective is to stimulate school learners

in becoming progressively independent in their learning procedure (Klenowski, 2009). Bulunuz et al. (2016) demonstrated that FA provides chances to advance the improvement of thinking for different levels of students. However, this enhancement might be different between genders which can be associated with the characteristics of the teachers (Falch & Naper 2013) or to the students' cognitive abilities as stated by (Reilly, Neumann & Andrews 2018). Furthermore, there is evidence from the National Assessment of Educational Progress (NAEP) of the imbalances in genders' performance.

Moreover, this type of assessment can prompt students' self-learning and provide them with constructive feedback on their academic performance (Bennett, 2011; Dix, 2017). Most teachers have confidence in the ability of FA to make a deep impact on the motivation and the attainment of school learners (Cauley & McMillan, 2010). Even though, teachers believe in the importance of FA practices (Young & Jackman, 2014) they are hesitant and less confident regarding the appropriate ways of implementing the FA strategies (Leahy et al., 2005; Marshall & Jane Drummond, 2006). There are several factors that cause this concern for the teachers. Some of these factors are related to a few constraints that might affect the educational reforms for instance modifying curriculum, stakeholders' opinions, cooperative learning environment, educators' responsibilities in addition to the school setting that would impact teachers to receive and execute the FA strategies (Adamson, 2011; Verger, Altinyelken, & De Koning, 2013; Hui, Brown, & Chan, 2017). Nevertheless, these restrictions would influence the teachers from different domains particularly the external domain, the individual domain and the practice domain. These domains will affect different vital factors that teachers need for a better learning process such as teachers' source of motivation and improvement, their personal opinions and attitudes in addition to their experimentation in work accompanied by its consequences which is linked to the results of the teaching process (Komba, 2007).

Consequently, by evaluating these domains, the educational investigation results have set up some potential factors known as the internal factors that would impact teachers to adopt FA. For example, the resources, policies and other contextual factors (Antoniou and James, 2014; Izci, 2016). In the meantime, teachers underline that these variables might lead to an educational gap between theories and practice of FA (Yeh, 2010). In this specific situation, teachers' point of views that are connected to the above stated factors are considered imperative (Alotaibi, 2016; Kyaruzi,

Strijbos, Ufer, & Brown, 2018) not exclusively to narrow the mentioned gap yet additionally to overcome the limitations in implementing FA (Frunza, 2014).

The purpose of FA is to examine the knowledge and the skills of the school learners in different academic levels in order to accomplish anticipated learning results (Dwyer, 2013; Clark, 2015). In fact, the concept of "assessment for learning" creates an unambiguous learning procedure via stimulating the independence of students and regulating the FA process (Warwick et al., 2014). Moreover, FA increases the learners' motivation, and enthusiasm, along with the self-guideline and the completion of the new plans in the processes of evaluation practices (Missett, Brunner, Callahan, Moon, & Price Azano, 2014). Hence, FA permits the educators to obtain a more profound comprehension of cognitive gaps in the learning of the students as well as empower them to discover new ways for viable instructing and to limit the gaps of learning (Looney, Cumming, van Der Kleij, & Harris, 2017).

In previous decades, there was revived attention from instructors towards the utilization of standardized benchmark measures to differentiate as well as individualize guidance for learners (Public Agenda, 2008). In spite of the fact that school teachers might utilize their own assessment methods (homework, quizzes and tests) for observing learning, it is quite difficult for them to balance the students' internal assessments with their performance in the external assessments for instance, nationally normed standardized tests. Benchmarks estimate intelligence of such outside tests, which might be more valuable in helping educators settle on choices about differentiating ways of teaching and guidance, which thus can prompt gains in the learning of the students and enhancements in schoolwide accomplishment (Baenen, Ives, Lynn, Warren, Gilewicz, & Yaman, 2006). Good benchmark assessments provide a significant addition to an inclusive assessment system (Herman, Osmundson, & Dietel, 2010).

Benchmark assessment comes between state and formative assessment which is specified as follows: "Benchmark assessments are assessments administered periodically throughout the school year, at specified times during a curriculum sequence, to evaluate students' knowledge and skills relative to an explicit set of longer-term learning goals. The design and choice of benchmark assessments is driven by the purpose, intended users, and uses of the instruments. Benchmark assessment can inform policy, instructional planning, and decision-making at the classroom, school and/or district levels" (Herman et al., 2010). This type of exam is created by a team of

expert educators who come from a commercial company for assessment. Those educators are responsible for consulting various classroom teachers as well as university faculty. The administration of the exanm follows benchmark exams' standards. All participated students respond to the same questions and receive the same instructions. Benchmark exams are designed to be taken by many students within a state, province, or nation, and sometimes across nations (Seifert and Sutton, 2009).

There are various important types of benchmark tests that are currently implemented in the UAE but the Northwest Evaluation Association's (NWEA) Measures of Academic Progress (MAP) program is considered as one of the most extensively utilized and commercially accessible systems. Northwest Evaluation Association is a not-for-profit organization that serves school districts throughout the nation in improving learning through assessment. MAP exam was established by NWEA in 1976 led by the Kingsbury Center which is considered as the research organization for NWEA (Medford, 2014). It is a "collection of computerized adaptive assessments" (NWEA, 2012, p. 4). The MAP test has the capacity to provide a clear idea about the learners' academic level and the way to improve that level through incorporating the results from the standardized assessment and the suitable and differentiated instructions for the preparation for the next assessments (Cordray et al., 2012; Torres, 2019). It can help teachers in planning their instructions and strategies in an easier way depending on the results of the MAP exam as stated by one of the authors when he confirmed the importance of the MAP exam, he said "It allows teachers to adjust whole-group instruction and create flexible grouping for students at similar achievement levels" (Ash, 2008, p. 20).

MAP exam can be used by all stakeholders of the school in order to help them in increasing the students' opportunities to gain a higher score level in the MAP exam as well as in the standardized tests. This exam can assist most students, specifically the students in the middle school to achieve the required national average of the country. In this case, students will be more prepared to join college and to have positive impacts on their communities in the future (Barber, 2017). In addition, MAP exam can be used to analyse the effectiveness of teachers' instructions, activities, FA strategies, and lesson planning for all students from different academic levels depending on MAP assessment data. This data can be also used to monitor learner's success and the efficiency of the

differentiation lessons that should be suitable for all students in addition to power the classroom environment in a way that can improve students' performance (Medford, 2014).

MAP test shows students' abilities and skills in different subjects including English, mathematics, and science (Thum, and Hauser, 2015). Furthermore, it can also be administered to train teachers and help them to approach the MAP resources through the most proficient method to utilize information from these evaluations to differentiate instruction and guide them in their daily lesson planning (Reinhardt, 2018). MAP tests are currently in use in nearly all the American curriculum schools in the United Arab Emirates (UAE) for different grade levels.

The results of MAP test can be beneficial and responsible for providing subject teachers with indepth data for each student separately. Moreover, it shows a clear idea about the skills that the students have mastered and the help required to become proficient at the other ones (Reinhardt, 2018). It can also allow teachers to have a clear idea about the skills that the students require to grow as academics readers (NWEA, 2018b).

In science, the MAP exam can provide reliable and valid data about students' knowledge, understanding, and skills that are linked to various science concepts and their practices (Northwest Evaluation Association, 2004). MAP can measure the thinking skills for each student based on his/her success in answering challenging questions in different levels. The MAP exam has several advantages, such as, the provided questions are aligned with the standards of the subject. Therefore, teachers will be able to provide a high predictive validity about each student according to the required level that each country is concentrating on (Cronin, Kingsbury, Dahlin, Adkins & Bowe, 2007; Northwest Evaluation Association, 2005). The versatile idea of the MAP exam offers more extensive and a more powerful example of the whole used sample of the participating students than a fixed-form test does (Northwest Evaluation Association, 2003); using the scaled scores which are known as (MAP RIT scores) will permit for additional precise assessment that can be used to compare between different academic levels of learners. Teachers have a clear idea about the standards that should be covered in the science MAP exam but they have no idea about the exam questions specifically, therefore, teachers are not requested to elucidate the nature of the exam as well as training to particular exam questions instead teachers have to concentrate on the main concepts of each topic and connect them with the required standards for each grade level (Marshall, Smart, and Alston, 2017). In addition, teachers will be provided with the growth

projection for each student. The growth projection represents the expected growth that each student must achieve in the next exam depending on the student's result in the last exam as specified by NWEA.

All the American curriculum schools in the UAE are required to implement Measures of Academic Progress (MAP) as an external assessment measure of progress in order to meet the UAE National Agenda targets. In the UAE, educators believe that the MAP test is used to benchmark students' performance because it allows them for better academic progress, however, this should be implemented under certain conditions. For example, using the MAP test in an effective and authentic way in terms of modifying instructions towards meeting the needs of students (El Dor, 2019). Most of the UAE schools prefer to conduct the MAP exam three times per year. The first MAP exam should be conducted in September, then teachers use the analysis results as the students' baseline metric. The second MAP exam is usually implemented in January. Science teachers have to utilize the results of the exam and compare them together with the results of the previous exam in order to determine the growth level of the thinking skills in all participants individually while the third exam has to be conducted by the school in April. Teachers are requested again to follow the same method in order to gain accurate results about the students' academic level (Marshall, et al., 2017). Moreover, another advantage of the MAP exam is its ability to cover the all the domains of science which include (life, earth, physical, and space). In this case, the MAP exam can provide important information about the student's academic improvement in each domain whether it had been taught by the teacher or not (Marshall, et al., 2017).

The UAE government has a big focus towards the results of students' international and benchmark tests as an essential tool towards measuring the learners' development level. The three entities that control education in the UAE which includes the Ministry of Education, Abu Dhabi Education Council (ADEC), and Dubai Knowledge and Human Development Authority (KHDA) depend on using the data from these exams to compare the results of UAE students with the results of other students in top countries in education.

Since the UAE made the significant reform in their educational system, the country has considered the international exams as sound and targeted measures for evaluating the students' development (Morgan, 2018). Although the students of the UAE have made simple enhancements in their international and benchmark assessments, they remained below the required average of the

Organization for Economic Co-operation Development (OECD) in both exams (Navdar, 2016). The OECD is the organization that is responsible for the program of the international assessments for all students.

1.3 Statement of the Problem

Formative assessment has been on policy agendas globally for a considerable length of time, yet its accomplishment has turned out to be in need of testing to check its accountability (Birenbaum, et al., 2015). Albeit, numerous analysts recognize that FA can positively affect students' learning outcomes specifically in the external and benchmark exams, the evidence for this has not been supported by logical proof to be confirmed. Furthermore, the contrasting conceptualizations of FA have prompted a large assortment of practices, and it is difficult to decide which factors encourage or block its execution (Heitink et al., 2016).

Several researchers believed in the importance of using FA to close students' learning gaps (Sadler, 1989) in various areas and contexts in sciences (Miller, 2019). For instance, Ninomina (2016) stated that FA, "Aims to improve teaching and learning by focusing on the learning process, particularly on the dialogue between the teacher and student". This explanation is in accordance with an assortment of different researchers (Spector, Ifenthaler, Sampson, Yang, Mukama, Warusavitarana, & Bridges, 2016) where they said that "emphasis is on forming judgments about learners' progress that then affects the subsequent flow of instruction" while other authors concentrated on another important point which is related to the significance of providing feedback, Cohen and Sasson (2016) specified that, "The goal of formative assessment is to gather feedback to guide improvements in ongoing teaching and learning". Other authors (Jacoby, Heugh, Bax, and Branford-White, 2014) stated that, "Not all assessment needs to contribute to the final summative grade, but they can be used for self-assessment formatively whereby students can determine their own progress". Another group of researchers (Clinchot, Ngai, Huie, Talanquer, Lambertz, Banks, & Sevian, 2017) confirmed that, "Formative assessment helps teachers identify strengths and weaknesses in their students' understanding and focuses students' attention".

According to the beliefs of many researchers, there is evidence that indicates the importance of using FA to fill the needs of students. On the other hand, other researchers have different points of

views regarding FA. Torrance (2012) stated that the theory and practice of FA requires further examinations. The study covered different claims from different authors. One of these claims stated that problems appeared when FA was used as a small summative assessment (Ninomiya, 2016). Another claim indicated that a genuine danger to the value of FA happened when it is used more extensively for example, when it had been utilized to evaluate the framework of the National Curriculum in England. In contrast, some authors defended the significance of FA by confirming that these claims which are against the use of FA originated from misinterpretation of the advanced type of FA (Ninomiya, 2016).

Moreover, a research study indicated that students confirmed the importance of FA in providing them with important feedback that can play an essential role in filling the gaps in their learning process. In the same research study, a huge group of learners stated that FA can inspire them to achieve the deep learning as well as it can organize the plan of their study in a positive way (Das, Alsalhanie, Nauhria, Joshi, Khan, and Surender, 2017). On the other hand, a few learners thought that FA might impede their skills to be independent learners, which may affect negatively their outcomes in the summative assessment. The authors of this study confirmed that FA has the capability to support a lot of the students positively in their summative tests if they are able to schedule it properly (Das, et al., 2017).

According to Kettler, Reddy, Glover, and Kurz (2019) FA can improve the practices of numerous classrooms all over the world by using the teacher's strategies assessment system. This system includes classroom continuous and direct observations, the use of appropriate rubric to evaluate teacher's instructions and practices, identifying targets. Teachers benefit from their professional development experiences and providing suitable plans to monitor students' progress.

According to the UAE National Agenda 2071, there is a great deal of attention towards improving students' academic skills in order to achieve the UAE goal of being the best country in education in the whole world (UAE Centennial Vision 2071). In order to reach this goal, students have to attain high scores in various types of high-stakes exams. The UAE made many significant changes in their educational system in order to improve students' results in the international and benchmark exams. Furthermore, the UAE government spent on education more than the OECD averages (Bibolov, Cakir, Garcia, Martinez, & Tamirisa, 2017). These positive changes resulted in achieving the highest score between all the participating Arab countries in the Progress in

International Reading Literacy Study [PIRLS] in the year of 2016. However, this achievement has not yet reached the required target that the UAE students must achieve as an international average. Unmistakably there is a rapid development in the educational field and much has been accomplished, however the UAE still can do more.

Moreover, regarding the standardized tests, UAE students gained poor results which confirmed the perspectives of several investigators and external specialists (Gallagher, 2019) about the needed changes that the country has to concentrate on. Therefore, the Abu Dhabi Education Council which represents the capital city's local education authority confirmed the importance of creating a "long-arching strategy to achieve dramatic quality improvement" in education (ADEC, 2012). This plan pointed to the importance of developing students' skills by modifying and changing the way and the strategies of teaching for accomplishing better results.

A variety of studies indicated the positive relationship between FA strategies and students' results in various international and national exams. For example, a recent study was conducted in the UAE about investigating the impact of applying different FA strategies on students' learning outcomes in the summative assessment. The results indicated that FA can be used as a tool to improve the academic level of students (Radhwan, 2019). On the other hand, in the United States another study identified the alignment between using FA strategies and students' results in high-stakes exams. These exams are related to making important decisions in regards to schools, educators, and students, most ordinarily with the purpose of accountability. For example, the attempt by federal, state, or local government organizations and school administrators to ensure that students are registered in effective schools and being taught by effective and successful teachers. There is some evidence from different researchers related to the impact of formative assessment practices on learners' attainment on standardized tests (Box, 2019; Karpinski, et al., 2019; Kingston & Nash, 2011, 2015; Maldonado and Andrade, 2018; Wiliam, Lee, Harrison, & Black, 2004). Furthermore, another research study stated the correlation between grade eight students' results in the MAP exams and teachers' selection of FA strategies that should be implemented to develop their skills (Barber, 2017).

Regarding the MAP exam and according to the report of the NWEA (Northwest Evaluation Association), UAE students are still underperforming in this exam. Although there are many

specialized benefits of MAP evaluations have been generally referenced in professional journals and educator publications (Ash, 2008; Clarke, 2006; Olson, 2007). A limited number of research studies mentioned the correlation between the impact of using formative assessment strategies and students' academic outcomes in the MAP tests all over the world. No studies have been carried out in the UAE regarding this, even though a great deal of attention towards students' results in the MAP tests.

For that reason, studying educational leaders' perceptions regarding the implementation of formative assessment strategies on enhancing students' learning results is needed with the purpose of supporting the 21st century learning skills (Spector et al., 2016), increasing the awareness of all stakeholders towards the improvement of students' achievement, and most importantly to achieve the UAE National Agenda targets. Precisely, the connection between FA strategies and students' results in the MAP exams. Therefore, this research study targets at filling this gap and investigating educational leaders' perceptions regarding the implementation of formative assessment strategies on enhancing students' results in the MAP exams in American private schools in the UAE.

1.4 Purpose & Research Questions

The purpose of the presented research study is fourfold: (1) to investigate teachers' perceptions about the implemented formative assessment strategies in American private schools in the UAE, (2) to investigate teachers' perceptions about the effect of using formative assessment strategies on enhancing students' skills in American private schools in the UAE, (3) to explain grade eight students' progress in science MAP exams in the light of FA strategies implemented in American private schools in the UAE, and (4) to explore science leaders' beliefs about how grade eight teachers use formative assessment strategies in preparing students for the MAP exams in American private schools in the UAE.

Therefore, the study will respond to the four purposes in order to shed the light on the use of FA strategies on enhancing students' results in the MAP exam which leads me to my exploration questions:

Q1: What are teachers' perceptions about the implemented formative assessment strategies in American private schools in the UAE?

Q2: What are teachers' perceptions about the effect of using formative assessment strategies on enhancing students' skills in American private schools in the UAE?

Q3: What is grade eight students' progress in science MAP exams in the light of FA strategies implemented in American private schools in the UAE?

Q4: What are the science leaders' beliefs about how grade eight teachers use formative assessment strategies in preparing students for the MAP exams in American private schools in the UAE?

1.5 Significance of the Research Study

All over the world, several studies indicated the importance of using and implementing FA strategies on students' learning outcomes (Bartholomew, Strimel & Yoshikawa, 2018; Gallagher, Arshan & Woodworth, 2017; Hallam, 2019; Le Thai Hung & Ha, 2019; Prashanti and Ramnarayan, 2019; Radhwan, 2019; Zhang, 2018). However, there were no research studies to specify the relationship between using FA strategies and students' results in the MAP exam. Therefore, this study is aiming to investigate educational leaders' perceptions regarding the implementation of formative assessment strategies on enhancing students' results in the MAP exams.

The connection between FA strategies and students' results in the benchmark exams can provide many benefits for both teachers and students. Some of these positive points are related to helping teachers in setting the appropriate plans and strategies that can improve students' results (Arrafii & Sumarni, 2018; Le Thai Hung & Ha, 2019) depending on students' strength and weaknesses through the use of the exam data. These data can also assist teachers to decide whether they need to modify their lesson plans (Boston, 2018; Dixson and Worrell, 2016), adjusting their FA strategies (Le Thai Hung & Ha, 2019), or if they are moving toward the right path of the teaching and learning process.

This study can shift teachers' concentration from the teaching process to the learning process when they realize the importance of generating students with high order thinking skills (Ebby and Petit,

2018). Furthermore, teachers will recognise the positive impact of being a classroom facilitator to help students to control the process of their learning by being able to take decisions independently (Autieri, Amirshokoohi and Kazempour, 2016) in order to be life-long learners (Hellwig et al., 2015). In this case, teachers will be able to construct on students' knowledge that they gained earlier (Fook & Sidhu, 2013). In other words, teachers will be capable to form a constructivist environment in order to be a "guide on the side not sage on the stage" (Slavin, 2012).

Through the use of MAP exam's data, students can receive clear feedback about the important points that they have to focus on. It can also provide teachers with information to help them decide the needed tasks and activities (Prashanti and Ramnarayan, 2019) that they have to plan for their students with the aim of developing their thinking skills (Kang et al. 2014). Moreover, understanding the correlation between FA strategies and students' assessment results can have a significant role in narrowing the gap between the current level of the students and the required learning level (Das et al., 2017; Pellegrino (2018). In addition, it can provide teachers with information about the appropriate teaching plan that they have to apply with their students which should include various suitable FA strategies and effective discussions between teachers and students about their learning goals and how to achieve them (Assessment Action Group, 2002–2008).

Additionally, selecting the appropriate FA strategies depending on the analyzed data from the MAP exam can provide a guidance for both teachers and students which they can use in order to improve students results in other types of exams for instance, international and other benchmark exams (Barber, 2017) as well as summative exams (Broadbent, Panadero & Boud, 2018).

When educators and specifically science teachers understand the relation between implementing a variety of effective FA strategies and students' results in various types of exams, students will have a better opportunity to develop their knowledge, understanding, and skills. This may improve their learning outcomes, their abilities in discussions and working with others inside and outside the classroom (Harrison 2014). Furthermore, when teachers focus on building various positive skills in students more than concentrating on attaining high grades, students can be better prepared for high school and for their future at university because they are critical thinkers and problem solvers (Nagle, 2013).

These skills will be generated in students once teachers believe in the importance of implementing suitable FA strategies and their effects on students' learning success. As a result of that, teachers will use various challenging tasks and activities that concentrate on enhancing students' skills rather than assessing their knowledge depending on their memorization. This can also increase the learners' understanding level of each science concept and that will enable them to build their own skills in the future (Clark, 2015).

In regards to the targets of the NA 2021 when the three UAE entities are responsible for evaluating all UAE schools to improve the education of the country, a number of school reports from previous years indicated that schools with "Good" judgment had introduced better use of FA strategies in their science subjects. However, these schools were recommended to enhance the utilization of thinking skills and more effective practices in order to develop the academic results of their learners. On the other hand, schools that attained "Weak" judgment, were advised to use effective strategies, high-order thinking skills in the daily lesson plans, and utilize various assessment for students' learning. In the second situation, these schools are required to re-plan and improve their FA strategies in every session continuously (NAQQAET, 2014). Therefore, teachers need to improve their FA strategies and plan them according to students' needs which can be identified by their results in the MAP exams. In this case, students might have a better opportunity to enhance their results in the next exam or in other international or benchmark exams.

1.6 Overview of the UAE Educational Reform

A great effort had been made in order to change the quality of education in the UAE (Gallagher, 2019). To elucidate the fast educational advancement that has been made, important variations should be mentioned. In the 1970s, almost half of the UAE adults (48%) were illiterate. However, 40 years later and as a result of the positive implementation of the educational plan reform, most of the UAE adults were educated with a percentage over 93% (Crown Prince Court, 2011). In 2018, the illiterate population of the UAE represented a percentage below 1% of the total UAE population (Government.ae, 2018a). Furthermore, the UAE increased the enrolment rose in both secondary with 71% and tertiary education with 29% in the years between 1973and 2009 as stated by the UAE Crown Prince Court (Crown Prince Court, 2011).

In the UAE, there is a great attention given towards education and the ways that can help in improving it positively. In 2016, the Cabinet of the UAE made the biggest change in its educational structure. UAE formed the Supreme Council for Education and two new specific councils, the first one is for the youth while the second one is for the UAE scientists. Additionally, the Cabinet assigned two Ministers, the first one is responsible for the General Education while the second one is responsible for the Higher Education ("Khalifa Approves" 2016).

In the UAE, the system of education was controlled by three different governmental entities. The first one is called the Ministry of Education which has the full authority on all schools in Ras Al Khaimah, Fujairah, Umm Al Quwain, and Ajman in addition to all government schools that are located in the Emirate of Sharjah and Dubai as well. The second entity is the Abu Dhabi Education Council (ADEC) that is responsible of all the schools in the Emirate of Abu Dubai while the third entity is the Dubai's Knowledge and Human Development Authority (KHDA) which is responsible for all the private schools in the Emirate of Dubai (Morgan and Ibrahim, 2019). In 2017, educational reform combined ADEC and MOE in order to enhance the learning effectiveness as well as to improve resource allocations (Ministry of Education 2017). Furthermore, there was a change in the name of ADEC into the Department of Education and Knowledge (ADEK). These three entities are responsible to evaluate schools with the aim of achieving the targets of the UAE's 2021 National Agenda Vision. The main goal of this vision is to develop an outstanding system of education using a complete new transformational education system that includes new effective teaching strategies. In this case, students will be able to achieve a higher level of learning outcomes and will have a stronger opportunity to be ranked among the best countries in the world in reading, math and science exams (UAE Ministry of Cabinet Affairs n.d.). The UAE Ministry of Education, ADEK as well as the KHDA have a great responsibility towards translating the 2021 NA goals into policies and effective actions to be implemented in all UAE schools (Morgan and Ibrahim, 2019).

Moreover, in the UAE, education is considered as one of the most high-priority areas. The UAE government identifies education as a strong building block to arrive at its aspiration of expanding and building up its economy. It focuses on the essential features of K–12 education ecosystem which include the important roles of both the regulatory bodies and required reforms that are

linked to the current curriculum. The UAE gives great attention to innovations to be taught regularly through different subjects, precisely in the educational programs that are related to technology and vocation, and students' well-being (Kippels, and Ridge, 2019).

The UAE government and specifically the educational entities which include MOE, ADEC, KHDA, and Abu Dhabi Centre for Technical and Vocational Education and Training (ACTVET) planned and implemented various initiatives to support the process of reform in the educational field (UNESCO, 2016). For example, the program of teacher licensing which is considered as one of the important requirements to achieve the UAE national agenda goals in 2021 where all school teachers have to attend several professional development programs and pass a number of assessments in order to be certified as qualified teachers. The initiative of the teacher licensure will play an essential role in solving the problem of an inadequate quality of teachers in the UAE (Gallagher, 2019).

The World Bank published an official report that shed the light on the urgent requirement for the educational reform in the Middle East (Galal, Welmond, Carnoy, Nellemann, Keller, Wahba, & Yamasaki, 2008) accompanied by an confirmation report by Thacker and Cuadra (2014) to state the urgent necessity of the professional standards that should exist in each teacher and in every school. Therefore, a piloting program for implementing these standards was applied in 2015-2017 to prepare the teachers in the UAE to gain their required licensure along with an important plan for all teachers in order to train them to attain the teacher licensing by 2021 (Pennington, 2017). The Ministry of Education in the UAE targets to raise the pedagogical knowledge of every teacher by concentrating on involving expert educators from higher education to collaborate in training teachers (Gallagher, 2019).

Furthermore, there are other types of important initiatives that the UAE concentrates on becoming available in all schools. These initiatives are connected to increase the diversity of the schools' national curriculum, promoting communication between all the related stakeholders as well as expanding the quantity of publicly accessible research (Kippels, and Ridge, 2019). Obviously, the UAE education reform plans seek to achieve the NA targets 2021, which focus on establishing a world-class system in education to successfully benchmark students' knowledge in the UAE against other countries that are ranked at the top of the educational level (Warner, 2018).

1.7 The Structure of the Thesis

The purpose of this study is to investigate educational leaders' perceptions of the implementation of formative assessment strategies on enhancing students' results in the MAP exams in American private schools in the UAE. There are five key chapters that are presented in this research study. The first chapter demonstrates a clear description as precisely as possible about the importance of applying effective education in UAE schools by concentrating on applying effective FA strategies in science classrooms in order to help students to be prepared for future requirements. Those requirements are closely related to UAE NA targets 2021 which are concentrated on enhancing the quality of education in order to be one of the top countries in education. In addition, the provided information in the research background covered the essential role of all stakeholders and specifically teachers in enhancing positive quality of education in the UAE. Moreover, this chapter focuses on the importance of balancing between classrooms' FA strategies and students' results in benchmark assessments in order to achieve the targets of the UAE NA 2021. Similarly, the study problem and rationale that connects between FA strategies and students' results in the MAP exam have been combined with the aim of highlighting remarkable historical literature which recognizes the gap in the study. In the same chapter, the study significance has been revealed through clarifying the effect of using effective FA strategies on students' learning outcomes in various exams in addition to positively developing their knowledge, understanding, and skills. The significance of the study also concentrated on the effect of using effective FA strategies as a measuring tool that can help teachers to measure the progress of learners as well as its important effect to clarify the crucial changes that should be implemented in the process of educational reform. The statement of the problem accompanied by four research questions has been posed in order to elucidate how the research study intends to close the gap in this current research. Another section in this chapter is related to cover all the essential changes that have been implemented regarding the educational reform in in UAE and its context.

Detailed information has been provided in the second chapter of the study which firstly starts with the theoretical framework in order to clearly explain as well as support the main purpose of the study and provide the appropriate theories that can help in guiding the path of the study. In the second part of this section, latest research studies have been described and connected with the main

purpose of the study in order to promote the probability of connecting both the FA strategies and the students' results in the MAP exams.

Subsequently, the mixed method approach has been illuminated in the third chapter of the study which was selected to be conducted in the current research. An explanatory sequential mixed method design has been identified in order to collect the needed data that can elucidate and answer the questions of the study along with fulfilling its purposes. In addition, site selection, instrumentation, and population as well as the participants of the study, validity and reliability accompanied by the ethical considerations of the study have all been identified and justified as well.

The fourth chapter of the study focuses on explaining how the data collected and analysed from both qualitative and quantitative instruments while the final chapter of the research study concentrates on the required discussion of the achieved conclusions accompanied by the logical result. Furthermore, this chapter also provides the upcoming implications as well as the related recommendations that can help other researchers for future studies.

Chapter Two: Theoretical Framework and Literature Review

2.1 Overview

The purpose of the present study is to investigate educational leaders' perceptions of the implementation of formative assessment strategies on enhancing students' results in the MAP exams in American private schools in the UAE. This chapter delivers an overview of the literature which is documented and reviewed in order to address the main focus of the study from various angles that are all linked to the study four-fold purposes which include (1) to investigate teachers' perceptions about the implemented formative assessment strategies in American private schools in the UAE, (2) to investigate teachers' perceptions about the effect of using formative assessment strategies on enhancing students' skills in American private schools in the UAE, (3) to explain grade eight students' progress in science MAP exams in the light of FA strategies implemented in American private schools in the UAE, and (4) to explore science leaders' beliefs about how grade eight teachers use formative assessment strategies in preparing students for the MAP exams in American private schools in the UAE.

A variety of studies all over the world have been conducted to evaluate different components, techniques, and strategies that have a vital role in contributing to develop the level of understanding the relationship between the formative assessment and the students learning outcomes as well as understanding the teachers' role in implementing that (Beesley, Clark, Dempsey, and Tweed, 2018; Broadbent, Panadero, & Boud, 2018; Ebby, Remillard, and D'Olier, 2019; Hoerr, 2016; Le Thai Hung & Ha, 2019; Maldonado and Andrade, 2018; Ozan & Kıncal, 2018). This chapter is divided into different sections that are presented depending on the researcher's review the latest literature, closely related to the current study. These sections are organized to illuminate the theoretical framework, the literature review including the related sub-sections, and the situated literature.

Specific attention is paid to both the historical and the theoretical backgrounds of the study, which firstly shed the light on the theoretical framework of the study in order to provide a focus point that will help to find a correlation between the study's theories and the used model with the main purposes of the study. The main first section of the study is covered with the important theories and models which are considered as a central point that is able to link between the two key components of the study, which are represented by the FA and the MAP exam. The section consists

of three theories and one model as follows; The Social Constructivism Theory, Constructive Alignment Theory, Self-Determination Theory in addition to the Depth of Knowledge Model (DOK).

As this research study is focusing on investigating educational leaders' perceptions regarding the implementation of formative assessment strategies on enhancing students' learning in the middle school stage where teachers have to conduct different activities, strategies, and tasks in the science classes with the aim of developing thinking skills for all students in different levels. The school students were working cooperatively with the aim of generating solid relationships between different concepts of science in order to foster their thinking skills. For that reason, the researcher used Vygotsky's social constructivism theory as one of the building blocks that this examination depends intensely on (Amineh and Asl, 2015; Armstrong, 2019; Aubrey and Riley, 2018; Baran, Canbazoglu Bilici & Mesutoglu, 2016).

Currently, teachers have to concentrate on all the related components that have a vital role in the development processes of students' learning. These components are connected to the intended learning outcomes (what should learners know or be able to do), the nature and the complexity level of the provided activities (how will the students learn), and the assessment tasks that all educators are responsible for (how will learning be measured). In addition to the lesson plans preparation and its alignment to the curriculum standards. Therefore, the theory of constructive alignment is the second theory that will underpin this study by connecting all the needed components for each teacher in order to be on the right path of the teaching process (Fitzallen, Brown, Biggs, and Tang, 2017; Gynnild, Leira, Myrhaug, Holmedal, and Mossige, 2019; Jain and Utschig, 2016).

Motivation is the key to encourage students to be interested in developing their learning skills. This can happen when the students have their psychological needs met which include competence, relatedness and autonomy. These essentials are related to learning a variety of skills and gaining them, experiencing a feeling of having an effective role in dealing with environment and connection with other individuals, and feeling responsible for their behaviours and goals. Consequently, the self-determination theory is the third theory that the study used to address its target (Deci, Olafsen, and Ryan, 2017; Clark, 2011; Núñez and León, 2015; Ryan & Deci, 2017).

All of the above theories will be connected to the depth of knowledge model (DOK) in order to assess the level of the students' thinking skills. This model is considered as one of the most significant tools where the subject teachers can classify all students from different academic levels and analyse their cognitive demand. DOK is a supportive model because it consists of four different categories that are appropriate for a range of assessment tasks which are required for effective learning (Anderson, Mathys, & Mills, 2015; Karuguti, Phillips, and Barr, 2017; Weay, Masood, and Hawa, 2016; Patten, and Harris, 2016).

The second main section is related to the literature review of the presented research study which concentrate on different components that are able to elucidate the key ideas of the study and the factors that might effect it. This section focuses on clarifying the essential meaning of FA in the educational field followed by its important role and effect on students' outcomes (Broadbent, Panadero & Boud, 2018; Burton et al., 2018; Dixson & Worrell, 2016; Heitink et al., 2016; López-Pastor and Sicilia Camacho, 2015; Nasr et al. 2018).

Other sub-sections in the second section are related to shed light on the MAP exam with clear explanation about the nature of both of them accompanied by their important role in students' learning and in reaching the targets of the UAE's 2021 national agenda (Chapman & Aspin, 2013; Cizek & Gierl, 2016; Paul, 2015; Sada, 2019). Furthermore, the study elucidated the four effective types of FA strategies that had been chosen by the researcher from many other strategies to use as a tool for measuring their effect on the learning of students. These four strategies involved think-pair-share strategy, feedback strategy, problem-based learning strategy, and self-assessment strategy. The four chosen strategies are able to cover a variety of secondary factors which are imbedded within the main ones (Boaler, 2016; Fandy, 2019; Jax, Ahn, and Lin- Siegler, 2019; LaForce, Noble, and Blackwell, 2017; Small and Attree, 2015; Tint and Nyunt, 2015; Trent, 2013). The last sub-section in the second section of the study is concentrating on the important role of teachers in implementing the FA strategies in the right way in order to make sure that the teaching and learning process is on the right path towards improving the skills of the students (AlShamsi and Ajmal, 2018; Mantra, 2016; Moss and Brookhart, 2019).

The last section of this chapter is linked to the situated literature review where the researcher focused on some of the similar studies that had been conducted in the same area of the presented

study (Abrams, McMillan & Wetzel, 2015; Sabel, Forbes, and Zangori, 2015; Shepard, Penuel, & Pellegrino, 2018).

2.2 Theoretical Framework

The study concentrates on providing an understanding into the relationship between the FA and the students' results in the MAP exam through using different types and levels of strategies in students' daily practices. Therefore, theories and models had been used and clarified to reinforce the educational strategies and practices that are used in the learning process. The following diagram represents the educational used theories and models to strengthened the claim of the study.

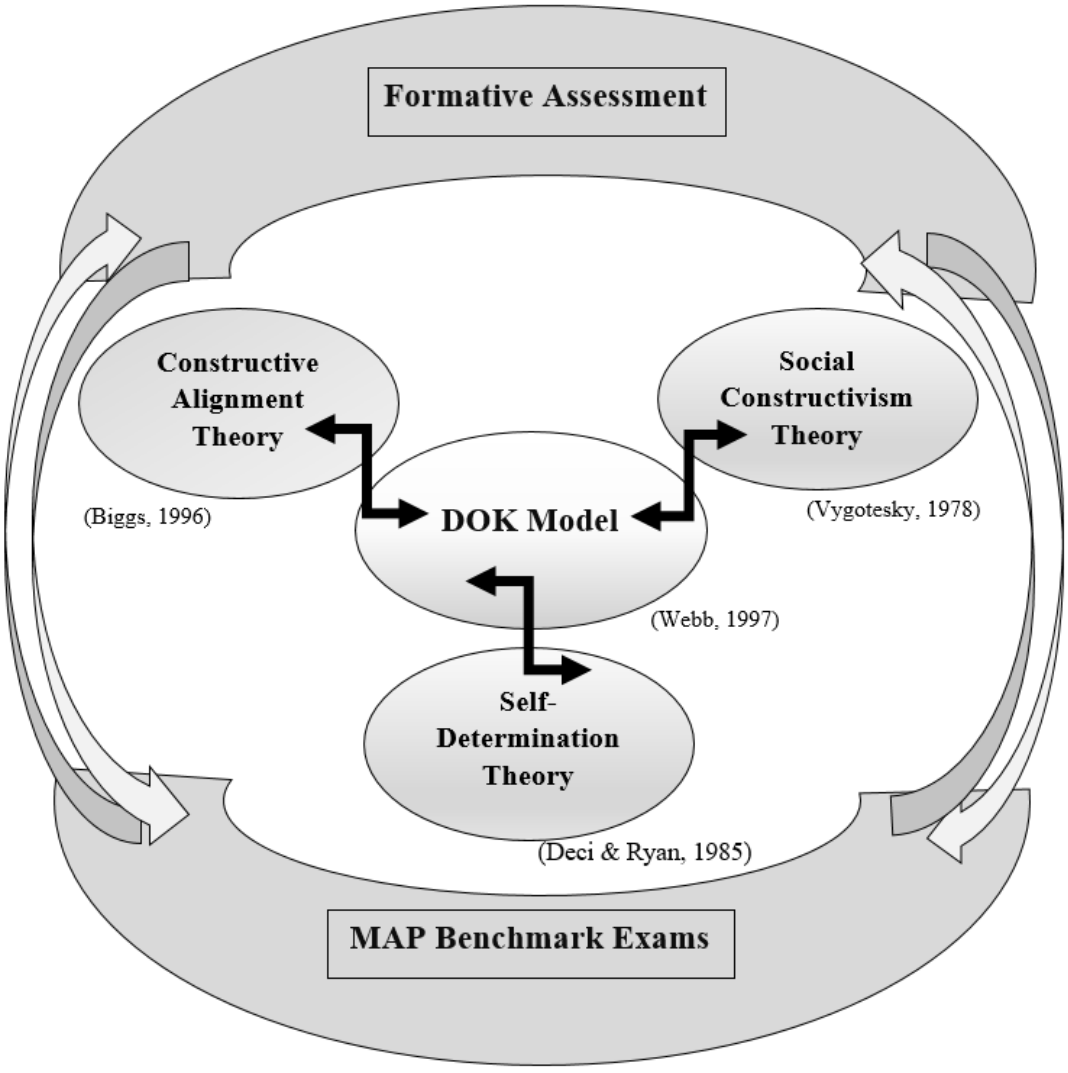

Figure (2.1): Theoretical Framework of the Study

2.2.1 Social Constructivist Theory

In the field of teaching and learning, constructivism is presently discussed in numerous schools as the best strategy in education and as one of the most powerful philosophies in the 21st century (Krahenbuhl, 2016). Constructivism is 'an approach to learning that holds that people actively construct or make their own knowledge and that reality is determined by the experiences of the learner' (Elliott et al., 2000, p. 256). Constructivism is fundamentally a theory. It is based on observation as well as scientific study that is related to how students learn. Students are able to construct their own understanding and knowledge when they experience things through discussions, tasks and activities then reflect on those experiences. At the point when learners experience something new, they need to accommodate it with the previous experience and ideas. This might include changing beliefs or discarding the new information as irrelevant.

According to educators' perspectives and with the aim of using the concept of constructivism effectively, teachers have to identify the knowledge level of their students so learners can generate their individual meaning when they receive new information. In any type of teaching classrooms, if teachers are aware of the meaning of constructivism they will have the capability to teach students constructively. In their future plans and with the aim of improving education, teachers' strategies have to have constructivism as a part of their daily lesson plans for a significant change in education (Kalina & Powell, 2009).

Constructivism supports the teachers to prepare a successful lesson in their classrooms (Casas, 2006). Moreover, if teachers know how to implement the constructive strategies in their classrooms appropriately, these strategies will have a cognitive and social effect on students' performance. Therefore, teachers must comprehend and utilize strategies of social constructivism with the intention of improving an effective constructivist learning session (Kalina & Powell, 2009).

Social constructivism is a very powerful strategy for teaching and training different levels of learners towards enhancing their success by incorporating both cooperation and social interaction. According to Lev Vygotsky, the establishing father of social constructivism confirmed the importance of social collaboration as a vital piece of the learning process.

One of the important factors that this theory depended on is the social communication between students in conjunction with an individual critical thinking procedure. The majority of Vygotsky's theories and investigations are aggregately engaged with the social constructivism and the

language improvement, for instance, social interaction, cognitive and inner discourse, the zone of proximal development (ZPD) and culture (Vygotsky, 1962). Consequently, to build and improve an effective classroom, students' interaction should be prominent.

The Social Constructivism Theory elucidates the way of constructing knowledge actively by the students of the school through the social learning environment (Vygotsky, 1987). According to Vygotsky (1978), the cognitive development happens firstly at a social level and afterwards it can happen inside the person.

The Zone of Proximal Development (ZPD) which is considered as a basic component in the theory of Vygotsky as it alludes to the limit of learners to adapt more information with the help of others. Vygotsky branded the (ZPD) as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p. 86). Therefore, one of the crucial factors that play an important role for active and successful learning is the social environment where viable communication helps in changing imperative learning encounters (Schunk, 2008).

The theory of development which had been stated by Vygotsky in addition to the majority of its language features are different concepts that are considered as a piece of social constructivism. One of the important theories that had been created by Vygotsky is the zone of proximal development (ZPD) which controls the learning way of the child. The concept of (ZPD) is clarified in many psychological educational resources due to its significance and Vygotsky's theories center around the distinctive psychological capacities that develop during child growth. This enhancement in child learning will be produced in the zone of the student's ZPD with teachers' help inside the study hall (Vygotsky, 1962). If teachers can assist students in learning, they will learn in an easier way within the ZPD zone and this will also prove Vygotsky's point of view about the importance of assistance. When learners accomplish the objective of the initial task, their ZPD zone will grow and they will be able to accomplish more. This includes the social constructivist strategy where the students decide on things that they can do independently then as a next stage with the help from their teacher, they will be able to learn new ideas and concepts dependent on their previous experience individually.

Moreover, Vygotsky (1962) utilized scaffolding as part of his theory in order to understand the importance of teachers' help in providing students with a more effective way of learning.
Scaffolding is considered as an essential part in the process of learning that can support the work of the ZPD zone with the aim of reaching the next stage of students' understanding which can take place with help from their teachers or peers. For example, when the learner is responsible to complete a challenged task which needs the teacher to assist in facilitating the important methods to complete the required task. In this case, the teacher will be represented as a support system that can help most of the students to be critical thinkers and problem solvers.

According to Vygotsky (1978), cooperative learning is a fundamental piece of generating a deeper understanding for students. To create a successful social constructivist classroom, students need to cooperate with their teachers and other learners as well. They need to gain deeper thinking skills through discussions and working collaboratively to complete their activities as a team. Teaching by using the strategy of cooperative learning indicated higher accomplishment in different subjects than teaching students by using the traditional method (Melihan and Sirri, 2011; Zulfiqar & Alvi, 2019). At this point, the internalization of the new knowledge happens for every learner at a diverse rate depending on their personal experience. As stated by Vygotsky (the firm believer in social interaction), the method of the learning progression is inherently social as well as embedded constructed in a specific cultural setting.

Different points of views on types of educational strategies can open a new path towards better opportunities for all learners especially when teachers are able to create new tasks where the students can collaborate effectively and obtain new experience. This can be more beneficial for students specifically when the educators consider the importance of constructing cognitive internalization of knowledge in students' skills. Moreover, teachers have to be aware of the variety of the class and grasp their disparities. These differences can be characterized as different backgrounds from various cultures, personality and biological contrasts which provide each individual with a different way and level of understanding (Woolfolk, 2004). In this situation, the teacher has an essential role in preparing the students to understand themselves and their colleagues before starting with the educational plan. Furthermore, the teacher must explain the differences in culture and prepare her/his students to understand this diversity and to respect it.

Correspondingly when the learners discuss their various societies, they ought to likewise examine the material being instructed. A few educators believe that talking during class is unfavorable to learning but in fact, they have to promote conversations and exchange ideas about the used curriculum and materials which might enable them to think critically about their learning plan which will lead them to build their personal experience independently and this is considered as one of the main targets of social constructivism that is enhanced through variety.

In order to embrace diversity, there should be a common language between all participants which is represented by learners, peers and the teacher as well. This communication happens in the area where ZPD and scaffolding are both presented. As stated by Vygotsky, the shared language between all participants is considered as the key of the social constructivist settings which have the ability to improve learning through enhancing the students' knowledge and thinking skills.
In this case, teachers play a crucial role in centered on recognizing learners' regions of progress and controlling them to comprehend the ideas required, along with having the capacity to reflect on students' understanding (Orlich, 2013).
Some of the pedagogical rules which include cognitive, collaboration, and development are depend on the constructivist theory. These pedagogical guidelines are suggested in light of the fact that they all can be converted into active practices in the educational field (Lin and Hsieh, 2001; Steffe and Gale, 1995; Tam, 2000; Wilson, 1998) which is one of the essential factors in reaching the depth of knowledge.

The theory of Vygotsky along with the ZPD model highlighted the significance of the social context through the right cognitive development and the different types of challenging tasks where the students are able to build their understanding by applying their knowledge (Slavin, 2014; Long et al, 2011). Besides, Vygotsky (1978) has faith in learning as a nonstop development process from the present intellectual level to a more elevated amount which all the more intently approximates the student's potential. This improvement happens in the zone of proximal development (ZPD) because of social collaboration. Vygotsky also underlines that human mental action is a specific instance of social experience. Therefore, understanding the knowledge and the way of thinking of a human relies upon two important things, a comprehension of social experience and the power of the cognitive procedure from social communication.

This theory is related to one of the important teaching strategies of FA that are used in classrooms especially when learners engage and work collaboratively to complete a social task (Amineh and Asl, 2015). Furthermore, this theory stated that reality cannot be discovered by individuals only because it comes after social invention, not before it. In addition, it advances student-centered guidance, in which students rely upon their past information and communication with other learners to pick up an understanding of new terms and ideas.

Moreover, this theory is also related to the teacher's essential role in applying and facilitating the formative assessment strategies through preparing the appropriate tasks that provide effective collaboration work between students with continuous development (Moss and Brookhart, 2019). In addition to teachers' beliefs that are related to the capabilities of students which have a close connection with the provided learning opportunities by teachers themselves (Diamond, Randolph, & Spillane, 2004; Jackson et al., 2017; Sztajn, 2003). Teachers' expectations were shown in the sorts of learning objectives they held for their learners, in view of their convictions about the needs of their students, and that these were thus connected with learners' socioeconomic background and the subsequent chances to learn (Sztajn, 2003).

Social constructivism energizes, uses and rewards students as a fundamental piece of the learning process. It supports the student's very own variant of reality that is affected by the learner's experience and knowledge of world. Moreover, social constructivism additionally focuses on the significance of the student's social collaboration with learned individuals from the general public. The author specified that youthful kids build up their thinking capacities through communication with other students, grown-ups and the physical world as well (Wertsch, 1997). Thus, communication and collaboration between different groups of learners during investigations and social negotiation through discussions advance the way toward building knowledge for better learning (Baran, Canbazoglu Bilici & Mesutoglu, 2016). Moreover, FA connects between cognition and social communication into a practical theoretical framework through placing the student cognitive improvement in a setting of cooperative classroom activity (Clark, 2011).

2.2.2 Constructive Alignment Theory

The concept of "Constructivism" is connected to building the knowledge of students by using a variety of related learning activities while the concept of "Alignment" is assigned to the learning environment that the subject teacher creates, with the aim of supporting active learning exercises, for achieving the expected learning results (Jaiswal, 2019).

The theory of constructive alignment (CA) was created by Biggs (1996). Biggs extracted his theory from the constructivist approach that is related specifically to the leading process of teaching and learning. These processes should be implemented by concentrating on students' knowledge that have to be acquired and aligned with the assessments that the teachers have to prepare for all levels of students.

The principle of this theory is related to many important learning components that play an important role in a successful lesson. This essential theory is related to the educational resources, the learning methodology, all the related tasks and activities that should be aligned with the required curriculum along with the learning goals, the provided opportunities for each student according to his/her educational level in addition to students' assessments and rubrics that should be prepared to evaluate the learning outcomes for each student according to his/her level. All these components in the constructivist approach should be connected to each other to advance the intended learning outcomes (ILOs). Consequently, in constructivist alignment the focus is on advancing the students' learning opportunities in an active way by utilizing student centred approaches accompanied by an effective curriculum that supports the students' learning exercises and assessments to envisioned learning results that will measure the academic level of students.

All types of schools must follow a specific planned and formal curriculum. The school curriculum is consistent of two types: the first type is related to the planned curriculum and its domains which are linked with designing, developing, implementing, and evaluating the curriculum (Ornstien & Hunkins, 2014). This type concentrates on the lesson's objectives, assigned activities, and contents. On the other hand, schools and specifically the educators who responsible for designing the curriculum have to focus on the second type of curriculum which is connected with the significance of the unplanned curriculum (Ornstien & Hunkins, 2014). This type of curriculum is associated with the socio-psychology interaction which is related to learners' feelings, attitudes as well as their behaviors, which take place between the subject teacher and the students of the

classroom interacting with each other. These needs are part of the humanistic approach that spotlights on the individual and social parts of the educational plan and guidance. It is extremely focussed on different social viewpoints and the topic artistic in addition to other important factors such as the important need of reaching the students' self-actualization between others accompanied by the socio-psychological elements of the study hall (Ornstien & Hunkins, 2014). This vision has established a dynamic way of thinking in addition to the student-centred approach (Dewey, 1934; Kliebard, 1989; Schwab, 1969; Taba, 1962). Therefore, teachers who are responsible for designing the curriculum for their students have to consider the required learning outcomes as a goal for their students while they work on the school curriculum in order to make sure that they are on the right path of teaching and learning process (Wiggins & McTighe, 2005).

Constructive Alignment theory (CA) is related to planning, advancing and assessing the profound learning of the school student (Biggs, 1996). It begins with the thought that the student develops his / her own learning by using significant learning exercises. The main responsibility of the teacher is to make a learning domain that underpins the learning exercises proper to accomplishing the ideal learning results. The vital key to doing that is to focus on all the components of the teaching framework and adjust to one another including the curriculum, teaching strategies, activities, and assessments in all types. All these elements will lead to the ideal learning results (Biggs, 1999; Biggs, 2003).

Moreover, this theory (the constructive alignment theory) has been used in a variety of research studies in an effective way. It is used for different aims such as forming an appropriate template that covers the vital skills for students (Sumison & Goodfellow, 2004) as well as for the purpose of evaluating the design and the planning of the curriculum (Frazer & Bosanquet, 2006; Larkin & Richardson, 2013; Leigh et al., 2012). Additionally, this theory refers to how learners obtain their knowledge and learn from different types of activities. Constructivist learning needs the learner to be engaged effectively to construct knowledge by himself without depending on the direct guidance from the subject teacher.

In constructivism, the student presents the role of an active learner who is capable to explore and build new understandings as well as convert their learning knowledge without help (McDonald and Van der Host, 2007). In consequence, the constructive alignment theory has generated with

the aim of facilitating the development of new comprehension of reality for students by aligning many essential components: students learning outcomes, teaching and learning activities, and assessment tasks (Biggs, 1996). Furthermore, this theory concentrated firstly on what learners should know (knowledge). Secondly, what they can do (skills), thirdly, planning effective activities that should be connected to real life applications and finally to the way of measuring these abilities (Biggs, 1999).

CA theory can be used as a structure for educating what students are expected to learn, besides the way of expressing their learning which should be specified before the actual teaching and learning process starts. The way of teaching should be designed to increase their odds of accomplishing those results, and assessment assignments are intended to empower clear decisions about how well those results have been achieved. For each situation, the objective demonstration is without a moment's delay the expected result, the technique for instructing, and the methods for surveying whether the ideal measure or standard of the result has been met. This way is called student-centred which focuses on student's needs to accomplish and the best strategy of engagement towards achieving the required standard. The design of teaching which is results-based and assessment is essentially criterion- referenced (Biggs, 2014).

Constructive alignment theory has a focused role in creating an appropriate framework which is used for planning a high level of lesson objectives (Pierce & Fox, 2012). The first step to implement an effective lesson is to determine the objectives that the students should be able to do, then a variety of appropriate assessments have to be prepared for the whole lesson in order to observe the learning process of the students and to decide the extent that the learners can achieve from the required objectives (Biggs, 1996). Additionally, teachers must provide students with many activities including pre-class activity, during, and post-class activity with the aim of better outcomes (Persky and McLaughlin, 2017).

This theory is related to the cognitive apprenticeship that includes a group of instructive standards planned for offering students the needed experiences that are related to the skilful practices as well as the cognitive procedures of a talented professional (Collins, Brown, Newman, 1989). It also concentrates on building abilities and deep learning (Biggs and Tang, 2007; Lawrence, 2019) that

are considered as the foundation stage towards better understanding and thinking that should be close to professional thinking.

Developing these skills might be neglected by numerous teachers. Therefore, this constructive alignment theory sheds the light on the importance of using and promoting the right learning activities, curriculum and assessments (Croy, 2018; Gerritsen-van Leeuwenkamp, Joosten-ten Brinke, and Kester, 2019) that enable learners to reach a higher stage of thinking skills for better outcomes (Collins, Brown, Newman, 1989; Persky and McLaughlin, 2017).

Moreover, there is an important requirement for all teachers which is related to their significant role in implementing this theory through their ability to understand their targets and the abilities of their students individually. Afterwards, they will be able to provide them with suitable plans, activities, and assessments that are aligned with the required curriculum learning goals (Biggs & Tang, 2007). According to Saroyan & Trigwell (2015) where they confirmed that, "We need a better understanding of what we are trying to achieve". In this case, teachers will be able to cover the important elements that the idea of constructive alignment is related to, at that point students can scarcely abstain from learning the correct things (Biggs, 2012).

This research study clarified the importance of implementing effective FA strategies in daily teaching processes which should be included in the educational plan that is used to cover all the needs of students daily. Teachers are responsible to prepare these strategies to address the standards of the school curriculum by the use of the constructive alignment through three important stages (Biggs and Tang, 2007). In the first stage, all educators who are responsible for planning the curriculum should identify the required learning outcomes for all students in different academic levels accompanied with understanding the suitable complexity of the implemented knowledge and skills for all students. The second stage is related to create and prepare a variety of assessments that should be aligned with the required results while the last stage is linked to the needed activities that are able to encourage students to be engaged in different tasks towards achieving the learning goals that have to be connected to real life applications. In addition, teachers have a crucial role in this process because they have to provide their learners with a constructive feedback in order to enable them to critique their learning and decide whether if it suitable for their learning process or they are required to change or modify it (Rust, 2002).

The main goal of the current study is to concentrate on educational leaders' perceptions regarding the importance of FA and its effect on students' results, therefore, students' assessments have to depend on their acquired knowledge from what have been learnt (Biggs, 2003) in different subjects especially English, science, and math where the MAP exam will be implemented in them. In this case, teachers have to be aware of how to conduct the appropriate FA strategies in order to prepare all students for different types of assessments.

Furthermore, the CA theory is also related to the current study through providing a clear picture about the used framework for improving the students' results in the MAP exam. It can also support teachers in providing much evidence that can help them to decide whether they need to create another plan and/or modify the used FA strategies according to the needs of all students. In addition to design and implement effective lessons to support students with high-level learning aims (Biggs, 1999; Biggs, 2003; Persky and McLaughlin, 2017).

This theory can help in the process of classroom development where it shows the way to move from traditional classrooms to constructivist ones. Teachers should focus on making an essential paradigm shift in their knowledge as well as learning. In addition to an important element which is related to rethink the existing teaching strategies that they follow (Brooks & Brooks, 1993). The authors concentrate on five crucial standards for successful teaching plans that result from constructivism. These principles include posing, structured primary concepts, evaluating learners' opinions, modifying curriculum and assessing the learning of the students. Brooks & Brooks, (1993) confirmed that the process of learning is more related to "how students learn and how teachers teach".

Moreover, in order to support the process of learning, it is required that FA must be grounded in clear and solid models or theories of learning (Shepard, Penuel & Pellegrino, 2018), in light of observational investigations in conjunction with curricular conceptualizations that can identify the students' desired results along with the pathways and the critical stages in the direction of competence.

It is important to use CA towards enhancing the quality of teaching and learning along with assessments. CA can enhance positive teaching and profound learning. It examines the utilization of useful arrangement to structure evaluation criteria and rubric for an educational programs unit (Lawrence, 2019).

2.2.3 Self-Determination Theory

One of the significant theories used in the educational field is the self-determination theory (SDT) (Deci & Ryan, 1985, 1991, 2000, 2012, 2017), which is mainly associated with stimulating the students' motivation, attention, and enthusiasm for learning. SDT is considered as one of the strongest motivation theories that has been experimentally supported by a great deal of research and it is also accessible nowadays (Jang, Kim, and Reeve, 2016; Klein, 2019; Potgieter, Potgieter, and McCabe, 2019; Ryan and Deci, 2000). Motivation represents an essential component that can support the process of teaching and learning in a positive way because it has been characterized as a force of both cognitive (Bahri, and Corebima, 2015) and affective. This force is capable to initiate, sustain and direct the students' engagement behaviors as an internal procedure of development which has derived from the person's experience, opinion and interpretation (Reeve, 2012). It represents an inside psychological motivation promoting learners to actively engaged in different activities (Abrahams, 2011; Bandura, 1986a; Jackson, 2016).

SDT represents a comprehensive framework to understand students' motivation and their personalities that put emphasis on individuals' intrinsic inclinations towards improving learners' development and self-actualization through gaining satisfaction of their basic psychological needs which is aimed at autonomy, competence, and relatedness. These components lead to a high level of learning, understanding different levels of topics together with enhancing self-awareness and adapting to change (Deci & Ryan, 2017).

During recent decades, SDT has been considered as a leading paradigm of the worldview. It has been created from working on a consistent series of theoretical expansions and developments in addition to a huge number of experimental investigations that have been conducted to efficiently test the principles of the framework systematically (Ryan and Deci, 2017). SDT has been used by a variety of areas from all over the world in an effective way. Some of these areas include health care (Williams & Deci, 1996) as well as work climate which stated by a lot of authors (Deci et al., 2001). Furthermore, this theory has been applied successfully in other fields such as politics (Losier et al., 2001) and religion (Neyrinck et al., 2005). Moreover, Guay et al. (2008) indicated the importance of SDT as a guide for hundreds of experimental instruction research studies since its beginning with Deci and Ryan in (1985).

The term of self-determination can be defined as "a quality of human functioning that involves the experience of choice . . . [which becomes] the determinants of one's actions" (p. 38) as stated by Deci and Ryan (1985). Therefore, teachers must provide their students with suitable opportunities and different activities (Zainuddin, and Perera, 2019) that can help them to be more self-determined in their actions. As a result, students will obtain their basic psychological needs which will lead them to increase their motivation, cognitive skills (Silva, Redondo, and Cárdenas, 2018) and positively improve their behavior and vice versa (Deci and Ryan, 2012).

Moreover, Ryan and Deci (2000) stated that this can happen when the learners reach the satisfaction level of their psychological needs which the theory of self-determination classified them into three fundamental psychological requirements that are assumed to be globally well-known (Clark, 2011). These psychological needs are represented as follows:

The first psychological need is called (Autonomy) which is refer to as "being the perceived origin or source of one's own behavior" (Ryan & Deci, 2002, p. 8). This psychological need describes the individuals' feeling when they act according to their inward interests or wants (Benita, Roth, and Deci, 2014; Ryan & Deci, 2000). In this case, when learners experience autonomy, they will have the feeling of being responsible about their own behavior and performance. Consequently, this can enhance their motivation to be self-determined and more engaged with other students (Griffith & Grolnick, 2014) in order to improve their learning.

Autonomy might represent the main element in the students' psychological needs that is closely related to the theoretical model behind the FA which is to grow learners with full autonomy, who are able to assess their assigned tasks and provide significant conclusions from it along with planning the subsequent stages for further advancement (Black and Wiliam, 1998a; 1998b).

The second psychological need is known as (Competence) which is connected to the state of "feeling effective in one's ongoing interactions with the social environment and experiencing opportunities to exercise and express one's capacities" (Ryan & Deci, 2002, p. 7). This psychological need can be experienced when students believe in their abilities and accept the idea of having the skills to complete their task and/or are capable to be engaged in a specific activity (Ryan & Deci, 2000). Accordingly, students who perceive competence can improve their self-determined motivation through urging themselves to look for new difficulties by which to test their abilities (Ryan & Deci, 2012).

The third psychological need is titled as (Relatedness). According to Ryan and Deci (2002) where they stated that this type is described as “feeling connected to others,” and the desire to be “cared for by those others” in return (p. 7). Relatedness can be experienced by learners when they interact with other students in the class or with the social community (Ryan & Deci, 2000). This type of psychological need can promote students’ self-determined motivation through offering the required help and the secure connection with the aim of developing and exploring (Ryan and Deci, 2000). Additionally, many authors confirmed that when teachers have a positive relatedness with the students of the classroom, this will lead to promoting their intrinsic motivation for learning in different subjects such as English (Guay, Stupnisky, Boivin, Japel, and Dionne, 2019), Maths (Gottfried, 2019; Zakaria, Malmia, Irmawati, Amir, and Umanailo, 2019), Science (Mujtaba, Sheldrake, Reiss, and Simon, 2018; Potgieter, Potgieter, and McCabe, 2019), and Science through physical activities (Mackenzie, Son, and Eitel, 2018).

McCaslin (2004) participates in identical conceptions in the field of motivation by supposing a socio- cultural point of view which, “locates and co-regulates human activity in the social realm rather than envisioning activity as a characteristic of the individual” (p. 254). Depending on Vygotsky's idea that is related to the importance of others. The author McCaslin underlines the significance of opportunities in applying different types of learners’ discussion in order to reach and influence the understandings of them. These conversations are made by interpersonal contact which result in obtaining new values that are adopted and can be considered as students’ future goals.

This theory of motivation which had been established by Deci and Ryan (1985) recommends that individuals have a tendency to be motivated by a need to develop and gain satisfaction. The principal supposition of SDT is related to people’s need to be effectively coordinated towards development. Picking up mastery over difficulties and taking in new encounters are fundamental for building up a firm feeling of self. Despite the fact that individuals are normally motivated to act by outer rewards, for instance, money and acclamation which is identified as extrinsic motivation. The focal point of the SDT is the central foundation of motivation, for example, the personal need to obtain and improve knowledge or independence which is recognised as intrinsic motivation.

There is an inadequate cooperative learning environment in students' classrooms. Furthermore, these classes lack the effective support for the three important elements of this theory that are needed for students. Thus, it seems that the students work collaboratively in groups but in fact they are not (Black and Wiliam, 2005). On the other hand, the Assessment Action Group /AiFL Programme Management Group (AAG/APMG, 2002-2008) stated that learners reacted positively to working cooperatively with various students in their evaluation. They confirmed that students are interested in helping each other during different tasks that include activities and assessments especially when they apply a range of motivated formative assessment strategies.

As indicated by Ryan and Deci (2000, 2009), there is an important support that the learners can receive from the contextual of the lesson which is led by the subject teacher (Klaeijsen, Vermeulen, and Martens, 2018). The process of contextual support can enhance the learners' motivation and well-being to a high level which can be implemented through providing adequate opportunities for them in order to satisfy their essential needs (Ryan and Deci, 2017). On the other hand, the opposite results might be obtained when the students lack the opportunity of receiving the contextual support which will lead to reduce the level of their motivation and well-being as well. Guided by the level of need fulfillment, SDT places three fundamental types of motivation as intermediating procedures between students' need of satisfaction and his/her well-being.

There are three types of motivation, the first one is called the intrinsic motivation which is considered as a central point in the learning process, the second type is known as the extrinsic motivation while the third type is named Amotivation. The three types are clarified as follow:
The Intrinsic motivation is viewed as the main type that can promote self-determined motivation as well as in a social context whereby it can be used as an ideal motivation (Guay et al., 2008). This type of motivation alludes to the situation where the students perform a specific behavior with the purpose of their interest and/or satisfaction that they find in their assigned tasks (Ryan and Deci, 2000). In order to reach this target, teachers' activities have to be enjoyable and, full of challenges, so as students will be interested in participating in these tasks and as a result, they will gain positive benefits that can support them in their learning (Ryan and Deci, 2002).

Intrinsic motivation is particularly significant for students in the middle school stage (Beck, 2018). Numerous lecturers plus sessions that are related to professional development dedicate a lot of

time in order to discuss the right way of constructing students' intrinsic motivation (Beck, 2018). A research study on intrinsic motivation found that the higher students' marks in different subjects in MAP exams have a direct connection between learners' work habits (students' self-regulation levels) and their academic outcomes (Ervin, Wash and Mecca, 2010). Therefore, according to this evidence, it seems that the intrinsic motivation will have the most effect on students' performance compared to the other two types of motivation.

An assortment of authors (Reeve, Ryan and Deci 2018; Ryan and Deci 2000) had confirmed the important role of teachers in implementing the students' intrinsic motivation to acquire knowledge and learn. Furthermore, in prior research, other researchers experienced a low level of learners' intrinsic motivation. This situation happened due to the lack of students' needs as a result of their apathetic teachers. It is subsequently obvious that the fundamental pillar in the framework of formative assessment is the positive conversation among the main members which are represented by the students, however, it is essential that the subject teacher continue to be engaged with students and provide help for them at all times (Ryan and Grolnick, 1986).

In order to achieve students' autonomy, it is essential to highlight the intrinsic learning targets in addition to reduce the outside control. This can be implemented through providing the positive required circumstances such as providing the right support in which psychological and enthusiastic health is advanced with the goal that learning happens in a suitable environment without any risk. Deci and Ryan relate the result of using effective FA strategies with learners' autonomy through the concentration on the intrinsic motivation in a proper classroom environment (Clark, 2011).

The second type of motivation is the extrinsic motivation which obviously depends on external factors. In this type, individuals perform a specific behavior toward gaining a separable result (Ryan & Deci, 2000). These people might behave according to an external incentive, their own feelings of guilt, or an individuals' particular benefit. These extrinsic motivational behaviors might generally stop when the external factors are never provided again (Ryan and Deci, 2000).

The third type of motivation is amotivation which had been identified according to Ryan and Deci (2002) as "the state of lacking intention to act" (p. 17). Generally, this type takes place when individuals have a feeling of lacking competence or when they realize that there is no contingency or significance to do their tasks (Ryan & Deci, 2002). In this case, individuals have two options,

the first one when they decide not to do the task at all while the second option is to complete their task but without objective (Ryan & Deci, 2000).

This theory is related to the current study in different ways. Firstly, it is considered as a motivational method to implement different ways of teaching to raise the academic results for the students in the middle school. This can occur by increasing their autonomy feelings through improving the used activities and classroom environment which can acknowledge their interests and abilities (Alley, 2019).

Secondly, by focusing on the important role of teachers as a vital factor in motivating students through gaining their psychological needs. Teachers need the required skills that can help them to use different effective and challenging activities which are aligned with the school curriculum in order to promote the students' enthusiasm towards positive outcomes in different subjects (Christenson et al., 2012; Dilshad, Nausheen, and Ahmed, 2019; Ryan and Deci, 2009; Taştan, et al., 2018). Moreover, a previous study suggested that "… at the classroom level, teacher support, positive teacher-student relationships … autonomy support and authentic and challenging tasks have been associated with student engagement" (van Uden et al., 2013, p. 44).

Thirdly, the correct procedures to implement the strategies of FA should be through the modification of instruction and strategies in the direction of addressing the students' academic needs. These needs are cognitive, regarding supporting knowledge attainment and they are also effective in addressing the point of view of Ryan and Deci (2000) where they stated the importance of students' self-motivation and personal integration to cover their basic psychological needs.

This theory explains the importance of the implementation of motivation by the teachers on students' engagement and nurturing them for the coming future (Reeve, Ryan and Deci, 2018). It is closely related to the strategies that are implemented on a daily basis in every classroom using the prepared lesson plans by teachers.

2.2.4 Depth of Knowledge Model (DOK)

According to the requirements of the coming academic future and the necessities for career readiness, it is essential to enhance the degree of rigor in school classrooms for all students' levels and in different grades. In order to be on the right track, choosing the Common Core State Standards will be a good start in positive development. Nonetheless, these standards will not be able to carry thoroughness to our study halls without other important factors such as improving the extending thinking for students through using the practical tools, critical thinking, quantitative reasoning, constructive feedback and cooperative learning. This way will help to develop the curricula and the assessments as well as towards promoting classrooms' discourse associated to advanced stages of cognitive demand (Skinner & Feder, 2014).

Depth-of-Knowledge (DOK) schema which had been generated by Norman Webb has turned out to be one of the important fundamental models teachers can make use of towards analysing the students' cognitive demand (complexity level) planned by the use of different essential elements such as the recommended standards, the appropriate activities that are related to the implemented curriculum activities, and the assessment tasks as well. In order to be on the right direction of the standardized assessments path towards improving the learners' positive attainment, each school should align between their standards and assessments. Webb (1997) built up a procedure and criteria to achieve this target systematically in addition to narrow the gap between them. From that point forward the procedure and criteria have shown application to evaluating curricular arrangement also. DOK model is helpful for all levels of students because it consists of different categories of cognitive stages that are suitable for a variety of assessment tasks which are required for effective and successful learning of K-12 students.

Furthermore, a content illustration of the DOK model had been articulated by Hess (2004-2012) for a better practice by the educators of the school guiding alignment studies (Hess, 2012).

To achieve the best and the highest results of students' outcomes, there should be a model that the teachers can use in order to classify students according to their academic level and have a clear idea about the needed strategies for them. Additionally, this model is to align the analysis of standards, objectives, curriculum, and assessments all together. Students should be presented to an assortment of educational errands at contrasting dimensions of intricacy to learn and develop (Meador, 2018). This can be done through the Webb's Depth of Knowledge (DOK) model, which

consists of four levels depending on the complexity and difficulty of cognitive thinking. These levels include recall and reproduction, skills and concepts, strategic thinking, and the last and the highest level is the extended thinking (Weay et al., 2016). Webb (1997) developed the DOK model, which highlighted the instructional progressions of learner's thinking, tasks and evaluation. The model depends on the supposition that curricular components may all be classified depending on the cognitive requests required to create an adequate reaction. Each gathering of undertakings mirrors an alternate dimension of intellectual desire, or depth of knowledge, required to finish the errand.

Webb's DOK model is suitable for the new nature of society requirement, it is beneficial in planning the suitable activities and challenges for the students of the school according to their academic needs. Teachers can also use this model to prepare learners to work cooperatively in different academic group levels in order to solve problems and complete the assigned challenges depending on students' cognitive and communication skills. In this level, the role of the teacher will be to facilitate the knowledge of the learners, not to dispense the attainment of it by guiding them to reach the right decisions by themselves. Therefore, students will be effective members in society and they will fit the new needed requirements of the 21st century through being independent learners, analytical, critical thinkers and professionals at collaborating with others in addition to be socially astute learners (Darling-Hammond et al., 2013).

The provided assessments for students of different school levels and grades which include a variety of questions derived from the four levels of DOK model are essential for several aims. Some of these targets are linked to obtaining sufficient information about learners and her/his motivational sources for further improvement combined by the degree level of knowledge improvement of them in addition to the provided information that are related to students' mentors and their effectiveness of the facilitation strategies that they used in their daily plans. The DOK model can measure the development of students understanding according to its four levels of complexity which can help both the teacher and the students in their future plans (Czarnocha & Baker, 2018).

This model can analyse the association between two important factors, the standards and the benchmark assessments, in addition to connecting that with the school curriculum. Then the model will employ to investigate the cognitive expectation needed by standards, different curriculum accomplishments plus assessment tasks (Webb, 1997).

Level 1 Recall & Reproduction	Level 2 Skills & Concepts	Level 3 Strategic Thinking	Level 4 Extended Thinking
a. Recall or recognize a fact, term, definition, simple procedure (such as one step), or property b. Demonstrate a rote response c. Use a well-known formula d. Represent in words or diagrams a scientific concept or relationship e. Provide or recognize a standard scientific representation for simple phenomenon f. Perform a routine procedure, such as measuring length	a. Specify and explain the relationship between facts, terms, properties, or variables b. Describe and explain examples and non-examples of science concepts c. Select a procedure according to specified criteria and perform it d. Formulate a routine problem given data and conditions e. Organize, represent, and compare data f. Make a decision as to how to approach the problem and explain it g. Classify, organize, or estimate h. Compare data i. Make observations j. Interpret information from a simple graph k. Collect and display data	a. Interpret information from a complex graph (such as determining features of the graph or aggregating data in the graph) b. Use reasoning, planning, and evidence c. Explain thinking (beyond a simple explanation or typical respond) d. Justify a response with supporting evidence e. Identify research questions and design investigations for a scientific problem f. Use concepts to solve **non-routine** problems/more than one possible answer g. Develop a scientific model for a complex situation h. Draw conclusions from experimental data, citing evidence/data as support	a. Select or devise approach among many alternatives to solve problem b. Based on provided data from a complex experiment that is novel to the student, deduct the fundamental relationship between several controlled variables. c. Conduct an investigation, from specifying a problem to designing and carrying out an experiment, to analysing its data and forming conclusions d. Relate ideas within the domains of the content area or among content areas e. Develop generalizations of the results obtained and the strategies used and apply them to new problem situations or investigations

g. Perform a **simple** science process or a set procedure (like a recipe) h. Perform a clearly defined set of steps i. Identify, calculate, or measure j. Identify the kind of information found in a representation (graph, table, diagram, map) k. Retrieve information from a table or graph to answer a question (e.g., how far did it go?) l. Recall or organize names and uses for scientific tools m. Use scientific tools to collect & record data (e.g., measure distance or time) **NOTE:** If the knowledge necessary to answer an item automatically provides the answer, it is a Level 1.	l. Translate between tables, graph, words and symbolic notation m. Retrieve information from a table, graph, or figure and use it solve a problem or make a prediction n. Summarize findings **NOTE:** If the knowledge necessary to answer an item does not automatically provide the answer, then the item is at least a Level 2. Most actions imply more than one decision.	i. Complete a multi-step problem that involves planning and reasoning j. Provide an explanation of a principle k. Justify a response when more than one answer is possible l. Cite evidence and develop a logical argument for concepts m. Conduct a designed investigation and use data to draw conclusions n. Research and explain a scientific concept o. Explain phenomena in terms of concepts	**NOTE:** Level 4 activities often require an extended period of time for carrying out multiple steps; however, time alone is not a distinguishing factor if skills and concepts are simply repetitive over time.

Table (2.1): DOK model in science based on Webb (Karin Hess, 2007)

In Webb's Depth of Knowledge Model, students' high order thinking skills play a fundamental role in its third and fourth levels where students' capabilities are correlated to their cognitive dimension. Students should be able to give reasoning with evidences, make connections between

their previous and current knowledge and evaluate it (Webb, 2018). In this case, teachers need to acquaint learners with more activities that are connected to students' thinking skills in order to enable them to be prepared for making decisions, interpreting, analysing, solving complex problems and manipulating information in different situations. These abilities are not easily gained by students directly, it needs to be generated by training them through a range of tasks that will help them to build these skills and develop them in a long path (Retnawati et al., 2018). Teachers are also responsible for using the active learning method and encouraging collaborative work between students by creating student-centered learning for further improvement (Akyol & Garrison, 2011; Limbach & Waugh, 2010).

Developing the students' thinking skills can be achieved through different types of active learning and various strategies that are able to train learners towards a developmental academic level for example problem-based learning (Mokhtar, Tarmizi, Job, & Nawawi, 2013), project-based learning (Vidergor & Krupnik-Gottlieb, 2015) and inquiry-based learning (Orlich, Harder, Callahan, Trevisan, & Brown, 2010). Other types of modules or strategies that are connected to contextual problems, discussions and interdisciplinary problems can be also used for the same purpose (Goethals, 2013).

Furthermore, schools are requested to hire knowledgeable teachers whom have an active role in all aspects that are related to the process of teaching and learning for instance lesson planning, applying knowledge as well as evaluating students' skills. Therefore, teachers should have solid experience about the way of implementing different effective strategies of formative assessments to build learners' high order thinking skills (Bartell, 2012).

On the other hand, numerous studies indicated some of the difficulties that the teachers faced while preparing and building thinking skills for their students. Some of these teaching obstacles are related to how to decide the right strategies and tools that will help students in building and improving these skills (Jailani & Retnawati, 2016; Retnawati, Munadi, Arlinwibowo, Wulandari, & Sulistyaningsih, 2017; Thompson, 2008). Other problems are connected to the difficulty of evaluating the learners thinking skills (Retnawati, Hadi, & Nugraha, 2016). Moreover, a lot of teachers stated that the low academic level of students is considered as one of the main problems that they are facing during the academic year and specifically in their exams when they have to deal with complex questions (Retnawati, Kartowagiran, Arlinwibowo, & Sulistyaningsih, 2017).

The DOK model connected to the presented study in different areas. Firstly, the study has to shed the light on the evolution in science which required a use of a variety of strategies, methods, and instructions that can help in developing students' understanding of science. Therefore, educators and specifically science teachers have to think about the best ways that might help them in applying effective FA strategies to enhance the students' knowledge and understanding about the new science concepts and the right way for conducting them in different real life applications (Leonor, 2015).

Science teachers are required to utilize a variety of FA strategies that should be linked to the school curriculum and the appropriate activities and assessments in order to cover the needs of all students. According to Willoughby (2012), all students have different abilities and there are no two students with the same capacities or experiences. Nevertheless, all students are required to master the same objectives, terms, and abilities. For that reason, teachers should implement different strategies that can address the needs of different levels of learners.

Depending on the DOK model and its levels, experienced teachers will be able to classify the skills of each student according to the levels of the DOK model. This can help teachers in deciding positively to select and implement the appropriate FA strategies, activities and assessments that each student should receive from their teachers according to their needs in order to improve their academic abilities in a correct way. If the students can connect between knowledge, understanding, skills, with the curriculum, this will lead them to work independently in the future (Willoughby, 2012).

Effective strategies of differentiation come from experienced teachers who can react to the various capabilities of students (Tomlinson and Imbeau, 2010). This model is considered as a challenge for subject teachers who are interested in meeting the needs of all students. It may also be able to build the basis plan of the implemented curriculum that can address the required skills for all learners (Leonor, 2015).

The DOK model can also be used by the teachers to decide whether there is an alignment between the implemented assessments that they selected for their students and the used standards which is considered as a core in the educational systems (Case, Jorgensen, & Zucher, 2004; Burkam, 2013). It can also be recognized as the fundamental principle to achieve standard based educational changes (Webb, 1997). Furthermore, several types of exams including the benchmark exams for

example MAP exam and the international exams such as PISA depend on the level of students' cognitive skills (Le Hebel, Montpied, Tiberghien, and Fontanieu, 2017) which can be explained and achieved by following the required strategies in the DOK model.

2.3 Literature Review

As the study expressed in the previous chapter, one of the main difficulties of education is to nurture and raise new generations that are capable to efficiently contribute to modelling the future of this world (Thomas & Jose, 2018). Nowadays, learners ought to be provided with all the required higher reasoning abilities that would empower them to wind up effective pioneers and enable them to partake later on learning economy (UAE Ministry of Education, 2015). As stated by Clark (2012), teachers should develop assessment strategies to collect evidence of students' mastery of scientific concepts and practices, which need active and successful feedback techniques through FA. Formative assessment is considered as a toolkit for teachers to help them in assessing their students (Wright, Clark, and Tiplady, 2018).

The literature review of this research study will be divided into five main sections to illuminate the importance of FA, MAP exam, and other significant sections that will have influence on the result of this study.

2.3.1 Formative Assessment

Currently in the educational field, a variety of authors (Hallam, 2019; Huisman, 2018; Menéndez, Napa, Moreira, and Zambrano, 2019; Moss and Brookhart, 2019; Zhao, 2019) promote the importance of formative assessment as one of the most effective interventions regarding its vital role in enhancing learners' accomplishment, especially in basic science (Black & Wiliam, 1998; Furtak, Heredia, and Morrison, 2019; Klute, Apthorp, Harlacher & Reale, 2017).

At first, the term of "formative" did not exist, the most original reference that is related to formative approaches might be found in 1963 when Cronbach published an article about the development of the course content. In (1967) four years after Cronbach's article, Scriven (1967) started the term

of “formative” to be applied in a way that was consistent with the one that had been used by Cronbach. There is a fundamental advancement regarding the traditions of formative assessment which is related to replacing progressively Scriven's term of the “formative evaluation” by the term of “assessment” because it is related to the learning way of students in different classrooms (Allal and Lopez, 2005) as well as to clarify the role for each type of assessment in the curriculum (Scriven, 1967).

After this period, different authors from the educational field gave emphasis to the importance of providing students with a variety of balanced assessment practices in the classrooms which can help learners in their academic accomplishment as well as concentrating on the cultural advancement of the student (Bloom, Hastings, & Madaus, 1971; Sadler, 1989; Black & Wiliam, 1998a, 1998b, 2006a; Assessment Reform Group [ARG], 1999; Organization for Economic Cooperation and Development [OECD], 2005; National Association of State Boards of Education [NASBE], 2009). As a result of that, there was a decision to implement policy initiatives for a long period of time on a worldwide scale. One of the examples that are related to the noteworthy increase in awareness that is connected with the advantages of FA is the study of the Organization for Economic Co-operation and Development (OECD) that was conducted in (2005) which highlights commendable cases from different secondary schools in a variety of countries such as Finland, Queensland in Australia, Canada, England, Italy, Denmark, New Zealand, and Scotland.

Formative assessment is the process by which instructors provide their students with the suitable information amid the learning procedure in order to alter their understanding and self-controls well (Burton et al., 2018; López-Pastor and Sicilia Camacho, 2015). This can happen through improving their knowledge attainment abilities, social maturity, their cognitive processing progression capabilities (Harlen and James, 1997) to become students as lifelong learners (Hellwig et al., 2015).

According to Black & Wiliam (2010), the concept of “Formative Assessment” refers to “activities undertaken by teachers and by their students in assessing themselves that provide information to be used as feedback to modify teaching and learning activities”. FA is considered as a strong method which can help teachers to measure the level of knowledge, understanding, and skills for each student and this can help them to plan towards a positive improvement of their students'

academic skills (Arrafii & Sumarni, 2018; Le Thai Hung & Ha, 2019; Schneider and Johnson, 2018).

The same opinion had been confirmed by another author where he stated that FA "gives teachers information that they can use to inform their teaching and improve student learning while it is in progress and while the outcome of the race can still be influenced" (Greenstein, 2010, p. 2). This can be implemented by different essential actions that are created by teachers not exclusively to the used tasks in order to generate opportunities for the learners of the school towards sharing their thinking and develop it (Kang et al. 2014).

Moreover, this type of assessment can be used as a fundamental tool to collect important information and sources for teachers to observe the understanding levels of learners. In this case, FA can illuminate the key objective of the students' learning for the students themselves and for their parents as well, with the purpose of having a clear image about the changes that they are required to do in their daily teaching plans, strategies, and instructions. These modifications will be implemented with the aim of reaching an advance level of future effective outcomes (Black & Wiliam, 2010; Dixson and Worrell, 2016; Radhwan, 2019). FA can be also related to both teachers' and students' instructional practices as thoughts are made unequivocal combined by providing constructive feedback to boost the learning process of students (Bennett, 2011).

There are several forms of FA. It started with experts such as Black & William (1998) who worked on hundreds of research studies to state that FA is one of the most powerful strategies to increase learner success and enhance their learning outcomes in a positive way. Black and Wiliam (1998), "Inside the black box," discovered the essential role of FA in promoting the learners' academic results positively when it implements appropriately in their classrooms through their active participations which is considered as an influential tool in this teaching process compared to the traditional way led by teachers.

One of the forms of FA can be characterized as an important feedback that can be conducted by both teachers and students in order to develop the student's self-regulation learning process towards better academic results (López-Pastor & Sicilia-Camacho, 2015) and for adjusting the teaching procedures to enhance the learners' results according to teachers' expectations (Le Thai Hung & Ha, 2019). Feedback represents one of the most powerful components that develops

learners' success and it also indicates the quality of the used FA whether it is effective or not. The main condition in reaching the effectiveness level of feedback is to be constructive by concentrating on describing the situation more than evaluating it or by judging it (Prashanti and Ramnarayan, 2019).

Another form of FA had been indicated by Brookhart (2013) where he stated that the results of FA can represent as a useful data to show the right method of moving students' academic level forward and to show the way of establishing and developing their learning. Furthermore, it can be focused on the most effective ways of learning which prompts better outcomes in summative assessments through the use of effective data from the FA (Das et al., 2017; Gardner, 2012; Radhwan, 2019). FA can be also classified as a form for estimating students' advance by using the provided data as an expectation for a benchmark test, a learning goal, or a standard, and to determine the next step cooperatively with learners when they meet the required aim, or when they do not meet it (Popham, 2011).

It is significant that the scores of the students in all forms of assessments must meet the least possible standards (AERA, APA, & NCME, 2014). The utilization of FA at the entire school level, as a predecessor to formal evaluation, has prompted educators to expand their dependence on evaluation. This expanded utilization of FA has brought about test publishers that create and approve FA strategies that depend on national examples and that produce further psychometrically powerful scores than those regularly created and utilized by instructors (Dixson & Worrell 2016; Gresham, 2007).

FA is called and depicted as Assessment for Learning (AFL) (Assessment Reform Group, 2002; Birenbaum et al., 2015; Heitink, van der Kleij, Veldkamp, Schildkamp & Kippers, 2016; Stiggins & Chappuis, 2008). Assessment for Learning is a way to deal with FA that happens as a component of continuous classroom practices, that is seen as a social and a logical experience that emphasizes around the nature of the learning procedure (Heitink et al., 2016). AFL has the ability to generate a positive environment with strong learning where learners will be able to enhance their cognitive and metacognitive strategies. This can happen by observing the progress of students as well as offering them scaffolds that can play an essential role in shedding the light on the following important step that the students have to receive as part of the learning process (Baas, Castelijns,

Vermeulen, Martens, and Segers, 2015). In the present trend, scientists in the educational field have endeavoured to utilize high - stakes exams formatively to enhance instructing and learning in every class (Nasr et al. 2018; Wei, 2017). AFL embraces a move from challenging for testing's sake in the direction of assessing for the sake of learning (Elizabeth, 2017).

Furthermore, AFL should be taught as a learned behaviour. Teachers should teach their students about AFL as part of their daily lesson plan. Students must understand the meaning of AFL and have a clear idea about its concepts and terminology (DeLuca, Chapman-Chin, LaPointe-McEwan and Klinger, 2018).

The students of the school play an indispensable role in AFL. They are required to participate in measuring and evaluating their own learning along with their peers learning. A noteworthy long haul objective of Assessment for Learning is to promote the independence of students by assisting them in figuring out how to learn (Heitink et al., 2016). According to Oyinloye and Imenda (2019), in science, students that follow the instructions of AFL can achieve statistically higher results than students who follow the traditional instructions in their classes.

FA can provide a form of flexible teaching through offering a variety of effective activities that can be implemented to measure the students' learning progress (Prashanti and Ramnarayan, 2019). Teachers need to implement different types of activities that can reinforce students' concepts about the topic, break the monotony and the repetitiveness in addition to allowing subject teachers to have a clear idea about the learning process of students. FA can provide freedom for all teachers through offering a lot of approaches towards assessing learners' understanding (Gareis, 2018).

The process of assessing students should be observed and implemented from multiple points of view away from grades and marks. It should be represented as a yardstick to measure the knowledge, understanding, and skills that learners have gained and their way of thinking to implement that (Geissler and Stickney, 2018). FA is considered as "good" when teachers depend informally on students' marks while it is considered as "best" when they do not rely on their students' marks at all (Abu-Zaid, 2013). For that reason, teachers have to use and concentrate on the best instructional strategies (Popham, 2018).

Moreover, teachers should make effective use of time by increasing the difficulty and the challenges for students when the teacher notices the deep understanding from them, if not teachers have to re-explain the topic in another way by using different strategies. In this case, FA can be

represented as a form of clue to decide whether teachers need to continue with their current plans or whether they must modify them according to the needs of students (Boston, 2018).
The main objective behind the FA is to observe the advancement of the student in the direction of a coveted target, trying to narrow the gap (Das et al., 2017) between the existing situations of the learner and the desired result. “This can be achieved through processes such as sharing criteria with learners, effective questioning and feedback” (Assessment Action Group, 2002–2008).

There are several opinions regarding FA but Bennett (2011) submitted a succinct outline in regards to the controversy encompassing it. One opinion conceives that FA alludes to an instrument as stated by Pearson (2005), as in a diagnostic test. The other point of view indicates that FA is a procedure rather than a test (Popham, 2008).
Bennett (2011), stated that this difference of opinion reveals an oversimplification, nevertheless, it is helpful to illuminate our position. His argument supports the curriculum implanted during the FA instructional procedures that represented two central points. The first one concentrated on the information value given by evaluation exercises while the second one focused on support bolster productive, learning-centered " assessment social practices" using the appropriate materials and tools. Following this way will be more important and useful than depending on students’ scores which offer instructors insufficient information about the next step. It is significantly more vital that FA questions, assignments, and exercises offer instructional visions about learners thinking in addition to what beneficial subsequent stages may be taken (Shepard, Penuel & Pellegrino, 2018).

Systems that regularly depend on the quantitative information provide teachers with grid results in a matrix form indicating class programs crossed with subtest scores. Educators at that point commonly utilize this information to reteach the goals missed by the most learners (Foster & Poppers, 2011; Shepard, Davidson, and Bowman, 2011). According to Shepard, Penuel & Pellegrino (2018) they confirmed that this assessment information must be combined with several individual discussions with each student in order to provide teachers with clearer pictures for accessing students’ thinking. In schools, teachers are responsible for creating suitable learning environments by using both assessments and critiques, which are considered as a main part of successful common work (Penuel and Shepard, 2016a). Teachers must have the ability and the experience of using key factors in their daily learning process. These enabling factors include

capability, development, work habits, responsiveness, and participation along with the mastery of educational targets as stated by Brookhart et al. (2016).

Several surveys confirmed that teachers' learning strategies which mostly depend on teachers is the reason behind the low students' abilities in critical thinking skills and have not included pupils effectively amid the process of learning (Fuad, et al., 2015). FA can be an effective instructional tool when students get explicit practice and input with respect to their capacities to build up a case, interface proof to a claim, select significant evidence from different sources and remark on the validity of source material and utilize it for motivations behind outlining (Gallagher, Arshan & Woodworth, 2017).

FA is considered as an instructional practice which includes persistently eliciting and deciphering information, indication about the students' way of thinking that will be collected from the work of the learners with the purpose of informing teaching and learning (Black & Wiliam, 2009). Gathered information from teachers' current investigations where they used students' work to illuminate guidance points to tendencies for different types of educators to concentrate on students' abilities to do a variety of things and what they are not able to do, instead of on what they comprehend (Ebby & Sirinides, 2015; Christman, et al., 2009; Goertz, Oláh, & Riggan, 2009; Kazemi & Franke, 2004; Supovitz, Ebby & Sirninides 2013), or clarify learner performance by comparing his/her present and prior decisions and beliefs about their academic capacity (Horn, 2007; Jackson, Gibbons, and Sharpe, 2017; Wilson, Sztajn, Edgington, Webb, Myers, 2017).

This research will develop the teachers' knowledge about the way of students' thinking by investigating how class teachers interpret and react to the work of learners during the procedure of FA and how their understandings reflect basic perspectives on learning. The directions of learning are "empirically supported hypotheses about levels or waypoints of thinking, knowledge, and skill in using knowledge, that students are likely to go through as they learn sciences" (Daro, Mosher, and Corcoran, 2011, p. 12). Teachers can improve the progression of FA by giving a guide to defining objectives or setting map targets at the same time they have to respond and evaluate students' thinking for more evidence (Ebby and Petit, 2018; Heritage, 2008).

2.3.1.1 The Importance of Formative Assessment Internationally and its Reform

In light of past studies, it was realized that determining an appropriate strategy of learning is crucially required to promote learners' 21st century skills by using different levels of learning tasks and activities (Wicaksono and Susilo, 2019). Moreover, the educational system implementation had been changed globally (Turiman, Jizah, Adzliana, Kamisah, 2011) and according to that, students all over the world need to have the ability to solve a variety of critical problems by thinking efficiently, particularly in science education.

Instructing the science subject is associated with discovering different concepts and getting valuable experience through using the scientific method in addition to correlating science with innovative progresses and studying their influence on both the society and the environment (Mansour, 2009). In the meantime, and according to the new teaching strategies that many schools are providing their students with, these advanced strategies will help in preparing the current generation to be active citizens that can apply their science knowledge to solve socio-scientific issues. Understanding science will provide students with sufficient learning that will enable them to be decision-making individuals, participate in solving critical problems and study their effect on innovation and society as well as enrich the scientific needed knowledge to be capable to work in this period of time (Autieri, Amirshokoohi and Kazempour, 2016).

Internationally great attention is given from a variety of educational stakeholders towards FA as it reveals and reinforces the learning of students (Bell and Cowie, 2001; Torrance and Pryor, 2001; Wiliam, 2011). In the United States of America (USA), FAs are utilized in more than 25 states as becoming one of the most important official strategies that are used in schools (Altman et al., 2010; (Dixson & Worrell, 2016). Moreover, math teachers of the USA stated that following the strategies of FA provide high improvement and offers thoughts that ought to be valuable to mathematics teachers over the globe (Bartholomew, Strimel & Yoshikawa, 2018; Burton et al., 2018).
In England, educational policymakers and teachers have introduced the program of FA starting from preschool since 2000. In other countries such as Scotland, similarly, educators are urged to utilize FA in their daily processes of teaching and learning. In New Zealand, educators based their National Assessment Strategy which had been implemented in 1999, on the use of FA (Ozan & Kıncal, 2018).

According to numerous researchers, FA is remarked as a top educational strategy in Canada. A variety of educators in this country agreed that FA is the most critical assessment strategy that should be implemented in all schools in Canada (Organization for Economic Co-operation and Development [OECD], 2005; Swaffield, 2011).

In Finland, which is considered as a top country in education besides other countries such as Spain, Sweden, and Germany additionally underlining the significance of FA in addition to the need of the consistent evaluation of every learner utilizing diverse assessment methods for example verbal feedback and conversations (Klinger, Volante, & DeLuca, 2012; Looney, 2011).

In Singapore, which is likewise another foremost nation in education, FA adds to educators' professional development and to the learning of students through transferring the important practices of the professional development to the lesson plans (Koh, Lim, and Habib, 2010).

They take an interest in learning and showing exercises, as well as utilizing evaluation data to recognize objectives, settle on choices about their very own improvement, and build up a comprehension of how qualified a job will be (Berry, 2008). In Singapore, FA is considered as a tool used by teachers to inform them about the students' educational level. These assessments will give a pointer capability to how the educators should design their next lesson activities and exercises (Wuest & Fisette, 2012).

In Vietnam, the ministry of education confirmed the importance of using FA strategies in daily teachers' assessments to promote students' learning attention and enhancing their progress (Le Thai Hung & Ha, 2019).

There are several actions and reforms that have been taken by many countries from all over the world regarding the importance of the assessment reform process with a specific spotlight on the experiences and altering scene of chose educational frameworks as required. These reforms have been made to the assessment according to the circumstances of each country, that's why there is a weak relationship between the policy of the country and the assessment practices in some of these countries which might affect the required results of this reform. The main factor that is needed to succeed in this reform is to have qualified teachers who can implement this type of assessment as a key to learning (Berry, 2011).

Many countries have concentrated on factors that play an important role in improving the level of education, some of these factors are explained below for a sample of schools with a high quality of education.

In Finland, teachers must complete their master's degree in order to be able to teach except teachers with strong vocational skills. Teachers must receive continuous professional development through the year accompanied by 35 hours of different programs that are related to self-directed learning (Pither and Morris, 2019). Finnish teachers have a high level of autonomy which had a positive effect on students' scores in PISA test. In this country, schools are always provided with an updated effective educational system that helps them to keep the high level of education in place (Sahlberg, 2015). Finnish students are provided with two systems to study; the academic and vocational system which starts from the age of 16 in order to prepare all students for future life (Meriläinen, Isacsson and Olson, 2019). There is equity in education for the whole country, a strong preschool educational program starts at the age of one then every learner from grade (1-9) can receive a common comprehensive education which is free of charge (Pither and Morris, 2019).

Assessing the learning outcomes is conducted by the teachers themselves through self-evaluation accompanied by the Finnish Education Evaluation Centre which provides schools with recommendations for more improvement without ranking. Formative assessment is used with the aim of producing significant learning outcomes led by teachers in addition to peer and self-assessment which should be done by students themselves (Pither and Morris, 2019).

In Ireland, many educational reforms had been made such as introducing the high-stakes assessment (East, 2015), applying FA in teaching different subjects and English specifically (Chen, Kettle, Klenowski, & May, 2013), updating teachers' practices way in mathematics (Pourdavood, Wachira, & Pitre, 2015). In science, many actions had been implemented for example, re-designing the science curriculum and assessments depending on experienced teachers (Erduran & Msimanga, 2014; Ryder, Banner, & Homer, 2014), concentrating on innovation in science, technology, engineering and mathematics (STEM) in order to cope with the required assessments (Tan & Leong, 2014).

In Singapore, the most important factor that the country is concentrating on is providing teachers with effective professional development that can help them to implement formative assessment

and building their abilities to innovate in order to improve students' outcomes. Teachers must have a clear idea about FA strategies and how to implement these strategies in the classrooms to develop students' thinking skills (Koh, Lim, Tan, and Habib, 2015). The country places emphasis on using FA strategies more than summative assessment in different subjects for instance design and technology and in different computer implications as well (Change, 2009). According to MOE (2009), the latest reform is related to replacing the semester exams with bite-sized modes of assessment, which can have an important role in providing the parents of the students with continuous feedback about the progress of their learning on a regular basis. This type of assessment will help in focusing on learners' holistic development. It can also offer a balance between students' knowledge and skills.

In Singapore, educators concentrate on the paradigm shift by using differentiated tasks with the aim of meeting numerous academic requirements of learners in addition to working on curriculum changes through the help of school leaders from different stages according to students' needs (Koh et al., 2015). Furthermore, principals in Singapore have a significant role in providing effective assessments. They represent as a catalyst to transform education in the positive direction as well as to provoke new and unfamiliar ways of thinking in every individual who is involved in the educational process (Tay and Tan, 2019). In science subject framework, Singapore's teachers utilize effective strategies to implement their curriculum. Both teachers and students receive continuous training to be responsible for the process of learning (Singapore Ministry of Education 2013). Additionally, teachers offer their learners incessant support accompanied by effective feedback to identify their strength and weaknesses towards better learning results (Hogan, 2014).

In China, there is strong focus given to reform initiatives which helped the country to "achieve modern education, establish a learning society, inspire everyone to develop one's potential, and be world-class in educational development and human capital utilization". This should be implemented effectively by the year 2020 (Shanghai Municipal Education Commission, 2010). These targets can be reached through different types of assessments that contain the skills of enhancing the innovation level of learners, critical thinking skills, tasks that are related to real life applications, and providing the in-depth use of knowledge (Tan and Ng, 2018). Teachers are responsible to teach students by using effective assessments in order to be able to "acquire, add to, exchange and apply knowledge, as well as carry out research and solve problems" (Shanghai

Municipal Education Commission, n.d.). In China, educators focus on FA strategies and especially in science (Yin and Buck, 2015) because it plays an essential role in students' motivation and enhancing their achievements' results. China concentrates on applying valuable FA strategies because of its importance in building a learning habit that can guide the students and the teacher towards a positive learning process (Zhang, 2018).

2.3.1.2 The Importance of Formative Assessment Nationally and its Reform

In recent years, there has been a multiplication of various researches regarding reforming the UAE education. Nowadays, the UAE is concentrating on creating an effective plan for both government and private schools in order to reform education for international students and the Emirati students as well (O'Sullivan, 2015). A study that had been conducted in the UAE stated that there are evident inadequacies in some of the American private schools in the UAE. One of the reasons behind that is the gap or the confound between policy and practice in education. However, both teachers and learners are considered as enthusiastic supporters of reform but a few of them are not sure about the right way to implement this process. With the aim of positive educational reform, there should be a fundamental and urgent change in most of the private schools in the UAE in order to keep the required education reform pace that should be implemented appropriately in the whole country (O'Sullivan, 2015).

In the United Arab Emirates, schools that use different curricula are focusing on using and developing assessment for learning. These schools believe that FA can improve the relation between three important pillars of education which are represented by learning, teaching and assessment. This will encourage all learners to concentrate on the learning goal rather than their grades in a specific test in addition to clarify the strength and the weaknesses points about the effect of teachers' strategies that can promote students' outcomes (Abujaja and Abukari, 2019).

A research study conducted in the UAE stated that FA can improve students' results in summative assessments (Radhwan, 2019). FA is a tool that can be used to improve the academic level of students, adding to the process and results of learning. It has a strong association with the educational framework that is used in each school (Black and Wiliam, 1998). According to

Mahdawi (2019) where she stated that there is a close positive connection between implementing effective FA strategies and middle school students' achievement in science.

In the UAE, there is a lot of attention on using FA not only in schools but in universities as well (Gunn, 2013) with the aim of providing learners with constructive feedback to clear their way for further learning development and to fill the gap between the students' actual level of learning and the expected outcomes in different academic stages (Dani and Nasser, 2016). FA can also help university students to be self-directed and active life-long learners by having the abilities to assess themselves (Shaban, et al., 2016). Furthermore, FA is considered as an important instruction and technique to be used for kindergarten children in order to promote their learning through recording the development that is happening in their daily experiences. These pedagogical documentation are beneficial for students, teachers, and parents as well because they have the ability to enhance the learning outcomes and teachers' awareness about their daily lesson plans whether it is suitable to improve the students learning or not, and to offer parents useful information that can help them to obtain a clearer and stronger understanding about the procedure of learning for their children (Buldu, 2010).

As indicated by the centennial vision 2071 of the UAE, the government of the nation manufactured a comprehensive program that incorporates the improvement of a national methodology to upgrade the nation's notoriety. Regarding education, the UAE government concentrated on investing in the progression of technology; introducing morals and values in the current and the coming generations; incrementing efficiency of the economy and improving society unity. This new program should be implemented within the coming decades (five decades) was motivated by the talk of His Highness Sheikh Mohammed bin Zayed, Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces, who has placed the foundation for the new future for the UAE's generations to appreciate a more joyful life in a superior domain, with more noteworthy chances, stronger communications, and more association with the whole world. The program expected all educators to have effective roles towards creating rich educational guidelines to build life-long learners in order to reach the new target of the UAE government. According to the national media council where they stated that by 2071, UAE education should be ranked as number one between all the countries in the world, concentrating on science, advanced technology,

and engineering (UAE Centennial 2071). In this case, all educators and specifically teachers should use the best effective strategies in their daily plans that can improve the students' exam results in order to reach the new target of the UAE. FA strategies represent an important component in this target because they cover different essential needs for all students from different academic levels which will play an important role in reaching the UAE's target because teachers use and implement these strategies with their students as part of their daily learning procedures.

There are many other factors that the UAE should pay a lot of attention to in order to achieve the required level of the educational reform and to prepare the suitable environment to implement effective FA strategies and to gain better learning results. Some of these important factors can be related to the school culture (Per, 2004) where all the norms and the principles of the reform should be decided and agreed by all members of the school. A successful reform must be implemented in all levels of the school (Palmer, Dunford, & Akin, 2009) and shared with all stakeholders of the school.

The role of effective principals and leaders is considered as a key factor in the school success through emphasising the values of the school, supporting teachers and specifically the novice teachers (Ali, 2018), ensuring that the school is implementing effective learning strategies and effective leadership for further improvement (Litz, Juma, and Carroll, 2016), and ensuring positive communications with the whole staff of the school, students and parents as well (Ibrahim and Mahmoud, 2017) in addition to developing teachers' professionalism and their effect on students' outcomes (Brown and Militello, 2016).

Another essential factor is related to the quality of teachers and their essential role in reforming education. These teachers are considered as the leaders of change in most of the school aspects.

Furthermore, the UAE concentrated on providing teachers with professional development sessions that can have a positive effect on their skills in preparing their lesson planning, using a variety of teaching strategies and tools in addition to their classroom management (El Afi, 2019).

The UAE is concentrating on a lot of components that can improve the quality of education. Some of these components are related to effective teachers' planning, providing supportive school leaders, and offering professional development sessions which had been stated by Ibrahim, Al-

Kaabi, & El-Zaatari (2013) where they conducted their research study in many of the UAE schools and they had stated these important factors as some of the requirements that should be available for each UAE school in order to succeed in their teaching and learning process.

2.3.2 The Relationship between Formative Assessment and Students' Academic Results

According to Black & Wiliam (1998; 2010; & 2018) who have extensively studied formative assessment. They stated that FA strategies are considered as "activities undertaken by teachers and by their students in assessing themselves that provide information to be used as feedback to modify teaching and learning activities". In addition to improving and accelerating their learning (Black & Wiliam, 1998; Sadler, 1998). Additionally, their studies show that evaluations by giving specific marks don't provide sufficient information especially in the situation of students with low academic levels unless it is accompanied by other important factors such as a constructive feedback as an essential component of FA (Black & Wiliam, 1998). In FA, timely feedback narrows the gaps between the real learning situation and the predictable learning results. However, this might not be achievable because of other essential factors for example large class size (Chappuis, 2014).

According to Hondrich, Hertel, Adl-Amini & Klieme (2015) where they stated that there is a positive relationship between the implementation of the appropriate formative assessment strategies and students' outcomes in science classrooms. Another study confirmed the same opinion regarding enhancing the learning progression depending on the relationship between FA strategies and learners' achievements in the science subject (Alonzo, 2017). Consequently, teachers should be aware of pupils' learning progressions so they can framework inquiries at key focuses in the unit (Duckor, 2016).

In Australia, a study indicated the importance of using effective FA elements in order to benefit students in summative assessment (Broadbent, Panadero & Boud, 2018). Moreover, FA can notify and update students, teachers, and parents about their learning goal and its relation with school learners, plus what should be possible to enhance ensuing execution (Black and Wiliam, 2010;

Dixson and Worrell, 2016) as well as to expect students' scores in summative tests (Fancsali et al., 2018). FA is considered as a gap-minder since it causes the educator to remain cautious towards gaps in learners' advancement and to modify guidance as required before proceeding onward to the following level (Roskos & Neuman, 2012). As a result, this type of assessment can provide chances to advance the improvement of learner's abilities in explanation and reasoning (Bulunuz et al., 2016).

Moreover, the process of formative assessment implementation for students should be viewed as a consistent procedure including numerous parts shaping a closed circle that is gathering relevant and usable data as well. Therefore, these data should be shared between a learner and everyone involved in this process in question, to cooperate along with improving self-directed learning objectives, supervision, and resources with the intention of achieving these aims. Additionally, the implementation process needs to be frequently followed up to reach the distinguish advancement level plus to solve the obstructions that might affect the results in order to accomplish the FA objectives (Konopasek, Norcini & Krupat, 2016). In science, various researches are offered by the National Science Teachers Association where they stated the role of FA in improving the students' outcomes. Their statements support to guide different educators in the process of designing and implementing the curriculum that tends to significant science objectives and addresses significant science aims and standards (Wiliam, 2008).

Atech (2015) indicated the crucial role of understanding the level of students' conceptual knowledge in order to implement effective instructional decisions in science classes. In this case, teachers will be able to match their perceptions about the scientific FA practices that should be used in their classes and what should be considered as an effective FA. In this case, teachers might be able to improve the students' performance. In this situation and by using the right FA strategies, learners will understand and use their own suitable learning goals, select the appropriate learning strategies as well as evaluate their development. After that and in the next stage, students will be more confident and independent learners through teachers' motivation strategies. They might become progressively ready to persevere during the required tasks in addition to adjust and direct their own exertion and actions when they handle new learning difficulties (Andrade, Bennett and Cizek, 2019). Therefore, understanding the significance of FA and the right way to implement it in students' classrooms can show its important value. FA is considered as the key factor that will

lead to understanding the students' needs in a better way. FA can also be considered as an assessment factor for many teachers because it is able to show them the areas where the learners are struggling (Akkaraju, Atamturktur, Broughton, and Frazer, 2019) then they will have a clear idea about the next step that they have to prepare and use with their students.

A lot of studies (19 studies) had been conducted by the Regional Educational Laboratory (2017) in order to investigate the effect of using FA on the learning of school students. These studies provided adequate information to indicate the positive effect of FA (Klute, Apthorp, Harlacher & Reale, 2017). The results confirmed that all the participating learners who were engaged in the FA tasks gained higher scores than other learners who did not use FA. The conclusion of the 19 conducted studies stated that "On average across all the studies, formative assessment had a positive effect on student academic achievement" (Klute et al., 2017, p. 6). This study can shed the light on the importance of using FA as a main strategy in the process of teaching and learning for advising all educators who are working towards developing the skills and the high academic results for their students (Huisman, 2018).

On the other hand, the opposite way can be effective as well, teachers confirmed that it is important to use the analytical data of the students' benchmark test as a clue to modify their formative assessment strategies and instructions (Abrams, McMillan, & Wetzel, 2015). If teachers use this information accompanied by significant factors that are related to students such as cooperative work in different groups, receiving support, obtaining the skills of valid and clear exams, getting results with clear constructive feedback and individual discussions, all of these essential factors will indicate that the benchmark exam courses that are conducted throughout the year can provide meaningful FA strategies that will have an important role in enhancing students learning (Abrams et al., 2015).

2.3.3 The Importance of the MAP Exams

One of the most effective benchmark tests that all American curriculum schools are required to do is the MAP exam, which stands for "Measures of Academic Progress". This test had been generated by the Northwest Evaluation Association. A non-limited time test is utilized to quantify the knowledge, the understanding, and the learning skills of each student in different subjects

including Math, Science, Reading, and Language usage. It is a "computerized adaptive test" directed to students twice in each academic year (Cordray et al., 2012). However, some of the American curriculum schools in the UAE decide to implement the exam more than twice. It can be conducted three to four times in the same academic year in order to gain a clearer result about assessing the progress of the school students (Jones, 2015; Medford, 2014; Northwest Evaluation Association, 2012).

MAP exam can be changed and adjust the level and the difficulty of the exam questions according to the academic level of each learner after each given question (Cizek & Gierl, 2016; Jones, 2015; Medford, 2014; Northwest Evaluation Association, 2012). MAP exam is considered as one of the most effective projects that had been used by educators (Ash & Sawchuk, 2008). This type of exam can measure both the learner's progress and his-her academic growth in a specific period of time. After that, once the students complete their exam, the system will provide the school educators with detailed data that can explain the level of knowledge for each student and what they are able to learn (Cordray, Pion, Brandt, & Molefe, 2013).

This test starts by including a specific level of different questions that matches with the level of the students. What makes the MAP test special is its way of implementation or instance, when the student is not able to answer the question correctly, the computer will then introduce a simpler question. Whatever is left of the questions then depends on the performance of the learner in the previous results (Paul, 2015). Although the MAP exam is a non-limited time exam, it might take forty five minutes or an hour to complete the test for one specific subject.

Students' performance can be seen using a single, cross-grade scale which is entitled as the RIT scale Northwest Evaluation (2013). This scale stands for Rasch Unit that represents as one of the models of IRT (Jones, 2015; Medford, 2014; Northwest Evaluation Association, 2012) which contains all the MAP exam items. It indicates the knowledge, the understanding, and the skills level of each student where the teacher can decide the appropriate academic level that he/ she has to start with each learner in order to improve their learning outcomes. IRT can be utilized to analyze the process of learning that is related to the MAP exam involving three important components; designing, scoring, and analysing (Hambleton & Swaminathan, 2013; Lord, 1980; Makransky et al., 2016). Moreover, RIT can be identified as the Zone of Proximal Development

when each learner reaches the point between the level of knowing and not knowing when answering the question in a wrong way (Barber, 2017).

Even though the MAP exam was not generated to essentially relate with other types of high stakes testing and its goal was to illuminate guidance and clarify teachers' instructions. Numerous investigators assessed it for the effect on learners' scores in different types of exams (Barber, 2017). Furthermore, a research study confirmed that the benefits of the MAP exam concentrated on two important things; firstly, obtaining the students' assessment results from the computer several times in a year and secondly, the capability of using these data to re-plan teachers' instructions for better learning outcomes (Cordray, Pion, Brandt, and Molefe, 2013). Thus, using MAP exam for more than a year, several students' academic results indicated a significant improvement in the performance of both high and low ability students (Barber, 2017). According to Cordray et al. (2013) where he confirmed that "The MAP program may have the greatest effect among low and high ability students" (p. 10).

Currently, the utilization of standardized benchmark measures to distinguish and modify the educational instructions has received invigorated consideration from all educators (Public Agenda, 2008; Russo, 2002). Numerous areas and states invest a huge amount of both time and money with the intention of testing their pupils depending on different standards and states. In all American curriculum schools, educators must implement MAP exam learning continuum. According to Baenen et al. (2006), benchmark exams might be further valuable in assisting teachers to decide their future plans about separating instruction, which can prompt gains in students learning. In addition to gaining outcome improvement and higher scores in the standardized tests.

Educators are interested in using benchmark tests and especially the NWEA MAP (Measures of Academic Performance) test for their academic benefits. A lot of advantages had been stated by several researchers about the exam of MAP, mostly because of its own characteristics such as the grade-independence and the equal-interval scale (Jones, 2015; Medford, 2014; Northwest Evaluation Association, 2012). A portion of these advantages are identified with the individualized idea of information it gives. Instead of essentially recognizing whether a student is capable or not, MAP information demonstrates the strength and the weaknesses for every learner individually. It

additionally demonstrates every student's range of abilities on a learning continuum. This way has an essential advantage for the teachers to direct them to determine the needed skills to be developed for every learner (Johnson, 2019). On the other hand, the leaders of the school and specifically teachers should be experienced in using these data effectively in their learning procedures to enhance the students' achievement (Bertrand & Marsh, 2015; Johnson, 2019; Van Lare, 2016). According to Abrams, McMillian, and Wetzel (2015) where they stated the importance of using the analysis of the learners' MAP results when they said that "Teachers described using benchmark test results formatively to make a variety of instructional adjustments, including, modifications to whole class instruction, working with students in small groups, and providing individualized support" (p. 1).

The continuous benchmark tests enable educators to look forward at abilities that might challenge students and aid them to develop their academic skills and outcomes (NWEA, 2018b). By collecting, comparing, and matching the information gathered from the MAP tests, teachers will have an additional tool to affect their guidance. According to Paul (2015), there is a significant difference between traditional standardized tests and the MAP tests. The first one concentrates on comparing the level of the students' performance with a big number of students of the same age. These types of tests can help in deciding and determining whether pupils have met specific educational standards. These outcomes would give next to no data about student's genuine adapting needs or advancement. On the other hand, the MAP exam is different and distinctive on the grounds that it adjusts to the academic level of the student. It can provide an indication to guardians and educators about the students' instructional level and recognize ideas and terms that the learner might be prepared to learn. At the point when students retake the exam again later in the school year, the outcomes can gauge the learner's advancement, development and after that be utilized to distinguish new concepts to concentrate on the progress of each student (Paul, 2015).
According to NWEA, MAP exam is useful to assess students in science. It gives a clear idea about their prior knowledge and the future academic needs in their science curriculum to prepare them for upper high school. The evaluations are adjusted to national and state standards built up by The American Association for the Advancement of Science Benchmarks for Science Literacy and the National Research Council's National Science Education Standards.

In science, NWEA stated that the MAP science exam which is used with the Next Generation Science Standards NGSS provides a wide variety of content intricacy and cognitive thoroughness. This is achieved by using the connection between the items of the MAP exams and the different level of Webb's Depth of Knowledge (DOK) that has the ability to assess and measure the student's academic and cognitive level starting from the first level of recalling the information to the highest level that is related to extended thinking such as reasoning and designing.

2.3.4 The Effectiveness of Formative Assessment Strategies on Students' Learning Outcomes

Implementing specific types of FA strategies in classrooms depend on various factors. Teachers must be knowledgeable enough in order to decide the aspects that they need to measure in their learners. At that point, they should select the strategies that can achieve both the required aspects and the students' learning preferences (Regier, 2012).

One of the advantages of FA strategies is the ability to use it in different ways according to students' need. For example, it can be given to the whole class, in small groups of students, as partners or (independently) for each individual. Teachers are required to utilize a variety of FA strategies that combine the individual needs and the group needs. In this case and when teachers use the group strategy, they will have a general idea about students' learning needs in order to plan accordingly. In the case of using the individual implementation strategies, teachers will have a clear image about the knowledge, the understanding, and the skills that they have to measure for each learner. After this stage, students will also be able to utilize the information of FA to change the process of their learning positively (Regier, 2012).

At the point when teachers work collaboratively with their students and link their forces together in the procedure of FA, their cooperation creates an influential learning result in a positive direction. In this case, different changes will take place in class in relation to teachers' effectiveness and the active engagement development for students in order to be assessment-capable, and the two of them (the teacher and the student) will become international learners (Moss and Brookhart, 2019). Formative assessment strategies have a strong effect on students learning. When teachers implement various effective strategies in the classroom as part of a daily lesson plan, this will lead to strengthen the formative classroom practice. As a result, teachers will have

better opportunities in categorising the needs of the learner in addition to adjusting the process of teaching and learning accordingly (Andersson and Palm, 2017).

Even though a lot of studies indicated the importance of FA and how it is observed as an active and favourable strategy towards improving the process of educating according to the new up to date academic standards, there is a substantial requirement for further research on specifically how these strategies affect the learning of the students and what types can have a noticeable effect on teaching and learning (Rakoczy, Pinger, Hochweber, Klieme, Schütze, and Besser, 2019).

In the United Arab Emirates, most teachers believe in using collaborative work as one of the most effective teaching strategies with the intention of implementing active learning between students towards better accomplishment results. Educators in the UAE stated that these positive outcomes can be achieved inside and outside the learning environment when learners work cooperatively with each other on different complexity levels of tasks and activities (Almekhlafi, 2016).

Various studies specified (Gok, 2018; Puente and Swagten, 2012; Seung, 2013) that using the didactic teaching approach which is led mostly by teachers (Teacher-centered) is not adequate to reach the required knowledge skills, understand different scientific terms effectively, solve critical and reasoning problems and to develop analytical thinking abilities for all levels of students (Fraser, Timan, Miller, Dowd, Tucker & Mazur, 2014; Gok, 2012; Gok, 2015; Kuo and Wieman, 2016). Therefore, teachers should use student-centred teaching as an effective teaching strategy in their daily lesson plans. As stated by Talbert, Hofkens, and Wang (2019) where they confirmed that there is a positive relationship between the student-centred teaching strategy and the excellence and the equity improvement in education. Moreover, this strategy will enhance the students' cognitive, behavioural and social engagement skills in their future performance.

The following formative assessment strategies that all teachers have to utilize in everyday classrooms will provide constructive feedback that can help in identifying the missing skills that each student needs in addition to offering teachers strong evidence that will help them to decide whether they need to re-direct their instructions or not. Furthermore, it can provide learners with information that will help them in assessing their own learning and their colleagues' learning.

These FA strategies are described as examples about some of the strong interactions that should be existing between the students and different educators (Cizek, Andrade, and Bennett, 2019).

2.3.4.1 Think-Pair-Share Teaching Strategy

The Think-Pair-Share (TPS) strategy is considered as a cooperative learning strategy (Sampsel, 2013) where students are encouraged to complete the assigned tasks collaboratively. It can provide all learners with opportunities to explore and express their opinions with other classmates and reflect on them (Tint and Nyunt, 2015). Through working cooperatively, students will be able to connect between the topic's new information and their current knowledge, fostering the awareness of being responsible for an important role in the team with the aim of fulfilling the targeted objectives (Trent, 2013). In addition, students will be more effectively engaged while considering the ideas introduced during their discussions (Kaddoura, 2013).

According to Lyman (1981) who established the TPS strategy, whereby he specified that this strategy provides a learning practice that includes additional challenging activities. It consists of three steps. The first step (Think) is related to the individual thinking about the given question or the problem by the teacher (Lyman, 1981; Umam, Suswandari, Wibowo, and Rohim, 2017). The second step (Pair) is connected to discussing ideas, opinions and exchanging information with other students in the team while the third and last step (Share) is linked to sharing the final conclusions from each team with other groups and the whole classroom (Abidin, Amin, and Sulaiman, 2018; Supardi and Zukarnain, 2016; Tint and Nyunt, 2015). In TPS strategy, each student must have a role and participate in a particular stage of the assigned task with the rest of the class. By sharing and discussing different ideas, students will have better opportunities to gain communication skills and to be more confident (Mutakinati, Mudzakir, and Supriyanti, 2015). All of these three steps should be completed in a specific time which has to be assigned by the teacher while learners need to share their ideas and reach their conclusions within the specified period of time in order to accomplish the idea of Think-Pair-Share (Azlina, 2010).

The TPS strategy is considered to be one of the most effective teaching strategies in the educational field according to its relation to numerous important factors for future academic requirements

(Kothiyal, Majumdar, Murthy, & Iyer, 2013) such as working with others collaboratively and having the needed speaking skills to participate in a variety of discussions (Fandy, 2019). It can be utilized as an assessment tool when the leaners share their thoughts in different teams, the teacher will be able to evaluate them according to their abilities in these discussions (Gok, 2018).

This strategy has an essential role in developing the learners' communication skills through reducing the difficulties that hinder oral communication, generating a collaborative learning environment, growing the creativeness of students to reach a better level of active learning in addition to improving their reading skills (Maulana, 2019; Sumekto, 2018). Think-Pair-Share strategy can also build important skills in students' personality, for instance being more confident in sharing and discussing their ideas with other students from different academic levels (Raba, 2017; Rifa'I and Lestari, 2018). This strategy has many advantages. For example, it is easy and not complicated, needs few instructions within a short time. It can be conducted in diverse group sizes and in any stage of the learning process (Allen & Tanner, 2002; Kothiyal et al., 2013; Prahl, 2017; Raba, 2017; Trent, 2013). Furthermore, the role of the teacher in this strategy should be to facilitate the instructions and guide the students while working cooperatively (Barkley, Cross, & Major, 2005). Teachers can assess the understanding of the learners by observing their performance during all the stages of the TPS strategy (Gok, 2013).

In the United Arab Emirates, a study confirmed the positive effect of working cooperatively through different teaching strategies in improving the students' outcomes in science subjects (Radhwan, 2016). TPS strategy can promote the students' learning not only in science subjects (Gok, 2018; Ogunyebi, 2018) but in other subjects and other countries as well, as stated by (Bamiro, 2015; Kwok and Lau, 2015) where they indicated the importance of using Think-Pair-Share strategy in enhancing the learners' achievement in general science, chemistry and mathematics. They also specified that by using this strategy, students will have greater potential and they will be able to obtain significantly higher scores than students in sessions that depend on a didactic teaching approach which is led by teachers.

Moreover, other authors (Puente & Swagten, 2012; Redish, Saul, & Steinberg, 1998; Seung, 2013) indicated that the conventional way of teaching is not effective enough to help learners to understand different scientific concepts in depth, to find solutions for complex problems, to

develop scientific reasoning abilities as well as to promote students skills that are related to critical and analytical thinking (Fraser, Timan, Miller, Dowd, Tucker, & Mazur, 2014; Gok, 2012; Gok, 2015; Kuo & Wieman, 2016).

According to the results from Pietarinen, Vauras, Laakkonen, Kinnunen and Volet (2019) where they stated the importance of using collaboration work in peer groups as one of the FA strategies. Their results indicated the positive affect on students' performance in different tasks regardless of the high cognitive demands. The authors used the structural equation modelling in order to analyse the effect of utilizing cooperation work on learners' performance in groups, the study admitted the link between the effect of teamwork and the students' outcome.

Moreover, teachers' outcomes demonstrated an equal connection between positive effect, logical understanding, cooperation, students' confidence and support. The results from this investigation add to the rare writing about the nature and significance effect of teamwork on learning in science.

Various studies had confirmed the positive relationship between FA and the TPS strategy. TPS strategy can provide learners with numerous chances to make sure that the learning process is on the right path by using formative assessment with other members in the classroom through solving different problems and promoting high order thinking skills (Cortright, Collins, & DiCarlo, 2005; Gok, 2015; Sampsel, 2013; Smith, Wood, Adams, Wieman, Knight, Guild, & Su, 2009). Additionally, Demirci and Düzenli (2017) indicated that teachers can use the TPS strategy in order to stimulate students' active learning and conduct FA in a time-effective and well-organized way. Another study confirmed that using FA and TPS strategy for junior high school led to a positive significant increasing in the results of learners by being active participants in the classrooms (Pradana, Sujadi, and Pramudya, 2017). According to Faulconer & Wood (2019) where they stated that FA can be used as an engagement strategy when students are thinking and sharing their ideas with their peers. This can also have a significant role in recognizing learners' gaps with the aim of identifying students' points of strength and weakness for a better plan creation.

2.3.4.2 Feedback Strategy

The effectiveness of the formative assessment procedures depends on significant strategies; giving feedback is one of these strategies. This strategy can be directed from the teacher to the student or

from the students themselves to each other. The main challenge for educators is to make sure that the students can perceive feedback and to find the suitable ways in order to improve their academic level (Small and Attree, 2015).

There is an important connection between the students' opinions and feedback about themselves and their academic results, especially when they compare it to their peers. Students who can reflect on their work, decide their need for further improvement and control the process of their own learning are considered as the most powerful learners (Boaler, 2016).

As stated by Boaler (2016), "the perceptions that students develop about their own potential affect their learning" (p. 146). These students have better capabilities to generate a successful learning environment for themselves and they will have less distractions in addition to effective learning partners (Schunk and DiBenedetto, 2016).

Feedback is a fundamental feature that is directly related to teacher's successful strategies for all students from different levels in all subjects (Gan, Nang & Mu, 2018). In the educational field, there is a close and direct relationship between teachers' feedback and students' assessment outcomes. Formative feedback is considered as a key strategy in the process of teaching and learning (Poulos and Mahony, 2008) that can help learners to succeed (Bhagat and Spector, 2017; Spector &Yuen, 2016). It represents an essential part of students' evaluation which incorporates the three main pillars of education: teaching, learning, and assessment (Lee, 2017).

Formative feedback has a powerful effect when it implements appropriately, specifically if it is related to cognitive and motivational factors simultaneously (Brookhart, 2017; Lee, 2008). Hence, in formative assessments, teachers should provide their students with descriptive and diagnostic feedback with the aim of helping them to understand their academic level and strong and weak points, as well as to develop their learning (Lee, 2017). In this case and when the subject teacher offers effective feedback in various structures such as (written and oral feedback), students will get the main points of the successful personal assessment in order to support themselves in learning the needed requirements from the provided assessment tasks that they will experience during the academic year (Dessie and Sewagegn, 2019).

There are different types of students' feedback, one of these types is called diagnostic feedback which is defined as "grounded in a knowledge base about how learning takes place," it is recognized as an active type of feedback (Jang & Wagner, 2013, p. 2-3) because it is considered

as an essential factor in identifying strengths and weaknesses in learners' understanding. This type of information can support students in reflecting on their work and learning from their mistakes (Jang & Wagner, 2013). These students have a better opportunity to learn faster than other students who depend on their marks only as well as develop their self- perceptions (Boaler, 2016).

The other type of feedback is called constructive feedback which plays an important role in identifying effective ways that enable students to develop and stimulate additional educational progress (Lamb, 2019). According to Sadler, when students receive information about their academic level, they should use this evidence as an active way for their development. Additionally, they need to understand the specific criteria that the teacher used to assess them. In addition, teachers must provide them with the right tasks for better progress (Landers & Reinholz, 2015).

In the educational field, giving constructive feedback is considered as a neglected issue (Walker, 2009) because teachers rarely provide their students with the essential information about how to build and develop their missing skills. Therefore, many students face difficulties to meet their learning goals (Al-Hattami, 2019).

Although feedback is considered as one of the most powerful strategies in students' learning, procedures and achievements (Dessie & Sewagegn, 2019), this might have either a positive or negative effect depending on its type and the way it is given to learners (Hattie & Timperley, 2007). Providing students with constructive feedback will help them in promoting their metacognition and recommend how certain feedback can increase higher-order learning results (Tan, Whipp, Gagné, and Van Quaquebeke, 2019).

In addition, constructive feedback can assist learners to think properly and empower them to be self-regulated students (Fautley and Savage, 2008; Moss and Brookhart, 2009; Sadler, 2010). This type of feedback will be simply understandable for all learners and it will play an important role in closing the academic gap between students and providing different opportunities for class discussion (Irons, 2008). Furthermore, teachers' constructive feedback can provide learners with guidance for their future plans because they will be able to specify their current educational level and the needed skills to improve that level (Sadler, 2010). If students understand what to do and

the reason behind doing that, they will be motivated for further development as they feel that they can control their learning.

On the other hand, teachers should provide students not only with constructive feedback but with different and suitable learning tasks for a better educational level (Brookhart, 2017). These tasks should depend on cooperative work where students can participate in solving different problems and discuss them with others by using their high order thinking skills (Eleanore, 2012). In this case, students' paradigm shift will move from the traditional way of assessment practices to the authentic way. After that, they will have the capability to evaluate their thinking skills and increase their responsibility towards building their learning profile (Black and Wiliam, 1998; ARG, 2002). Additionally, teachers need to have the right competence accompanied by a positive belief in their students' abilities for effective feedback (Gul, Tharani, Lakhani, Rizvi & Ali, 2016). They must ask their students to concentrate on the missing skills by re-doing the work with different strategies under teachers' supervision in order to make sure that they are able to meet their goals (Al-Hattami, 2019). However, there is a misconception about understanding the concept of feedback from a lot of teachers, whom thought that students' graded work can be considered as effective feedback (Moss and Brokhart, 2009). This type of feedback has a negative effect on the students' academic level because it depends on their marks only which will lower their perceptions about themselves and it will cause students' demotivation specifically if they compare their results with other students that have a higher academic level. In contrast, teachers and students must concentrate on gaining skills from the learning procedures (Boaler, 2016). Furthermore, teachers believe that written feedback is a waste of time and students do not depend on this type of judgment, instead, they only care about their actual results (Spiller, 2014).

According to Black and Wiliam (1989) where they recommended that formative feedback has to focus on showing the students' positive points, offer suggestions for further progress, and abstain from comparing one student with another. In this case, the provided feedback might be especially useful to low achieving students since it emphasizes that learners can enhance their learning when they put in an effort (Ames, 1992: Prashanti & Ramnarayan 2019). According to Brookfield (2015) where he stated that,

> "*Feedback should not leave students just feeling good or bad about what they've done; they should provide guidance as well. If students only feel warmed or ashamed by our evaluation then formative assessment will fail in its purpose to be educative*".

Teachers' feedback has to contain information that focus on the gap of the student's learning in order to compare and identify between the actual knowledge level of the learner and the desired level that his/her should be reached (Ramaprasad, 1983; Sadler, 1989). This type of feedback should be done accurately, timely, clearly can provide the students with the needed reinforcement to reflect on their own learning process as well as to gain the feeling of the important change (Gray, 2018). In this situation, FA should be implemented in a way that can provide students and teachers with an early plan to have enough time to assist in making the needed modifications for the student's learning process (Garrison and Ehringhaus, 2018; Prashanti & Ramnarayan 2019). Therefore, teachers' feedback plays an important role in delivering and enhancing a significant effect that is able to develop students' learning outcomes (Kyaruzi, Strijbos, Ufer, and Brown, 2019).

2.3.4.3 Problem-Based Learning Strategy

Problem-based learning (PBL) strategy is a student-centered pedagogy where they can learn effectively by gaining new experiences via solving different open-ended problems in various subjects specifically in science and math subjects. This strategy concentrates on developing learners' desirable abilities and attributes (LaForce, Noble, and Blackwell, 2017).

PBL is a strategy that enables students to improve their autonomy, work independently by controlling the learning process through shifting the focus from the class teacher to learners in addition to applying their knowledge and skills towards developing appropriate solutions to problems with different levels of complexity (Savery, 2015). In addition to provide students with a higher level of motivation, engagement as well as critical thinking (Grant, 2011; Jerzembek & Murphy, 2013; Sungur & Tekkaya, 2006; Tamim & Grant, 2013). Problem solving is considered as one of the most essential life skills that involve different processes such as analyzing, reasoning, and reflecting (Anderson, 2009; Karatas and Baki, 2017).

In science, several educators identified PBL as one of the best strategies that they depend on in teaching their subject in interdisciplinary ways because it has the ability to improve students' thinking and reasoning abilities in science (Asghar, Ellington, Rice, Johnson, & Prime, 2012; Merri, Lee, Rillero, & Kinach, 2017; Schettino, 2016). Furthermore, PBL offers learners with inquiry skills and real-life applications that have a direct connection with science knowledge (Hmelo-Silver, 2004; Navy, Edmondson, Maeng, Gonczi, and Mannarino, 2019).

Educators have observed that students who learn science through the PBL strategy are more satisfied than the others. In addition, this strategy can build a positive and strong relationship between the teacher and the student (Hugerat, 2016). One of the essential factors that can help students to reach a high level in PBL is the effective use of FA strategies (Mahdawi, 2019).

In science, the strategy of problem-based learning has an important advantage for science teachers because they can use PBL as a differentiated strategy for students from different academic levels. This strategy is suitable for all ages of the students starting from K-12 students to college students, it provide questions from real life situations with the purpose of preparing learners to gain experience that can help them to face similar situations in their future life (Cotton, 2019).

Teachers should prepare an effective lesson plan that involves well-structured problems with various conceivable solutions, these scientific problems must be connected with unfamiliar problems, brainstorming, implementation, and assessment (Gorghiu, Drăghicescu, Cristea, Petrescu, and Gorghiu, 2015). In this situation, students need to have a strong background knowledge that should be built during the previous years in order to find the appropriate possible solution. Additionally, this strategy will shift the teaching style away from the traditional method which is led by teachers to a student-centered method where the students control the learning process. This strategy will improve the students' thinking skills and enhance their knowledge about the content of science (Burris & Garton, 2007).

There is a clear relationship between the data of the students' outcomes in the international exams such as the Third International Mathematics and Science Study (TIMSS) test and the Program for International Student Assessment (PISA) test with teachers' practices and assessments in science and math subjects. These exams can prove if the teacher is taking learners on the right path of the next academic stage or if she/he needs to modify or change the subject practices' task (Mullis, Martin, Gonzalez, Gregory, Garden, O'Connor, Chrostowski, & Smith, 2000; Kartono, Arumsasi,

and Mariani, 2019; Simamora, Sidabutar, and Surya, 2017) that the students have to provide with. Hence, TIMSS and PISA exams explain an obvious association between the skill of problem-solving and students' academic success in science (Karatas and Baki, 2017; Sugiharti, and Hamid, 2019).

Teachers must implement PBL strategy in their yearly curriculum in a challenging way through encouraging students to work collaboratively and independently (Karatas and Baki, 2017; Pecore, 2013). Additionally, they have to provide learners with suitable assessment practices that match the level of the problem solving skill (Grant, 2011; Tamin & Grant, 2013).
Moreover, teachers' understanding of the new rules of teaching strategies is a crucial factor for better outcomes (Bakkenes, Vermunt, & Wubbels, 2010; Pecore, 2013; Sabah & Du, 2018). One of these important factors is the teachers' belief in modifying learners' behaviour and practices (Mihaela & Alina-Oana, 2015; Rico & Ertmer, 2015). Teachers' beliefs and their subject task preparation accompanied by their instructional decisions and the classroom environment are closely related (Wang & Du, 2016) because they reflect the understanding of them about selecting and implementing the appropriate instructions that can enhance the results of the students (Ahonen, Pyhalto, Pietarinen, & Soini, 2014; Al Said, Du, ALKhatib, Romanowski, and Barham, 2019).

FA plays an important role in implementing the PBL strategy and planning for it. Specifically, in science, a study confirmed that the FA can be used as a starting point to plan for PBL instructions in the classrooms, probe learners' prior knowledge and understanding, discover their interests and plan accordingly (Trauth-Nare and Buck, 2011). Furthermore, another study indicated that FA has an essential role in PBL through enhancing the interests of students to learn and to advance their perseverance on tasks, and improve their competences in different areas for example critical thinking, working collaboratively in groups, solving more complex problems, and to increase their desire of being more effective in creativity and innovation (Koh, Delanoy, Thomas, Bene, Chapman, Turner, Danysk, and Hone, 2019).

2.3.4.4 Self-Assessment Strategy

One of the significant educational targets is to prepare students to be independent learners. This process should take place gradually until they reach the level where students will be able to learn without guidance from their teachers (Jax, Ahn, and Lin- Siegler, 2019). One of the basic components of this aim is the capability of learners to reflect on their work and to self-assess their own development and understanding as well (Ho, Leung, Mok, & Cheung, 2013; Mok, 2013).

Self-assessment can be defined as 'the involvement of learners in making judgements about their achievements and the outcomes of their learning'. It is considered as one of the most valuable approaches that can support the learning of students, mainly when utilized formatively. This type of strategy is able to support students in their learning process in addition to its importance as a required skill to help students in being life-long learners because it improves their ability to be evaluators for their own learning (Wride, 2017).

Brown and Harris (2013) believed in the significance of self-assessment strategy. They defined it as a "descriptive and evaluative act carried out by the student concerning his or her own work and academic abilities" (p. 368). On the other hand, other authors like Panadero, Brown, and Strijbos (2016) considered the strategy of feedback as a "wide variety of mechanisms and techniques through which students describe (i.e., assess) and possibly assign merit or worth to (i.e., evaluate) the qualities of their own learning processes and products" (p. 804).

Consequently, this strategy is closely related to the important features that should be built in students' character such as their abilities, control, and authority (Brew, 1999; Wride, 2017). In this situation, teachers will have a vital role in transferring these characteristics to their students (Brew, 1999; Wride, 2017).

Self-assessment is considered as a feedback (Andrade, 2010) with the aim of informing modifications to practices that deepen the process of learning as well as to enhance the performance of the learners (Andrade, 2019). This strategy has a lot of advantages on the whole field of education, it can provide each student with individual and personal information and reflection that is related to his/her own learning. It will also enhance the potential of students' improvement as a lifelong learner (Sharma Jain, Gupta, Garg, Batta, and Dhir, 2016).

Furthermore, it can help the students in having a clear idea as well as identifying their strengths and weaknesses and the main points that they have to work on in order to enhance their performance (Fahimi & Rahimi, 2015; Falchikov & Boud, 1989; Graham and Harris, 1993; Boud, 2000; Zimmerman, 2002).

Self-assessment strategy can motivate learners in a better way towards promoting their academic results in addition to assist them in developing their thinking skills. In this case, students will have better opportunities in evaluating their work (Sharma, Jain, Gupta, Garg, Batta, and Dhir, 2016). In the educational field, the ability to assess an individual performance is considered as a pervasive concept because it is the key component for students to be an autonomous learner (Benson, 2011; Borg & Edmett, 2018).

According to the National Research Council Committee on Conceptual Framework for the New K-12 Science Education Standards, self-assessment is crucial to scientific literacy. In addition, it has been integrated into the Next Generation Science Standards (NGSS). Nonetheless, minimal evidence records which educational tools are useful in increasing learners' self-assessment in educating science (Jax, Ahn, and Lin-Siegler, 2019).

Self-assessment is related to different essential factors more significant than the one that is related to a student's mark on a specific test. It is important in determining and defining what is considered as a good performance (Boud, 2013; Panadero, Tapia, & Huertas, 2012). Precisely, it is connected to monitoring and evaluating the students' thinking quality as well as their behaviour (Peters & Kitsantas, 2010). It is also linked with identifying the appropriate strategies that can improve a learners' way of understanding and building abilities (Dunlosky & Rawson, 2012; Pintrich, 2004; Zimmerman, 2006, 2008).

When students can evaluate their own work and recognize their performance differences and classify them according to weak and strong points between the previous and the current stage, they will be capable of developing their performance (Mok, 2013). Through this way, students will be on the right path towards a better judgment for their self-regulation and critical reflection, which will lead to improve their academic achievement (Azevedo, 2005a; Lin-Siegler, Shaenfield, & Elder, 2015; Peters & Kitsantas, 2010; Lopez, Nandogopal, Shavelson, Szu, & Penn, 2013; Winne, 2005; Zimmerman, 2008).

In order to make the right decision about the students' academic level, they have to utilize their own feedback derived from their own self-assessment accompanied by additional external resources such as (subject teacher, criteria, and/or class work solutions) which can lead them to

more precise answers (Ho et al., 2013; Mok & Lee, 2017; Veenman, 2011; Zimmerman, 2006, 2008; Zimmerman & Campillo, 2003). As a result of that, using this strategy will be beneficial in fostering planning, monitoring the learning process, and organizing its efforts (Eva & Rigehr, 2007). Furthermore, and according to the results from the National Research Council Committee on Conceptual Framework for the New K-12 Science Education Standards (2012) where they identified both the strategy of self-assessment and the strategy of self-regulation as significant components in understanding the scientific concepts. They confirmed that "scientists need to be able to examine, review and evaluate their own knowledge and ideas and critique those of other" (p. 27).

According to the Next Generation Science Standards, the basic idea of science relies upon the student's competency to grasp the difficulties of learning and generating new information with the aim of perceiving the lack of one's own judgments and personal experiments, to react to feedback from different peers in addition to having the ability to determine and readdress mistakes (Lin-Siegler, Ahn, Chen, Fang, and Luna-Lucero, 2016; Shumow and Schmidt, 2015).

There is an important need for learning how to assess our work for instance, scientists faced many difficulties and failure when conducting different experiments but learning from their mistakes led them to effective and positive results (LinSiegler et al., 2016; Shumow & Schmidt, 2015). Teachers must build and support students in evaluating themselves critically in addition to finding solutions and modifying them if needed (Mok & Lee, 2017).

There are several benefits that the learners can make a positive use from by following the strategy of self-assessment and the teachers' instructions. Some of these advantages are related to being motivated to complete the learning task and monitor the work results independently. These learning characteristics are essential components in improving students' thinking and problem solving skills (Andrade, 2010; Boud, 2013) along with taking the responsibility for their own decisions (Boud, 2013).

Therefore, self-assessment is considered as a fundamental strategy in teaching the science subjects because these subjects depend on effective skills such as the ability of students to control their own learning and making their own decisions without depending on others for giving judgments (Karelina & Etkina, 2007). Additionally, it supports learners' self-improvement, assisting them to become more active and positive learners (Boud, 2013) through allowing them to modify their

learning process according to their needs (Schwartz, Tsang, & Blair, 2016). Moreover, it helps the students to engage together in the direction of understanding the appropriate criteria for effective practices and positive academic results (Jax et. al., 2019).

In regards to the relationship that connects between the self-assessment and the FA, a study conducted by Andrade (2019) stated that students' self-assessment will be more beneficial and effective on the learning outcomes of each learner when it is implemented formatively in the classroom through the use of FA. Moreover, Harris and Brown (2018) indicated that using self-assessment strategy with FA is considered as a key component for active learning because FA can provide the required components of different resources that is aiming to support students' learning in disciplines of education (Lee, Pomeroy, and Schneider, 2018).

2.3.5 Teachers' Role in Implementing Effective Formative Assessment Strategies

There are various factors that a successful education depends upon, but teacher competence is considered as one of the most significant aspects that will affect the improvement of education directly (Astawa, Mantra, Widiastuti, 2017). The term "Competence" can be identified as a combination of knowledge, abilities, as well as attitudes. This set must be practiced, learned and understood by each subject teacher through their performing and displaying professional responsibilities (Dantes, 2014). Teachers represent the main core of attention to build a positive quality of education by having a good competence level (Mantra, 2016).

The competence of school teachers is translated into the unanimity of teachers' knowledge, skills, and attitudes. These essential factors can be evaluated through their capabilities and obligations in implementing different educational tasks that will help them in following the right path of learning and making suitable changes for better academic outcomes. The ability of an educator incorporates individual skill, pedagogic and social abilities. In the field of education, all teachers should have planned strategic roles in the process of the national improvement in order to develop the necessities of the professional teaching method as a distinguished profession. Qualified teachers are in charge of carrying out the national education and achieving its targets that is totally related to improving the potential of all students from different academic levels with the intention of

preparing them to be knowledgeable, talented, innovative and independent citizens through building a high professional level of good character (Maba, 2017; Maba & Mantra, 2018). These essential factors can be built through the implementation of effective FA strategies and the enhancement of collaborative learning between students.

Teachers' demonstrable skills are affected by different elements. These variables incorporate many factors such as the policy of the country's government, the principal, and all the stakeholders in addition to other external elements that might affect the efficiency of teachers in their obligation. Usually, if teacher competency is low, the quality of education will be low as well and this will lead into a low level of human resources (Maba, Perdata, Astawa, and Mantra, 2018).

Teachers use FA strategies in their daily process of teaching with the purpose of using the appropriate information to adjust their strategies to meet the needs of their students. Teachers should be able to decide whether these strategies are suitable to improve the students' outcomes or if they need to be changed or adapted according to the academic level of the learners and needed requirements for the next stage (Regier, 2012).

In contrast, if teachers are not aware of how to evaluate the students' capabilities according to the results of their formative assessments, they will be lacking solid evidence on which the teaching process depends. Additionally, this will affect both the teachers and the students in a negative way because teachers will not be able to decide the required knowledge, skills and strategies that the students need to achieve the learning targets. Furthermore, teachers will face difficulty in providing their learners with constructive feedback. As a result and without realizing the right way to evaluate, control and modify the required learning process, students will be incapable of selecting the appropriate steps that will help them to develop their learning skills before moving to the next stage. On the contrary, when both teachers and learners cooperate to use evidence from their daily process of learning towards making constant changes with the aim of advancing learning, those modifications are bound to be influential in a positive way (Wiliam, 2018).

Effective formative assessment strategies represent the core processes of the appropriate teaching approach in every classroom that concentrate on three significant inquiries which are related to the students' academic target, their knowledge about it and the suitable strategies to achieve this target (Moss and Brookhart, 2019). These three inquiries can be translated into three main questions that the whole teaching process depends on, the first question is (Where am I going?), the second

question is (Where am I now?) while the third one is (What strategies can help me to achieve my target?). These three essential questions manage the needs of every teacher and student combined by everything that teachers and their learners do together.

Regardless of the simplicity of these questions, to address them teachers need to be skilled evaluators in order to collect evidence that is related to the understanding of learners and its relation to their learning goal. At exactly that point the learning team that consists of the teacher and the students is able to utilize the evidence to settle on educated choices about what to do straightaway and decide the best strategies that have the most obvious opportunity to close the gap with the aim of raising learners' accomplishment (Moss and Brookhart, 2019).

According to Moss and Brookhart (2019) "the most effective teaching and the most meaningful student learning happens when teachers design the right learning target for today's lesson and use it along with their students to aim for and assess understanding" (P.9). In order to take part in FA, at that point, educators must work to plan and share a learning objective, choose the right challenging level and the appropriate level for the lesson tasks, utilize that aim with their learners to evaluate and measure the current level of learners' understanding, and afterwards cooperate with students to advantageously narrow the gap between the present situation of the students and where they have to go to accomplish their aim. In this case, all educational decisions that are prepared by the subject teacher and their students must be up to date with the evidence of students' learning in connection to the exercise's particular learning objective.

The three crucial questions of FA that are mentioned above are considered as an essential and great beginning stage for the leaders of the school regarding their role in helping the school educators identify and utilize the FA procedure in their classrooms. Moreover, these questions can guide teachers to set the right outline of their lessons, monitor the strategies of their teaching in addition to support their learners to self-direction and self-assessment. Subject teachers can display these key questions in association with the objectives of each lesson to remind their learners of them during the stages of each topic to reflect about them in advance, during, and even after they gain their experience of the lesson (Moss and Brookhart, 2019). In addition, teachers have to be fully aware about the academic level of each student in order to be able to select the right type of the questions that will lead to develop the level of student's depth of knowledge (Arrafii & Sumarni, 2018).

By using FA, teachers will be able to determine the rate at which learners are gaining knowledge, the present understanding of them, the needed and the missing skills for the next stage. Moreover, according to the results of students' formative assessments, teachers can decide if the learning opportunities that they provide their students with are effective enough or if they need to modify or adapt them into new teaching strategies. Additionally, results from FA will inform teachers about the expected progression of students and if teachers are ready to move with their students to the next academic level or if they need to provide them with extra opportunities for the missing skills and concepts to enable learners to accomplish the useful aptitudes for the same level that they are in before moving to the next one (Regier, 2012).

Consequently, FA can have a transformational effect on both teachers as well as the process of teaching. For the reason that it can promote evidence-based self-assessment, the procedure of FA can reveal the effectiveness of teachers' decisions individually that will enable them to see a clear picture about the distinction between the intent and the effect of their choices. In addition to this new point of view, educators can make useful and new moves in their teaching plans. They start to gather and utilize evidences of precisely what works and other actions that do not work with their learners. Furthermore, as they fundamentally analyse their own understanding and working suppositions daily through every exercise, and every collaboration work with their learners they become inquiry-minded and strongly conscious of precisely where they have to center the improvement endeavours and what subsequent stages need to take to raise learners accomplishment (Moss and Brookhart, 2019).

On the other hand, FA information is not only beneficial for teachers, in fact, students from different academic levels are capable of using this evidence in order to figure out what they have to do to accomplish the objectives or results of the unit. They might also need to make a change or adapt their learning through other new ways to attain better curriculum results. Furthermore, the FA information can be useful in enabling learners to reflect on their learning targets for the current situation in order to keep or set new aims (Regier, 2012).

In the previous sections, the study concentrated on different types of FA strategies that can help many school teachers in enhancing their students' learning but at the same time there are other types of strategies that can be recommended by teachers for further improvement. These strategies

should be implemented independently by the students themselves with the aim of increasing the results of their learning outcomes in a positive way.

Some of the students' effective formative assessment strategies can be classified into six types (Regier, 2012). The first strategy is called (Ask), it starts by posing a question from the teacher about students' knowledge, understanding, and skills for each topic. Students must decide their strengths and weaknesses in order to be discussed with their teacher to re-plan and determine the role of both the teacher and the student towards achieving the required goals.

The second strategy is titled (Checklist) where the students can collect significant data about their performance in addition to determine the areas that they have to concentrate on for further learning development. This can take place when the teachers provide their learners with the required checklist in order to be used at the end of each task to decide whether the students are capable of completing all the required steps for a given task or to accomplish a scientific assignment with all the desired information.

The third strategy is called (Journals). In this strategy, helpful data can be provided for both the teacher and the student as well. Students should be encouraged enough by the teacher to determine their academic needs as well as to decide the best ways that can help them in achieving these requirements. The next step will be conducting a discussion with the subject teacher in order to respond with the learner's inquiries. The teacher must provide each student with additional suggestions and let the student choose the best action or way that can promote his/her needs.

The fourth strategy is entitled (Process Exemplars). This is considered as one of the strong strategies that can provide each student with the needed information about the way of their thinking. In this strategy, each learner must record the used steps in each thinking question accompanied by a detailed description that explains the way that he/she utilized to complete the given question. When the students collect various process exemplars about each question, they acknowledge that there are a variety of methods to solve the same question. In this case, students can evaluate various procedures and locate the best option for them.

The fifth strategy is called (Provide Exemplars) where the teacher provides students with different examples to be considered as models for the right answers. Students will be able to assess their work by themselves depending on the given exemplars then they must decide the needed modifications to demonstrate a high level of work.

The sixth strategy is called (Self-Marking Quizzes). This type of strategy will help students in identifying the level of their understanding, their strength and weaknesses points, and the areas that they need to develop. This can be implemented positively through checking the quizzes' questions by the students themselves using a specific answer key that should be provided by the subject teacher. These quizzes contain several questions with various academic levels, the main goal of these questions is to address the areas that each student needs to develop regardless of the total number of right or mistaken answers.

In the UAE, researchers indicated that the government has focus on building members that will have active roles as leaders in the society. They should be able to take full responsibility when they work, therefore, leaders also should have the suitable skills to build active members that will be inspired and motivated by them (AlShamsi and Ajmal, 2018). In contrast, a level of incompatible knowledge between students through various areas makes it hard to fabricate trust amid individuals in their career (Park and Lee, 2014). Furthermore, the level of success in the process of sharing and implementing knowledge can be determined by the proficiency of the leader as a most essential factor that might have a direct effect on the process of sharing and building knowledge (AlShamsi and Ajmal, 2018) besides the leader's ability to build trust with others (Bremer, Andersson, and Carlsson, 2013). This can be achieved through creating an appropriate learning culture in the classroom led by a qualified teacher (Mohd Noor, Hajar, and Idris, 2015). Especially if the leader is capable of building the decision-making skill in learners' personalities where they will be able to make an effective effect in any organization that they will work in for the coming future (Alipour, Idris, and Karimi, 2011; Kumar, Jain, and Tiwary, 2013; Rahim, 2014). As stated by Zhao (2016) where he confirmed the ability of the effective leader in influencing the reactions of people towards positive changing.

Although many studies that are mentioned in the previous sections indicated the positive affect of implementing FA strategies on students' academic results, other studies stated that there are various challenges that might affect negatively or threaten the successful process of FA (Adachi, Tai, and Dawson, 2018; Alam, 2019; Alonzo, 2018; Andrade and Cizek, 2010; Cisterna and Gotwals, 2018; Schildkamp, 2018; Yerushalmy and Hess-Green, 2018).

Some of these challenges might be related to teachers and/or students. These challenges are classified into two sections, the first section is linked to teachers' challenges such as the accountability pressure which had been recognized in some of the European countries. In China, although the new curriculum is focusing on FA implementation, several school teachers are concentrating on summative assessment more than FA to keep a good record of students' high scores level in these exams. The main concern in some of these counties is to raise students' scores instead of improving their learning skills because due to the law of some countries, each school has to announce their national scores formally through the social media in public (Schildkamp, 2018). This law is conducted in Australia and that's why some of the teachers face difficulties in attaining the full complexity levels of learning for all learners.

In India and Singapore, a few schools do not concentrate on important factors of learning due to their high-stakes summative assessment context for example; achieving the required level of knowledge and skills that should be taught depending on the students' results in different types of international assessment, improving more assessment methods and types, lacking of teachers' competences (Schildkamp, 2018) and providing constructive feedback (Bryan and Clegg, 2019; Schildkamp, 2018),

In one of the studies, the author mentioned some challenges that are linked to the difficulty in implementing the required curriculum (Andrade et al., 2019) while another study stated that teachers are struggling in applying effective FA strategies due to their heavy workloads (Arrafii & Sumarni, 2018). These teachers considered their workload as a main barrier, particularly when they are asked to apply these strategies in big classrooms that contain a large number of students.

Duckor (2016) confirmed that one of the important challenges is the ability and the competence of teachers to ask deep questions that might be unfamiliar to students, but these questions are able to build new knowledge for students. In some situations, students find this way as a new classroom culture of learning. Furthermore, teachers (formative assessors) should have a clear understanding about the learning progression level of each student in order to scaffold suitable questions about the main points of each topic that have to meet the student's learning needs.

The second section about FA challenges are related to students themselves. Students' involvement is considered as one of the important strategies that is related to the students themselves which can affect the results of the whole process of teaching and learning as mentioned before (Assessment

for learning). This is the reason why Hawe and Dixon (2017) stated that "an everyday practice with students, teachers, and peers seeking, reflecting upon and responding to inform from discussion and interactions in order to reach goals" (p.9). Therefore, students must participate in discussions that should be implemented in an appropriate learning environment in order to learn from their mistakes and to build new knowledge. This strategy might lead to foster learners' meta-cognition and to strengthen their self-assessment skills.

Another challenge that is related to the importance of students' language learning progressions in order to understand and implement FA tasks in mathematics in a correct way (Wylie et al., 2018). Another study concentrated on implementing FA strategies in English where the researcher indicated that there are many contradictions about understanding the concept of FA for both teachers and students as well. These contradictions are associated with students' involvement and scores, teachers' feedback in addition to the way that they are following to revise their texts and assess themselves.

2.4 Situated Literature Review

There are a few studies that are similar in a way to the current study. For instance, research by Abrams, McMillan & Wetzel (2015) stated that US school districts are executing benchmark evaluations to inspect how educators were utilizing benchmark test results to change guidance and enhance the learning of students. Instructors described utilizing the results of the benchmark test formatively to create an assortment of instructional alterations, including class guidance modification, student-centred groups, and giving individualized help, though essential components affected the degree of utilization. The discoveries of this examination propose that benchmark testing programs have the capability of giving important formative evaluation because there is a positive relationship between FA and benchmark exams and vice versa.

Another study implemented in Turkey stated the noticeable role of FA in increasing the positive results of students in the standardized science test. The study suggested that students should be skilled by using effective teaching strategies based on FA strategies that advance the improvement of learners' abilities of clarifying and interpreting, and thinking skills (Bulunuz et al., 2016).

Martin Jr (2018) stated that there are strong and moderately strong correlations between the strategies of FA and the results of benchmark exams. Furthermore, in some states schools, teachers are evaluated according to the results of their students in the benchmark assessments. In Canada, a research study indicated the association between assessments and standardized benchmarking in a variety of countries, not only for developing students, but to improve teachers' performance as well (Sliogeriene, 2019).

A study stated that by implementing a high quality of FA strategies, educators expect an obvious connection between the results of three important factors which include firstly, what students can do currently. Secondly, the students' requirements to be able to meet the learning targets and thirdly, the activities that teachers must select depending on the needed learning outcomes (Nichols, Meyers, and Burling, 2009; Wiliam, 2010). In this case, FA will concentrate on improving students' knowledge, understanding, and skills. Actions by teachers should be implemented for each student depending on her/his specific learning targets that should be suitable for the students' academic level. Consequently, FA strategies are certainly attached to the targets of the students' outcomes that every teacher must focus on in order to reach a high level of the required students' attainment in the benchmark exams. These procedures had been used in various states as the student growth measure (Schneider and Johnson, 2018).

According to Cisterna and Gotwals (2018) where they stated that FA strategies showed an ability to enhance the used instructions in the subject of science. Results from this study also indicated that teachers who used these strategies in an effective way obtained accurate and quick responses from their students in addition to reach a deeper understanding while exploring and using the scientific ideas of learners using FA. In this case, students will have increased opportunity of improving their results in the benchmark exams. In addition, these students will have the capability to build a community in the future that depends upon their learning experience and achievements (Akkaraju, Atamturktur, Broughton, and Frazer, 2019).

Another research study that had been conducted for grade 8 students, which indicated that the students' results in the MAP reading test can predict their scores in the Palmetto Assessment of State Standard PASS exam (Barber, 2017). As indicated in the same study that middle school American students are under the expected level in their literacy which include reading comprehension and students' critical thinking skills to text (Brozo, Sulkunen, Shiel, Garbe,

Pandian & Valtin, 2014). In American schools, literacy is considered as the cornerstone that can enable them to improve their academic achievement (Craig, 2014). Results of the study confirmed that when all stakeholders used the analysis data from the students' MAP reading exam regularly and plan accordingly, students had a better opportunity to score the expected level or even exceed that level which the country is aiming for in their standardized exams (Barber, 2017).

Johnson (2019) investigated elementary teachers' perceptions about the effect of using data-driven instructions on developing students' scores in English and math MAP exams. The outcomes demonstrated that most of the teachers use the MAP data as a helpful tool to successfully evaluate the strengths and weaknesses for all students. With teachers' modification plans and instructions that had been re-built depending on the results of students' MAP exam, the study findings showed that there is a positive change in students' results in the subsequent MAP exam.

In 2014, an author conducted a research study in order to investigate the possibility of using students' MAP results in predicting their scores in PSAE and ACT exams. The findings indicated that there is a positive noticeable correlation between the three exams which can assist teachers in determining students' academic path in an appropriate way. The students' MAP results will be useful in deciding whether the level of their educational attainment in grades (5-10) is sufficient to meet the state standards for grade eleven PSAE in addition to be prepared for the standards of ACT for both the university and the professional field (Brown, 2014).

There is no published study in the area of the current research in the UAE. Even though, the previous studies are related to the present one in connecting between formative assessment and students' outcomes in international and benchmark exams.

Chapter Three: Methodology

Considering the literature review, it has been shown that there is a need for examining educational leaders' perceptions of the implementation of formative assessment strategies on enhancing students' results in the MAP exams. There are limited studies that connect between FA strategies and its effect on students' results in the benchmark exams in the United Arab Emirates. There are no studies that refer to the effect of using FA strategies on students' results in the MAP exams. Therefore, the current study has four-fold objectives in order to achieve the purpose of this study which is related to: (1) to investigate teachers' perceptions about the implemented formative assessment strategies in American private schools in the UAE, (2) to investigate teachers' perceptions about the effect of using formative assessment strategies on enhancing students' skills in American private schools in the UAE, (3) to explain grade eight students' progress in science MAP exams in the light of FA strategies implemented in American private schools in the UAE, and (4) to explore science leaders' beliefs about how grade eight teachers use formative assessment strategies in preparing students for the MAP exams in American private schools in the UAE. This study was completed over a period of ten months. It has been conducted in five private schools from different Emirates in the United Arab Emirates (UAE) that follow the American curriculum system.

The FA strategies are considered as one of the imperative necessities for the 21st century skills (Spector et al., 2016) that had been declared in the National Agenda of the UAE 2021 vision. In addition, FA can provide the school educators with clear instruments that have positive effects on students' results individually. For that reason, this research is targeted to look for broadness with the purpose of covering several aspects that are related to the same phenomena. Therefore, the current study used a mixed-method approach in order to get the closest accurate results.

This chapter consists of six main sections in order to cover the methodology of the study by using an informative description. These sections are divided as follow: The approach design, research method, site selection and participants, instrumentation accompanied by the pilot study of the teachers' questionnaire to provide the reliability and validity statistical evidence. Additionally, data analysis and ethical considerations of the study were covered in this section as well.

3.1 Research Approach

Educational research can be defined as an application of scientific investigation that aims to collect helpful and significant data in order to investigate a specific educational procedure and address its problem (Tuckman and Harper, 2012). Thus, the nature of the research study and its goals are considered as the main points that can help in deciding the most suitable approach in order to direct the pathway of the research study (Fraenkel, Wallen and Hyun 2015). Educational research, specifically, highlights a wide range of tested information, so the provided outcomes are reliable. These results can be trusted and shared with others with the aim of improving the planning and processing of teaching and learning in a positive way (Morrell & Carroll, 2010).

In this research study, a mixed method approach was followed to collect the needed data in order to answer the main questions of the study which fulfilled its purposes. According to Johnson & Christensen (2014) where they defined this approach as "research that involves the mixing of quantitative and qualitative methods or other paradigm characteristics" (p. 488). Creswell (2014) confirmed that mixed method approach should be available in every research continuum because it has the ability of combining numerous features of qualitative and quantitative approaches which can provide valuable contribution to the research study (Creswell 2009). He stated that mixed methods research can be defined as, "an approach to inquiry that combines or associates both qualitative and quantitative forms" (Creswell 2009, p. 4). He also illuminated that mixed method approach which include both qualitative and quantitative approaches are not considered as polar opposites, but they represent two ends of the research continuum (Creswell, 2014). Consequently, depending on conducting one approach will not be efficient to address the present phenomenon under investigation (Investigating the effect of using FA strategies on students' results in the MAP exams).

For that reason, the study conducted the mixed method approach in order to overcome the weaknesses of using a single approach as well as to strengthen the advantages by constructing on the outcomes from the first approach.

This type of approach is considered as the foundation of research that is experienced in daily life (Creswell and Plano Clark, 2011). It never limits the researcher again to specific paradigms that represent the general situation before and is viewed as an authentic method for conducting research

in both social and human science as well (Creswell and Plano Clark, 2011). Moreover, it can link the purpose of the study and its questions with the procedures of the research method by using any paradigm (Morgan, 2014).

According to Creswell (2015) where he stated that several studies have cited the importance of using a mixed methods approach in the educational researches field as the third paradigm of the methodology that provides legitimation in contrast with the traditions of other methods (Tashakkori & Teddlie, 2010; Teddlie & Tashakkori, 2009). This method has blossomed and extended quickly for the last twenty years (Tashakkori and Teddie 1998, 2003, 2010a, b). Many published research studies that have used both types of data (qualitative and quantitative data) that are related to the same common fields for instance the social, the behavioural, and the educational field, highlighted that there are no new areas to be added in this type of approach. Despite the fact that there is a number of challenges in regard to choosing the best methodology for conducting a research study (Archibald, Radil, Zhang, and Hanson, 2015), this approach retains in increasing its attention in the education.

Furthermore, there is a usefulness and a positive effect through combing the utilization of both qualitative and quantitative methods towards accomplishing better profundity and broadness comprehension of the examination phenomenon (Hoover & Krishnamurti, 2010; Fraenkel & Wallen, 2012). In addition, this method can improve the researcher's confidence about the results of the study through providing more evidence than using the ones from one particular approach (Caruth, 2013; Creswell and Plano Clark, 2011) accompanied by a rigorous and reliable source of information (McBride, MacMillan, George, Steiner, 2019).

Some researchers did not believe that using one type of research method will be adequate to get the accurate results. For example, Fraenkel, Wallen, and Hyun (2015) specified that qualitative researches are not able to present all the strong points that should be indicated in the results of the study because of the unavoidable subjectivity. The outcomes of the qualitative study can be achieved by utilizing the subjective sources (Hancock & Algozzine, 2006; Meriam, 2009) for example meeting notes through interviews, and/or document analysis. Therefore, the qualitative research concentrates on the deep understanding of an individual experience of the research variables (Merriam, 2009). Hence, using a mixed method approach tends to lead to more extensive inquiries giving an increasingly extensive and innovative way to deal with research (Johnson &

Onwuegbuzie, 2004). It will also help in addressing more extensive questions that could have generally been missed (Creswell and Plano Clark, 2011).

One of the essential advantages that the investigator can benefit from the utilization of the mixed method approach is the capability of gaining all the solid evidence from both types (qualitative and quantitative methods) in addition to minimize the weak evidence that might take place by using a single method (Brewer & Hunter, 1989; Johnson & Turner, 2003). In the meantime, many authors identified the importance of using the mixed method approach in the field of teaching and learning. Fraenkel, Wallen and Hyun (2015) expressed that the qualitative method is recognized as a continuous procedure where the researcher continues in observing individuals who are involved in the researched topic as well as the related occurrences with the aim of revealing the mysterious concerns about the research. Together with the gathered information from the quantitative approach, the study will have accurate data about the results of the investigated topic.

Other authors confirmed the opinion of the previous researchers where they stated that using one of the two methods will lead to decrease the solid indications in the results, increase bias and reduce the accuracy of conclusions (Creswell and Plano 2007; Denscombe 2008; Reams and Twale 2008). The quantitative approach is mostly considered as a deductive method which is suitable for the measure of the recognized phenomena involving expectations and suggestions of causality. On the other hand, the qualitative approach is titled as an inductive method which can be utilized in order to specify a formerly unknown procedure or elucidate the reason behind building this phenomena and how this happens (Pasick, Burke, Barker, Joseph, Bird, Otero-Sabogal, Tuason, Stewart, Rakowski, Clark, Washington, & Guerra, 2009). Therefore, Creswell (2013) asserted using the mixed method approach in order to reach the stage of deep understanding for every research.

The mixed method approach can provide the researcher with an important value by the use and linking of both types of data in different directions (focalized and unique) and (convergent and divergent) in addition to the integral qualities that are extensively seen and the limitations which can be largely observed and used by the researcher (Johnson & Christensen, 2014). According to numerous authors, the qualitative approach starts with an assumption then from that point onward, the researcher will collect the required evidence depending on the idea of the main inquiry and the

use of the appropriate theories that are related to the nature and the direction of the study (Pasick et al., 2009). Therefore, using one approach will not be sufficient to address and achieve the depth of understanding of the phenomenon of the presented study (educational leaders' perceptions of the implementation of formative assessment strategies on enhancing students' results in the MAP exams in American private schools in the UAE). On the other hand, utilizing a mixed method approach will help to reinforce the advantages through expanding on the outcomes from the earlier approach, and to gather evidence that are more significant and reliable for the current study and the future recommendations (Creswell, 2013; Creswell & Plano, 2007; Johnson, Onwuegbuzie & Turner 2007; Teddlie & Tashakkori, 2009). Moreover, this rationale gives the expectation of expanding the validity and the reliability of the study's outcomes (Creswell, 2009).

Explanatory sequential mixed method design implemented in the present study where firstly, the quantitative part has been applied by using a questionnaire and data analysis as the basis of the next part which is the qualitative part by conducting interviews (Creswell, 2013). The explanatory sequential design is defined by Creswell (2013, p.211) as "The sequential explanatory strategy is a popular strategy for mixed methods design that often appeals to researchers with strong quantitative learnings. A sequential explanatory design is typically used to explain and interpret quantitative results by collecting and analyzing follow-up qualitative data".

This means that the collected results from the teachers' FA strategies questionnaire was used to gain clear ideas about different teachers' perspectives. It explained their understanding regarding FA strategies used in various subjects and their effect on students' learning outcomes. It also highlighted how to implement these strategies in their daily lessons, the provided FA tasks, strategies used to evaluate students' knowledge, understanding, and skills. In addition, it indicates the importance of the collected FA results and how to use them in order to improve students' learning. Furthermore, these results used to develop the questions of the interviews with heads of the science departments and the lead science teachers which helped in achieving the accurate results of the study.

In addition, the inquiries from the open ended questionnaire of the quantitative part were answered by using the qualitative part through conducting interviews with the heads of the science departments and the lead science teachers in order to cover any ambiguous areas of the investigation (Almalki, 2016). In this case, the qualitative data enriches the outcomes from the

quantitative data as well as help in generating new information that might be needed to strengthen the results of the research (Stange, 2006). This research combined the advantages of both methods by connecting concepts, opinions and comparing conclusions with data collected from diverse situations and times (Alhojailan, 2012). As indicated by Fraenkel, Wallen, and Hyun (2015) where they confirmed that the explanatory sequential design utilizes the qualitative outcomes to improve and enlarge the information gained from the quantitative method.

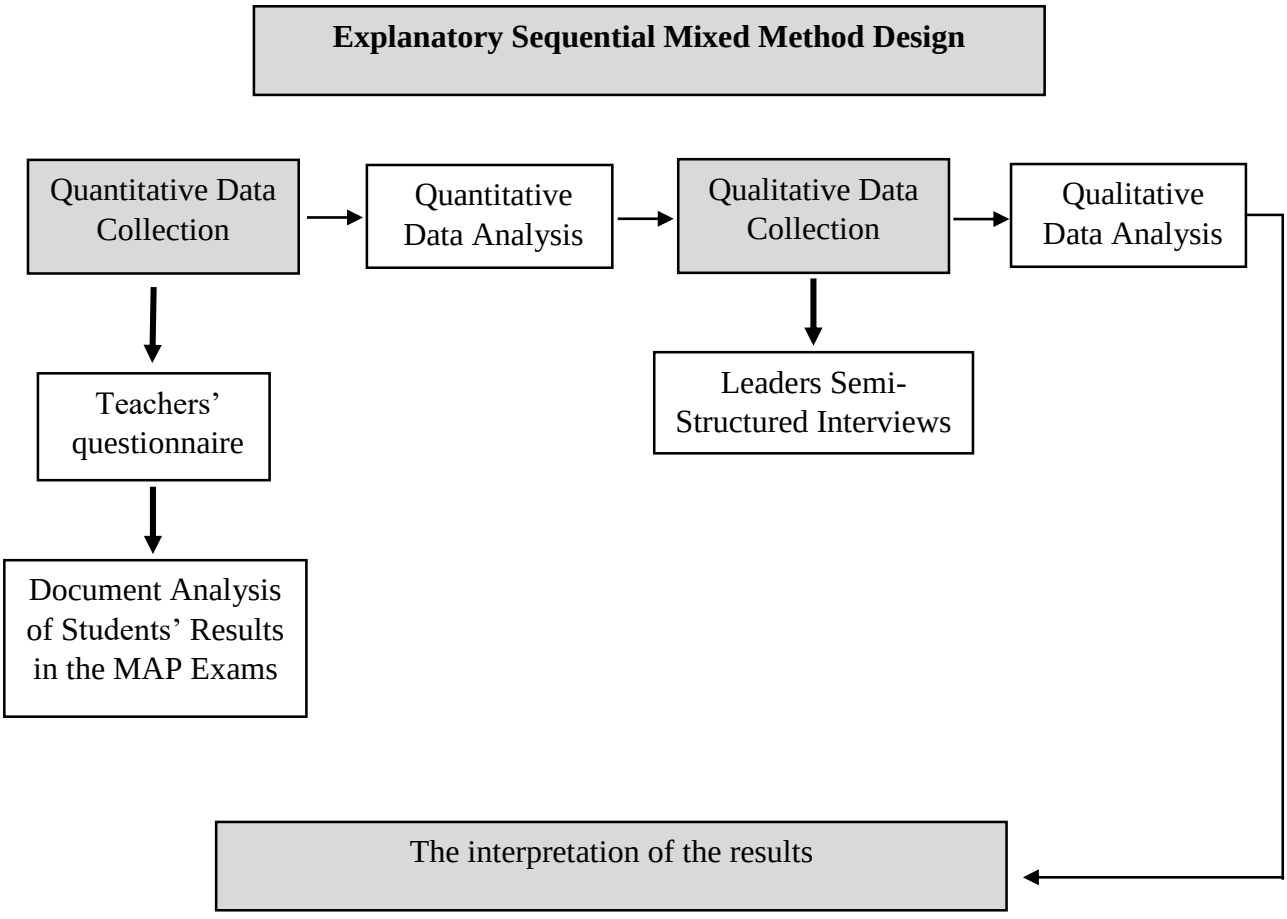

Figure (3.1): Stages of the Explanatory Sequential Mixed Methods Design

Figure (3.1) illuminates the stages of the explanatory sequential mixed methods design that explains the ways of collecting the results of the current study and connecting between the quantitative and qualitative data, which indicates that the obtained analysis from the first data was

used to gain the results of the second one. Each stage of the explanatory sequential mixed method design was different than the other based on the accessibility and availability of the study participants. Therefore, it took almost ten months to collect and analyse the data of the quantitative method including the development of the qualitative instrument (Interviews' questions). The next stage (qualitative data collection) took place in almost two months in order to collect and analyse its results.

The first resource is related to collecting evidence from the teachers' questionnaire which had been conducted and analysed in a period of three months. The gathered results were used to answer the first and the second questions of the study. For the second source, nine months were needed to collect the students' MAP results in the exam of window one for the year of (fall 2018) and the exam of window one but for the year of (fall 2019). These results were analysed in order to provide all the required information to answer the third question of the study. The third source is linked to the interviews of science leaders, these leaders include five heads of the science departments (HODs) and 5 middle school lead science teachers. It was conducted over the course of two months, but the analysis was completed in about three months to be clearly sufficient to answer question four of the study. Overall, the explanatory sequential mixed methods design was conducted in almost ten consecutive months.

Therefore, the present research problem concentrates on having both a strong and deep understanding about FA strategies and investigating their effects on students' results in the MAP exam through leaders' perceptions. In addition, the study compares different perspectives (Heads of the science departments, lead science teachers, various subjects' teachers) drawn from analyzing and interpreting both types of data (qualitative and quantitative data). Consequently, the current study chose the pragmatic position as a philosophical assumption. In this case, researchers have the advantages of using both types of approaches without being restricted by only one (Creswell, 2009).

The research informative layout depends on the philosophy of pragmatism because it is determined by foreseen consequences as it emerges out of different cases and actions as opposed to antecedent conditions (Cherryholmes, 1992). Rather than giving emphasis to the methods, pragmatisms concentrate on the investigation problem and infer the necessary information by incorporating all the accessible approaches to deal firmly with all the perspectives that can address the problem of

the research (Rossman and Wilson 1985; Tashakkori and Teddlie 1998; Morgan, 2007; Patton, 1990). Hence, Cherryholmes (1992) specified the basis of pragmatism as well as clarified that this philosophy resulted from the work of several researchers such as, Peirce, James, Mead, and Dewey.

Moreover, an important point of view was stated by Dewey (1944) where he extended other researchers' work such as Peirce (1905) and James (1907). Dewey assumed that concentrating on the consequences of the research study is more important than anything else and this priority must be considered while exploring the meaning of the idea (1920). He explained his opinion by shedding the light on considering the empirical and practical consequences before making a decision about thoughts by investigating them. This aims at understanding the philosophical positions and support in choosing the appropriate action to achieve a better comprehension of the real-life phenomena (Johnson and Onwuegbuzie, 2004). Dewey expressed that pragmatic researcher attempts to give solid proof that fulfills the epistemological standard which is titled "warranted assertability" (Johnson and Christensen, 2014). Thus, when the existing research study presented solid proof about FA strategies and its relationship with students' results in the MAP exams, at that point this gave confirmation that met the standard. Consequently, educational research sees the mix of various methods and points of view as a solid approach. This research depended on various sources of evidence with the purpose of justifying and warranting its conclusions.

Additionally, Cohen, Manion, & Morrison (2013, p.23) stated that "pragmatism prefers utility, practical consequences and outcomes, and heurism over the singular pursuit of the most accurate representation of reality". The philosophy of pragmatism depends on gathering a thoughtful mixture of both types of methods (qualitative and quantitative data) that should play an important role in addressing the principle need of the research (Johnson & Christensen, 2014). It takes the study to an area that is beyond the used method, it is more related to approve "what practically works" (Creswell, 2014) rather than envisioning the concluding clue, through revealing insight into how research methodologies can be blended productively (Hoshmand, 2003). In this philosophy, presumptions are drawn from different resources that include the qualitative and the quantitative approaches with the aim of having a higher comprehension of the research topic. In this case, the investigators concentrate more on choosing what works best for their study (Cohen

et al., 2013; Creswell, 2013; Johnson and Christensen, 2014), assume the methodologies appropriate with predetermined final outcomes (Creswell, 2013), and reach the final decisions dependent on unmistakable reality (Cohen et al., 2013).

Pragmatists are considered as the builders of the real world and the builders of the truth (Ghenea, 2015). Consequently, there is an essential role that pragmatism is responsible for because it has a solid philosophical dependable balance in the mixed method. Thus, utilizing the mixed method approach in this current study is to catch the best effective elements of the learning condition in science classes that depend on the pragmatist philosophy's ethos which is able to make room and prepare the way to various compilations that are related to student-teacher cooperation information. Particularly, the utilization of the suitable FA strategies together with teaching a variety of science concepts and skills represents a complicated procedure that needs a pragmatic approach with the aim of building a straightforward reality that can address the study questions in an accurate way. Therefore, the philosophy of pragmatism supporting this research took into consideration a precise utilization of the most helpful way towards addressing the questions of the study. Several authors confirmed that pragmatists suggest that researchers utilize whatever fills the need of their study in order to find clear answers to its questions. Therefore, this investigation used the suitable instruments that filled its need to address the research questions (Fraenkel, Wallen and Hyun, 2015).

In a nutshell, the pragmatism paradigm targets to find the right and detailed knowledge about the problem statement (Educational leaders' perceptions regarding the implementation of formative assessment strategies on enhancing students' results in the MAP exams), which is considered as an important part of the study that needs to be understandable from all of the possible approaches. Pragmatism helps the researcher to collect the results of the study by using both quantitative and qualitative approaches (Rahi, 2017) and to look for a more prominent variety of different perspectives (Tashakkori & Teddlie, 2010). The mixed method approach offers better conclusions along with decreasing unimethod bias from utilizing either positivism or constructivism only (Subedi, 2016). This investigation needs to be executed in numerous ways to deal with gathering satisfactory data to best address the exploration issue, and profoundly see every one of its angles (Creswell, 2014; Fraenkel and Wallen, 2012).

This study has many purposes that cannot be covered by using one approach only. Therefore, there is no doubt that using a mixed method approach affects various authors to turn out to be more holistic and adaptable to any unforeseen difficulties during the examination (Onwuegbuzie and Johnson 2006).

In order to have strong evidence that can explain teachers' perceptions about the effect of using FA strategies on students' results in the MAP exam, the study needs to conduct a controlled setting by using a questionnaire. In this way, various objective types of measurements can be used in order to gather numerical data for the aim of answering the first and second questions of the study. On the other hand, using the quantitative approach will not be sufficient to answer the rest of the questions because incorporating FA strategies and students' results in MAP exam is considered as a new variable in the UAE context that should be explored. Therefore, a qualitative approach should be used for a natural setting similar to the one in this study where various inquiries are required to be answered by gathering qualitative data from participants' perceptions (Fraenkel & Wallen (2012).

Therefore, the study starts with collecting data about teachers' perceptions through a questionnaire regarding the implementation of FA strategies. The participating teachers are responsible for preparing students for the MAP exams using FA strategies. Furthermore, additional evidence and inquiries can be gathered by using open-ended questions in the teachers' questionnaire. In addition to the analysed data from the students' results in the MAP exams. The evidence was gathered using the quantitative approach. On the other hand and in order to have a clear image to achieve the results, the researcher conducted interviews with the heads of the science departments and lead science teachers in order to know the details about the process of teaching and learning inside the classrooms and evaluate its results. This type of evidence was gathered using the qualitative approach.

This inquiry pursues to clarify leaders' perceptions regarding the effect of using different strategies of FA on middle school students' results in MAP exams. Moreover, the study will provide a clarification and an explanation of how middle school teachers use this type of assessment with regards to preparing students for the MAP exams.

In this research study, firstly, the information will be gained by collecting evidence about teachers' perceptions of FA strategies through using a questionnaire. In addition to the data analysis of the students' results in the MAP exams. Secondly, the outcomes from analysing the documents about the formal meetings with science leaders. These gathered information from both quantitative and qualitative methods, which will be used to decide the possible effect of using FA strategies on students' results in the MAP exams and to provide sufficient information that can answer the questions of the investigation.

3.2 Research Methods

In this section, the study will clarify different factors that are related to the site selection, participants, data collection and instruments in addition to the ethical consideration. The following table elucidates the outline of the methodology to understand the approach of the study, design, instruments, participants, as well as the type of data analysis that is based on the research questions in this presented study:

The main purpose of the study	To investigate educational leaders' perceptions of the implementation of formative assessment strategies on enhancing students' results in the MAP exams in American private schools in the UAE.				
Approach	Mixed Method				
Design	Explanatory Sequential Design				
The Research Question	**Paradigm**	**Instruments**	**Sampling Technique**	**Participants**	**Data Analysis**
1. What are teachers' perceptions about the implemented formative assessment strategies in American private schools in the UAE?	Quantitative	Teachers' questionnaire	Convenience sampling	163 teachers	Descriptive & Inferential

2. What are teachers' perceptions about the effect of using formative assessment strategies on enhancing students' skills in American private schools in the UAE?	Quantitative	Teachers' questionnaire	Convenience sampling	163 teachers	Descriptive & Inferential
3. What is grade eight students' progress in science MAP exams in the light of FA strategies implemented in American private schools in the UAE?	Quantitative	Document analysis of students' MAP results	One-Stage Cluster Sampling	250 Students	Descriptive analysis
4. What are the science leaders' beliefs about how grade eight teachers use formative assessment strategies in preparing students for the MAP exams?	Qualitative	Semi-Structured Interviews	Extreme-Case Sampling	5 Heads of the Science Departments and 5 Middle School Lead Science Teachers	Coding and recoding

Table (3.1): Summary of the Applied Methodology of the Research Study

Table (3.1) demonstrates the structure of the study that aims to find educational leaders' perceptions of the implementation of formative assessment strategies on enhancing students' results in the MAP exams. The study is designed to utilize the "Explanatory sequential mixed-method" where the quantitative data was gathered first by using the teachers' questionnaire and

students' results in the MAP exams. After that, a qualitative tool was used in order to have a deep understanding of the quantitative results. The integration of the outcomes is utilized to achieve the four-fold purposes of the research study.

3.3 Site Selection, Sampling, and Participants

The study was conducted in different emirates in the United Arab Emirates through the participation of five private American curriculum schools. These schools include two private schools in Sharjah, one private school in Dubai, one private school in Al-Ain, and another private school in Abu Dhabi. This study chose the private schools that follow the American curriculum. According to the UAE Ministry of Education, all American private schools are recommended to conduct the MAP exams from grade (3-9) as stated by Northwest Evaluation Associates (2018b) as part of the benchmark exams in order to measure the learning progress of students. Additionally, these schools are implementing the MAP exams as one of their top priorities in building the up to date skills for their students. Therefore, the American curriculum will be an appropriate source of data for the current investigation that assesses the reflective practices of FA strategies in science classes.

The used curriculum of science, which represents the chosen subject in this study, was set up in arrangement with NGSS framework standards. The selected schools followed the Next Generation Science Standards which are mainly related to developing students' abilities by practising descriptive skills, opinions, analysing data and sharing ideas with others in addition to refining them over time through the use of disciplinary core ideas, crosscutting concepts, and science and engineering practices. In this case, students will be able to assess their own understanding and improve the needed skills to do and understand the scientific inquiry and its nature through the changes that are required from both the students and the teachers as well (Carnegie Corporation of New York & Institute for Advanced Study, 2007; National Research Council [NRC], 2007; Tyler & Britton, 2018). NGSS targets to make the teaching of science more in the manner in which scientists essentially work and think as well, and influencing guidance to consider exploring discoveries that show the significance of building lucid understandings over the long haul (Council, Education & Assessment, 2014).

The main goal of these schools is to achieve the UAE National Agenda and the 2021 Vision targets which concentrate on the "students ranking among the best in the world in reading, mathematics and science exams, and to have a strong knowledge of the Arabic language. Moreover, the Agenda will aim to elevate the rate of graduation from secondary schools to international standards and for all schools to have exceptional leadership and internationally accredited teaching staff". Furthermore, these schools also target to increase the quantity of talented students with critical thinking and problem solving skills that will prepare them to be independent and successful learners in the future.

The population of the study can be recognized as a complete set of the required components which have the same characteristics that are related to the criteria of the study sampling (Mertens, 2010). Johnson & Christensen (2014) defined the population of the study as a complete group of individuals that the researcher selected for the study.

The participants of the current study consist of four groups: Heads of the science departments, lead science teachers, teachers, and grade eight students. For the quantitative data which is the first part of the explanatory sequential design, the sample population of this part includes 163 (science, English, and math) teachers who are responsible to teach and prepare their students for the MAP exam by implementing FA strategies. This sample is "convenience sampling" which represents the available and volunteered participants who accepted to participate in this research study (Johnson & Christensen, 2014). In order to make sure that all the participants are fulfilling the required criteria of the study, the researcher described the demographic information for each participant (Johnson & Christensen, 2014) in the first section of the questionnaire. This step helped to identify the characteristics of the participants. Moreover, in the case of not meeting the study criteria, the researcher excluded the participant from participating in the study. All teachers who were involved in this current study shared the required characteristics. These participants are responsible to teach, design, and plan their lessons by using different FA strategies. Furthermore, the students of the participant teachers are all requested to conduct the MAP exam, therefore, these participants can represent a sample population that is familiar with both the FA strategies and the MAP exam. An online questionnaire through a survey monkey link was sent to all the participating schools (five schools). Even though, the total responses were (197) from all the participating schools but some of these responses were not completed or did not meet the criteria of the

participants, hence, the researcher excluded them and kept the actual number of total responses of (163) teachers.

In the same quantitative part of the explanatory sequential design, data analysis for the MAP results of (250) grade eight students from both genders (boys and girls) had been collected and analyzed. The sample is selected equally from each participating school. It is called the "One-stage cluster sample" which represents two random clusters (one grade 8 class for boys and another one for girls) in order to form the total number of participants (Johnson & Christensen, 2014). This sample was chosen in order to study the possible effect of using different FA strategies on students' results in the MAP exam which represents the main focus of the study. The document analysis for this study was collected from five different schools in the UAE after getting the approval from all the principals of these schools (Appendix A). Moreover, using this sample for the existing study is considered as a suitable number based on the suggested sample size for the current population (Johnson and Christensen, 2008). Moreover, there was another reason behind selecting grade 8 students. According to Piaget's cognitive development theory, students in the age of (12 till adulthood) are considered to be in the formal operational stage. These students have specific characteristics and abilities. At this age, students can think in a more sophisticated way, they are able to create solutions for different scientific problems in a logical way through thinking and connecting between the theoretical concepts. Furthermore, these students have other skills that are related to deductive reasoning as well as systematic planning.

The second part of the explanatory sequential mixed method design is related to the qualitative data. The evidence was collected by conducting interviews with science leaders. This sample is a criterion-based selection which includes five heads of science departments and five lead science teachers, which represent the total number of the science leaders in all of the participating schools. These participants were chosen as an "Extreme-case sampling" based on specific criteria from the researcher (Johnson & Christensen, 2014). All the participating science leaders shared the same responsibility with their teachers, they must prepare effective lesson plans that should contain various FA strategies for all students. They must conduct appropriate activities and assessments that can develop students' learning skills which should be closely related to the science curriculum. Furthermore, these leaders are responsible to observe all science teachers and make sure that they follow the right process of teaching with their students. These participants have to answer the

questions that are connected to the way of preparing students for the MAP exam by implementing FA strategies and, how do they evaluate the progress of all students. Moreover, they have to decide about the best FA strategy/strategies that can help to achieve the school targets in the science classrooms accompanied by an explanation for that; how to use the MAP results in planning the classrooms' strategies and developing students' skills, in addition to clarifying the inquiries that will appear from the results of the teachers' questionnaire and specifically from the open-ended questions. Furthermore, science leaders must clarify the reason or the challenges behind achieving inadequate improvement in some of the participating schools.

3.4 Instrumentation

The concept of "Instrumentation" can be defined as "the whole process of preparing to collect data, it involves not only the selection or design of the instruments but also the procedures and the conditions under which the instruments will be administrated" (Fraenkel & Wallen 2012, p. 118). This section includes three subsections that addressed the main aim of the research and its relation to the suitable design and procedures of the data collection which was implemented through an explanatory sequential mixed method design. This design consists of two parts, the first part starts with the quantitative method, which will be followed by the qualitative method.

The power of utilizing multi instruments (three instruments) from both types of methods (quantitative and qualitative methods) accomplished a comprehensive explanation of reality that can answer the study questions. These instruments include; teachers' questionnaire, document analysis of the students' results in MAP exam, and interview protocols for both heads of science departments and lead teachers. According to Bowen (2009) where he specified that the availability of various resources of information (triangulation evidence) enable the researcher to relate, compare, and acquire an unmistakable picture of how the thoughts developed over time. This type of method requires time and exertion (Arizon & Cameron, 2010) to enable the researcher to be aware and to understand profoundly the phenomenon of the study (Creswell, 2013; Fraenkel et al., 2015; Johnson & Christensen, 2014), and to expand on the quality of the mixed method approach (Bell, 2010; Creswell, 2013; Fraenkel et al., 2015).

3.4.1 Teachers' Questionnaire

The teachers' questionnaire is the first instrument in this study, it is considered as one of the "Written-response instructions" (Fraenkel & Wallen 2012, p. 122) that is specified as "a self-report data-collection instrument that each research participant fills out as part of a research study" (Johnson & Christensen 2012, p. 162). The questionnaire involves different objectives that are related to the teachers' perspective about the effect of using FA strategies on students' results in the MAP exam. This objective is considered as the main target of the questionnaire in addition to other objectives such as, the teachers' way in preparing students for the MAP exam, and the best strategies that can help in improving students' learning results. These objectives are identified according to the problem of the study with the aim of providing the required data. One of the advantages from utilizing the quantitative methods is the use of the questionnaire which can be anonymous, has uniform processes, and it has easy characteristics to be scored (McMillan and Schumacher 2010).

A questionnaire was used to collect data to elicit teachers' perceptions about the effects of using FA strategies on students' results in the MAP exams. The questionnaire (Appendix B) designed for all teachers from different grade levels who are responsible to teach the subjects of the MAP exam and they implement FA strategies in their daily teaching processes. This questionnaire consists of different multiple-choice questions and a few open-ended questions for more explanation and validation. Additionally, there is a rating scale to read the results in an easier way (Fraenkel and Wallen, 2006; Muijs, 2011).

In the quantitative part of the study, an online questionnaire link was sent to all MAP subjects' teachers in five different private schools through a Survey Monkey link in order to collect quantitative data that represent their perceptions, experience, thoughts, and beliefs. In this study, 163 English, science, and math teachers from different grades and schools contributed in this research study as a convenience sample (Fraenkel & Wallen, 2012) in order to examine their opinions about the implemented FA strategies in their classes and the effect of using these strategies to prepare students for the MAP exams. However, the study will be concentrating on the science subject for the final results.

The participant teachers have a variety of experience in teaching the key subjects and they implement FA strategies in every topic and in their daily lesson plans as a main way to assess their

students' understanding (Creswell, 2014). In addition, their students are recommended to participate in the international and benchmark exams according to the requirements of the American curriculum schools.

The questionnaire is modified from a recent published article by (Eltanahy, 2018). It includes four sections which properly coordinate the fundamental elements of the present research. The first section is "Closed-form items" (McMillan & Schumacher 2010, p. 197) which is related to participants' demographic information that cover different information about their school, nationality, gender and teaching experiences in addition to their academic qualifications, the grade level taught, and if they received professional development training that is related to their teaching experience.

The second section of the questionnaire describes teachers' beliefs about the essential strategies of FA based on the Likert scale (5=strongly agree, 4=agree, 3=neutral, 2=disagree, and 1=strongly disagree) towards indicating the teachers' rank order that are related to their agreement or disagreement (Bell, 2005). The Likert scale is defined as, "A rating scale on which all points are anchored" (Johnson & Christensen 2014, p. 202). The scale provided in the current questionnaire is designed to offer extraordinary flexibility of the possible replies that can reflect teachers' perceptions in the best way (McMillan & Schumacher 2010).

The second section of the questionnaire consists of two sub-sections, the first one is related to the implemented FA strategies that the teachers used in their classes. These strategies describe the way that the teachers interact with the students such as, working cooperatively, sharing and discussing their ideas, assessing themselves and receiving consistent constructive feedback. Furthermore, it indicates if teachers can provide students with various effective questioning strategies that can improve their skills. For example, critical thinking and problem solving questions. In addition to teachers' motivational tasks and the way that they use to evaluate their students. This sub-section is also related to teachers' constructive alignment where she/he should have a clear idea about what learners should know or be able to do and how they will learn. Furthermore, it contains the information that is associated with teachers' preparation of the lesson plans, students' activities, progress, and assessments and how these teaching components are aligned with the school curriculum. The second sub-section is related to the effect of using formative assessment strategies (Appendix B) on developing the students' skills and assessing the teaching strategies. Moreover, it indicated its relation to the manner of preparing students for the national and international exams.

The third section of the questionnaire explains teachers' perceptions about the level and the skills that most of their students can do according to the DOK model. The last section is linked to two open-ended questions as an additional part towards validating the information (McMillan & Schumacher, 2010) and to furnish educators with sufficient space to uninhibitedly express their opinions about this advancement. Moreover, these questions provided the participants with bigger opportunity, freedom, and sufficient space to uninhibitedly express their opinions and responses about the ambiguous aspects and the hidden information that might be difficult to be quantified. Using the mixed questionnaire provided the study with extra opportunity for a fuller exploration by expressing and clarifying different teachers' views (Johnson & Christensen, 2012) as well as increasing the validity of the quantitative data that had been collected to answer the study questions (Fraenkel & Wallen, 2012).

The questionnaire was sent to all MAP subjects' teachers in five different private schools in the UAE in the month of October by email to gather the quantitative data about their knowledge, understanding, and practices of FA strategies. A period of three weeks that was given to all participating schools in order to complete the questionnaire accompanied by a few reminder emails in the same period in order to accelerate the teachers' response rate.

3.4.1.1 Piloting of Formative Assessment Teachers' Questionnaire

In every research study, piloting is a fundamental part that should be incorporated in the outline of the study. It is considered as a beneficial way that assists with illuminating the statement of investigation, questions of the study, and the process of measurement (Glesne, 2011). Despite that, driving a pilot test may not guarantee the achievement of the inquiry, it grows the chances of progress by providing important knowledge of the investigation strategies and the instruments arranged. That is the reason it is helpful as a feasibility and attainability inquiry as it has been considered as a smaller type of a full-scale examination (Teijlingen and Hundley, 2005). Consequently, a pilot study conducted as a basic scale methodological test (Fraenkel & Wallen, 2012).

According to Fraenkel, Wallen and Hyun (2014), the main reason behind the process of piloting is the purpose of validity and reliability. In order to make sure that there is consistency between

all the items of the teachers' questionnaire. Cohen, Manion & Morrison, (2007) stated that Cronbach's Alpha test should be used to implement this process. Furthermore, the same authors identified the alpha coefficient as "> 0.9 very highly reliable; 0.80-0.90 highly reliable; 0.70-0.79 reliable; 0.60-0.69 marginally reliable; and <0.60 unacceptable".

3.4.1.2 Reliability

According to Johnson and Christensen (2014) they identified both terms (the reliability and the validity) as follows: The term of reliability is recognized as the consistency as well as the steadiness of the outcomes while the term of validity is known as the capacity to quantify what it is expected to gauge. The anonymous questionnaire can reach the level of reliability because the participants of the study will be encouraged to be honest and straightforward in their replies.

The questionnaire that had been used in this study was modified from a previous study that was conducted in the UAE (Eltanahy, 2017). This study showed a strong result in the importance of using the appropriate assessment methods in order to make a big difference in students' results in both national and international exams that are implemented in Dubai.

For additional reliability, the same questionnaire that was used by Eltanahy (2017) was also adapted for another study in Malawi (Susuwele, 2005) where the researcher indicated the limited knowledge and abilities of teachers to utilize a variety of effective methods in their teaching processes in order to assess their students using the right way. In addition, this questionnaire had been used from the very beginning in two other studies, the first one was from (Weiss, 1999) while the second research study was by Szpyrka (2001) where she focused on the implementation of teachers' instructions, the equity between students, and their assessments. This study was conducted for the middle school science students in the United States. Her results indicated that teachers are not aware of the right way to follow regarding preparing students for assessments and they mostly depend on the externally ready tests in order to evaluate their students.

Additionally, twenty eight participants represented as a convenience sampling for the piloting test which include (15 science teachers, 6 English teachers and 7 mathematics teachers). All of these teachers implement FA strategies in their daily lesson plans and they are responsible to prepare their students for the MAP exams. Furthermore, they were employed conveniently in order to react to the FA teachers' questionnaire. The total number of the study's participants is 163 teachers,

thus, 17% of the total population represented as an appropriate size for conducting an effective piloting (Kotrlik & Higgins, 2001). As per the input given from the participants of the pilot test, minor modifications were conducted to more readily suit the study objectives such as a few of scientific concepts that were challenging for some of the English and math teachers. Moreover, the whole process of piloting was reviewed by an expert in this field to approve the content and the quality of the questionnaire (Simon, 2011).

For the current study, the result of the reliability test of Cronbach's Alpha was equal to (0.950). This indicated that the items of the study questionnaire are very highly reliable and consistent according to Cohen, Manion & Morrison (2007).

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.949	.950	29

Table (3.2): Reliability Test Result of Teachers' Questionnaire

3.4.1.3 Validity

Johnson & Christensen (2014) confirmed the importance of the instrument validity where they stated that it "refers to the accuracy of the inferences or interpretations you make from the test scores" (p. 165). Therefore, the validity of the instruments is considered as an essential principal (Adejimi et al., 2011; Maree, 2007; Kothari, 2004) in order to acquire reliable and solid outcomes (Merriam, 2009) as well as to guarantee effectiveness, accuracy and significance of inferences that had been made by the researcher (Fraenkel, Wallen & Hyun 2015).

This study used a mixed method approach accompanied by a variety of instruments in addition to the way that the researcher collected the data of the study to reach a high level of validity. Furthermore, it minimized the weaknesses towards increasing the internal validity of the research study (Creswell, 2014). Moreover, designing and planning to use a variety of instruments (questionnaire, document analysis, and interviews) to gather the needed information was helpful to build a strong credibility that supported the results of the study (Johnson & Onwuegbuzie, 2004).

The maturation is an additional threat that is related to the internal validity which suggests in choosing the participants of the study to be similar as much as possible (Fraenkel, Wallen and Hyun, 2014; Creswell, 2014). Heads of departments and lead teachers have the same characteristics in the educational field. They both have a specific role and responsibility in planning, implementing, and assessing science curriculum, strategies, and assessments for all students. Moreover, the researcher selected the students of grade 8 whom are all the same age group to participate in this study (Creswell, 2014; Johnson & Christensen, 2014).

Regarding the external validity which might emerge because of either the inappropriate inferences or if there is a type of bias during collecting the qualitative data (Fraenkel, Wallen & Hyun, 2014). This had been kept away from the design of the investigation because the study used the mixed method approach where the first part started with the quantitative method followed by the qualitative method so as to understand the significant changes happened with both teachers and students.

In order to proceed consistently with the framework of the research and the objectives of it, the study used a modified teachers' questionnaire from a recent study conducted in the UAE. Additionally, the same questionnaire had been adapted, modified, and used from more than one study as mentioned in the previous section which increased the reliability of the current study.

Furthermore, the questionnaire had been sent to an expert in the field with the aim of taking his judgment on the used instrument that in known as "content-related evidence" (Fraenkel, Wallen & Hyun, 2014) for more validity. Regarding the qualitative instruments, the used questions in the meetings of the interviews were reviewed by an expert educator to ensure the validity of them.

In future, the participant teachers will have a good opportunity to build a strong relationship with other colleagues by sharing the used study documents to enhance the accessibility to important documents that are essential in the study. In general, the research design of the presented study depended on the academic data and the capability of the researcher to superbly utilize the two distinct methods in a single investigation (Creswell, 2008).

3.4.2 Document Analysis

The document analysis is the second instrument in this study. This instrument can be defined as an efficient technique for exploring or assessing documents. Document analysis needs to examine and interpret data with the purpose of gaining understanding and developing empirical knowledge (Corbin & Strauss, 2008). The current study had defined some of the main document analysis objectives that are considered to be essential in this research (Fraenkel, Wallen and Hyun, 2014). These objectives are linked to the importance of using document analysis in order to gain descriptive data about the effect of using FA strategies on students' results in the MAP exam. It is utilized to approve the conclusions of the investigation with other instruments that are corresponding to it. Additionally, it can provide the researcher with valuable information that has a crucial role in dealing and managing educational problems. It can also assist in investigating possible connections or examine different ideas. Another significant aspect that ought to be considered to find pertinent information is to analyse the connection between substances that are adjusted and the goals of the study (Fraenkel, Wallen and Hyun, 2014).

According to Fraenkel, Wallen and Hyun (2014) they stated that there are a range of ways that can be used in order to analyze the data of the study and understand its findings. Some of these ways involve descriptive statistics, counting, frequencies, or narrative descriptions. The presented study used the descriptive statistics in order to analyze their documents.

Furthermore, the same authors confirmed that there are a variety of both advantages and disadvantages from using the document analysis instrument (Fraenkel, Wallen and Hyun, 2014). One of the most essential advantages is its capability to analyze the related documents without the need of the research participants to be present and they also do not need to be aware that these documents are under the process of examination that's why this instrument is considered as an unobtrusive analysis (Fraenkel, Wallen and Hyun, 2014). Another advantage is linked to the nature of this instrument where Fraenkel, Wallen and Hyun (2014) described it as a simple and economic analysis contrasted with other different strategies. They also specified that document analysis is not restricted by a period of time or a specific place. On the other hand, there are some disadvantages that might have an effect on some indications of the results such as its limitation to the recorded data which show a difficulty in demonstrating the participants' abilities or behaviors (Fraenkel, Wallen and Hyun, 2014).

In this part of the study, the conclusions of the document analysis which is related to students' results in the MAP exams over the whole year helped in answering question three of the study which is linked to the effects of using formative assessment strategies on students' results in the science MAP exams.

3.4.3 Semi-Structured Interview

The interview is the third instrument in this study which was conducted with the science leaders (heads of the science departments and lead science teachers). According to Fraenkel and Wallen (2006), the interview is an oral reaction to organized inquiries for gathering information from the subject with a decent chance to clear up investigations and examine the respondents' answers further whenever required. Moreover, interview permits and enables the researcher to confirm that the collected information which are related to many issues in the research study are accurate (Fraenkel et al., 2015). They can also provide a deeper understanding and insight through listening to different opinions and experiences of the participants (Seidman, 2013). It is also considered as a technique in order to find out what the participants are thinking of, what their hidden thoughts are, how they are able to deal with these thoughts, to feel about them, and make a useful use of them (Fraenkel et al., 2015).

On the other hand, the participants of the study might be able to express their thoughts more freely (Sabah et al., 2014) through discussion rather than answering questions by using a questionnaire. Hence, semi-structured interview was adopted in this present study by the researcher because it is considered as one of the most convenient and effective types that can meet the aim of the study (Kvale & Brinkmann, 2009). This can take place by building two-way discussion (Maree, 2007) to permit the researcher to reflect and respond in an appropriate way (Creswell, 2013; Phellas, Bloch & Seale, 2012). In addition, the interview's participants lean towards providing more details and information through discussions in a confidential place (Phellas et al., 2012).

In this study, semi-structured interviews (Appendix C) were carried out with ten science leaders including five heads of the science departments and five lead science teachers who will be selected as an "Extreme-case sampling" in order to examine and analyse their opinions regarding the fourth question of the research study (Fraenkel & Wallen, 2012). This question is related to science

leaders' beliefs about how middle school teachers implement FA strategies in preparing students for the MAP exams. All these participants should be aware of this information according to their job descriptions. Science leaders are responsible to plan, prepare, observe, and assess both teachers and students for implementing effective teaching and learning process.

A specialist professor has revised all the questions of the interview in order to confirm the validity of its content (Johnson & Christensen, 2014) and his criticism had been utilized to change some recommended wording. Moreover, with the intention of enhancing trustworthiness of study data, the official interview form was sent to three heads of the science departments in three different schools in order to pilot the questions of the interview through face-to face meeting. The researcher used their responses to re-design a few of the interview questions that might not be understood by some of the science leaders (Belet Boyaci and Güner, 2018). The actual time to complete each interview took around one hour with each science leader.

This study focused on achieving the required quality of the interview through concentrating on three fundamental standards. These standards are related to keep the collected information secure, preserve a positive relationship between the researcher and the interviewer in addition to avoid bias as stated by Schensul, Schensul & LeCompte (1999). A variety of notes were written through various discussions. All the gathered results were analyzed by coded and recoding in a way that can help in clarifying their answers to reach in-depth understanding (McMillan and Schumacher, 2010). The science leaders' interviews target to shed the light on their understanding about the relationship between FA and the MAP exam. Moreover, it can provide them with various opportunities to clarify the relationship between their perceptions regarding FA strategies and students' results in the MAP exam and to elaborate upon future recommendation for better academic outcomes.

Science leaders were requested to answer six open-ended questions (Appendix C) in face-to-face interviews (Creswell, 2009) to take into consideration examining to urge them to portray the most extreme measure of suitable and valuable data. According to Fraenkel & Wallen (2012) where they stated that conducting interviews with different participants that work in the same field provides more effectiveness through social interaction. More details can be gathered through face to face conversations which are difficult to observe and collect by using a questionnaire only. The interview questions are related to the important factors and strategies that all middle school

teachers have to use in order to prepare their students for the MAP exam, the role of MAP data in improving students' learning outcomes, best strategies that can improve students' learning results, the way of evaluating students' progress, and the reasons behind the insufficient development results in some schools. Therefore, the heads of the science department and the lead teachers' interviews were completed with the purpose of clarifying the different intentions of a variety of school managements in addition to clarifying the important processes that many schools are following towards improving the quality of teaching and learning for the science classes in different schools.

In the research study, there should be an appropriate sequence of the questions provided in order to conduct effective interviews (Cohen et al. 2000). The procedures of the interview protocol followed the educational research guidelines which started by completing the demographic information about each interviewee, followed by the explanations about the reason and the central point of the investigation, then concluding with the qualitative questions, which started from the general level of the questions to the more precise and detailed debatable questions that should be gathered "perceptions-based data" (Louis 2000, p. 305) in order to enable the researcher to be on the right path of the study. Therefore, in collecting the qualitative data, interviews are considered as the most well-known instrument for the reason that it typically assists the researcher to collect additional authentic data that are related to participants' experience and views about specific topics better than other types of data collection (Melles, 2005).

The various instruments which include teachers' questionnaire, document analysis, and semi-structured interviews provided the current study with strong data and led the investigation endeavours to offer "a confluence of evidence that breeds credibility" (Eisner, 1991, p. 110). The provided results helped the researcher to avoid biases that might be present in using a single approach. Patton (1987, 1990) stated that triangulation enables the researcher to achieve more valuable outcomes that focus on more than a single source or examiner's inclination.

3.5 Data Analysis

This study is designed to utilize an explanatory sequential mixed method which includes both types of data (qualitative and quantitative). These data were collected in a specific sequence then analyzed as well as interpreted in a separate way according to their nature. After that, the results of these different data were compared and integrated in order to achieve the purpose of the current research study.

The first part of data analysis covered the results of the teachers' questionnaire and the document analysis of the students' results in the science MAP exams. While the second part of this section was related to analyze the evidence from the science leaders' interviews. The details of the data analysis are elucidated in the following sections below.

3.5.1 Quantitative Data Analysis

In this current research study, the utilized methods assumed that each type of data, quantitative or qualitative, has to be analyzed individually (Brace, Kemp & Snelgar 2009; Bryman, 2012; Niglas, 2004; Sandelowski, 2000). Both descriptive and inferential statistical tests were utilized in order to achieve the required results by analyzing the data. The study used the descriptive statistics in order to find the mean, standard deviation, and frequencies with the aim of analyzing the quantitative results. In addition, conducting the inferential statistics in the current study helped, "to go beyond the immediate data and to infer the characteristics of populations based on samples" (Johnson & Christensen 2014, p. 518).

This type of analysis had been conducted on the closed-ended questions of the teachers' questionnaire. The other type of analysis which is called the thematic analysis was applied with the aim of analyzing the results of the two open-ended questions after gathering the responses from the participating teachers. In the next stage, firstly, the findings that the researcher collected from both types of analysis were incorporated at the interpretative level. Secondly, the results were compared as well as evaluated. Lastly, the researcher formulated the final results that can answer the questions of the research study by addressing the conclusions from the qualitative and quantitative data (Creswell & Clark, 2011; Greene, 2007). Additionally, the reliability and validity tests were both implemented with the aim of assessing the internal consistency together with the trustworthiness of the collected data from the teachers' questionnaire.

According to Greene (2007) where he stated that there are five various steps that the researcher must follow in order to analyze the quantitative data of the study in an effective way. These steps were implemented by the researcher. It started firstly by cleaning the collected data through excluding the invalid responses. Secondly, the collected raw data was analyzed in the form of descriptive statistics by using the process of data reduction. Thirdly, the process of transforming data where the researcher used the consolidated opinions from various participants with the aim of generating the overall and appropriate theme for the science leaders' interview questions. In the fourth step, the data was compared and correlated in order to decide the connections and the differences between them. In the last step, the researcher implemented higher-order analysis to achieve the required results.

As the study followed the "Explanatory Sequential Mixed-method" where it began with the findings of the quantitative data and the analysis of its results. The results from the quantitative data was used as the basis of the qualitative data. It had been used to create the interview questions with the purpose of addressing all inquiries that came out from the teachers' questionnaire and especially from the open-ended questions. In addition to the inquiries of the analyzed results of students' science MAP exam. The first part of the explanatory sequential design was completed through the use of the teachers' questionnaire (the quantitative data) in order to answer the first and the second questions of the study which were related to the implemented FA strategies and the effects of using these strategies on students' results in the MAP exams. All the responses from 163 teachers of English, math, and science subjects were gathered using the survey monkey website. In order to analyze the outcomes of the teachers' questionnaire, the researcher generated a database to measure the descriptive statistics, which include the mean, standard deviation, percentages, and frequencies regarding all the questionnaire's items (29 statements per teacher). In addition to specific tables that presented the level of teachers' agreement for each statement with the aim of answering the first and second questions of the study.

Furthermore, as part of the inferential statistics the one sample *t*-test was conducted by utilizing the Statistical Package for Social Sciences (SPSS, version 23) in order to determine if there is statistical difference between the sample mean and a known population mean of the FA strategies in the teachers' questionnaire. These results can help the researcher to accomplish the best significant conclusions from the acquired data (Muijs, 2011). Moreover, the one sample *t*-test is

connected to the *p*-value. If the *p*-value is < 0.05, this specifies that there is significant statistical difference in mean in the current study.

Regarding the demographic information of all the participating teachers, the researcher examined the differences between the six main variables of the teachers' questionnaire. These variables include: the gender of the participant, the average number of students in each teacher's classroom, years of teachers' teaching experience, the grade level taught, and the FA professional development training that they received. In order to find the results for the examination of differences, *t*-test and One-Way ANOVA test were conducted with the aim of comparing mean scores among various groups. Two-sample *t*-test was used to find significant differences between males and females and between teachers who received professional development training and those who did not. On the other hand, the one-way ANOVA was used to find significant differences between teachers' groups in terms of Average Number of Students in Classes, Teaching Experience, Grade Level Taught, and Academic Qualifications.

The quantitative data that had been collected from the teachers' questionnaire was analyzed using descriptive statistics in order to find frequencies, mean, standard deviation as well as the percentages of teachers' responses. The reason behind using the descriptive statistics is "to describe, summarize, or make sense of a particular set of data" (Johnson & Christensen 2014, p. 518). Furthermore, descriptive statistics is considered as the groundwork of this type of data analysis. Hence, it is utilized to describe the main features of the study then summarize the attained data about the two principle variables which are linked to the effect of using FA strategies on students' results in the MAP exams.

Regarding the document analysis of the students' MAP results in the science subject, the researcher used the descriptive statistics to describe and summarize the results by conducting SPSS in order to find the frequencies and the percentages of the students' progress in the MAP exams.

3.5.2 Qualitative Data Analysis

The qualitative data was gathered from the results of the science leaders' interviews. These leaders include: the heads of the science departments and the middle school science lead teachers. In this part of the qualitative analysis, the researcher focused on making "sense" of the collected data then

compiled them into various section of information that identified as themes or codes (Creswell, 2007). The results of the qualitative data were analysed by coding and recoding in order to create themes and clarifying quotes. Coding is considered as a worldwide method; it is an essential aspect of the analytical procedure because of its ability to analyse data in order to generate something new. “Coding is the process of analysing qualitative text data by taking them apart to see what they yield before putting the data back together in a meaningful way” (Creswell, 2015, p. 156). A variety of science leads’ ideas and expressions were explained in these themes (Kvale, 2007). Furthermore, an expert in the educational field who was represented as a third party consultant reviewed the created themes by the researcher in order to make sure about the effective quality of the leaders’ interview transcripts (Creswell, 2007). This helped in alleviating the researcher biases as well as possibly excluding the over-analyzing of data that might exist.

The results were analyzed with the aim of answering the fourth question of the study, which is related to the science leaders’ beliefs about how grade eight teachers implement formative assessment strategies in order to prepare students for the MAP exams. Furthermore, the outcomes from the qualitative data are utilized to limit the extent of the quantitative data and elucidate the quantitative outcomes. The analysis of the information gathered utilizing the different instruments will be explained and clarified in the next chapter (chapter 4). The analysis from both types (the quantitative and the qualitative analysis) gave plentiful data about the exploration topic.

3.6 Ethical Considerations

Ethical consideration is considered as one of the crucial concerns that the investigator should take into consideration. In this study, all the conducted work in every official step was gained using authorised written consents. Firstly, a consent letter from the British University in Dubai (BUiD) was sent to all the participating schools in different emirates in order to gain the approval from the director of each school (Appendix A). Then there was a meeting with each school principal in order to provide the researcher of the study with an opportunity to meet the main participants (heads of the science departments and lead science teachers) who will be responsible for completing the required documents for the researcher. The main participants introduced the study researcher to the key subjects’ teachers (English, science, and math) whose students’are involved in the MAP exam where the researcher illuminated the purpose of the study. With the intention of

avoiding the ethical issues, there was a written agreement between the researcher and the school principal who was considered as the "gatekeeper". According to Barrett (2006), the gatekeeper is the person who is responsible to provide the researcher with the needed approval that will allow the researcher to communicate with the participants of the study.

According to the rules of the British University in Dubai (BUiD), all the gathered information must be kept confidential alongside the personal details of the participants. Furthermore, an informed consent includes a clear explanation about the procedures of collecting the research evidence, its confidentiality, the main purpose of the study and its objectives were provided for all study participants. In this case, this consent can enhance the research accessibility with total security (Creswell, 2012).

Moreover, the informed consent was shared with every participant with the aim of providing an explanation of the study and the important role of each participant in each stage of the study (Johnson and Christensen, 2008). All the information had been collected by following authorized procedures, therefore, the information gathering instruments are not expected to put the participating members in any type of danger. During the interviews, the investigator focused on the ethical code of conduct in order to prevent any issues that are related to the individual details or delicate data that might be uncovered through the information gathering stage (Johnson and Christensen, 2008). By following the confidentiality protocol as stated by the AERA Code of Ethics (2011) via using the instructive study code of ethics, an official document was sent to all members illustrating their entitlement to anonymity through the examination and after its fruition (Creswell 2014; Johnson and Christensen, 2008).

All the participants of the study including (the principal, heads of the science departments, science lead teachers, and the science, English, and math teachers) read the official letter (consent form) from BUiD university to the addressed schools as it elucidated the required information about the researcher, the aim of the study as well as the needed actions from each school (Appendix A). School teachers were keen on participating in this study. The principal and every one of the contributing teachers who partook in the investigation signed the required consent form for the research study. As a result, the researcher gained the formal authorization from both the schools' principals and the participants from the schools. This permission represents an important mandatory action to avoid an ethical issue during the period of gathering the reliable and the valid

data (Cohen, Manion & Morrison, 2007). Nevertheless, if any questionable situation arises about the study, the researcher must apply the consent form (Cohen et al., 2007). Considering that, all the participants had a clear idea about the study purpose through the provided consent form.

Furthermore, there is another essential action that the researcher must concentrate on which is related to the voluntarism. Although all the used study instruments are completely anonymous, this type of ethical consideration can offer all participants the freedom of choice as to whether they want to participate in this study or not (Cohen, Manion & Morrison, 2007) and the researcher has to accept and respect their choice. On the other hand, there was a complete description about the characteristics of all participants who agreed to participate in the study through the first part of the questionnaire which is associated with their demographic information.

Additionally, with the aim of increasing the gathered qualitative data trustworthiness, all the approvals were collected before implementing the research study. A clear and strong explanation was provided to all participants in order to understand the importance and the benefits of the current study and how this research can support them in their daily teaching procedures in the coming future. The researcher provided the participants with opportunities to answer their inquiries linked to any aspect of the study. This is also considered as one of the ethical considerations where the researcher must accept the suggestions of the participants. Moreover, the researchers should maintain the visibility of work with the intention of increasing the value of the study (Cohen, Manion & Morrison, 2007). In addition to offering a clear description that is related to any expected risk accompanied by an explanation about the instructions that the researcher has to follow in every stage that the participants should be involved in.

All these procedures represent important ethical consideration types (Cohen, Manion & Morrison, 2007). Consequently, in every research study, the researcher must introduce himself/herself, the aim of the study as well as all the ethical considerations that are linked to the anonymity of the participants of the research data.

In this study, the researcher was able to adopt with all the different aspects of the study such as the chosen topic, the selected participants, and the context of the study. This position classified under the term of positionality (Savin-Baden & Major, 2013). Moreover, selecting the pragmatic philosophy enabled the researcher to avoid bias by using a single type of research while the researcher utilized an extensive and eclectic methodology. Consequently, the positionality

provided the researcher to exist inside and outside the study by considering both the views of the participants and the views of the researcher.

From the researcher's point of view and many other authors, confidentiality and anonymity are the most essential ethical considerations that should be available in every research study, therefore, these were some of the important actions that the researcher focused on. Firstly, there was a high regard for the protection of the study participants (Cohen et al., 2013) along with the confidentiality related to all the special documents for each school (Waters-Adams, 2006). Secondly, the researcher replaced all the names of the students that participated in the analysis of the MAP exam with numbers. Thirdly, the location of the participating schools was not mentioned, instead of that, the study mentioned only the name of the emirate the school is located in. Lastly, all the received responses from all the participants of the research study were saved anonymously in all circumstances, even when the researcher had to submit and share the results of the study with the professional community.

The researcher concentrated on another important practical ethical consideration which is associated with the size of the study sample as well as the availability participants' number that are considered as one of the requirements for each study (Barrett, 2006). Therefore, the chosen sample size consisted of 163 teachers to answer the questionnaire and 250 students for analyzing their results in the MAP exam in order to guarantee adequate information that should be gathered and analyzed from a large enough sample in order to be able to generalize the findings.

Eventually, the final results and conclusions that contain all the details about the examination issues, decisions and recommendations relying upon data information, opinions, and views were shared with all the principals of different schools in various emirates separately in order to discuss the school situation and use this investigation to give an idea about the school self-evaluation and the updated improvement plan if needed.

For that reason, the investigator led the examination depending on her own ability. The researcher looked for the required information and aptitudes to direct this exploration and to keep up a reasonable individual competency level. Moreover, the examiner was alerted towards the utilization of the information and the data uncovered from the examination and to abide to the code of the ethical requirements (AERA Code of Ethics, 2011).

This research study concentrates on professional issues such as the code of conduct of all stages of the study, beginning from selecting the focus area of the topic, until the examination is completed with reliable outcomes. The investigation is focused on the transparency in the exploration proposition and keeping in mind directing the real research (Johnson and Christensen, 2008).

Chapter Four: Data Analysis and Results

This chapter presents the analyses of the collected data from the participants of the current study. It consists of two main sections, namely: quantitative data analysis results and qualitative data analysis results accompanied by a summary for each one of them.

In this study, the multifold purpose includes (1) to investigate teachers' perceptions about the implemented formative assessment strategies in American private schools in the UAE, (2) to investigate teachers' perceptions about the effect of using formative assessment strategies on enhancing students' skills in American private schools in the UAE, (3) to explain grade eight students' progress in science MAP exams in the light of FA strategies implemented in American private schools in the UAE, and (4) to explore science leaders' beliefs about how grade eight teachers use formative assessment strategies in preparing students for the MAP exams in American private schools in the UAE. A mixed-method approach includes two types of instruments (quantitative and qualitative) was used in order to achieve the objectives of the study.

The following questions were posed with the aim of investigating educational leaders' perceptions of the implementation of formative assessment strategies on enhancing students' results in the MAP exams in American private schools in the UAE.

Q1: What are teachers' perceptions about the implemented formative assessment strategies in American private schools in the UAE?

Q2: What are teachers' perceptions about the effect of using formative assessment strategies on enhancing students' skills in American private schools in the UAE?

Q3: What is grade eight students' progress in science MAP exams in the light of FA strategies implemented in American private schools in the UAE?

Q4: What are the science leaders' beliefs about how grade eight teachers use formative assessment strategies in preparing students for the MAP exams in American private schools in the UAE?

Therefore, each of the previous questions assists in determining the best way of analytical approach with the purpose of ensuring that the data gained can provide a full answer to each question in addition to successfully addressing the problem of the research.

4.1 Quantitative Data Analysis Results

This section presents the first part of the explanatory sequential mixed method design which starts with the quantitative part. This section covers the results of both the teachers' questionnaire and the students' results in the science MAP exams as the following:

4.1.1 Results of Formative Assessment Teachers' Questionnaire

The main purpose of this section is to elicit teachers' perceptions regarding the implemented formative assessment strategies and their effect on enhancing students' skills in American private schools in the UAE. Hence, a cross-sectional questionnaire was sent to five different schools in various Emirates including two private schools in Sharjah, one private school in Dubai, one private school in Al-Ain, and another private school in Abu Dhabi. As a result, 163 complete responses had been received and analyzed through the use of the Statistical Package for Social Sciences (SPSS, version 23). Furthermore, the collected participants' responses of the two open-ended questions were also analyzed by using coding and recoding and presented in the qualitative result section.

The gained analytical data was utilized in order to answer the following research questions:

- What are teachers' perceptions about the implemented formative assessment strategies in American private schools in the UAE?
- What are teachers' perceptions about the effect of using formative assessment strategies on enhancing students' skills in American private schools in the UAE?

In this section, two types of analysis were applied include the descriptive and inferential statistical analyses in order to address all the essential items of the current study.

Descriptive statistics are considered as the basis of the quantitative analysis. This type of analysis has many advantages, it can help the researcher "to describe, summarize, or make sense of a particular set of data" (Johnson & Christensen 2014, p. 518). Therefore, it is utilized to represent the fundamental highlights and to summarize the gained information with respect to the two principle variables (effect of using FA strategies and students' results in the MAP exams). The

descriptive statistics applied analysis include information about frequencies, percentages, means, and standard deviations. Regarding the inferential statistical analysis, independent samples t-test and One-Way ANOVA test were applied with the purpose of implementing the required quantitative data analysis (Muijs, 2011). The analysis of these two tests include information regarding the mean scores between various groups. Additionally, another examination was applied in order to investigate the differences between the six demographic variables in the teacher questionnaire.

The reliability test of the used teachers' questionnaire was conducted by utilizing Cronbach's Alpha coefficient for section 2 of the questionnaire. This section consists of two clusters, the first cluster is related to the implemented FA strategies in students' classrooms which include (23) statements. The second cluster is linked to the effect of using FA strategies on enhancing students' learning skills. This second cluster consists of (6) statements. According to Tavakol & Dennick (2011), this test is considered as an essential method that must be applied in order to evaluate the accuracy and stability of the teachers' responses.

Item-Total Statistics

	Scale Mean if Item Deleted	**Scale Variance if Item Deleted**	**Corrected Item-Total Correlation**	**Cronbach's Alpha if Item Deleted**
1. I encourage my students to assess themselves.	95.53	56.300	.431	.906
2. I encourage my students to talk, share ideas, and working cooperatively through Think-Pare-Share strategy.	95.25	57.041	.450	.906
3. I provide students with different problem-solving questions for each topic.	95.58	55.011	.571	.904
4. I use Exit-Ticket strategy at the end of each topic.	95.49	55.523	.548	.904
5. I use various questioning strategies in each lesson.	95.47	56.201	.460	.906
6. I'm aware of what learners should know or be able to do and how will they learn.	95.56	53.988	.633	.902
7. My lesson plan is aligned with the required curriculum.	95.50	54.918	.598	.903
8. I plan and/or modify the lesson with differentiated tasks according to the needs of all students from different academic level.	95.81	54.785	.517	.905

Item-Total Statistics				
	Scale Mean if Item Deleted	**Scale Variance if Item Deleted**	**Corrected Item-Total Correlation**	**Cronbach's Alpha if Item Deleted**
9. I use a variety of teaching strategies for each topic.	96.07	55.631	.397	.908
10. I use different websites for assessing the skills of my students.	95.79	54.635	.602	.903
11. My lesson progress based on students' responses.	95.86	54.974	.517	.905
12. I plan my teaching instructions based on students' MAP results.	95.76	54.652	.574	.903
13. I assess students' understanding according to their abilities in the 4 Cs.	95.72	55.253	.499	.905
14. I analyze the results of students' assessments.	95.55	54.743	.591	.903
15. I use various motivational tasks so students can gain competence, relatedness, and autonomy.	95.81	53.809	.626	.902
16. I ask students to connect between the topic's new information and their current knowledge.	95.55	55.064	.564	.904
17. I provide a consistence constructive feedback for each student.	95.75	54.680	.557	.904
18. I use students' graded work as a feedback about their level.	95.81	55.538	.478	.905
19. I use critical thinking questions in every topic.	95.75	55.004	.518	.905
20. I provide students with different open-ended problems that is related to real life situations.	95.72	55.226	.526	.904
21. I encourage my students to work independently in every lesson.	95.88	55.898	.420	.907
22. I encourage students to decide their needs for further improvement.	95.83	54.695	.558	.904
23. I ask students to decide their strengths and weaknesses without guidance.	96.02	55.555	.423	.907

Table (4.1): Values of Cronbach's Alpha Coefficient of the variables in cluster one of the teachers' questionnaire

Table (4.1) demonstrates the values of Cronbach's Alpha coefficient regarding each variable included in cluster one of the teachers' questionnaire of the current study. The results of all the related variables in cluster one which are related to the implemented FA strategies in students' classrooms indicated that the highest value of Cronbach's Alpha was (0.908). As for the lowest value of cluster one Cronbach Alpha, it was (0.902). This result indicated that all the items of

cluster one are very highly reliable and consistent because it is between the ranges of (0.902-0.908) which is > 0.9. Therefore, all the items of cluster one (23 items) in teachers' questionnaire are analyzed below.

Regarding the results of the reliability test of the second cluster in the teachers' questionnaire, which is related to the effect of using FA strategies on enhancing students' learning skills as reported in table (4.2).

Item-Total Statistics				
	Scale Mean if Item Deleted	**Scale Variance if Item Deleted**	**Corrected Item-Total Correlation**	**Cronbach's Alpha if Item Deleted**
1. To enhance students' academic attainment.	21.53	4.374	.498	.752
2. To assess the teaching process and modify it accordingly.	21.33	4.778	.415	.770
3. To evaluate students' progress.	21.36	4.393	.532	.743
4. To group students for differentiated activities.	21.37	4.259	.596	.726
5. To prepare students for national and international exams.	21.38	4.435	.564	.735
6. To improve students' skills.	21.55	4.298	.545	.740

Table (4.2): Values of Cronbach's Alpha Coefficient of the variables in cluster two of the teachers' questionnaire

Table (4.2) demonstrates the values of Cronbach's Alpha coefficient regarding each variable included in cluster two of the teachers' questionnaire of the current study. The results of all the related variables in cluster two which are related to the effect of using FA strategies on enhancing students' learning skills indicated that the highest value of Cronbach's Alpha was (0.770). As for the lowest value of cluster one Cronbach Alpha, it was (0.726). This result indicated that all the items of cluster two are considered as reliable because it is between the ranges of (0.70-0.79). Therefore, all the items of cluster two (6 items) in the teachers' questionnaire are analysed below. Hence, a total of (29) items are analyzed in the coming sections as a total number of items in section 2 of the teachers' questionnaire. Finally, the value of the Cronbach Alpha of all the questionnaire's items was equal to (0.945) which is considered as very highly reliable. This result

indicated that all the items of the teachers' questionnaire are considered as an appropriate and consistent tool to measure aspects of formative assessment strategies.

4.1.1.1 Results of Demographic Data Analysis

The total number of participants in the teachers' questionnaire is 163 (English, science, and mathematics teachers) who implement FA strategies in their daily teaching process. A general overview of the sample demographic information broken down by gender, average number of students in classes, teaching experience (years), grade level taught, academic qualification, and professional development is reported in the following tables.

Gender of teachers:

Gender	Frequency	Percentage
Male	24	14.7%
Female	139	85.3%

Table (4.3): Demographic Information (Teachers' Gender) of the Participating Teachers (N = 163)

Average number of students in classes:

Number of students	Frequency	Percentage
Less than 20 students	30	18.4%
21 – 29 students	119	73.0%
30 and more	14	8.6%

Table (4.4): Demographic Information (Average number of students in classes) of the Participating Teachers (N = 163)

Teaching experience for teachers:

Experience	Frequency	Percentage
1 – 4 years	31	19.0%
5 – 10 years	48	29.4%
More than 10 years	84	51.5%

Table (4.5): Demographic Information (Teaching experience for teachers) of the Participating Teachers (N = 163)

Grade level taught by teachers:

Grade taught	Frequency	Percentage
Elementary school	43	26.4%
Middle school	42	25.8%
High school	78	47.9%

Table (4.6): Demographic Information (Grade level taught by teachers) of the Participating Teachers (N = 163)

Teachers' Academic qualifications:

Qualification	Frequency	Percentage
Bachelor	93	57.1%
Diploma	11	6.7%
Master	59	36.2%

Table (4.7): Demographic Information (Teachers' Academic qualifications) of the Participating Teachers (N = 163)

Teachers' Professional Development Trainings:

PD	Frequency	Percentage
Yes	122	74.8%
No	41	25.2%

Table (4.8): Demographic Information (Teachers' Professional Development Trainings) of the Participating Teachers (N = 163)

The participants include (24) males which represent (14.7%) of the whole percentage and (139) females that represent (85.3%) of the whole percentage. The previous table illustrated the number of participants according to their experience and the professional development sessions that they received about FA strategies across Gender groups. Several (122) teachers from both gender (male and female) confirmed that they received professional development sessions about FA strategies. This means that (74.8%) of participants should have a general and clear idea about the use of FA strategies. Moreover, half of the participants have more than ten years of teaching experience and they represent (51.5%) from the whole sample. The other half of the participants are divided into two sections, the first one represents (29.4%) with an average experience in teaching from (5-10) years while the second section represents (19%) with an experience between (1-4) years in

teaching. Additionally, there are (115) participants out of (163) teachers, whom received professional development sessions about FA strategies and at the same time they have more than 10 years of teaching experience.

The total number of students that each participant teaches in every classroom is characterized by three levels. A number of (119) teachers which represent the highest percentage (73%) of the whole sample stated that they teach the average number of students which is between (21-29) students. This represents the normal level of students' numbers in the classroom. (18%) of participants teach less than (20) students in one class while only (8.6%) of participants teach more than 30 students in one classroom. Crosstabulation of Professional Development against Teaching Experience across Gender groups reveals that males are more experienced than females. That is, males with more than 10 years of teaching experience represent (66.7%) of the total male group, while females with more than 10 years of teaching experience represent (48.9%) of the total female group. Moreover, females with less than 10 years of experience represent (51.1%) of the total female group, while males with less than 10 years of experience represent (33.3%) of the total male group. Furthermore, males with more than 10 years of teaching experience (50% of total males) receive more professional development sessions than females who have the same teaching experience (35% of total females), see Figure (4.1).

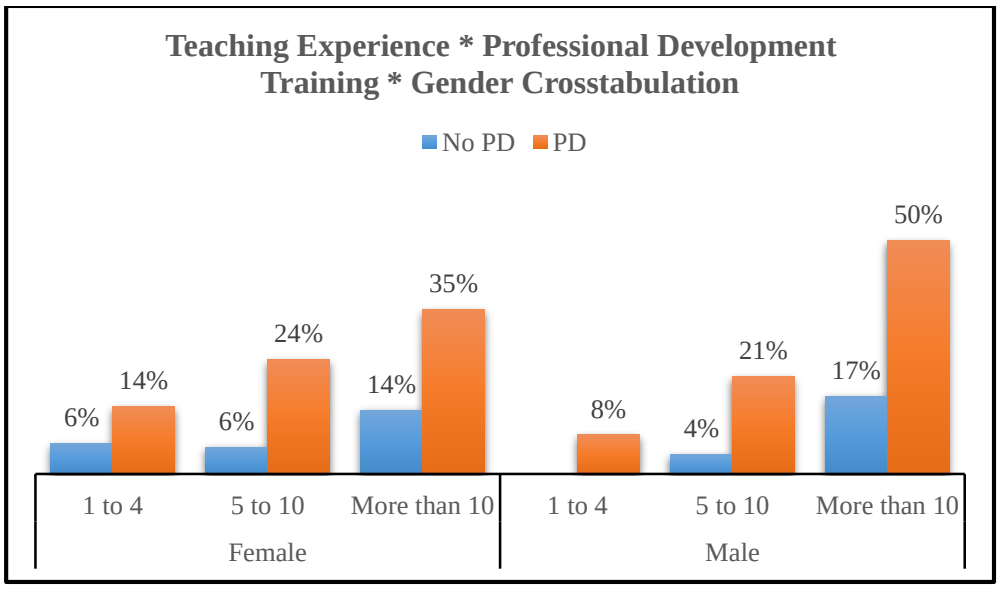

Figure (4.1): Percentage of Participants According to Professional Development and Teaching Experience across Gender Groups

Crosstabulation of Grade Level Taught against Teacher's Academic Qualification across Gender groups shows that the academic qualifications of the (24) male teachers are divided equally between the bachelor and the master's degree. Most of the male participants have more experience in teaching high school students rather than elementary or middle school students. They are represented by (19) participants from the whole male sample. On the other hand, (81) female participants have a bachelor educational degree followed by (47) female participants who have a master's degree while only (11) female teachers have a postgraduate diploma. Furthermore, the female teachers have more experience in teaching different grade levels than male teachers. Several (80) female teachers from the total (139) female participants teach primary and middle school students evenly while (59) female participant teachers are represented as high school teachers, see Figure (4.2).

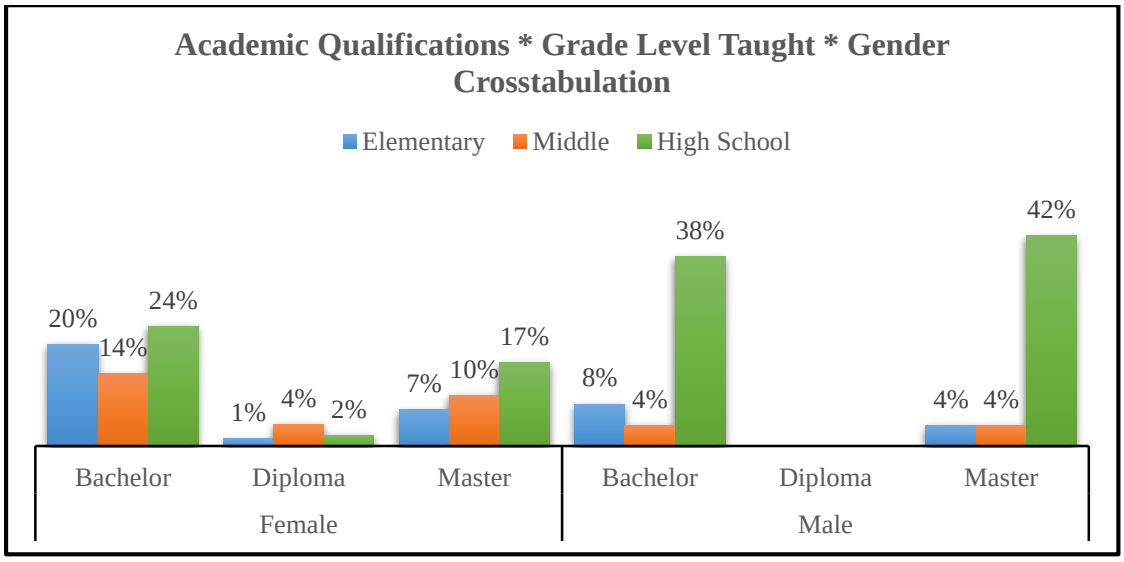

Figure (4.2): Percentage of Participants according to Grade Level Taught and Teacher's Academic Qualification across Gender Groups

4.1.1.2 Results of Teachers' Perceptions Regarding the Implemented Formative Assessment Strategies and their Effects on Enhancing Students' Skills

In this section of the study, the closed-ended survey questions were analyzed according to the (English, science, and math) teachers' perceptions. This section is divided into two sub-sections (two clusters), the first one is related to the implemented FA strategies that the teachers use in their classrooms. It consists of (23) statements that are related to different strategies including various

teaching and assessment strategies. The second cluster contains (6) statements where the participants must state the effect of using FA strategies on enhancing students' skills.
Teachers were asked to think about these statements and state their decision based on the Likert scale by using a number from one to five (1 = "Strongly Disagree", 2 = "Disagree", 3 = "Neutral", 4 = "Agree", and 5 = "Strongly Agree").

A one-sample *t*-test is conducted in order to test whether or not the mean score of all the questionnaire's statements (29 statements) in section (2) would be equal to the general mean score of (4.34). The results are reported in the table below.

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
overall mean	163	4.3364	.32434	.02540

One-Sample *t*-Test

	Test Value = 4.34					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
overall mean	-.143	162	.886	-.00363	-.0538	.0465

Table (4.9): Inferential Statistics of Section Two Questionnaire's Statements

Table (4.9) revealed the results of the one-sample *t*-test inferential statistics for all the questionnaire's statements in section 2. The test result showed that the p-value = 0.886 ($p>0.05$) which indicates that there is no significant difference in teachers' responses. Most of the teachers agreed on the same FA strategies that should be implemented in their classes in order to enhance students' learning skills.

Cluster 1: The Implemented FA Strategies in American Private Schools in the UAE

The first cluster in section 2 of the teachers' questionnaire is related to the statements' analysis regarding the implemented FA strategies that the teachers use in American private schools in the UAE. The analysis of the collected results and the distribution of teachers' responses percentages are represented in the following table.

Cluster 1 The Implemented FA Strategies	Strongly disagree		disagree		Not decided		Agree		strongly agree	
	#	%	#	%	#	%	#	%	#	%
1. I encourage my students to assess themselves.	0	0.0%	0	0.0%	3	1.8%	73	44.8%	87	53.4%
2. I encourage my students to talk, share ideas, and working cooperatively through Think- Pare-Share strategy.	0	0.0%	0	0.0%	1	0.6%	31	19.0%	131	80.4%
3. I provide students with different problem solving questions for each topic.	0	0.0%	0	0.0%	5	3.1%	76	46.6%	82	50.3%
4. I use Exit-Ticket strategy at the end of each topic.	0	0.0%	0	0.0%	2	1.2%	68	41.7%	93	57.1%
5. I use various questioning strategies in each lesson.	0	0.0%	0	0.0%	2	1.2%	65	39.9%	96	58.9%
6. I'm aware of what learners should know or be able to do and how will they learn.	0	0.0%	0	0.0%	10	6.1%	64	39.3%	89	54.6%
7. My lesson plan is aligned with the required curriculum.	0	0.0%	0	0.0%	4	2.5%	65	39.9%	94	57.7%
8. I plan and/or modify the lesson with differentiated tasks according to the needs of all students from different academic level.	0	0.0%	0	0.0%	18	11.0%	88	54.0%	57	35.0%
9. I use a variety of teaching strategies for each topic.	0	0.0%	0	0.0%	38	23.3%	90	55.2%	35	21.5%
10. I use different websites for assessing the skills of my students.	0	0.0%	0	0.0%	11	6.7%	99	60.7%	53	32.5%
11. My lesson progress based on students' responses.	0	0.0%	0	0.0%	18	11.0%	96	58.9%	49	30.1%
12. I plan my teaching instructions based on students' MAP results.	0	0.0%	0	0.0%	12	7.4%	92	56.4%	59	36.2%
13. I assess students' understanding according to their abilities in the 4 Cs.	0	0.0%	0	0.0%	11	6.7%	87	53.4%	65	39.9%
14. I analyze the results of students' assessments.	0	0.0%	0	0.0%	6	3.7%	70	42.9%	87	53.4%

15. I use various motivational tasks so students can gain competence, relatedness, and autonomy.	0	0.0%	0	0.0%	18	11.0%	88	54.0%	57	35.0%
16. I ask students to connect between the topic's new information and their current knowledge.	0	0.0%	0	0.0%	5	3.1%	72	44.2%	86	52.8%
17. I provide a consistence constructive feedback for each student.	0	0.0%	0	0.0%	13	8.0%	89	54.6%	61	37.4%
18. I use students' graded work as a feedback about their level.	0	0.0%	0	0.0%	13	8.0%	98	60.1%	52	31.9%
19. I use critical thinking questions in every topic.	0	0.0%	0	0.0%	13	8.0%	88	54.0%	62	38.0%
20. I provide students with different open-ended problems that is related to real life situations.	0	0.0%	0	0.0%	9	5.5%	92	56.4%	62	38.0%
21. I encourage my students to work independently in every lesson.	0	0.0%	0	0.0%	18	11.0%	99	60.7%	46	28.2%
22. I encourage students to decide their needs for further improvement.	0	0.0%	0	0.0%	16	9.8%	96	58.9%	51	31.3%
23. I ask students to decide their strengths and weaknesses without guidance.	0	0.0%	0	0.0%	32	19.6%	95	58.3%	36	22.1%
IFAS Total	0	0.0%	0	0.0%	278	7.4%	1881	50.2%	1590	42.4%

Table (4.10): Frequency Analysis of Teachers' Perceptions about the Implemented FA Strategies (% Distribution)

Table (4.10) illustrates the analysis of the collected results from 163 (English, science, and math) participating teachers. These results are related to 23 statements that explained the important types of various FA strategies that the teachers implement with students as a part of their daily lesson plan. The results of the questionnaire indicated that over (92%) of teachers' responses are categorized between strongly agree and agree in all the related items. Teachers believed the importance of applying these strategies in their classrooms. The highest percentage was related to encouraging students to talk, share ideas and working cooperatively through the Think-Pair-Share Strategy with (80.4%) strongly agree for this statement. On the other hand, the least percentage was linked to using a variety of teaching strategies for each topic with a percentage of (21.5%) of strongly agree. Moreover, the results indicated that (7.4%) of teachers were not able to decide regarding the implemented FA strategies. The highest percentage was related to using a variety of teaching strategies for each topic with (23.3%) not decided. As for the lowest percentage, (0.6%) of teachers were not able to decide about the importance of using Think-Pair-Share Strategy.

Furthermore, none of the teachers' responses was linked to disagree or strongly disagree with the provided statements.

The mean, standard deviation, and percentages that are related to the implemented FA strategies in various classes and grades by English, science, and mathematics teachers are presented and classified in the table below.

Cluster 1 The Implemented FA Strategies	**Likert Scale**			**Descriptive Statistics**	
	Not decided	**Agree**	**Strongly Agree**	**Mean**	**SD**
1. I encourage my students to assess themselves.	1.8%	44.8%	53.4%	4.52	0.54
2. I encourage my students to talk, share ideas, and working cooperatively through Think- Pare-Share strategy.	0.6%	19.0%	80.4%	4.80	0.42
3. I provide students with different problem solving questions for each topic.	3.1%	46.6%	50.3%	4.47	0.56
4. I use Exit-Ticket strategy at the end of each topic.	1.2%	41.7%	57.1%	4.56	0.52
5. I use various questioning strategies in each lesson.	1.2%	39.9%	58.9%	4.58	0.52
6. I'm aware of what learners should know or be able to do and how will they learn.	6.1%	39.3%	54.6%	4.48	0.61
7. My lesson plan is aligned with the required curriculum.	2.5%	39.9%	57.7%	4.55	0.55
8. I plan and/or modify the lesson with differentiated tasks according to the needs of all students from different academic level.	11.0%	54.0%	35.0%	4.24	0.64
9. I use a variety of teaching strategies for each topic.	23.3%	55.2%	21.5%	3.98	0.67
10. I use different websites for assessing the skills of my students.	6.7%	60.7%	32.5%	4.26	0.57
11. My lesson progress based on students' responses.	11.0%	58.9%	30.1%	4.19	0.61
12. I plan my teaching instructions based on students' MAP results.	7.4%	56.4%	36.2%	4.29	0.60
13. I assess students' understanding according to their abilities in the 4 Cs.	6.7%	53.4%	39.9%	4.33	0.60
14. I analyze the results of students' assessments.	3.7%	42.9%	53.4%	4.50	0.57
15. I use various motivational tasks so students can gain competence, relatedness, and autonomy.	11.0%	54.0%	35.0%	4.24	0.64
16. I ask students to connect between the topic's new information and their current knowledge.	3.1%	44.2%	52.8%	4.50	0.56
17. I provide a consistence constructive feedback for each student.	8.0%	54.6%	37.4%	4.29	0.61
18. I use students' graded work as a feedback about their level.	8.0%	60.1%	31.9%	4.24	0.59
19. I use critical thinking questions in every topic.	8.0%	54.0%	38.0%	4.30	0.61
20. I provide students with different open-ended problems that is related to real life situations.	5.5%	56.4%	38.0%	4.33	0.58

21. I encourage my students to work independently in every lesson.	11.0%	60.7%	28.2%	4.17	0.60
22. I encourage students to decide their needs for further improvement.	9.8%	58.9%	31.3%	4.21	0.61
23. I ask students to decide their strengths and weaknesses without guidance.	19.6%	58.3%	22.1%	4.02	0.65

Table (4.11): Descriptive Statistics of Implemented FA Strategies in American Private Schools in the UAE

Table (4.11) identifies the descriptive statistics which include the mean, standard deviation, and percentages regarding the (23) statements that are related to the implemented FA strategies in students' classrooms. The results of the mean scores are presented to identify the highest and lowest rates of the implemented FA strategies in various classes including (English, science, and mathematics). The range is between (3.98) and (4.80) with a general mean score of (4.35). As reported in table (4.10), the majority of respondents strongly agree was nine statements while they agree was 14 statements. The highest mean of the implemented FA strategies by teachers is (4.80) with (0.42) standard deviation where (99%) of school teachers were between (80.4%) strongly agree and (19%) agree. These teachers stated that they encourage their students to talk, share ideas, and working cooperatively through Think-Pair-Share strategy. On the other hand, the results of the lowest mean of the implemented FA strategies by teachers is (3.98) with (0.67) standard deviation where (76.7%) of school teachers were between (21.5%) strongly agree and (55.2%) agree. These teachers indicated that they use a variety of teaching strategies for each topic. The rest of the participating teachers were not able to decide if they can use more than one teaching strategy for each topic with a percentage of (23.3%).

Moreover, the previous table indicated that the highest percentages for the category of the "Strongly Agree" were linked to the use of the following strategies arranged from the highest to the lowest rates of implementation. These strategies include Think-Pair-Share strategy with (80.4%) which represent the highest percentage, Questioning strategy with (58.9%), Exit-Ticket strategy with (57.1%), Self-Assessment strategy with (53.4%), Constructive Feedback strategy with (54.6%), and Problem-Based Learning strategy with (50.3%). To sum up, above (96%) of the participating teachers stated that they focused on the importance of using the following strategies: Think-Pair-Share, Exit-Ticket, and Self-Assessment, and Problem-Based Learning as the main strategies used in students' classrooms.

Regarding the inferential statistics, the researcher conducted a one-sample *t*-test in order to test whether or not the mean score of a statement would be equal to the general mean score of 4.35. The results are reported in the table below.

One-Sample Test						
Cluster 1 **The Implemented FA Strategies**	**Test Value = 4.35**					
	t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**95% Confidence Interval of the Difference**	
					Lower	**Upper**
1. I encourage my students to assess themselves.	3.931	162	.000	.165	.08	.25
2. I encourage my students to talk, share ideas, and working cooperatively through Think- Pare-Share strategy.	13.666	162	.000	.448	.38	.51
3. I provide students with different problem solving questions for each topic.	2.795	162	.006	.122	.04	.21
4. I use Exit-Ticket strategy at the end of each topic.	5.091	162	.000	.208	.13	.29
5. I use various questioning strategies in each lesson.	5.567	162	.000	.227	.15	.31
6. I'm aware of what learners should know or be able to do and how will they learn.	2.808	162	.006	.135	.04	.23
7. My lesson plan is aligned with the required curriculum.	4.726	162	.000	.202	.12	.29
8. I plan and/or modify the lesson with differentiated tasks according to the needs of all students from different academic level.	-2.221	162	.028	-.111	-.21	-.01
9. I use a variety of teaching strategies for each topic.	-7.009	162	.000	-.368	-.47	-.26
10. I use different websites for assessing the skills of my students.	-2.057	162	.041	-.092	-.18	.00
11. My lesson progress based on students' responses.	-3.322	162	.001	-.160	-.25	-.06
12. I plan my teaching instructions based on students' MAP results.	-1.322	162	.188	-.062	-.15	.03
13. I assess students' understanding according to their abilities in the 4 Cs.	-.399	162	.691	-.019	-.11	.07
14. I analyze the results of students' assessments.	3.287	162	.001	.147	.06	.24
15. I use various motivational tasks so students can gain competence, relatedness, and autonomy.	-2.221	162	.028	-.111	-.21	-.01
16. I ask students to connect between the topic's new information and their current knowledge.	3.352	162	.001	.147	.06	.23
17. I provide a consistence constructive feedback for each student.	-1.166	162	.245	-.056	-.15	.04

18. I use students' graded work as a feedback about their level.	-2.412	162	.017	-.111	-.20	-.02
19. I use critical thinking questions in every topic.	-1.034	162	.303	-.049	-.14	.04
20. I provide students with different open-ended problems that is related to real life situations.	-.551	162	.583	-.025	-.11	.06
21. I encourage my students to work independently in every lesson.	-3.764	162	.000	-.178	-.27	-.08
22. I encourage students to decide their needs for further improvement.	-2.850	162	.005	-.135	-.23	-.04
23. I ask students to decide their strengths and weaknesses without guidance.	-6.418	162	.000	-.325	-.43	-.23

The mean difference is:
*Significant at 0.05 level
**Highly significant at 0.01
***Extremely significant at 0.001

**. None of the respondents scored "1" or "2".*
***. General Mean = 4.35*
Cronbach's α = .908

Table (4.12): Inferential Statistics of the Implemented FA Strategies in American Private Schools in the UAE

Table (4.12) represents the one-sample *t*-test results which was conducted to test whether the mean score of a statement would be equal to the general mean score of (4.35). The results revealed that the mean score of statements 1, 2, 3, 4, 5, 6, 7, 14, and 16 was significantly higher than the general mean score of 4.35, $p < 0.05$. On the other hand, the mean score of statements 8, 9, 10, 11, 15, 18, 21, 22, and 23 was significantly lower than the general mean score of 4.35, $p>0.05$. In addition, there was no significant difference between the mean score of statements 12, 13, 17, 19, and 20 and the general mean score of (4.35).

Cluster 2: The Effect of Using FA Strategies on Enhancing Students' Skills in American Private Schools in the UAE

The second cluster in section 2 of the teachers' questionnaire is related to the statements' analysis regarding the effect of using FA strategies on enhancing students' thinking skills in American private schools in the UAE from teachers' perceptions. Table (10) illustrates the descriptive analysis of the collected results from 163 (English, science, and math) participating teachers. These results are related to (6) statements that explained teachers' beliefs about the important skills that can be built and developed in students by implementing FA strategies in their lessons. These skills are related to students' learning skills that have a direct effect on their attainment and progress in

the national and international exams. The percentage distribution of teachers' responses is represented in the following table.

Cluster 2 The Effect of Using FA Strategies on Enhancing Students' Learning Skills	Strongly disagree		disagree		Not decided		Agree		strongly agree	
	#	%	#	%	#	%	#	%	#	%
1. To enhance students' academic attainment.	0	0.0%	0	0.0%	21	12.9%	93	57.1%	49	30.1%
2. To assess the teaching process and modify it accordingly.	0	0.0%	0	0.0%	6	3.7%	90	55.2%	67	41.1%
3. To evaluate students' progress.	0	0.0%	0	0.0%	11	6.7%	85	52.1%	67	41.1%
4. To group students for differentiated activities.	0	0.0%	0	0.0%	11	6.7%	86	52.8%	66	40.5%
5. To prepare students for national and international exams.	0	0.0%	0	0.0%	8	4.9%	94	57.7%	61	37.4%
6. To improve students' skills.	0	0.0%	0	0.0%	21	12.9%	96	58.9%	46	28.2%
EFAR Total	0	0.0%	0	0.0%	78	8.0%	544	55.6%	356	36.4%
Overall (IFAS & EFAR)	0	0.0%	0	0.0%	356	7.5%	2425	51.3%	1946	41.2%

Table (4.13): Frequency Analysis of Teachers' Perceptions about the Effect of Using FA Strategies on Enhancing Students' Skills (% Distribution)

Table (4.13) illustrates the analysis of the collected results from 163 (English, science, and math) participating teachers. The results of cluster two of the teachers' questionnaire indicated that (92%) of teachers' responses are categorized between strongly agree and agree for all the related items. Teachers believed that FA strategies have a positive impact on students' learning skills and their attainment and progress in the national and international exams. The highest percentage was related to the improvement of students' progress and assessing the teaching process and modifying it according to the needs of students with (41.1%) strongly agree for each statement. On the other hand, the least percentage was linked to improving the students' learning skills with a percentage of (28.2%) of strongly agree. Moreover, the results indicated that (7.5%) of teachers were not able to decide about some of the effect of the FA strategies. The highest percentage was related to enhancing the students' attainment and improving their skills with (12.9%) not decided for each statement. As for the lowest percentage, (3.7%) of teachers were not able to decide whether FA

strategies are able to assess their teaching process and modify it accordingly. Furthermore, none of the teachers' responses was linked to disagree or strongly disagree with the provided statements.

The mean, standard deviation, and percentages that are related to the effect of using FA strategies on enhancing students' skills in American private schools in the UAE are presented and classified in the table below according to English, science, and mathematics teachers' perceptions.

Cluster 2 **The Effect of Using FA Strategies on Enhancing Students' Learning Skills**	**Likert Scale**			**Descriptive Statistics**	
	Not decided	**Agree**	**Strongly agree**	**Mean**	**Standard deviation**
1. To enhance students' academic attainment.	12.9%	57.1%	30.1%	4.17	0.63
2. To assess the teaching process and modify it accordingly.	3.7%	55.2%	41.1%	4.37	0.56
3. To evaluate students' progress.	6.7%	52.1%	41.1%	4.34	0.60
4. To group students for differentiated activities.	6.7%	52.8%	40.5%	4.34	0.60
5. To prepare students for national and international exams.	4.9%	57.7%	37.4%	4.33	0.57
6. To improve students' skills.	12.9%	58.9%	28.2%	4.15	0.62

Table (4.14): Descriptive Statistics of the effect of Using FA Strategies on Enhancing Students' Skills in American Private Schools in the UAE

Table (4.14) identifies the descriptive statistics which include the mean, standard deviation, and percentages regarding the six statements that are related to the effect of using FA strategies on enhancing students' skills in American private schools in the UAE. The results of the mean scores are presented to identify the highest and lowest rates of the effect of using FA strategies on enhancing students' learning skills. The range is between (4.37) and (4.15) with a general mean score of (4.28). The previous table shows that the highest mean of the effect of FA strategies is (4.37) with (0.56) standard deviation where (96%) of school teachers were between (41.1%) strongly agree and (55.2%) agree. These teachers agreed on the effect of using FA strategies in order to assess the teaching process and modify it according to students' need. On the other hand, the results of the lowest mean of the effect of FA strategies is (4.15) with (0.62) standard deviation where (87.1%) of school teachers were between (28.2%) strongly agree and (58.9%) agree that the use of FA strategies can improve the students' learning skills.

Moreover, table (4.13) indicated that the highest percentages for the category of the "Strongly Agree" were linked to assessing the teaching process and modifying it according to the needs of students as well as evaluating the students' progress evenly with (41.1%). However, the mean and standard deviation for the first and the second statements is slightly different. The mean score for the second statement which is related to assessing the teaching process and modifying it accordingly is (4.37) and the standard deviation is (0.56). As for the third statement which is linked to evaluating the students' progress, the mean score is (4.34) and the standard deviation is (0.60). These results represent the highest percentages in this second cluster of section 2 of the teachers' questionnaire. For the second category which is related to "Agree" responses, the highest percentages were linked to the ability of FA strategies in improving the skills of students with a percentage of (58.9%) of the total participants. Also, more than half of the teachers (57.7%) indicated that they use FA strategies in order to prepare students for the national and international exams. Furthermore, teachers indicated that these strategies play a significant role in enhancing students' attainment with a percentage of (57.1%). To sum up, above 93% of the participating teachers stated that the effect of using various FA strategies is closely connected to four essential targets which include assessing the teaching process and modifying it accordingly, preparing students for national and international exams, to evaluate students' progress, and assign them to different tasks and activities based on their results in the formative assessment.

Regarding the inferential statistics, the researcher conducted a one-sample *t*-test in order to test whether or not the mean score of a statement would be equal to the general mean score of 4.28. The results reported in table below.

One-Sample Test						
Cluster 2 **The Effect of Using FA Strategies on Enhancing Students' Learning Skills**	**Test Value = 4.28**					
	t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**95% Confidence Interval of the Difference**	
					Lower	**Upper**
1. To enhance students' academic attainment.	-2.178	162	.031	-.108	-.21	-.01
2. To assess the teaching process and modify it accordingly.	2.162	162	.032	.094	.01	.18

3. To evaluate students' progress.	1.347	162	.180	.064	-.03	.16
4. To group students for differentiated activities.	1.221	162	.224	.057	-.04	.15
5. To prepare students for national and international exams.	1.020	162	.309	.045	-.04	.13
6. To improve students' skills.	-2.589	162	.011	-.127	-.22	-.03
The mean difference is: *Significant at 0.05 level **Highly significant at 0.01 ***Extremely significant at 0.001			*. None of the respondents scored "1" or "2". **. General Mean = 4.28 Cronbach's α = .778			

Table (4.15): Inferential Statistics of the Effect of Using FA Strategies on Enhancing Students' Skills in American Private Schools in the UAE

Table (4.15) revealed the results of the one-sample *t* test inferential statistics. The test showed that the second statement which is related to "assess the teaching process and modify it accordingly" had a significantly higher mean score (4.37) than the general mean score of 4.28, $p = 0.032$, $p < 0.05$ respectively. However, the statements "To enhance students' academic attainment" and "To improve students' skills" had significantly lower mean scores (4.17 and 4.15) than the general mean score of 4.28, $p = 0.031$ and 0.011, respectively.

4.1.1.3 The Relationship between Teachers' Demographic Information and the Implemented FA Strategies to Enhance Students' Learning Skills:

Descriptive and inferential statistics were conducted in this section of the study in order to examine the relationship between various variables. The table below shows the overall link between teachers' responses regarding both cluster one which is related to the implemented FA strategies and cluster two that is linked to the effects of using these strategies on enhancing students' learning skills with teachers' demographic information. This demographic information is related to teachers' gender, teaching experience, academic qualifications, professional development programs in addition to the number of students in classrooms and grade level taught.

In the table below, significant differences between groups of teachers based on their demographic information were tested and reported. Two-sample *t*-test was used to find significant differences between males and females and between teachers who received professional development training and those who did not. On the other hand, one-way ANOVA was used to find significant

differences between teachers' groups in terms of average number of students in classes, teaching experience, grade level taught, and academic qualifications. The results of the two tests are presented as follows:

Statement	Mean	Standard Deviation	Test result
Gender	M = 4.32	M = 0.29	t-test t = - 0.284 P-value = 0.777
	F = 4.34	F = 0.33	
Professional Development training	Yes = 4.37	Yes = 0.32	t-test t = 2.454 P-value = 0.015
	No = 4.23	No = 0.32	
Number of students in class	Less than 20 = 4.43	Less than 20 = 0.33	ANOVA test F = 4.593 P-value = 0.011
	21 – 20 = 4.34	21 – 20 = 0.32	
	30 or more = 4.12	30 or more = 0.23	
Experience	1 to 4 = 4.36	1 to 4 = 0.31	ANOVA test F = 0.409 P-value = 0.665
	5 to 10 = 4.36	5 to 10 = 0.36	
	More than 10 = 4.31	More than 10 = 0.31	
Grade level taught	Elementary = 4.44	Elementary = 0.35	ANOVA test F = 3.404 P-value = 0.036
	Middle = 4.33	Middle = 0.31	
	High = 4.28	High = 0.30	
Qualification	BA = 4.32	BA = 0.34	ANOVA test F = 0.881 P-value = 0.416
	DP = 4.25	DP = 0.24	
	MA = 4.37	MA = 0.31	

Table (4.16): Overall Teachers' Responses Based on Their Demographic Information

Table (4.16) revealed that there was no significant difference between teachers' responses and their gender (p-value = 0.777), experience (p-value = 0.665), and qualification (p-value = 0.416). The results indicated that the p-value of these three sets of demographic information are greater than (0.05). In contrast, the significant difference found between teachers' responses and the following groups: Professional Development training (p-value = 0.015), number of students in class (p-value = 0.011), and grade level taught (p-value = 0.036). The results indicated that the p-value of these three sets of demographic information are less than (0.05). The highest mean was shown to be (4.44) with the grade level taught for elementary teachers with a standard deviation of (0.35). For the professional development training, the highest mean is (4.37) for teachers who received FA programs with a standard deviation of (0.32). Furthermore, the highest mean of the number of students (less than 20) in class is (4.43) with a standard deviation of (0.33).

4.1.1.4 Results of Teachers' Perceptions about the Students' Academic Level According to the Depth of Knowledge Model (DOK).

In this section of the study, teachers decided the main skills that most of their students are able to implement depending on the four levels of the DOK model. The first level of the DOK model is related to the ability of students to recall, identify, use, and measure basic information where (22) teachers out of (163) decided that their students are in this level. These teachers represent (13.5%) of the total participating teachers. Most of the participating teachers (73 teachers out of 163) which represented (44.8%) of the total participants indicated that their students are in the second level of the DOK model. In this level, students can compare between multiple steps in order to find an appropriate solution by using different skills such as, classifying, organizing, estimating as well as collecting & displaying data. The rest of the results was related to the third level of the DOK model where (68 teachers out of 163) stated that their students are in this level. These teachers represented by (41.7%) of the total participants. Students who are in the third level of the DOK model are able to plan and provide scientific reasons in addition to their abilities for using evidence. They also have a higher level of thinking by using various skills, for example, justifying, explaining, and drawing conclusions.

Regarding the last level of the DOK model which is linked to the highest level of the thinking skills, no one from the participating teachers categorized their students in this level. Students in this level must be able to learn complex reasoning, developing their ideas and thinking through a specific period of time. In addition to make difficult connections between scientific concepts. Students' academic levels in the DOK model according to teachers' perceptions are presented in the following table.

	Level 1	**Level 2**	**Level 3**
The Level where Teachers believe that Most of their Students can do	22 (13.50%)	73 (44.79%)	68 (41.72%)

Table (4.17): Results of Teachers' Perceptions about the Students' Academic Level According to the Depth of Knowledge Model (DOK)

4.1.2 Results of Students' Science MAP Exams

For the second part of the quantitative data, document analysis is used in order to answer the third question of the study, which is: What is grade eight students' progress in science MAP exams in the light of FA strategies implemented in American private schools in the UAE?

Students' results in the MAP exams were collected from five different schools which implemented both FA strategies in their daily lesson plans and the MAP exams as one of the academic requirements in each American curriculum school.

Five private American curriculum schools in the United Arab Emirates participated in the current study. These schools include two private schools in Sharjah, one private school in Dubai, one private school in Al-Ain, and another private school in Abu Dhabi. The collected sample represented by (250) students from grade eight. The study data regarding the students' results in the MAP exam was collected from (10) science classes represented by two classes. The sample includes one class for males and another one for females from each participating school. These schools conducted the MAP exams three times a year (three windows). The first exam (window one) was conducted in the beginning of term one, the results are known as (Fall 2018). The second exam (window two) was implemented in the second term of the academic year, these results are identified as (Winter 2018) while the third and the last MAP exam was conducted in term three, the results are titled as (Spring 2019). In this study, the gathered results indicated grade eight students' scores in window one for (Fall 2018) and the other window one for (Fall 2019) in the science subject. This period signifies a complete academic year where teachers used various FA strategies in order to improve students' skills and prepare them for the next window of the MAP exam.

In addition, the results of students' progress were collected from the RIT score of the MAP exams. This score can indicate the level of students' knowledge, understanding, and skills. The collected information can help in deciding the level of students' progress in the MAP exam of fall 2019. This information helps in measuring and evaluating to what extent students' skills have been improved in both cases, whether the student met the target of the Projection Growth or did not achieve it. Furthermore, the students' results in this section are classified into three categories; the first one (Improved) which indicates that the student was able to make a progress by attaining a better score in the MAP exam of fall 2019. The second category (At the same level) shows that

the student neither improved nor declined. The third category (Declined) specifies that the student gained a lesser score in fall 2019 than his/her score in fall 2018. This analysis is important in implementing the needed quantitative data in this study (Muijs, 2011). Grade eight students' MAP results were analyzed by using (SPSS, version 23). Descriptive analysis was utilized to address the required data in order to answer the third question of the study. The provided results include frequencies and percentages of the students' progress in the MAP exams of each participating school. These results can be used as a strong evidence in order to decide about the effect of using FA strategies on students' results in the MAP exams for the current study.

The following figure illustrates the results of grade eight science students in the MAP exam of fall 2019 in five participating schools.

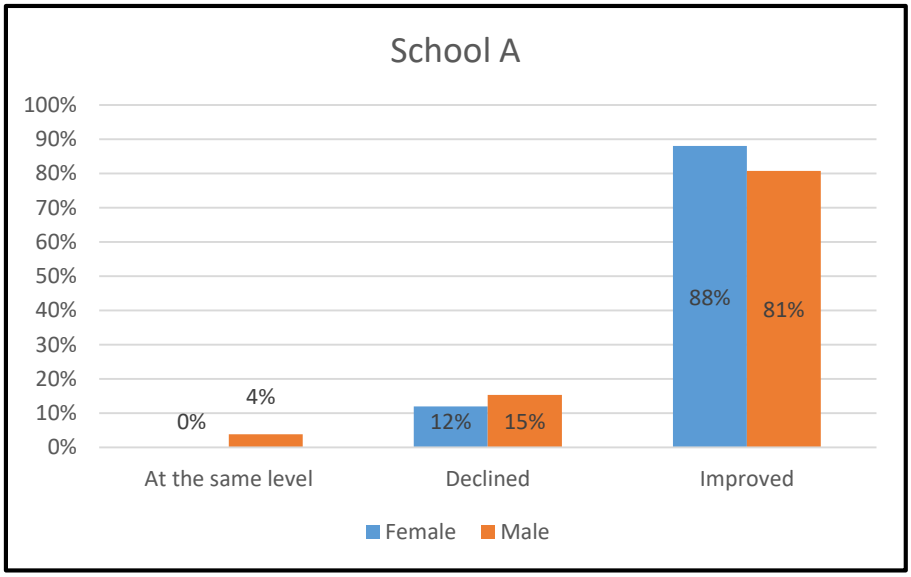

Figure (4.3): Students' MAP Results in Fall 2019 in School (A) Across Gender Groups

Figure (4.3) represents school (A) which includes (25) female students and (25) male students. The results indicated that (84%) of students showed improvement in the exam of fall 2019. This percentage includes (43%) of females and (41%) of males. On the other hand, (14%) of the total participants in school (A) declined in their results including (6%) of females and (8%) of males. Only one male student stayed at the same level which represents (2%) of the whole participants.

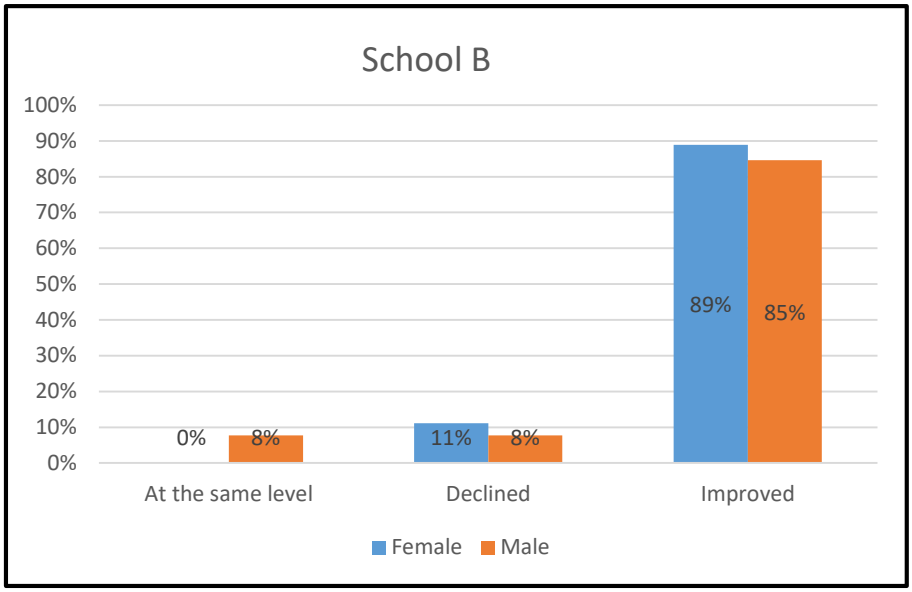

Figure (4.4): Students' MAP Results in Fall 2019 in School (B) Across Gender Groups

Figure (4.4) represents school (B) which includes (26) female students and (25) male students. The results indicated that (87%) of students showed improvement in the exam of fall 2019. This percentage includes (45%) of females and (42%) of males. On the other hand, (9%) of the total participants in school (B) declined in their results including (6%) of females and (4%) of males. Two male students only stayed at the same level which represent (4%) of the whole participants.

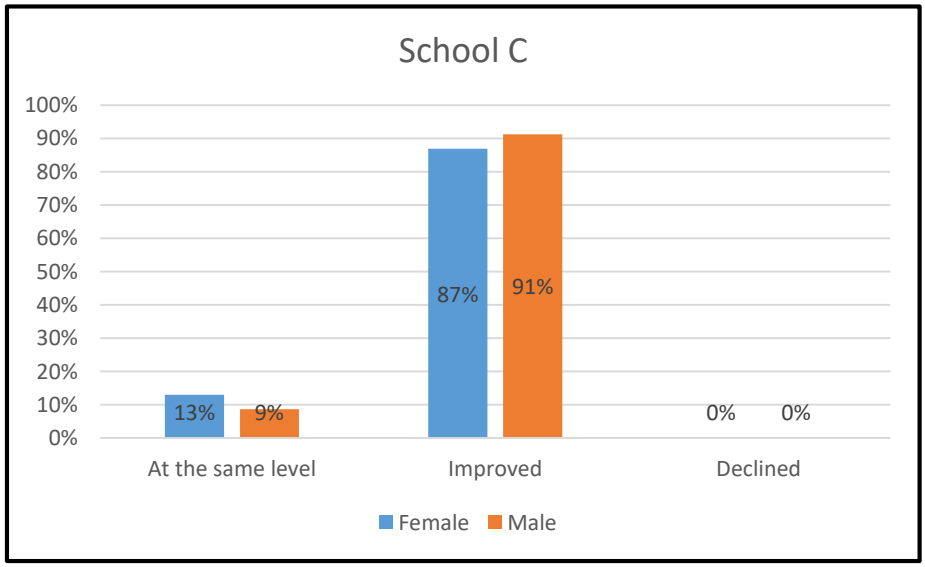

Figure (4.5): Students' MAP Results in Fall 2019 in School (C) Across Gender Groups

Figure (4.5) represents school (C) which includes (22) female students and (22) male students. The results indicated that (89%) of students showed improvement in the exam of fall 2019. This percentage includes (43%) of females and (46%) of males. On the other hand, none of the students declined in their results in the MAP exam of fall 2019. However, (11%) of the participating students stayed at the same level which represent (7%) of the female students and (4%) of the male students from the whole participants.

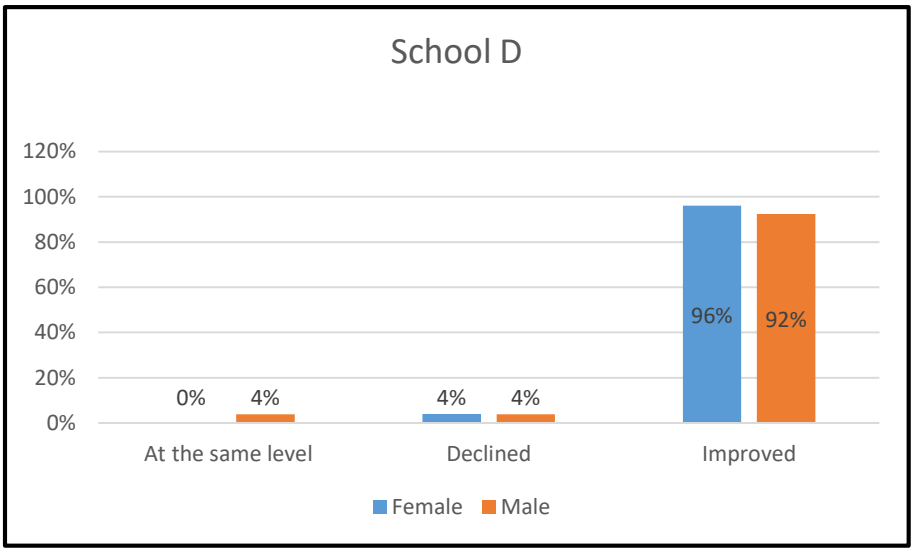

Figure (4.6): Students' MAP Results in Fall 2019 in School (D) Across Gender Groups

Figure (4.6) represents school (D) which includes (24) female students and (25) male students. The results indicated that (94%) of students showed improvement in the exam of fall 2019. This percentage includes (47%) of females and (47%) of males. On the other hand, (4%) of the total participants in school (D) declined in their results including (2%) of females and (2%) of males which represented by one student from each class. One male student only stayed at the same level which represents (2%) of the whole participants.

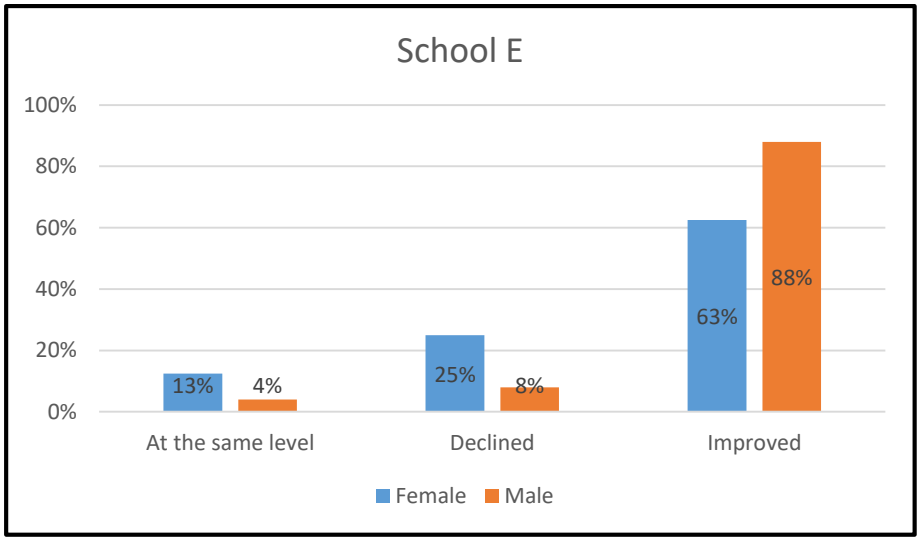

Figure (4.7): Students' MAP Results in Fall 2019 in School (E) Across Gender Groups

Figure (4.7) represents school (E) which includes (23) female students and (24) male students. The results indicated that (76%) of students showed improvement in the exam of fall 2019. This percentage includes (31%) of females and (45%) of males. On the other hand, (16%) of the total participants in school (E) declined in their results including (12%) of females and (4%) of males. Three female students (6%) and one male student (2%) stayed at the same level which represent (8%) of the whole participants. The following figure summarize the results of grade eight science students in the MAP exams of fall 2019 in the five participating schools.

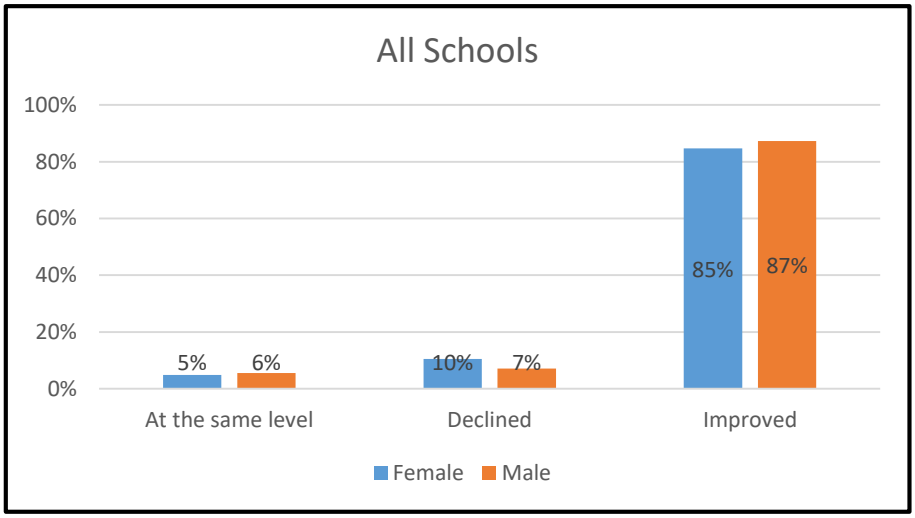

Figure (4.8): Students' MAP Results in Fall 2019 in All Participating Schools Across Gender Groups

Figure (4.8) indicated that all of the participating schools showed improvement in their students' results of the MAP exams in fall 2019 although they have not met the target of the Projection Growth that each student has to score. Four of the participating schools presented the three levels of the improvement description including (Improved, at the same level, and declined) except (school C) where none of the students declined in their results. From all participating students which is represented by (250) students from five different schools in the UAE, the results indicated that (86%) of students showed improvement in the exam of fall 2019. This percentage includes (124) female students and (126) male students. On the other hand, (9%) of the total sample declined in their results. This percentage includes (13) female students and (9) male students. Regarding the students who neither improved nor declined, the results indicated that (5%) of all the participating students stayed at the same level which represented by (6) female students and (7) male students.

4.1.3 Summary of Quantitative Data Results

Attributes of the FA teachers' questionnaire and the data analysis of the students' results in the science MAP exams are summarized as follows:

- Most of the teachers indicated that they are knowledgeable and aware regarding the importance of using FA strategies in their classrooms.
- Most of the teachers' responses are categorized between strongly agree and agree in all questionnaire's items. Furthermore, none of the responses was categorized in disagree or strongly disagree.
- Almost all of the teachers believe that the strategy of Think-Pair-Share is considered as one of the top strategies that can improve students' skills.
- A great number of teachers use various FA strategies in their daily instructions and specifically they concentrate on Problem-Based Learning, Self-Assessment, Exit-Cards, Questioning, and Feedback Strategies.
- Most of the teachers indicated the importance of analyzing and using the results of students' MAP exams and students' skills to build and modify their lesson plans in order to meet their needs.

- Most of the teachers agreed that using FA strategies can prepare students for the national and international exams, and to guide them in evaluating their teaching processes and modifying them.
- 45% of teachers believed that their students are in the second level of the DOK model where they are able to compare between multiple steps in order to find an appropriate solution by using different skills such as, classifying, organizing, estimating as well as collecting & displaying data.
- 42% of teachers assumed that their students are in the third level of the DOK model where they can plan and provide scientific reasons in addition to their abilities of using evidence. Furthermore, these students have higher level of thinking by using various skills, for example, justifying, explaining, and drawing conclusions as well.
- Various significant differences are presented between all teachers' demographic information and the implementation of FA strategies and its effect on enhancing students' skills. These significant differences are mostly related to teachers' professional development programs, average number of students in class, and the grade level taught.
- 86% of the participating students achieved better results in their science MAP exam of (fall 2019) although they have not met the target of the Projection Growth that each student must achieve.
- 86% of students showed improvement in the exam of fall 2019. This percentage includes (85%) female students and (87%) male students although they have not met the target of the Projection Growth that each student has to achieve. On the other hand, (9%) of the total sample declined in their results and (5%) of all the participating students stayed at the same level.
- The highest mean of the implemented FA strategies by teachers is (4.80) where (99%) of school teachers stated that they encourage their students to talk, share ideas, and working cooperatively through Think-Pare-Share strategy.
- The lowest mean of the implemented FA strategies by teachers is (3.98) where (76.7%) of school teachers indicated that they use a variety of teaching strategies for each topic.

- The highest mean of the effect of using FA strategies on enhancing students' learning skills is (4.37) where (96%) of school teachers indicated the effect of using FA strategies to assess the teaching process and modify it according to students' need.
- The results of the lowest mean of the effect of using FA strategies on enhancing students' learning skills is (4.15) where (87.1%) of school teachers indicated that the use of FA strategies can improve the students' learning skills.

4.2 Qualitative Data Analysis Results

This section presents the second part of the explanatory sequential mixed method design which starts with the qualitative part. This section covers the results of both the science leaders' interviews and the open-ended questions of the teachers' questionnaire as the following:

4.2.1 Results of the Science Leaders' Interviews

The second part of the explanatory sequential mixed method design is related to the qualitative data. The required information was collected from the science leaders in all the UAE participating schools including: 5 heads of the science departments (HOSD) and 5 middle school science leaders (MSSL) through semi-structured interviews. The results of these interviews can provide information about the science leaders' beliefs regarding how grade eight teachers use formative assessment strategies in preparing students for the MAP exams. Moreover, the interview with the science leaders clarify the resulted inquiries from the teachers' questionnaire and the results of the students in the science MAP exams.

As stated in the literature review, school leaders play an important role in planning, implementing, and evaluating the teaching and learning process of students. Therefore, leaders' opinions are significantly important to be included as part of the current study. Specifically, in relation to their perceptions about the effect of using of FA strategies towards improving students' skills and the learning procedures (Bell and Cowie, 2001; Torrance and Pryor, 2001; Wiliam, 2011). Furthermore, the results from leaders' opinions can answer the inquiries of the open-ended questionnaire's results (Almalki, 2016). The procedures of the interview protocol followed the

educational research guidelines based on (Louis, 2000), which started by filling in the demographic information about each interviewee, followed by the explanations about the reason and the central point of the investigation, then concluding with the qualitative questions which started from a general level of questions to the more precise and detailed debatable questions that should be gathered.

Six open-ended questions were discussed with the science leaders in the interviews. The type used to gather data was narrative by taking down notes and then later classifying them into themes by coding them. In each school, the meeting with the middle school science leader was conducted first in order to have a detailed picture of the teaching strategies and planning processes implemented in the department. In addition, the accessibility to scheduling a meeting with the science leaders was more flexible due to the fact that the head of the science department has more responsibilities, thus, meeting with him/her requires time. Then based on the results from the first meeting, the researcher attended the second meeting with the head of the science department. The following table represents a brief profile about the participating science leaders.

No.	Name of the school	Participant	Qualification	Years of experience
1.	School A	HOSD 1	Master's degree in Education	15 years
2.	School A	MSSL 1	Master's degree in Education	14 years
3.	School B	HOSD 2	Master's degree in Education	10 years
4.	School B	MSSL 2	Bachelor's degree in science	23 years
5.	School C	HOSD 3	Master's degree in Education	21 years
6.	School C	MSSL 3	Master's degree in Science	28 years
7.	School D	HOSD 4	PhD in Education	15 years
8.	School D	MSSL 4	Master's degree in Education	17 years
9.	School E	HOSD 5	PhD in Education	12 years
10.	School E	MSSL 5	Master's degree in Education	18 years

Table (4.18): Profile of Participating Science Leaders

The interviews were conducted, and the collected data was analyzed in order to answer the fourth question of the research study:

- What are the science leaders' beliefs about how grade eight teachers implement formative assessment strategies in preparing students for the MAP exams?

There are five essential stages that the researcher followed in order to analyze the results of the qualitative data. The first stage is related to reducing the amount of the gathered data and excluding the invalid responses. Then, the researcher organized the collected responses from all science leaders in a way that can elucidate the main ideas resulting from the interview meetings. In addition, the researcher analyzed these results in a form of descriptive statistics by using the process of data reduction. In the third stage, the gained results from the science leaders about how grade eight teachers implement FA strategies in preparing students for the MAP exams were coded and recoded in specific themes. In this stage, the researcher transformed the data from various participants to generate the overall and appropriate theme for the science leaders' interview questions. These results described the main ideas that most of the interviewees agreed on. In the fourth step, the data was compared and correlated in order to decide the connections and the differences between them. In the last stage, the researcher summarized and interpreted the results of the participants' perceptions which is considered as a conclusion of the qualitative data attained results through the implementation of higher-order analysis to achieve the required results.

The next sections demonstrate the science leaders' beliefs about each interview question.

Q1: How do middle school teachers implement formative assessment strategies in preparing students for the MAP exams?

All the science leaders demonstrated clear understanding about the importance of implementing FA strategies in preparing students for the MAP exam. Most of these leaders were able to decide about the effective ways and instructions that play an important role in achieving this target. Although numerous participants' leaders were experienced about the importance of FA strategies, the female head of the science department for school (D) was the most proficient leader in answering the interview questions.

According to leaders' beliefs, there are two themes that were extracted from this question. The first one is about the "student analytical skills". Many science leaders stated that analyzing students' academic skills is considered as an essential step that they must conduct before deciding about the appropriate ways they have to use in order to implement FA strategies in their science classes. According to the results of the student analytical skills, leaders can identify the gaps in the teaching process and the missing skills that the students need to concentrate on. As a result, leaders will be able to select the best and most suitable ways to implement FA strategies according to students' academic needs. This had been stated by the female head of the science department (HOSD) of school (D) who has PhD in Education and 15 years of teaching experience.

She said,

> "I ask my teachers to observe and analyze students' skills through their work in class to track their participation and progress. According to their skills, we use the Depth of Knowledge (DOK) model to pose better questioning techniques that enhance students' high order thinking skills".

Furthermore, the female HOSD of school (A) explained the importance of using the analysis of the previous MAP results in selecting the right ways to implement FA strategies. She stated,

> "My science teachers use the analysis of the previous MAP results (which is called the MAP growth report that displays their current and past RIT scores) for implementing proper strategies that differentiate students according to their results and structure the formative strategies accordingly to raise the level of all students".

Additionally, the male HOSD of school (C) signified the importance of conducting discussions about the students' skills

> "There are specific steps that teachers in my department follow to introduce and prepare students to the MAP exam. One of these steps includes discussing the results with teachers so teachers can discuss them with students. This step helps students know what they need to focus on and helps teachers recognize the exact support students need."

The second theme that was extracted from leaders' beliefs is about "continuous practices". Almost all the science leaders indicated the importance of continuous practices by using various FA strategies according to students' needs. The female HOSD of school (E) who has a PhD in Education and 12 years of teaching experience stated the positive effect of using FA strategies that matched with the previous MAP exam questions.

> "There are three ways to prepare students for the MAP test: the first is to ensure students practice MAP skills on a weekly basis (at least once per week) using MAP questions samples. The second way is to the use MAP Skills website as part of MAP Growth. Teachers assign formative assessment questions related to the concepts and skills taught. The third way is to integrate MAP skills in lesson plans by matching the common core standards with the concepts and skills in learning continuum. Teachers post concept check questions at different stages of the lesson".

The HOSD of school (D) confirmed the significance of continuous daily practices through Kagan instruction by using a variety of FA strategies that can lead to the required depth of knowledge for the MAP exam. She stated that,

> "The implementation of a range of strategies related to Formative assessment is highly emphasized in our school. That is why MAP questioning techniques are consistently embedded in the classwork sheets and group activities through Kagan instruction such as (Think-pair share and Mix-pair share) which are also utilized to enhance students' participation and outcomes. Accordingly, formative assessment practices are included in the daily lesson plans to guide both teachers and students to focus more heavily on depth of knowledge and problem-solving tasks which are emphasized in MAP exams".

Likewise, the MSSL of school (B) who has 23 years in teaching science for all grade levels noted that,

> "Several formative assessment strategies are utilized continuously such as standardized spiral questions based on MAP powered standards. Moreover, teachers assigning different types of high order thinking questions during lessons in addition to sending weekly homework on programs such as, IXL or Skill Navigator".

The middle school science female leader (MSSL) of school (C) who has a master's degree in Science Education and 28 years of teaching experience indicated the importance of using FA strategies for both teachers and students for a better MAP exam preparation. She mentioned that,

> "Teachers have to implement specific types of strategies that suit both themselves and students. For example, Think-Pair-Share strategy enables teachers to move around the class and evaluate students' skills to identify their needs. On the other hand, checklist strategy is beneficial for students because it indicates the areas they need to concentrate on. By collecting the results from both strategies, teachers can focus more on students' academic needs to prepare them for the MAP exam. Consequently, they modify their lesson plans accordingly to meet students' individual learning needs".

Q2: To what extent is MAP science exam data being used to drive FA strategies in science classrooms?

The science leaders confirmed the use of the students' MAP results analysis in their teaching processes. However, there are various ways that the leaders mentioned about how to beneficially use these data in their science classes. For instance, the MSSL of school (A) clarified that,

> "MAP exam provides significant insight about the school, grade and performance level of each student. According to the MAP results, the science department can decide whether the curriculum and the FA strategies that are used to implement the American curriculum are effective enough to improve the students' skills and results. Based on the results of each MAP exam, teachers can modify or change the used strategies in a way that can enhance students' abilities for the next MAP exam".

Likewise, the HOSD of school (B) explained the importance of using the MAP results in deciding the suitable strategies that should be used for improving the learning of students.

> "In science classrooms, most of the strategies used are based on the data analysis from the MAP exams. As to efficiently use personalized teaching and learning strategies, it is essential to analyze the results of each student in the MAP assessment. For example, concerning MAP it is important to analyze the progress of the students in each map test each semester in order to either sustain or raise his progress and use these results to plan which strategy will be more suitable".

The MSSL of school (D) indicated that the results of the MAP exam is considered as an alarm that can inform science teachers about the weak skills of students. She clarified that these results can help in re-planning their lessons by using more effective FA strategies and practices. She said that,

> "The MAP Data are usually analyzed to be aware of the areas of deficiency in science, which will inform the teachers' instruction in the classroom as well as the curriculum planning. According to that assessment, curriculum and instruction should be aligned and developed to put those deficiencies right. For example: if students are performing in life science below the norm, standards of life science will be focused, and all assessment practices will be designed to avoid students' misconceptions in this domain".

Both the HOSD and the MSSL of school (D) confirmed that their teachers implemented various FA strategies depending on the MAP results. They clarified some of the actions that they are following in regard to students with weak skills. They mentioned that,

> "More critical thinking and problem-solving questions will be discussed with students in the class. Additionally, inquiry-based learning practices are planned weekly to help engage students in scientific investigations. This allows teachers to assess their understanding and abilities in science.

We also focus on skill-based assessment in the light of MAP exams. That is why, teachers use exit-cards in all lesson to motivate students to give their feedback on a daily basis".

The MSSL of school (E) confirmed the opinion of the MSSL of school (D). He said that,

"Data from the MAP exam gives teachers a high-level of awareness about what students know and what they need to know. This helps teachers to anticipate and understand the gaps in students' skills. Consequently, teachers can utilize specific FA strategies that can help in developing the level of the student learning individually. For instance, enquiry- based strategies, more use of virtual labs and technology should be implemented in students' science classes".

The HOSD of school (E) added that,

"The MAP exam data is used to direct the teachers' lesson plan, prepare for differentiated work and adjust instructions which affect the quality of FA directed to students. Students are grouped based on their RIT score into below level, on level, and above level. The formative assessment strategies should be accommodated to the students' level, and, at the same time, they should ensure that learning objectives are achieved at all levels".

According to the previous viewpoints. All the participating science leaders indicated the use of the MAP results analysis in implementing FA strategies in different ways according to students' academic needs.

Q3: What are the factors that you/ your teachers depend on in order to select the FA strategies that should be implemented in science classrooms?

Science leaders' responses regarding the third interview question revealed three main themes. These themes are classified into (1) Internal Factors, (2) External Factors, and (3) Contextual Factors.

All the science leaders including both the heads of the science departments and the lead science teachers were conscious about the main factors that they put into consideration before selecting and implementing FA strategies in the science classes. Although all the chosen factors are significant and indispensable, science leaders presented different priorities in listing these factors according to the current situation in their school, students' needs, and their personal experience.

Most of the participants' responses were related to selecting the FA strategies according to students' MAP RIT scores.

A variety of factors were indicated by the HOSD of school (A). Some of them are related to internal factors and others linked with external factors. The HOSD who has 15 years in teaching experience stated that,

> "There are several factors used in order to select the formative assessment strategies that should be implemented in science classes. Primarily, MAP results data analysis which indicate the academic level of students' skills. Secondly, students' attainment and progress in class. Thirdly, the lesson objectives and the extent of depth required for understanding the concepts. Finally, the different groups of students found in the classroom".

The female HOSD of school (D) mentioned other types of factors that are not related to students' skills. She stated that she had 15 years of experience in teaching science accompanied by a PhD in education. This helped her to identify many external factors that she had faced during her job, which might alongside the internal factors affect the results of the students. She indicated that,

> "Teachers are influenced by many factors to select their formative assessment strategies, such as MAP RIT scores and its analysis, students' projection growth accompanied by their participation and engagement in the class. Students' abilities to solve problems and make logical decisions in the light of their data collected. In addition to other significant external factors that might directly affect the results of FA strategies, for example class size, materials, funding and time. These factors can limit the effectiveness of teachers' strategies".

The male HOSD of school (C) mentioned types of factors that are closely related to internal factors. He concentrated on students' skills in choosing the FA strategies that should be implemented in their daily lesson plans. The HOSD clarified that,

> "In the science department, the science teachers and I discuss the best FA strategies based on particular factors. Firstly, we focus on students' skills including (students with high and low abilities). Secondly, we select the FA strategies according to students' current skills, attitudes, and knowledge regarding subject matter. Thirdly, through measuring the areas of strengths and weaknesses in addition to the best learning styles that are appropriate to these areas. Lastly, FA strategies should be designated based on students' future requirements".

The MSSL of school (B) had another point of view regarding this question. She specified that selecting the FA strategies is directly related to the internal factors. However, these factors are closely related to student's academic level on the Depth of Knowledge (DOK) model. She said that,

> "We have three essential questions that all science teachers depend on before planning their lessons. These three questions are related to (Where am I now?), (Where am I going?), and (What strategies can help me to achieve my target?). Furthermore, students should be classified according to their level in the DOK model, which consists of four academic levels with various skills. According to the results' analysis of the previous factors, this enables the science team to plan accordingly."

The MSSL of school (E) confirmed the opinion of school (A and D) where he stated the importance of using MAP RIT scores in order to choose the appropriate FA strategies. However, he mentioned some of the new external factors that might affect this process. He indicated that,

> "The results of students' MAP exam is considered one of the important factors that science teachers take into consideration. These teachers collected important information about each student from the notes of the constructive feedback that they continuously implement in class. This will help in deciding the appropriate FA strategies that should be implemented. Furthermore, there are some of the external factors that might affect the results of the implementation of FA strategies, for instance time, teaching load (working conditions), and school resources to achieve meaningful change".

The HOSD of school (E) added new internal factors that other leaders did not mention. These factors are related to the teachers themselves. She stated that,

> "Other internal factors that might affect the process of implementing the appropriate FA strategies are related to teachers' personal values and beliefs, their pedagogical content knowledge as well as their motivations. In addition, teachers' understanding of the formative assessment itself".

On the other hand, the MSSL of school (C) mentioned the third type of factor which is related to the contextual factors. These factors are linked with the context and the policy of the school in addition to students' attitude. She indicated that,

> "In some schools, there is a big focus towards summative assessment because of its importance in maintaining students' high scores and indicating their improvement on standards. Therefore, some teachers concentrate more on this type of assessment due to school pressure and struggle in meeting the learning needs of students by implementing FA strategies. Therefore, in some

situations we focus on the strategies that can improve students' summative scores more than concentrating on developing students' skills".

The same MSSL also stated an important factor regarding students' attitude towards implementing FA strategies. She confirmed that,

"Because students are graded in summative assessment more than in formative assessment, this causes them to have a negative attitude towards participating in the strategies of FA. According to that, students' interactions might not be effective in science classes, which will provide teachers with negative feedback regarding the implementation of FA strategies".

The HOSD of school (B) and the MSSL of school (A) added additional external factors. They specified that,

"Science teachers are under a lot of pressure. They have great responsibility towards covering the entire curriculum before conducting the standardized, benchmark, and the national exams. The high stake and accountability assessment affect the performance of teachers and distort the process of implementing FA by not concentrating on students' learning skills. This leads to breaking the bond between three important components in education which include assessment, teaching, and learning".

Lastly, the MSSL of school (A) added another external factor related to teachers' experience and their abilities in implementing appropriate activities. These activities have a direct relationship with enhancing the students' academic results. She indicated that,

"Teachers have to participate in various professional development sessions in order to change their thoughts and understanding of the importance of FA strategies. They need a lot of support from the school to motivate them to change their practices. Our duty is to help teachers in developing their theoretical knowledge and practices".

Q4: What do you use to monitor/evaluate the progress of your students?

According to the analysis of the science leaders' responses, three main themes were created in order to answer this question. These themes are: (1) External Evaluation and monitoring (2) Teachers' evaluation and monitoring (3) Students' self-evaluation and monitoring.

All the science leaders indicated various ways to monitor and evaluate the progress of students. However, most of the leaders classify their ways of evaluation into two types. The first way is

related to the results of the external evaluation that had been collected by conducting the external exams including standardized and benchmark exams. While the second type of evaluation was gathered through teachers' analysis of the formative and summative exams.

One of the best monitoring and evaluation ways was mentioned by the HOSD of school (D). She indicated the use of a variety of ways that covered all the themes of this question. According to the external monitoring and evaluation the HOSD specified that,

> "MAP results are considered as an important component in students' evaluation and monitoring process. We usually compare window 1 to window 2 and finally window 3. This helps in tracking the students' attainment and progress each year and to identify their strengths and weaknesses".

Regarding the second theme that is related to the teachers' monitoring and evaluating process, she said that,

> "Teachers track the progress of their students through the internal assessments which include formative and summative assessments in addition to the collected notes from the oral and written feedback. These methods can help teachers in bridging the gaps and enhancing students' outcomes in order to achieve the school learning goals".

For the third theme which is related to students' self-monitoring and self-evaluating process, the HOSD indicated that,

> "We are implementing visible learning in the school where students are consistently trained to know what they are doing and what are their next step and targets of learning. Students' self & peer assessments are emphasized and considered to attain the learning aims. We use tracking sheets where four differentiated tasks are given in the light of Depth of Knowledge (DOK) model to provide students with a more meaningful learning path. In this case, students will be able to decide on their current abilities and new challenges to work on. Moreover, a students' presentation is then conducted to allow them to discuss their learning journeys, challenges and feedback. This process enhances students' metacognitive skills and allows them to share ideas for improvement".

All the HOSD of schools (E) and the MSSL of schools (B and E) had the same opinion about the ways that should be used in monitoring and evaluating grade 8 students. These ways are divided between the external and teachers' evaluation and monitoring themes. They confirmed that they

use both internal assessments which include formative and summative results progress data analysis in addition to international benchmarked MAP Results (MAP RIT growth that includes current and past RIT scores).

Likewise, the HOSD of school (B) added similar ways of evaluation of school (D) which covered the three themes. She said that,

> "We have a progress tracker in the form of an Excel file that monitor students' achievement in the MAP exams and the internal assessments. Additionally, students reflect on their own learning and goals in order to identify the gaps in their skills or knowledge. Then, they set new targets according to the evaluation results and the inspection criteria for attainment and progress. Moreover, informal observation provides teachers with significant insight into students' learning needs in addition to gathering various data through notes and checklists that can assist science teachers to track students' strengths and weaknesses".

The HOSD of school (C) and his MSSL focused more on teachers' evaluation and monitoring. They stated that,

> "We monitor and evaluate our students by using various ways including (1) Exams that are based on the content delivered during the year. (2) Teachers' observation of students' progress by interacting with them either in groups or individually. (3) The review of students' work which helps them adapt instructions to meet their needs. (4) Conducting frequent evaluations which provide specific information regarding students' individual needs. Lastly (5) Conducting a range of formative assessment strategies that provide ongoing information and feedback on students' learning".

Lastly, the HOSD of school (A) and her MSSL concentrated on four ways to monitor and evaluate their students. They indicated that,

> "We monitor and evaluate our students by using four different ways. The first way is related to using the standardized tests which cover the curriculum of the entire academic year. The second way is linked to teachers' observation and students' interactions in class that can provide teachers with significant recommendations about whether to adjust strategies, practices, and instructions or not. Frequent evaluations to determine students' areas of improvement in order to accomplish success. Lastly, collecting ongoing feedback about students through implementing various formative assessment strategies with the aim of improving students' learning skills".

Q5: Which formative assessment strategy/strategies best help to achieve your objectives in the science classrooms? Why? Give an example.

All the interviewed science leaders were knowledgeable about numerous FA strategies that should be implemented in science classes. However, these leaders had different points of views about the FA strategies that can work best in science classrooms. Most of the HOSD and MSSL of the same school had similar opinions about these questions. Several science leaders indicated that Think-Pair-Share is one of the best strategies that they often use in their classes accompanied by other types of strategies. As stated by the HOSD of school (E) where she confirmed that,

> "Think-Pair- Share helps both teachers and students. Teachers can collect feedback notes about the students' academic level. On the other hand, students are able to interact and improve their communication abilities and refine their thinking by working collaboratively and conducting various discussions. In addition, the use of KWL chart (Know, want to know, and learned) helps my teachers to implement this strategy in a better way".

The MSSL of school (A) added another strategy accompanied by the previous one. She said that,

> "Designing effective questioning and exit-card strategies are considered significant types of FA strategies that require students to think deeply. These strategies can help teachers in checking students' understanding as well as assisting students to solve many problems that are related to real life applications and answer significant questions, specifically critical thinking questions depending on their understanding and building on their knowledge".

The MSSL of school (B) confirmed the opinions of other science leaders but she classified the used strategies into two categories. Strategies that should be implemented by teachers and other strategies that have to be directed by students. She said that,

> "Many effective types of FA strategies are implemented in our science classes such as Think-Pair-Share, constructive Feedback, one-minute papers. When teachers implement these strategies constantly, students will have a big opportunity to enhance their thinking skills, improve and excel at their academic performance through critical thinking. Implementing these strategies will provide students a valuable insight with a deeper level of understanding".

The MSSL of school (B) also talked about the importance of implementing other types of FA strategies that can improve students' skills and be measured by the students themselves. She specified that,

> "The Ask strategy which is related to students' knowledge, understanding, and skills of each topic. Students have to decide by themselves their strengths and weaknesses to be discussed with their teacher in order to re-plan and determine the role of both the teacher and student to achieve the required goals"

On the other hand, the HOSD of school (D) and her MSSL had another opinion about the best strategies that they implement in their science classes. The HOSD confirmed that,

> "Feedback and self-assessment strategies work best in science classrooms because they provide students with the opportunities to talk about their learning and to identify their needs independently. This usually helps them to be more responsible and become autonomous learners. As we aim for enhancing independent learning in the school, we focus more heavily on providing students with activities that allow them to learn in a social environment and to give feedback for each other using the success criteria of each task".

Likewise, the HOSD of school (C) added another opinion about the best FA strategies. He confirmed that,

> "In our department, we implement various effective FA strategies such as Think-Pair-Share, Problem-Based Learning and Self-Assessment strategies. However, the best formative assessment strategy used is "skill assessment" which is a form of a longer quiz that is done once the teacher covers one main objective, and students are informed about it one week in advance in order to prepare themselves. It helps in both making students cover their topics timely and have the chance to ask before moving to the next main objective; in addition, it helps the teacher assess the teaching and learning process and the progress level".

The MSSL of school (C) had the same opinion of the MSSL of school (B) where she stated the significance of using FA strategies that should be implemented by both teachers and students. She indicated that,

> "Teachers have to share the responsibility of the teaching and learning process with their students. For example, Checklist strategy can be implemented by both teacher and students. It can help them to identify specific skills that they need to focus on in order to be able to complete the required tasks with the needed skills. Furthermore, Self-assessment strategy plays an important role in developing the high order thinking skills for all levels of students".

Q6: In the case of implementing FA strategies appropriately there was no/weak development in students' results, what are the reasons behind that?

There are various reasons mentioned by the science leaders regarding this question. However, all these reasons are considered as types of challenges. Therefore, three themes were created in order to classify these challenges which include (1) Challenges related to teachers, (2) Challenges related to students, and (3) Challenges related to external factors. Most of the science leaders indicated that teachers' strategies and instructions play a significant role in developing students' academic results. Nevertheless, they mentioned additional important reasons and challenges that covered many other areas related to this issue.

Regarding the challenges that are related to teachers, the HOSD of school (D) stated that,

> "If the formative assessment practices are implemented properly in the classroom but students' outcomes are not enhanced. This reflects lack of effective instruction in the classroom. I believe that this case refers to the implementation of teaching with the absence of learning. If teachers do not understand the MAP results and they do not use them successfully, all the learning process will be affected. Effective use of assessment data is recommended to inform both the instruction and the annual plan".

She also concentrated on a significant component that can affect the results of the students. She indicated that,

> "Most of the teachers are able to modify their lesson plans according to the students' MAP results. However, some of these teachers lack the ability of planning and implementing differentiated tasks that can cover the needs of students with various academic levels. In this case, students who did not receive the appropriate skills to develop their abilities will not be able to improve their scores in the next MAP exam".

Similar opinion was mentioned by the MSSL of school (D) where she confirmed the same point of view of her HOSD. She indicated that,

> "Teachers' competence is considered as one of the most critical components to enhancing students' success as well as closing the gap in their academic attainment. The significant difference between the least and most effective science classes is the teacher and her/his quality of teaching. The way of implementing differentiated instructions and strategies with students according to their needs is the foundation stone around which to structure successful schools".

The HOSD of school (E) concentrated on the foundation step of teaching. She specified that,

> "Lack of effective planning to achieve the required targets, identify the suitable strategies that should be implemented in science classes might affect students' achievement. Planning requires time and responsibility. Teachers' planning has to consist of the right teaching activities and assessments accompanied by the appropriate learning outcomes in order to be able to achieve positive results. On the other hand, implementing an effective plan can improve teachers' ideas to ensure their positive accomplishment".

The HOSD of school (C) focused on three main challenges that are related to teachers. He said that,

> "There are two important reasons that we have to pay attention on and to work towards solving them. The first one is linked to the lack of teachers' knowledge of their students' needs and abilities while the second one is associated with the lack of efficient analysis of students' results".

Then he continued and said,

> "There is an important component that all HOSDs need to focus on with their teachers which is connecting with aligning teachers' instructions to the required NGSS. Teachers need to provide their students with a constructive feedback that concentrates on the nuances of students' capabilities in order to make sense by utilizing science practices, crosscutting concepts as well as disciplinary core ideas. In addition, teachers need to use rubrics and set high expectations to enhance students' progress in their process of learning".

Regarding the second theme which is about the challenges that are related to students, the HOSD of school (B) stated that,

> "Students might face exams' anxiety. It is an emotional condition related to the fear of not getting a satisfactory score which some students face during the period of conducting the exam. This state might have a direct effect on students' mental abilities, for instance thinking and focusing, causing them dread and inability to achieve the required academic level. In addition to other factors that are related to gaps in students' knowledge, learning needs, cognitive abilities or attitude towards learning".

The MSSL of school (B) specified another issue that is also related to students. She confirmed that,

> "A few of our students have difficulty in understanding some of the concepts that are used in the MAP exam questions. On the other hand, teachers are not allowed to clarify these concepts

to students. In this case, the results of the students will be affected negatively because they are not able to understand the question properly which might lead to a drop in the results of the students".

The MSSL of school (C) mentioned a new challenge that might be related to both teachers and students. She said that,

> "Motivation is the procedure to initiate, guide, and maintain goal-oriented behaviors. It is the reason behind every successful step in your life. Students might lack the motivation to achieve their targets. If teachers know how to motivate their students, they will consider their previous failure as part of their forthcoming success by learning from their mistakes, which they will appreciate in the future. In my opinion, all stakeholders are responsible for this challenge in order to enhance students' motivation, enthusiasm as well as their commitment to learn".

Regarding the third theme for this question which is about the challenges that are linked to external factors, the HOSD of school (A) stated a new point of view. She indicated that,

> "In our department, teachers depend intensely on the data of MAP RIT Growth as a starting point to plan appropriate strategies for students. If the instructions and strategies are effective, there should be no weak development/ progress for most of the students. However, as sometimes happens there are special student cases that should be studied individually, for example students with external factors like family issues that are referred to the counselor and followed by both the HOSD, the vice principal for students' affairs and the principal".

Likewise, the MSSL of school (E) mentioned a similar opinion to the HOSD of school (A). He confirmed that,

> "Classroom climate is an important factor that affect students' participation in various discussion. Preparing a suitable learning environment at home and in school supports students in their learning and promotes positive interactions with peers. In addition, creating classroom norms provides students with opportunities to take different roles according to their abilities. As a result of that, students will be able to concentrate better on their own learning".

Although there are several factors and challenges that can affect the results of the students in the science MAP exams, three of the science leaders mentioned the same opinion at the end of the interview meeting. The first HOSD stated that,

> "The process of building students' skills through teaching and learning needs time to generate the foundation pillars and build on them. Therefore, school leaders, teachers, and students have to be patient and concentrate on building these skills as a future target. In this case, both

> teachers and students will have a better ability in implementing the required process for constructing the needed skills".

The second HOSD indicated that,

> "Understanding the school curriculum deeply is not sufficient to meet the students' needs. I do believe that the curriculum is an essential component in the teaching process. However, it is just considered as the baseline for all the required tasks, activities, experiments, and assessments that the teachers need to implement for all students in the whole academic year. The best teachers are defined as the teachers who can be creative and go beyond the curriculum by looking for effective strategies and methods that can enhance students' learning".

The third HOSD specified that,

> "Teachers need to construct and improve students' skills in order to be successful for the present and future working environment. Encouraging students to work cooperatively in order to complete a scientific challenge and asking them to reflect on their learning and assess themselves, will play an important role in helping them to gain better understanding and skills. In this case, students will be able to achieve their targets in the national, benchmark, and international exams".

4.2.2 Teachers' Responses (Qualitative Results)

This section is related to the last part of the teachers' questionnaire. Two open-ended questions were provided in order to explore the deep understanding of teachers from various subjects (English, science, and mathematics). The results reflected teachers' beliefs regarding the best FA strategies that should be implemented in their classrooms accompanied by the effect of these strategies on enhancing students' skills. Furthermore, the outcomes from the teachers' beliefs can offer additional support for the quantitative part of the results.

Effective Formative Assessment Strategies

Q1: Which formative assessment strategy/strategies best help to achieve your objectives? Why?

The teachers' responses varied regarding the implementation of different types of FA strategies, however, most of these responses emphasize the importance of using Think-Pair-Share strategy in order to enhance students' learning skills. Teachers believed that this strategy has a great impact

on students' academic results. TPS strategy provides a strong authentic practice through the use of various challenging and motivational activities. Most of the participating teachers indicated that TPS strategy motivates students to think individually with the aim of discussing and sharing ideas with other teams in a collaborative way. Therefore, students will be able to build and develop their learning skills through the specific role that they are responsible for. Additionally, results from teachers' perceptions stated that constructive and constant feedback that should be given to students is considered as an essential strategy in helping students to understand their strengths and weaknesses. Moreover, many teachers specified the significant role of self-assessment strategy in helping students to be independent learners towards improving their skills by taking responsibility for their own learning process. Teachers also specified other types of important FA strategies that can make a positive effect on students' skills such as exit-card strategy, questioning strategy, and problem-based learning strategy. However, according to numerous participating teachers, the first three strategies and specifically the Think-Pair-Share strategy has the most effect on enhancing students' skills and adjust their learning process.

Below are some of teachers' perceptions that are considered to be significant. These responses are presented as the follows:

> "Think-Pair-Share strategy allows students to participate cooperatively in various discussions. By sharing ideas, students become more confident in expressing their opinion and learn more through discussions. The TPS strategy is a versatile and simple technique for developing students' skills. It provides students with time to think and activates prior knowledge. This strategy can also enhance students' oral communication skills through participating in various discussions".

> "Exit-card strategy can provide students with opportunities to reflect on their understanding which will help me as a teacher to plan for the next lesson according to students' needs. Furthermore, self-assessment strategy is related to various fundamental factors for example, it is important in determining and defining what is considered as a good performance. Specifically, it is connected to monitoring and evaluating the quality of students' thinking".

> "Think-Pair-Share strategy. It allows students to think individually and organize their ideas to form conclusions. Moreover, it helps students provide feedback to each other by sharing their opinions. When teachers use effective formative assessment strategies in a consistent way, neither teachers nor students will be surprised by their final grades".

> "Strategic questioning and peer/self-assessment strategies can promote students' higher order thinking skills by using "how" and "why" in their questions. In addition, the strategic

questioning offers teachers numerous chances to help them in identifying the gaps in students' knowledge. Consequently, it will provide us with the required information to modify our teaching plan towards improving students' skills".

"Exit-Ticket, Think-Pair-Share, feedback, and Problem-based Learning strategies. I do believe that formative assessment strategies are considered as valuable guides for students to help them enhance their performance. Furthermore, FA can help teachers determine if further instruction is necessary".

"Ongoing feedback strategy plays an important role in identifying the strength and weaknesses of the targeted area that needs to be worked on. This allows our students to be part of the learning environment and to develop self-assessment strategies that might help them in understanding the needs of their own learning process".

"Think-Pair-Share strategy provides a great help for students when they have to solve critical thinking questions. Through this strategy, students need to think and evaluate their own thinking because they must take responsibility for their decisions before sharing with others. In this case, implementing TPS strategy will help my students to be independent learners as well as to be able to improve the required skills for their future".

"Think-Pair-Share strategy and Problem-Based Learning strategy have the ability to generate a positive environment with strong learning. As a result, cognitive and metacognitive skills of students can be enhanced in a specific period of time. This goal can be achieved by observing the students' progress and offering them scaffolds that can play an important role in shedding light on the following important step that the students must receive as part of the learning progression process".

Preparing Students for the MAP Exam by Using FA Strategies

Q2: How do middle school teachers implement formative assessment strategies in preparing students for the MAP exams?

Most of the participating teachers were knowledgeable about the best ways to help students to achieve their learning targets. Teachers provided a variety of methods and instructions that they currently implement in their schools. Most of these responses emphasize the importance of using MAP questions as an essential part in teachers' lesson plans using various FA strategies. Most of the teachers focused on analyzing students' skills in order to identify their learning gaps. Furthermore, teachers highlighted the importance of classifying students according to their abilities by using the DOK model. In this case, they will be able to build an effective teaching plan that can enhance students' skills. Additionally, teachers concentrated on the importance of

applying constant practices through implementing different types of FA strategies as well as monitoring students' progress. They indicated that these methods can help them in evaluating the teaching process and students' improvement with the aim of preparing them for the MAP exam. Below are some of the teachers' responses that reflect their opinions regarding the methods that can help them in preparing students for the MAP exam. These responses are presented as the following:

> "Analyzing my students' skills by using the DOK model has a positive effect on identifying their needs according to their next target. I usually implement various types of activities that include students to think critically in each topic. Then I evaluate their progress by using the FA strategies and their performance in the next MAP exam".
>
> "Establish and review formative assessment strategies and practices in order to embed MAP skills in them. Set goals for students according to their academic levels and assign tasks that can support them to achieve targets through the use of appropriate strategies".
>
> "I ask three important questions: (Where am I now?), (Where am I going?), (What strategies can help me achieve my target?). The answers of these questions will help me to plan effectively. Additionally, I provide my students with continuous practices either by using various FA strategies in class or by using effective websites such as propdog that is related to MAP practices and share these questions with my students as part of daily formative assessment".
>
> "Discuss with experienced teachers on how to adjust my lesson plans in order to implement more appropriate critical thinking, problem solving and high order thinking questions which can develop students' skills. Furthermore, monitoring student's progress is an essential component to achieve better results. This can be implemented by monitoring their results in the MAP exams for the whole academic year and modifying the teaching plan accordingly".
>
> "I use MAP skills navigator because it can be used based on the level of each student where I can follow up and create an individual plan by using this app in addition to give emphasis on the standards of science based benchmark".
>
> "Feedback is motivating and enhancing students' outcomes, specifically those who are really eager to learn. I usually provide my students with constructive feedback after each summative or formative assessment in order to train them on how to focus on their gaps to become critical thinkers".
>
> "Firstly, I must identify the students' strengths and weaknesses by using the results of various FA strategies and students' results in the last MAP exam, then plan accordingly. My plan should include different types of activities that can develop students' skills by using various problem solving questions and critical thinking questions. The last step should be related to evaluate and measure the students' skills through various types of exams and the DOK model".

4.2.3 Summary of Qualitative Data Results

The following table summarizes the science leaders' beliefs about how grade eight teachers implement formative assessment strategies in preparing students for the MAP exams.

Interview's Questions	Summary of the Results
Q1: How do middle school teachers implement formative assessment strategies in preparing students for the MAP exams?	• Science leaders agreed that according to student analytical skills results based on the DOK model, they decide the effective types of questions that can enhance students' high order thinking skills. • Provide differentiated tasks to meet the needs of all academic levels of students according to their results in the previous MAP exam. • Continuous feedback and motivational skills practices strategies to narrow the gaps in their learning. • MAP questioning techniques are consistently embedded in the class activities through various FA strategies and specifically the strategy of Think-Pair-Share.
Q2: To what extent is MAP science exam data being used to drive FA strategies in science classrooms?	Science leaders decided that MAP science exam data is used in: • Assessing the effectiveness of the used FA strategies and teachers' instructions. • Assessing the progress of students and identifying their strength and weaknesses. • Modifying teachers' lesson plans.
Q3: What are the factors that you/ your teachers depend on in order to select the FA strategies that should be implemented in science classrooms?	A variety of factors were specified by various science leaders include: • Students' MAP RIT scores and its analysis accompanied by the MAP RIT Growth for the next exam. • The needed skills for all students. • The availability of sufficient time, school policy and resources. • Feedback notes about each student. • Teachers' personal beliefs and motivations. • The time needed to cover the required curriculum.
Q4: What do you use to monitor/ evaluate the progress of your students?	• Students' results in the standardized tests. • Students' results in the three windows of the MAP exams. • Results of the formative and summative assessments. • Teachers' observation and their oral and written feedback notes. • Students' skills according to the DOK model. • Students' interactions.

Q5: Which formative assessment strategy/strategies best help to achieve your objectives in the science classrooms? Why? Give example.	• Most of the science leader confirmed that the strategy of Think-Pair-Share is considered as one of the best strategies that can enhance students' academic skills through working collaboratively and conducting various discussions. • Effective questioning strategy because it requires the student to think deeply through critical thinking and problem solving questions. • Exit-card strategy to check the student's understanding after each topic accompanied by identifications for areas of development. • Feedback strategy because it helps students to receive clear instructions that can guide them to enhance their learning and improve their assessment performance. • Self-assessment strategy provides students with opportunities to talk about their learning and to identify their needs independently. This usually helps them to be more responsible and become autonomous learners.
Q6: In the case of implementing FA strategies appropriately, there was no/weak development in students' results, what are the reasons behind that?	• Insufficient planning skills in implementing differentiated tasks that meet the needs of students of different abilities. • Teacher's competence in applying appropriate instructions, ability to use assessment data analysis. • Creating classroom environment conducive to learning enhances students' motivation to participate in discussions. • Students' exam anxiety and lack of enthusiasm to achieve their targets. • Gaps in students' knowledge, learning needs, cognitive abilities or attitude towards learning. • Family issues.

Table (4.19): Summary of Science Leaders' Beliefs about How Teachers Implement FA Strategies to Prepare Students for the MAP Exams.

Chapter Five: Discussion, Conclusion and Recommendations

Using formative assessment strategies in science classes might have a positive effect on students' results in the MAP exams. The current research was conducted using explanatory sequential mixed method design in order to address the four-fold purposes of the study. A triangulation evidence was implemented with the aim of providing the required information for the current research study. This evidence was gathered by conducting three various instruments which include: teachers' questionnaire, data analysis, and science leaders' interviews. Teachers' questionnaire targeted to investigate teachers' perceptions regarding the implemented FA strategies accompanied by their perceptions about the effect of using these strategies on enhancing students' skills towards improving their academic results. The data analysis aimed to explain students' progress results in science MAP exams in the light of FA strategies implemented in American private schools in the UAE. While the third evidence targeted to explore science leaders' beliefs about how grade eight teachers use formative assessment strategies in preparing students for the MAP exams.

The data was gathered by using mixed method approach. The research results from the three utilized instruments are integrated and discussed in the light of the theoretical framework of the study. The results are discussed according to the sequence of the research questions. Furthermore, the present section includes the discussion, conclusion, implications of the study in addition to the recommendations for future research accompanied by the limitations of the current research study.

5.1 Discussion

In this section, the research findings are interpreted in relevance to the theoretical framework and the previous studies in the literature review. The discussion concentrates on the effect of using FA strategies on enhancing students' results in the MAP exams. Basically, the current study has a fourfold purpose: (1) to investigate teachers' perceptions about the implemented formative assessment strategies in American private schools in the UAE, (2) to investigate teachers' perceptions about the effect of using formative assessment strategies on enhancing students' skills in American private schools in the UAE, (3) to explain grade eight students' progress in science MAP exams in the light of FA strategies implemented in American private schools in the UAE,

and (4) to explore science leaders' beliefs about how grade eight teachers use formative assessment strategies in preparing students for the MAP exams in American private schools in the UAE.

In addition, the obtained results using both the quantitative as well as qualitative instruments is demonstrated to address the following four research questions:

Q1: What are teachers' perceptions about the implemented formative assessment strategies in American private schools in the UAE?

Q2: What are teachers' perceptions about the effect of using formative assessment strategies on enhancing students' skills in American private schools in the UAE?

Q3: What is grade eight students' progress in science MAP exams in the light of FA strategies implemented in American private schools in the UAE?

Q4: What are the science leaders' beliefs about how grade eight teachers use formative assessment strategies in preparing students for the MAP exams in American private schools in the UAE?

The following sections present the discussion that is related to each research question in the current study independently.

5.1.1 Teachers' Perceptions about the Implemented Formative Assessment Strategies in American Private Schools in the UAE

Teachers play a significant role in the improvement process of education and in producing new generations with the required 21st century skills (Gallagher, 2019; Mantra, 2016; Ministry of Education 2017). Therefore, teachers from various subjects (Science, English, and Mathematics) who are responsible for implementing FA strategies in their daily lesson plans and preparing their students for the MAP exams participated in this study.

Almost all the participating teachers believed that the strategy of Think-Pair-Share is considered one of the top strategies to have a positive effect on students' communication and learning skills towards achieving better outcomes. This meaning is consistent with (Kothiyal et al., 2013) where they stated the importance of using TPS strategy in gaining various important factors for future

academic requirements through discussions and collaborative work. Furthermore, most of the teachers indicated the significance of implementing effective activities where students can share and discuss their ideas by working cooperatively in different teams in order to improve their learning results. The same point of view was specified by several researchers in the literature review (Almekhlafi, 2016; Faulconer and Wood, 2019; Moss and Brookhart, 2019; Pietarinen et al., 2019; Radhwan, 2016; Tint and Nyunt, 2015). Moreover, several researchers in the provided literature stated the positive effect of using TPS strategy on students' results specifically in the science subject (Bamiro, 2015; Gok, 2018; Ogunyebi, 2018; Kwok and Lau, 2015; Ogunyebi, 2018). This was also supported by the students' progress results in the MAP exam of window one (fall 2019) in the result of the current study. Additionally, according to Vygotsky's theory (1978), social collaboration is considered as a fundamental piece of the learning process. It can generate a deeper understanding of students where their cognitive development happens firstly at a social level and afterwards it can happen inside them. Moreover, Vygotsky stated that the enhancement in student's learning will be produced in the zone of the student's ZPD with teachers' help inside the classroom (Vygotsky, 1962). If teachers can assist students in learning, they will learn in an easier way within the ZPD zone and this will also prove Vygotsky's point of view about the importance of assistance. When learners accomplish the objective of the initial task, their ZPD zone will grow and they will be able to accomplish more. This includes the social constructivist strategy where the students decide on things that they can do independently then as a next stage with the help from their teacher or peers, they will be able to learn new ideas and concepts dependent on their previous experience individually.

A great number of participating teachers indicated the importance of using Self-Assessment strategy to encourage students to decide their needs for future improvement. Furthermore, most of the teachers confirmed the ability of this strategy in helping students to decide their strengths and weaknesses independently which will lead them to become autonomous learners. This is aligned with (Benson, 201; Borg & Edmett, 2018; Jax, Ahn, and Lin- Siegler, 2019) where they considered the strategy of Self-Assessment as one of the significant educational targets that can prepare students to be independent learners. Additionally, these results had been confirmed by (Andrade, 2019 and Wride, 2017) where they stated the capability of this strategy to support students in their learning process in addition to its importance as a required skill to help students in being life-long learners (Sharma Jain et al., 2016). It can also improve students' ability to be evaluators for their

own learning in order to enhance their performance (Fahimi & Rahimi, 2015). Moreover, these researchers specified that this strategy has more benefits and support on students' learning outcomes specifically when implemented formatively in the classroom using FA.

A large number of science, English, and mathematics teachers indicated the positive effect of using Problem-Based Learning strategy in developing students' thinking skills. This result matched with the conclusions of (LaForce, Noble, and Blackwell, 2017 and Tamim & Grant, 2013) where they considered the PBL strategy as an essential way to provide students with a higher level of motivation and engagement to enable them to improve their abilities. Therefore, it can shift the teaching style away from the traditional method which is led by teachers to a student-centered method where the students control the learning process and improve it (Gorghiu et al., 2015). These results were also specified by Deci & Ryan (1985) in their self-determination theory. They stated that this theory represents a comprehensive framework to understand students' motivation and their personalities that put emphasis on individuals' intrinsic inclinations towards improving learners' development and self-actualization through gaining satisfaction of their basic psychological needs which are aimed at autonomy, competence, and relatedness. When students are involved in motivational tasks, they will be able to reach a high level of learning, understand different levels of topics together with enhancing self-awareness and adapting to change (Deci & Ryan, 1985).

Additionally, most teachers confirmed the use of various open-ended problems that are related to real life situations accompanied by critical thinking questions. This meaning is consistent with (Anderson, 2009; Karatas and Baki, 2017) where they stated that PBL strategy is considered as one of the most essential life skills that involve different processes such as analyzing, reasoning, and reflecting specifically in the science subject (Merri et al., 2017; Navy et al., 2019; Schettino, 2016). Therefore, applying PBL strategy will increase the interests and motivate students to learn and to advance their perseverance in tasks. In addition, motivational open-ended problems can improve students' competencies in different areas for example critical thinking, working collaboratively in groups, solving more complex problems, and to increase their desire of being more effective in creativity and innovation (Koh et al., 2019).

Furthermore, the results indicated that a large number teachers who implemented FA strategy in their daily lesson plans believed in the benefits of using constructive feedback strategy for both teachers and students. This point of view corresponds with (Kyaruzi et al., 2019) where they confirmed the positive effect of providing students with information that can help them in clarifying the gaps in their learning process. In this case, students will get the key to successful personal assessment in order to support themselves in learning the needed requirements from the assessment tasks that they will experience during the academic year (Dessie and Sewagegn, 2019). Therefore, teachers' feedback plays an important role in delivering and enhancing a significant impact that can develop students' learning outcomes (Kyaruzi et al., 2019) by improving their way of thinking (Sadler, 2010).

Additionally, teachers elucidated that this strategy helped them to be aware of what students should know, evaluate their ability to learn, and the best ways that can help them to achieve better academic results. This was also confirmed by Sadler (2010) where he indicated that when students understand what to do and the reason behind doing, it, they will be motivated for further development as they feel that they can control their learning (Sadler, 2010). After that, they will have the capability to evaluate their thinking skills and increase their responsibility towards building their learning needs (Black and Wiliam, 1998). Furthermore, students will be able to reflect on their work and decide the requirements for further improvement. These students are considered as the most powerful learners (Boaler, 2016). Therefore, formative feedback is considered as a key strategy in the process of teaching and learning as stated by (Bhagat and Spector, 2017; Poulos and Mahony, 2008; Spector &Yuen, 2016) in the literature review.

In contrast, there are other strategies that most teachers believed in their significant role in enhancing students' learning outcomes such as, exit card and questioning strategies. In addition, a great number of teachers stated that they decide the FA strategies that they use in their classes depending on the analysis of the students' results in the MAP exams. This meaning is consistent with the constructive alignment theory where Biggs (1996) stated that this theory is an outcome-based method for planning, advancing and assessing the profound learning of the student.

It is related to the teaching strategies, all the related tasks and activities that should be aligned with the required curriculum along with the learning goals, the provided opportunities for each student according to his/her educational level in addition to students' assessments that should be prepared

to evaluate the learning outcomes for each student according to his/her level (Biggs, 1999; Biggs, 2003). Therefore, when teachers consider the students' results in their teaching plans, this will help them to select the appropriate strategies that match the students' academic level. This procedure is crucial to promoting learners' 21st century skills by using various tasks and activities (Wicaksono and Susilo, 2019). In addition, teachers can use this information to develop students' skills and generate deeper understanding through appropriate planning (Biggs and Tang, 2007; Lawrence, 2019). In this case, students will have a better opportunity to improve their learning outcomes (Persky and McLaughlin, 2017).

5.1.2 Teachers' Perceptions about the Effect of Using Formative Assessment Strategies on Enhancing Students' Skills in American Private Schools in the UAE

Almost all the participating teachers believed that FA strategies have a significant positive impact on students' learning outcomes when implemented in the right way. Teachers who use FA strategies on a daily basis confirmed that these strategies help them in assessing the process of teaching and modifying it according to the needs of the students. Teachers considered this step as a key to the students' learning success. Teachers believed that when they can provide students with the right strategies, they will have a strong opportunity towards enhancing the needed academic skills. As mentioned in the provided literature review, FA has an essential role on enhancing the interests of students to learn and advance their perseverance on tasks, and improve their competencies in different areas such as critical thinking, working collaboratively in groups, solving more complex problems, and to increase their desire of being more effective in creativity and innovation (Koh et al., 2019).

Furthermore, most of the teachers indicated that FA strategies can be used as a tool to assess students' learning skills and teachers' planning. This meaning is consistent with Black & Wiliam (2009) where they stated that FA is considered as an instructional practice which includes consistently eliciting and deciphering information, and an indication of the students' way of thinking that will be collected from the work of the learners with the intent of informing teaching and learning. In addition, schools in the UAE are focusing on using and developing assessment for learning. These schools believe that FA can advance the relation between three important pillars of education which are represented by teaching, learning, and assessment. This will motivate all

learners to focus on the learning goals rather than their grades in a specific test in addition to clarifying the strengths and the weaknesses regarding the effect of teachers' strategies that can promote students' outcomes (Abujaja and Abukari, 2019). Other studies also indicated the positive relationship between the implementation of the proper FA strategies and the improvement of students' outcomes specifically in science classrooms (Alonzo, 2017 and Hondrich, 2015).

The second important point is that almost all the science, English, and mathematics teachers concentrate on the ability of FA strategies to prepare students for the national and international exams. Teachers believed that FA strategies can build and develop the required skills that can help students to achieve their learning goals. However, some of the participating teachers stated that improving these skills needs time and competencies from teachers to face the challenges of the teaching process. This point of view represents the main focus of the current study which is related to investigate educational leaders' perceptions regarding the implementation of formative assessment strategies on enhancing students' results in the MAP exams. Various studies that were conducted inside and outside the UAE confirmed the improvement of students' outcomes in summative assessments using effective information from the implementation of FA strategies (Das et al., 2017; Gardner, 2012; Radhwan, 2019). Other studies in the literature review specified the positive relationship between the utilization of FA strategies and enhancing students' skills towards better results in the standardized tests. For example, a research study stated the noticeable role of FA in increasing the positive scores of school students in the standardized science test. The same study recommended that students should be skilled by using effective teaching strategies based on FA that advance the improvement of learners' abilities of clarifying and interpreting, and thinking skills (Bulunuz et al., 2016). Furthermore, many researchers (Baenen et al., 2006; Barber, 2017; Martin Jr, 2018) indicated that there is a strong relationship between the strategies of FA that are used in daily lessons and the results of students in the international exams.

Teachers also clarified the benefits of applying the Depth of Knowledge model in their FA strategic tasks and its positive effect on developing students' skills in understanding various scientific activities in depth. They stated that this model can help them to classify students according to their academic level. In addition to providing teachers with a clear idea about the suitable tasks that should be implemented through different FA strategies for each student according to his/her academic level. As a result of that, teachers stated that these selected strategies will play an important role in improving students' learning skills towards enhancing their attainment in the

international exams. Furthermore, teachers indicated that each school must align between curriculum standards, student's academic levels, and the implemented assessments and strategies. In this regard, Webb (1997) built up a procedure and criteria to achieve this target systematically in addition to narrowing the gap in the students' learning process. These procedures are represented by a DOK model which is considered as a helpful way that can be used for all levels of students because it includes different categories of skills' stages that are suitable for a variety of assessment tasks which are required for the effective and successful learning of K-12 students. Teachers should know how to classify their students according to their abilities then they can implement FA strategies that are helpful to enhance students' high order thinking skills. In this case, students will have a significant chance to improve the required capabilities that are needed for the international exams as stated by a substantial amount of literature (Mullis, Martin, Gonzalez, Gregory, Garden, O'Connor, Chrostowski, & Smith, 2000; Kartono, Arumsasi, and Mariani, 2019; Simamora, Sidabutar, and Surya, 2017).

This reflects the significant need for providing teachers with continuous professional development programs that concentrate primarily on the effective use of FA strategies in daily lesson plans (Koh et al., 2010; Pither and Morris, 2019). Therefore, the UAE is concentrating on providing teachers with professional development sessions as an important part of their educational reform according to the National Agenda 2071. Moreover, El Afi (2019) stated in his research study which was recently conducted in the UAE that FA professional development programs can have a positive effect on teachers' skills in preparing their lesson planning, using a variety of teaching strategies and tools that play an essential role in developing students' high order thinking skills.

Teachers specified that FA strategies can evaluate the progress of the students and expect the next level of their progression as well as differentiate them according to their strength and weakness areas. This concurs with (Regier, 2012) where he indicated the ability of FA strategies in informing teachers about the process of students' academic progression. Furthermore, these strategies can inform subject teachers if they are ready to move with their students to the next academic level with the required skills and concepts. Measuring the level of students' progression can be implemented in an easier way using DOK model as stated by Webb (1997) because it highlights the instructional progressions of learner's thinking, tasks and evaluation.

Additionally, teachers from various subjects indicated that FA strategies can provide both the students and teachers with the necessary information about students' abilities to attain knowledge and develop it. Moreover, teachers confirmed that these strategies can also enhance the communication skills of students by sharing ideas in various discussions. As stated by Vygotsky (1978), the method of the learning progression is inherently social, and it can be constructed in a specific cultural setting. In addition, the way of building deeper knowledge can be reached by solving problems in different teams cooperatively under the supervision of the teacher (Vygotsky, 1978). This aim can be attained by using the FA strategies.

Furthermore, FA is considered as the process that can provide suitable information amid the learning procedure in order to alter their understanding and self-control well (Burton et al., 2018; López-Pastor and Sicilia Camacho, 2015). This can happen through improving their knowledge attainment abilities, social maturity, their cognitive processing progression capabilities (Harlen and James, 1997) to become students as lifelong learners (Hellwig et al., 2015). Teachers have to offer a variety of effective activities that can be implemented to measure the students' learning progress (Prashanti and Ramnarayan, 2019). Additionally, different studies in the literature review confirmed the positive relationship between FA strategies and students' progress in the science subject specifically (Alonzo, 2017; Hondrich, et al., 2015).

The in-depth opinions which were collected from the open-ended questions for teachers stated that different types of FA strategies can generate a positive environment with strong learning. These strategies aim to enhance students' cognitive and metacognitive skills in a specific period of time. This goal can be achieved by observing the students' progress and offering them scaffolds that can play an important role in shedding light on the following important step that the students have to receive as part of the learning progression process (Baas et al., 2015). Additionally, this process can be improved by giving a guide to defining objectives. At the same time, teachers must respond and evaluate students' thinking for more evidence (Ebby and Petit, 2018).

Biggs confirmed in his theory that in order to improve the students' learning outcomes and develop their thinking skills, teachers must make a learning domain that underpins the learning exercises proper to accomplishing the ideal learning results. Teachers have to concentrate on the key component for a successful learning process. These components include the curriculum, teaching strategies, activities, and assessments in all types. All these elements will lead to the ideal learning

results (Biggs, 2003). In this case, students will have the opportunity to develop their learning results.

5.1.3 Grade Eight Students' Progress in Science MAP Exams in the Light of FA Strategies Implemented in American Private Schools in the UAE

According to the results of grade 8 middle school science students in five various schools in the UAE, it was indicated that there was an improvement in students' results in the MAP exams in all the participating schools. However, this improvement did not reach the growth projection that each student has to achieve in the MAP exam. The attained MAP scores revealed the positive effect of using FA strategies for a full academic year from (fall 2018) till (fall 2019). The results from the whole (250) participating students indicated that (86%) of students showed improvement in the exam of fall 2019. This percentage includes (124) female students and (126) male students. On the other hand, (9%) of the total participants declined in their results. This percentage includes (13) female students and (9) male students. Regarding the students who neither improved nor declined, the results indicated that (5%) of all the participating students stayed at the same level which is represented by (6) female students and (7) male students.

These results provide the answer to the main purpose of the study. The outcomes confirmed that using FA strategies might have a positive effect on students' results in the MAP exams, however, this positive effect is not at the required level. Therefore, teachers need to concentrate on using FA strategies in an effective motivational continuous way as well as know how to apply these strategies in all the main components of the teaching process in a successful and efficient way. In addition to the time factor because building the high order thinking skills and motivating students to develop their abilities needs time from both teachers and students. Beck (2018) stated that intrinsic motivation is particularly significant for students in the middle school stage. Furthermore, numerous professional development sessions dedicate a long period of time in order to discuss the right way of constructing students' intrinsic motivation. The same point of view was stated by Deci & Ryan (1985) in their theory about self-determination. They specified that students' motivation is considered as an essential component that can support the process of teaching and

learning in a positive way because it has been characterized as a force of both cognitive (Bahri, and Corebima, 2015) and affective.

The result of this question is matched with the conclusions of many research studies from various countries. These researchers investigated the relationship between the use of FA strategies and students' outcomes. The results indicated that there is a positive relationship between implementing FA strategies and students' learning academic outcomes (Beesley, Clark, Dempsey, and Tweed, 2018; Broadbent, Panadero, & Boud, 2018; Ebby, Remillard, and D'Olier, 2019; Hoerr, 2016; Le Thai Hung & Ha, 2019; Maldonado and Andrade, 2018; Ozan & Kıncal, 2018).

5.1.4 Science Leaders' Beliefs about How Grade Eight Teachers Use Formative Assessment Strategies to Prepare Students for the MAP Exams

The heads of the science departments and the middle school lead science teachers highlighted various effective methods and instructional strategies that play a vital role in enhancing students' learning skills. The researcher points out that educators can make use of these methods and strategies to set effective plans, equipping students with the required skills for the MAP exams. Three essential stages should be implemented by each teacher in order to prepare students for the MAP exams.

Regarding the first stage, science leaders refer to the importance of analyzing students' skills as a key procedure before deciding and setting the FA strategies that they have to apply in their classes. They confirmed that this technique will help them in identifying the needs for each student. Consequently, leaders will be able to select the most appropriate FA strategies to be implemented for different levels of students. This opinion corresponds with Webb (1997) where he mentioned the importance of using the Depth-of-Knowledge model as one of the important fundamental tools that teachers can use in order to analyze the students' cognitive skills. This analysis helps teachers in the right direction towards improving the learners' positive attainment. Webb's DOK model is beneficial in planning the suitable activities and challenges for the students of the school according to their academic needs, teachers can also use this model to prepare learners to work cooperatively

in different academic group levels in order to solve problems and complete the assigned challenges depending on students' cognitive and communication skills (Webb, 2018).

Furthermore, leaders also stated the significance of analyzing the students' results in the last MAP exam as a starting point for further improvement. This can play an important role in developing the skills of students by concentrating on their areas of development. This meaning is constant with (Ebby and Petit, 2018; Heritage, 2008) where they specified that teachers can enhance the progression of using FA strategy by responding and evaluating students' thinking skills (Ebby and Petit, 2018; Heritage, 2008). Moreover, Johnson (2019) indicated the effect of using data-driven instructions on developing students' scores in the MAP exams. The outcomes demonstrated that most of the teachers use the MAP data as a helpful tool to successfully evaluate the strength and weaknesses for all students. With teachers' modification plans and instructions that had been re-built depending on the results of students' MAP exam, outcomes showed that there is a positive change in students' results in the subsequent MAP exam.

Science leaders stated the significance of determining the present academic situation of each student depending on their current abilities, the needed skills that they must achieve, and the right strategies that can lead them to reach the required target. Moss and Brookhart (2019) indicated that there are three important questions that each teacher must put into consideration in their preparation plans. The first questions is (Where am I going?), the second question is (Where am I now?) while the third one is (What strategies can help me to achieve my target?). These three essential questions provide teachers with a clear target that can help them in planning their lessons and selecting the best strategies and tasks in order to improve students' high order thinking skills.

In addition, science leaders stated that the results from the students' self-evaluation should be included in planning for future lessons. This can be implemented by using other types of FA strategies that should be implemented by students in order to determine their strengths and weaknesses by themselves. This meaning is constant with (Regier, 2012) where he indicated that both teachers and students must decide the strength and weakness areas in the learning process for each individual. This procedure should be implemented through a feedback discussion meeting for each student. As a result, teachers will be able to collect all the needed information for re-planning the students' lessons towards achieving the upcoming goals. Wiliam (2018) stated that when both teachers and learners cooperate to use evidence from their daily process of learning towards

making constant changes with the aim of advancing learning, those modifications are bound to be influential in a positive way.

Regarding the second stage of the preparation process, middle school science leaders confirmed the importance of building an effective teaching plan considering the main results of students' skills analysis as a main key in generating the new plans. These plans should include various essential components that have a positive impact on enhancing students' learning skills. Leaders identified that the intended learning outcomes, curriculum activities, differentiated tasks, assessments, and students' feedback must be connected and suitable for the new learning target. Biggs indicated in his theory that the constructive alignment theory has been generated with the aim of facilitating the development of a new comprehension of reality for students by aligning many essential components: students learning outcomes, teaching and learning activities, and assessment tasks (Biggs, 1996). Furthermore, this theory concentrated firstly on what learners should know (knowledge). Secondly, what they can do (skills), thirdly, to plan effective activities that should be connected to real life applications and finally to the way of measuring these abilities (Biggs, 1999).

In addition, tasks and the activities that teachers are responsible to provide their students with must be implemented in various motivational ways in order to stimulate students' interest in learning. A number of researchers in the literature review indicated that teachers have to use different effective and challenging activities which are aligned with the school curriculum with the aim of promoting students' enthusiasm towards better academic results (Christenson et al., 2012; Dilshad et al., 2019; Ryan and Deci, 2009; Taştan, et al., 2018). Moreover, motivational learning has a force that can initiate, sustain and direct the students' engagement behaviors as an internal procedure of development which has derived from the person's experience, opinion and interpretation (Reeve, 2012). Moreover, science leaders specified that teachers must concentrate on implementing differentiated tasks for each topic according to students' need. This meaning is matched with (Koh et al., 2015) where they confirmed that many educators concentrate on the paradigm shift by using differentiated tasks with the purpose of meeting several academic requirements of learners. Especially, when teachers use different problems that are related to real life application (Cotton, 2019).

All the participating heads of the science departments and science lead teachers stated the importance of utilizing various FA strategies in their daily lesson plans in an effective way. They also confirmed that students' have to play the main role in these strategies under teachers' guidance in order to enhance their learning results. As stated by (Fandy, 2019) that working collaboratively through the Think-Pair-Share strategy is highly effective. This strategy can also be utilized as an assessment tool when the learners share their thoughts in different teams, the teacher will be able to evaluate them according to their abilities in various discussions (Akkaraju et al., 2019 and Gok, 2018). Other important FA strategies that teachers must focus on while preparing students for the MAP exams are feedback strategy, problem-based learning strategy, self-assessment strategy, questioning strategy, and exit-card strategy. Additionally, science leaders indicated that the FA strategies should include different types of critical thinking and problem solving questions that are matched with real life applications and are able to develop students' thinking skills, including both low and high achieving students. This meaning has been mentioned by various researchers where they specified the importance of implementing these strategies in students' analyzing, reasoning, and reflecting skills (Anderson, 2009; Karatas and Baki, 2017). In addition to achieve the advanced stages of cognitive demand (Skinner & Feder, 2014) and the in-depth use of knowledge (Tan and Ng, 2018). A number of researchers conducted 19 studies about the effect of using FA strategies on students' outcomes indicated that all the participating learners who were engaged in the FA tasks gained higher scores than other learners who did not use FA (Klute et al., 2017). Once teachers can understand the new rules and effectiveness of the teaching strategies as a crucial factor for better outcomes (Bakkenes, Vermunt, & Wubbels, 2010; Pecore, 2013; Sabah & Du, 2018) they will be able to plan accordingly.

Moreover, science leaders pointed out another important component that should be implemented to achieve the improvement target that is related to enhancing students' results in the MAP exams. This component is related to the continuous practice of constructing students' skills. This procedure must be applied as a significant part of the teaching process towards enhancing students' results in the MAP exams. Leaders indicated that there is a positive impact of using continuous practice on developing high order thinking skills of students. This can be achieved using various challenging activities, motivational tasks, and working cooperatively in a constant way. As stated by Vygotsky, if teachers can help students in learning, they will learn in an easier way within the ZPD zone. When learners accomplish the objective of the initial task, their ZPD zone will grow

and they will be able to accomplish more. This includes the social constructivist strategy where the students decide on things that they can do independently then as a next stage with the help from their teacher or peers, they will be able to learn new ideas and concepts dependent on their previous experience individually.

In addition, science leaders indicated that all teachers have to use a specific type of questions that require students to think critically in addition to using the previous MAP questions as a fundamental part in their preparation planning. This essential component matched with the theory of (Biggs, 1996) which is related to the cognitive apprenticeship that includes a group of instructive standards planned for offering students the needed experiences that are related to the skillful practices as well as the cognitive procedures of a talented professional (Collins, Brown, Newman, 1989). It also concentrates on building abilities and deep learning (Biggs and Tang, 2007; Lawrence, 2019) that are considered as the foundation stage towards better understanding and thinking that should be close to professional thinking.

Previous studies indicated that developing students' thinking skills might be neglected by numerous teachers. Therefore, the theory of constructive alignment sheds the light on the importance of implementing the right learning plans through the use of activities, curriculum and assessments (Croy, 2018; Gerritsen-van Leeuwenkamp, Joosten-ten Brinke, and Kester, 2019). As a result, students will be able to reach a higher stage of thinking skills that can enable them to achieve better outcomes (Collins, Brown, Newman, 1989; Persky and McLaughlin, 2017). Moreover, various researchers gave emphasis to the importance of providing students with a variety of balanced practices to be implemented in students' classrooms. These continuous practices have the capability to help students in their academic accomplishment (Sadler, 1989; Black & Wiliam, 1998a, 1998b, 2006a; Organization for Economic Cooperation and Development [OECD], 2005; National Association of State Boards of Education [NASBE], 2009).

According to the result of a study conducted by O'Sullivan (2015) in the UAE, there are evident inadequacies in some of the American private schools in the UAE. These schools have a gap between the school policy and the required practice in their educational process. However, teachers are considered as enthusiastic supporters of reform but a few of them are not sure about the right way to implement this process. Therefore, this study will shed the light on the fundamental and

urgent change in most of the private schools in the UAE in order to keep the required education reform pace that should be implemented appropriately in the whole country.

Furthermore, FA strategies have a strong effect on students' learning. When teachers implement various effective strategies in the classroom as part of a daily lesson plan, this will lead to strengthening the formative classroom practice. As a result, teachers will have better opportunities in categorizing the needs of the learner in addition to adjusting the process of teaching and learning accordingly (Andersson and Palm, 2017). This can be implemented appropriately once the teachers' believe in modifying learners' behavior and practices (Mihaela & Alina-Oana, 2015; Rico & Ertmer, 2015).

Regarding the third stage of the preparation process, science leaders indicated the vital role of monitoring and evaluating the results of the students in a continuous way in order to decide the effectiveness of the implementation process. This procedure can be conducted through different ways such as monitoring the results of the students in the three MAP exams over the academic year and comparing between them. Another way that had been specified by leaders is the classroom observation which is considered as an effective way to monitor the efficiency of the teaching process, teachers, and students as well. In addition to conducting a range of FA strategies that can provide ongoing information and feedback on students' learning individually. Pither and Morris (2019) stated that FA is used with the aim of producing significant learning outcomes led by teachers in addition to peer and self-assessment which should be done by students themselves in order to evaluate their progress. Moreover, leaders' opinions matched with Shepard, Penuel & Pellegrino (2018) where they indicated that FA questions, assignments, and exercises offer instructional visions about learners thinking in addition to the beneficial subsequent stages that may be utilized for future plans. FA is considered as an instructional practice which includes information about the students' way of thinking that will be collected from the work of the learners with the aim of advancing the process of teaching and learning (Black & Wiliam, 2009).
According to NWEA, MAP exam is useful to assess students' progress in various subjects. It gives a clear idea about their prior and current knowledge along with the future academic needs in order to prepare them for the next stage. By collecting, comparing, and matching the information gathered from the MAP tests, teachers will have an additional tool to affect their guidance positively (NWEA, 2018b).

On the other hand, science leaders pointed at various factors that are considered as essential challenges which might have a significant impact on the students' preparation process. One of the main factors is related to teachers' competence in delivering the right and motivational way of teaching that can improve the required skills of students. As stated by Ryan & Deci (1985) in their self-determination theory, motivation is the key to encourage students to be interested in developing their learning skills. This can happen when the students meet their psychological needs which include competence, relatedness and autonomy. These essentials are related to learning a variety of skills and gaining them, experiencing a feeling of having an effective role in dealing with environment and connection with other individuals, and feeling responsible for their behaviours and goals (Deci et al., 2017; Núñez and León, 2015; Ryan & Deci, 2017). Teachers represent the main core of attention to build a positive quality of education by having a good competence level (Mantra, 2016). Furthermore, Duckor (2016) confirmed that one of the important challenges is the ability and the competence of teachers to ask deep questions that might be unfamiliar to the students, but these questions are able to build new knowledge for students. Therefore, the UAE concentrates on the program of teacher licensing as one of the important requirements to achieve the UAE national agenda goals in 2021. All school teachers have to attend several professional development programs and pass a number of assessments in order to be certified as qualified teachers (Gallagher, 2019). In this case, teachers' beliefs, content knowledge, and their strategical decisions will be changed towards enhancing the results of the students (Al Said et al., 2019).

Another factor that can affect the preparation process is associated with school support. Schools must provide teachers with a reasonable teaching load, a variety of resources, suitable learning environment, and a moderate number of students in each class in order to achieve the required results. This meaning is consistent with Andrade, Bennett, and Cizek, 2019) where they specified that teachers struggle in applying effective FA strategies due to their heavy workloads (Arrafii & Sumarni, 2018). These teachers considered their working load as a main barrier, particularly when they are asked to apply these strategies in big classrooms that contain large amounts of students. Furthermore, a suitable learning environment is considered one of the crucial factors that play an important role for active and successful learning where viable communication helps in changing imperative learning encounters (Schunk, 2008). In addition, Vygotsky (1978) elucidated in his

theory that in order to construct knowledge actively, teachers must build an appropriate social learning environment for students (Vygotesky, 1987).

In the United Arab Emirates, most teachers believe in using collaborative work as one of the most effective teaching strategies towards better accomplishment in results. Educators in the UAE stated that these positive outcomes can be achieved inside and outside the learning environment when learners work cooperatively with each other on different complexity levels of tasks and activities (Almekhlafi, 2016). Therefore, almost all of the participating teachers and leaders believed in using the Think-Pair-Share strategy as an essential component in developing the learners' communication skills through reducing the difficulties that hinder oral communication, generating a collaborative learning environment, growing the creativeness of students to reach a better level of learning skills (Maulana, 2019; Sumekto, 2018). Additionally, the suitable learning environment can also build important skills in students' personality such as being confident in sharing and discussing ideas with other students from different academic levels (Raba, 2017; Rifa'I and Lestari, 2018).

The last factor that the heads of the science departments focused on is the time. Constructing an effective plan, building students' skills and improving them need time to show a great difference in their results. Therefore, all educators must be patient and continue working on their effective plans following the right instructions. This meaning is matched with (Garrison and Ehringhaus, 2018; Prashanti & Ramnarayan 2019) where they stated that teachers need to be able to plan ahead of time in order to have a sufficient period of time to help in making the necessary and required modifications for the student's learning process.

Based on the previous qualitative results and discussions, the researcher designed a roadmap that can help all teachers who are responsible for preparing students for the MAP exams. In addition, the following roadmap can offer all teachers an effective plan to improve students' learning skills in general.

The Roadmap for Preparing Students for the MAP Exam
Educators' role
Stage One: Analysis • Identify the students' current skills. • Classify students' skills according to their level in the Depth-of-Knowledge model. • Students' results in the last MAP exam with the identified Growth Projection for each student. • Ask: (Where am I now?), (Where am I going?), (What strategies can help me achieve my target?). • Results of teacher-student individual constructive feedback (The strength and weakness areas). • Results of student's self-assessment (The strength and weakness areas).
Stage Two: Building an effective teaching plan including: • Setting the needed skills for each student. • Identifying the intended learning outcomes. • Preparing appropriate differentiated motivational activities and tasks that are suitable for students' needs including critical thinking, problem solving that are related to real life applications, and previous MAP questions. • Implementing various formative assessment strategies such as, Think-Pair-Share strategy, Feedback strategy, Self-Assessment strategy, Problem-Based Learning strategy, Questioning strategy, and Exit-Card strategy. • Continuous practice. • Constant assessments including (discussions, individual constructive feedback, self-assessment, students' work).
Stage Three: Continuous monitoring and evaluating students' progress including: • The results of the students in the three MAP exams over the whole academic year. • Classroom Observation. • Evaluating ongoing information about students' progress through the use of various FA strategies.
School's role: • Ensure teachers' competence in delivering the suitable and motivational ways of teaching that can improve the required skills of students.

• School support. Schools have to provide teachers with professional development sessions, reasonable teaching load, appropriate learning environment, moderate number of students in each class, and a range of resources in order to achieve the required results. • Sufficient time.

Table (5.1): The Roadmap for Preparing Students for the MAP Exam

Table (5.1) demonstrates a roadmap regarding following an effective way which, resulted from the current study that can have a positive effect in preparing students for the MAP exam and to also improve their results. This table consists of three stages that all educators have to follow for achieving better academic outcomes. These stages are linked to the procedures that should be followed and implemented before, during, and after designing the teaching plan for all students. Moreover, the roadmap shows some of the important factors that might affect the teaching process which has a direct relationship with enhancing students' academic results. Schools need to focus on these factors and find the best solutions with the aim of developing students' learning skills that are linked directly to their abilities in the MAP exams.

5.2 Conclusion

The current research study aimed to investigate educational leaders' perceptions regarding the implementation of formative assessment strategies on enhancing students' results in the MAP exams in American private schools in the UAE. The questions of the study have been addressed where the results showed that the effective use of various FA strategies have a positive impact on improving the needed skills for the students. Triangulation evidence through explanatory sequential mixed method design proved that this improvement led the students to achieve better results in the MAP exams.

The results of the study revealed that Think-Pair-Share strategy is considered as one of the top educational strategies that is positively related to the development of students' academic skills. They also stated that there is a strong relationship between FA and the use of TPS strategy because it provides learners with various opportunities to make sure that the learning process is on the right path. This can be achieved by solving different problems and sharing ideas in small teams which

lead to promoting students' high order thinking skills. Furthermore, teachers believed that TPS strategy has the capability to stimulate students' active learning and conduct FA in a time-effective and well-organized way.

In addition, the results from science leaders and English, science, and mathematics teachers assumed that feedback strategy provides a great support for both teachers and students through gaining information related to the strengths and weaknesses of each student. In addition to a clarification about the quality and effectiveness of the used FA strategies. Consequently, students will be able to recognize the needed skills that he/she has to work on in a positive way. Therefore, in the UAE, there is a big focus on using FA not only in schools but in universities as well with the aim of providing learners with constructive feedback to clear their way for further learning development and to fill the gap between the students' actual level of learning and the expected outcomes in different academic stages.

Moreover, the current study indicated that when students are capable of assessing their work according to their skills, they will have the ability to critique their learning and decide if they are in the correct direction or if they need to change or modify their learning process. Therefore, the strategy of Self-Assessment has a significant feedback on students' skills in a motivational way because it is important in determining what is considered as a good performance. Specifically, this strategy is connected to monitoring and evaluating the students' thinking quality. Teachers believed that Self-Assessment strategy keeps students motivated to complete the learning task and monitor the work results independently. These learning characteristics are essential components in improving students' thinking and problem solving skills along with taking the responsibility for their own decisions. Additionally, teachers stated that using self-assessment strategy with FA can provide the essential components that are aiming to support students' learning in disciplines of education. In this case, students might be able to foster their meta-cognition and strengthen their self-assessment skills.

Additionally, the study findings identified the importance of using the strategy of Problem-Based Learning as a student-centered pedagogy where they can learn effectively. This can be achieved by gaining new experiences through solving different open-ended problems that enable students to improve their autonomy through shifting the focus from the class teacher to students. Furthermore, perceptions from both science leaders and teachers assumed that FA has an essential

role in PBL through enhancing the interests of students to learn and to advance their perseverance on tasks. Additionally, PBL strategy can improve students' competences in different areas for instance critical thinking, working collaboratively with others, solve more complex problems.
Therefore, and according to these results, it is highly recommended that teachers must apply various types of FA strategies that can improve students' skills in an effective way by encouraging them to take the responsibility for their own learning. If teachers can implement these strategies efficiently, students might be able to achieve the UAE National Agenda 2071 target of being the best country in education in the whole world.

At the present time, the UAE is concentrating on creating an effective educational plan that is suitable for all school students with the aim of reforming education in order to prepare them to compete against students in other countries that are ranked at the top of the educational level. The results of the current research study will have a significant role in achieving this target. The outcomes indicated there are many advantages that can be accomplished through the use of FA strategies. These advantages have a direct relationship with enhancing students' skills in a positive way. Teachers can use FA strategies to improve students' skills towards preparing them for both national and international exams which need specific cognitive abilities from the students. This can be achieved when teachers set their targets, apply differentiated effective and motivational activities, and conduct assessments that are aligned with all academic levels of students.

The results also indicated that FA strategies provide teachers with important information that can support them in deciding the level of student's attainment and progress. This advantage has a vital effect on teachers' lesson plans because they will be able to evaluate their teaching process in an effective way and modify it according to students' needs. Moreover, teachers indicated that the Depth of Knowledge model can help them alongside the FA strategies in classifying their students according to their current academic skills. DOK model is considered as a significant tool that can provide teachers with information about the essential target, strategies and skills that they must work on in the next stage. However, teachers should have the right knowledge and the required competence in evaluating students' skills appropriately and in preparing the suitable needs for further enhancement.
According to the results of the presented study, school leaders confirmed that FA strategies have a positive effect on students' results in the MAP exams. The data analysis of 250 participating

students in five different schools in the UAE revealed that 86% of them achieved better results in the science MAP exam of fall 2019 than the results of their MAP exam in fall 2018. However, the improvement of these students did not reach the international required level or to the UAE National Agenda target 2021. Therefore, teachers need to concentrate more on the required skills for all students and plan accordingly.

The findings of the qualitative data that were gathered by conducting interviews with the heads of the science departments and the science lead teachers indicated numerous ways that teachers can implement in order to prepare students for the MAP exams. The results specified the importance of analyzing the students' skills before building the teachers' lesson plan. This analysis can be implemented using students' previous results in the MAP exam, the collected information from implementing different FA strategies, students' abilities according to the DOK model in addition to their strengths and weaknesses. In this case, educators will have sufficient information to build an effective plan that can enhance students' learning abilities according to their needs.

The results also indicated that teachers must align all the required learning components in their lesson plans. These components include a modified curriculum, a variety of teaching strategies that can improve students' thinking skills through the use of discussions, individual constructive feedback, self-assessment, various problem solving questions that are related to real life applications. Furthermore, teachers must create and implement continuous motivational activities and tasks, previous MAP questions, constant practices, and effective assessments. All these components should be academically suitable to cover the students' need from different academic levels.

Monitoring and evaluating the teaching process is considered as a crucial component in a successful educational plan. The outcomes of the presented study confirmed the significance of evaluating the students' progress through the results of the MAP exams for the whole academic year. In addition to the essential role of the heads of the science departments and the lead science teachers in observing the teaching process in teachers' classrooms. Furthermore, constant evaluation is needed to measure the students' progress through the results of the used FA strategies. Following the provided procedures will have a vital role in preparing students with the required skills for the MAP exams.

The results of the study revealed that there is an essential role of the school towards supporting educators' strategies. Schools have to provide teachers with continuous professional development that can train them on how to implement FA strategies in an effective way towards enhancing their competence in order to have the capability of improving students' skills. Additionally, they must prepare the required learning environment with their teachers in order to promote the teaching and learning process that can help students in developing their abilities.

The results of the current study reflect that utilizing FA strategies plays a significant role in developing students' skills and preparing them with the necessary strategies to achieve better results in the MAP exam. However, building these skills and developing them need time, therefore, science leaders and teachers have to focus on designing effective lesson plans that incorporate various FA strategies while tracking students' progress throughout the lessons in order to fill any perceived gaps in their performance.

5.3 Implications

The result of the present study investigated educational leaders' perceptions regarding the implementation of formative assessment strategies on enhancing students' results in the MAP exams in American private schools in the UAE. These results shed the light on the importance of using these strategies in teachers' daily lesson plans in order to contribute to the UAE education reform plans that seek to achieve the NA targets 2021. The NA targets focus on establishing a world-class system in education in order to successfully benchmark students' knowledge in the UAE against other countries that are ranked at the top of the educational level. The discussions of the research study highlighted significant information that can provide teachers with deep insights and understandings regarding the types of FA strategies that have the potential to be considered as a great source in closing the gaps in students' learning process effectively. Specific details about students' skills that can be improved using particular FA strategies have been provided in the current study.

The study identified the valuable effect of using the Depth of Knowledge model as an evaluating tool that can measure students' understanding and abilities. In addition, supporting teachers with

evidence that can assist them in collecting the necessary information for building successful teaching plans with effective FA strategies that can promote students' competences.

According to the results of this study, a roadmap has been designed to help educational leaders and teachers in preparing students for the MAP exams. The roadmap concentrates on providing the required documents, strategies, skills, and challenges that should be available in every successful teaching plan. Therefore, this can be used as a significant support for various schools to achieve their educational targets. In addition, the roadmap will help teachers to understand the importance of shifting their concentration from teaching to learning towards improving students' learning skills which are considered as one of the most significant requirements for enhancing students' results in the MAP exams. Moreover, challenges that might hinder the implementation of FA strategies have been mentioned to be addressed by educators who lead this process with the intention of offering solutions that might solve various issues. For example, teachers' competences, appropriate learning environment, lack of resources and other difficulties. Furthermore, the results of the current study will shed light on the importance of providing teachers with more professional development programs that can develop their teaching competences. These programs are considered as one of the essential parts in the UAE National Agenda 2021 targets that aim to prepare teachers with a high level of professional teaching skills for the coming future towards improving the students' academic results internationally.

The findings of the current study can support the UAE educational reform that aims to change the quality of education in the UAE with the purpose of enhancing students' skills. In addition to paving the way towards achieving the targets of the UAE National Agenda 2071 in being the top educational country in the world.

5.4 Research Recommendations

Investigating the importance of using FA strategies on enhancing students' results in the MAP exams was the main priority of the current study in order to shed the light on its significant role in reforming the process of education towards developing students' learning skills. In addition to drawing the attention of educators by providing evidence regarding its positive effect on students' results. Therefore, the study recommends teachers to be observed with the aim of focusing on the implementation of FA strategies in teachers' classes in order to make sure that students are

constructing and developing the needed skills in an effective way. In addition to observing teachers' competence in building these skills through the active use of various FA strategies that should be implemented in every classroom.

The result of the first recommendation leads to the second one, which is related to the need of providing teachers with more practical professional development programs. These programs should be focusing on authentic assessments that can support teachers to improve their competence in generating and enhancing students' high order thinking skills. This is considered as one of the top priorities in the UAE National Agenda targets 2021 where all teachers must attend several professional development programs and pass a number of assessments in order to be certified as a qualified teacher. Furthermore, observing the teaching process in teachers' classrooms would offer additional evidence about other implemented FA strategies that might have a significant effect on students' results in the MAP exams rather than the types that the current study concentrated on.

It will also be beneficial to expand the outcomes of the study focus by including other subjects such as English and mathematics as another recommendation for a future research in order to measure the students' progress in all the subjects that are required to conduct the MAP exam. Comparing the progress results of the participating students in core subjects will provide valuable evidence about the correlation between the types and ways of the implemented strategies and their effect on students' results in the MAP exam. Furthermore, a future recommendation is to increase the sample size to include students from grades 3 up to grade 9. This offers the researcher further insight into how teachers build students' skills at an early age and improve them until they reach grade 9. It is noteworthy mentioning that comparing students' skills in grade 3 with those in grade 9 will clarify the gaps that teachers need to overcome in their planning to achieve better outcomes. This information will help the heads of departments to consider these gaps to modify their plans in order to meet the learning needs of all groups of students to achieve the school's target according to the UAE National Agenda 2071.

The last recommendation is related to students' perceptions. The researcher believes that it will be helpful to have the students' point of view in relation to FA strategies that can affect their learning skills. Moreover, students can offer a valuable opinion about specific types of FA strategies that they consider from their self-assessment can make a noticeable difference in their skills and should be taught in their classes.

5.5 Limitations

The present research study has some limitations that might lead to constitute new opportunities for additional inquiries. The reason behind these limitations is related to the difficulty of getting accessibility from the participating schools. The first limitation is related to the teachers' classrooms which need to be observed and considered in future research in order to collect further information about the ways and authentic practices that are applied by teachers using various FA strategies. In addition to evaluating teachers' implementation of FA strategies and the effects of these strategies on students in a real situation. The second limitation is linked to the sample size of the study. Although the used sample was selected from five different emirates in the UAE, the sample size was small due to the limitation of accessing more students' data of MAP results. The third limitation is connected to the grade and the subject used which are limited to grade eight students and to the science subject only. Therefore, the results will be more focused on the middle school stage and specifically for the science subject.

Moreover, another limitation is related to concentrating on educational leaders' perceptions regarding studying the effects of implemnting FA strategies on students' attainment, progress, and learning skills in general. Therefore, focusing on specific learning skills might provide a better picture of the results that can clarify their relationship with achieving higher results in the MAP exam.

References

Abidin, C., Amin, S.M., and Sulaiman, R. (2018). The Effect of Think-Pair-Share Learning with Contextual Approach on Junior High School Students' Mathematics Problem Solving Ability. In *Mathematics, Informatics, Science, and Education International Conference (MISEIC 2018)*. Atlantis Press, vol. 157, pp. (31-34).

Abrahams, I. (2011). *Practical work in secondary science: a minds-on approach.* London: continuum.

Abrams, L.M., McMillan, J.H., & Wetzel, A.P. (2015). Implementing benchmark testing for formative purposes: teacher voices about what works. *Educational Assessment, Evaluation and Accountability*, vol. 27 (4), pp. 347-375.

Abujaja, A.M. & Abukari, A. (2019). Using effective assessment to improve teaching and learning. *Journal for Researching Education Practice and Theory* (JREPT), vol. 2 (1), pp. 1-3.

Abu-Zaid, A. (2013). Formative assessments in medical education: a medical graduate's perspective. *Perspectives on Medical Education*, vol *2*(5-6), pp.358-359.

Adachi, C., Tai, J.H.M. and Dawson, P. (2018). Academics' perceptions of the benefits and challenges of self and peer assessment in higher education. *Assessment & Evaluation in Higher Education*, vol *43*(2), pp.294-306.

Adamson, B. (2011). "Embedding Assessment for Learning", in R. Berry and B. Adamson (eds). Assessment Reform in Education. Education in the Asia-Pacific Region. Springer, Dordrecht, pp. 197-203. https://doi.org/10.1007/978-94-007-0729-0_14

ADEC. (2012). *Abu Dhabi education reform: The road to 2030* [online]. [Accessed 27 January, 2020]. Available at: https://centres.insead.edu/innovation-policy/events/policy-breakfasts/documents/ad_ edu_ref_ pres-2012april.pdf

Adejimi, A., Oyediran, O. S., & Ogunsanmi, E. B. (2011). Employing qualitatively enriched semi structured questionnaire in evaluating ICT impact on Nigerian 'Construction Chain Integration'. *The Built & Human Environment Review*, vol. 3(1), pp. 42-62.

AERA Code of Ethics: American Educational Research Association Approved by the AERA Council February 2011. (2011). *Educational Researcher*, vol. 40(3), pp.145-156. Available at: https://doi.org/10.3102%2F0013189X11410403.

Ahonen, E., Pyhalto, K., Pietarinen, J., & Soini, T. (2014). Teachers' professional beliefs about their roles and the pupils' roles in the school. *Teacher Development*, vol. 18(2), 177-197. Available at: https://doi.org/10.1080/13664530.2014.900818

Akkaraju, S., Atamturktur, S., Broughton, L. and Frazer, T. (2019). Ensuring student success: using formative assessment as the key to communication and compassion among faculty, students, and staff. *New Directions for Community Colleges*, *2019*(186), pp.71-79.

Akyol, Z., & Garrison, D.R. (2011). Understanding cognitive presence in an online and blended community of inquiry: Assessing outcomes and processes for deep approaches to learning. *British Journal of Educational Technology*, vol. 42 (2), pp. 233–250.

Alam, M. (2019). Assessment challenges & impact of formative portfolio assessment (FPA) on EFL learners' writing performance: a case study on the preparatory English language course. *English Language Teaching*, vol. *12*(7), pp.161-172.

Albaaly, I. (2012). The effectiveness of using cyclic inquiry model (CIM) in developing some of science processes and the achievement in Science. *Journal of Educational Research, vol. 31(*26), pp. 259-283.

Alhojailan, M. I. (2012). Thematic analysis: a critical review of its process and evaluation. *West East Journal of Social Sciences*, vol. 1(1), pp. 39-47.

Al-Hattami, A. A. (2019). The perception of students and faculty staff on the role of constructive feedback. *International Journal of Instruction*, vol. 12(1), pp. 885-894.

Ali, S.O. (2018). Role of educational leaders in supporting beginning teachers in Al Ain schools in the UAE. In *Encyclopedia of Information Science and Technology, Fourth Edition* (pp. 7647-7658). IGI Global.

Alicia, C. (2018). An argument for formative assessment with science learning progressions, *Applied Measurement in Education*, vol. 31(2), pp. 104-112, doi: 10.1080/08957347.2017.1408630

Alipour, F., Idris, K., and Karimi, R. (2011), "Knowledge creation and transfer: role of learning organization", *International Journal of Business Administration*, Vol. 2(3), p. 61.

Allal, L. and Lopez, L.M. (2005). Formative assessment of learning: a review of publications in French. *Formative Assessment: Improving Learning in Secondary Classrooms*, pp.241-264.

Allen, D., & Tanner, K. (2002). Approaches in cell biology teaching. *Cell Biology Education*, vol. 1, pp. 3-5.

Alley, K.M. (2019). Fostering middle school students' autonomy to support motivation and engagement. *Middle School Journal*, vol. *50*(3), pp.5-14.

Almalki, S., (2016). Integrating quantitative and qualitative data in mixed methods research-challenges and benefits. *Journal of Education and Learning*, vol. 5 (3), pp. 288-296.

Almekhlafi, A.G.A. (2016). Pre-service and in-service teachers' perceptions of the utility of E-learning digital collaboration tools for teaching and learning. *Journal of Education and Social Sciences*, *4*(June), pp.297-305.

Alonzo, A.C. (2018). An argument for formative assessment with science learning progressions. *Applied Measurement in Education*, vol. *31*(2), pp.104-112.

Alonzo, A.C. (2017). An argument for formative assessment with science learning progressions. *Applied Measurement in Education*, vol. 31 (2), pp. 104-112.

Alotaibi, K. (2016). *Classroom assessment: perception and practices in Saudi Arabia.* Germany: LAP ambert Academic Publishing, pp. 145-161.

Al Said, R.S., Du, X., ALKhatib, H.A.H., Romanowski, M.H., and Barham, A.I.I. (2019). Math teachers' beliefs, practices, and belief change in implementing problem based learning in Qatari primary governmental school. *EURASIA Journal of Mathematics, Science and Technology Education*, vol. *15*(5).

AlShamsi, O., and Ajmal, M. (2018). Critical factors for knowledge sharing in technology-intensive organizations: evidence from UAE service sector. *Journal of Knowledge Management*, vol. *22*(2), pp.384-412.

Altman, J.R., Lazarus, S.S., Quenemoen, R.F., Kearns, J., Quenemoen, M., & Thurlow, M.L. (2010). *Accomplishments and new issues at the end of a decade of change.* Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes.

Amelia, W.G. (2018). Where are we now? Learning progressions and formative assessment, *Applied Measurement in Education*, vol. 31(2), pp. 157-164, doi: 10.1080/08957347.2017.1408626

Ames, C. (1992). Classrooms: goals, structures, and student motivation. *J Educ Psychol vol.* 84, pp. 261–271, doi:10.1037/0022-0663.84.3.261.

Amineh, R.J., and Asl, H.D. (2015). Review of constructivism and social constructivism. *Journal of Social Sciences, Literature and Languages*, vol. *1*(1), pp.9-16.

Anderson, J. (2009). "Mathematics curriculum development and the role of problem solving", in K. School (eds). *Proceedings of 2009 Australian Curriculum Studies Association National Biennial Conference. Curriculum: A National Conversation* pp. 1-8. http://www.acsa.edu.au/pages/page484.asp.

Anderson, D., Mathys, H., & Mills, A. (2015). Depth of knowledge of American elementary pre-service teachers' social studies lessons. *Journal of Studies in Education*, vol. 5(1), pp. 65-73.

Andersson, C. and Palm, T. (2017). Characteristics of improved formative assessment practice. *Education Inquiry*, vol. *8*(2), pp.104-122.

Andrade, H. G. (2010). "Students as the definitive source of formative assessment: academic selfassessment and the self-regulation of learning", in H. Andrade & G. Cizek (eds.), *Handbook of formative assessment*. New York, NY: Routledge, pp. 90–105.

Andrade, H. and Cizek, G.J. (2010). "An introduction to formative assessment: history, characteristics, and challenges", in *Handbook of formative assessment*. Routledge, pp. 15-29.

Andrade, H.L. (2019). A critical review of research on student self-assessment. In *Frontiers in Education*, vol. 4, p. 87. Frontiers.

Andrade, H., Bennett, R., Cizek, G. (2019). Handbook of formative assessment in the disciplines. New York: Routledge. https://doi.org/10.4324/9781315166933

Antoniou, P., & James, M. (2014). Exploring formative assessment in primary school classrooms: Developing a framework of actions and strategies. *Educational Assessment, Evaluation and Accountability, vol. 26*(2), pp. 153-176. https://doi.org/10.1007/s11092-013-9188-4

Archibald, M.M., Radil, A.I., Zhang, X. and Hanson, W.E. (2015). Current mixed methods practices in qualitative research: a content analysis of leading journals. *International Journal of Qualitative Methods*, vol. *14*(2), pp.5-33.

ARG (Assessment Reform Group). (2002). Assessment for learning: 10 Principles [online]. [Accessed 20 November, 2019]. Available at: http://www.qca.org.uk/libraryAssets/media/4031_afl_principles.pdf.

Arizon, M., & Cameron, M. (2010). The application of mixed methods in organizational research: a literature review. *The Electronic Journal of Business Research Methods*, vol. 8(2), pp. 95-105.

Armstrong, F. (2019). Social constructivism and action research: transforming teaching and learning through collaborative practice. In *Action Research for Inclusive Education*. Routledge, pp. 5-16.

Arrafii, M.A., & Sumarni, B. (2018). Teachers' understanding of formative assessment. *Lingua Cultura*, vol. 12(1), pp. 45-52.

Ash, K. (2008). Adjusting to test takers. *Education Week*, vol. 28(13), pp. 1-4. Available at: http://go.galegroup.com/ps/i.do?id=GALE|A189917328&v=2.1&u=nclivegwu&it =r&p=AONE&sw=w

Ash, K. (2008). Computer-adaptive testing addresses individual student needs, but cost and logistical challenges persist. *Education Week*, vol. 28(13), p. 19. Available at: http://go.galegroup.com/ps/i.do?id=GALE|A189917328&v=2.1&u=nclivegwu&it =r&p=AONE&sw=w

Asghar, A., Ellington, R., Rice, E., Johnson, F., & Prime, G. M. (2012). Supporting STEM education in secondary science contexts. *Interdisciplinary Journal of Problem-Based Learning*, vol. 6(2). https://doi.org/10.7771/1541-5

Assessment Action Group /AiFL Programme Management Group (AAG/APMG). (2002–2008). AifL-Assessment is for learning [online]. [Accessed 15 January, 2020]. Available at: http://www.ltscotland.org.uk/assess

Aubrey, K., and Riley, A. (2018). *Understanding and using educational theories*. SAGE Publications Limited.

Authority, S.Q. (2006). Assessment is for learning: Self-assessment toolkit. *Learning and Teaching Scotland.* Available at: http://www. wiredshire. org. uk/professional/support/csg/english/documents/AifLToolkitforschools. pdf.

Ash, K., & Sawchuk, S. (2008). Adjusting to test takers. *Education Week*, vol. *28*(13), pp. 19-21.

Ashraf, H., & Zolfaghari, S. (2018). EFL teachers' assessment literacy and their reflective teaching. *International Journal of Instruction*, vol. 11(1), pp. 425-436. https://doi.org/10.12973/iji.2018.11129a.

Assessment Reform Group (ARG). (1999). *Assessment for learning: beyond the black box*. Cambridge University: Cambridge School of Education.

Assessment Reform Group. (2002). "Assessment for Learning: 10 Principles." http://cdn.aaia. org.uk/content/uploads/2010/06/Assessment-for-Learning-10-principles.pdf.

Astawa, I.N., Mantra, I.B.N., & Widiastuti, I.A.M.S. (2017). Developing communicative English language tests for tourism vocational high school students. *International Journal of Social Sciences and Humanities* (IJSSH), vol. 1(2), pp. 58-64.

Autieri, S. M., Amirshokoohi, A., Kazempour, M. (2016). The science-technology-society framework for achieving scientific literacy: an overview of the existing literature. *European Journal of Science and Mathematical Education*, vol. 4(1), pp. 75-89

Avargil, S., Herscovitz, O., & Dori, Y. J. (2012). Teaching thinking skills in context-based learning: Teachers' challenges and assessment knowledge. *Journal of Science Education and Technology, vol. 21*(2), *pp.* 207-225. doi: 10.1007/s10956-011-9302-7.

Azevedo, R. (2005b). Using hypermedia as a metacognitive tool for enhancing student learning? The role of self-regulated learning. *Educational Psychology*, vol. 40(4), pp.199–209. doi:10.1207/ s15326985ep4004_2

Azlina, N.N. (2010). CETLs: supporting collaborative activities among students and teachers through the use of think-pair-share techniques. *International Journal of Computer Science Issues (IJCSI)*, vol. *7*(5), p.18.

Baas, D., Castelijns, J., Vermeulen, M., Martens, R. and Segers, M. (2015). The relation between Assessment for Learning and elementary students' cognitive and metacognitive strategy use. *British Journal of Educational Psychology*, vol. *85*(1), pp.33-46.

Bahri, A., and Corebima, A.D. (2015). The contribution of learning motivation and metacognitive skill on cognitive learning outcome of students within different learning strategies. *Journal of Baltic Science Education*, vol. *14*(4), pp.487-500.

Bakkenes, I., Vermunt, J. D., & Wubbels, T. (2010). Teacher learning in the context of educational innovation: learning activities and learning outcomes of experienced teachers. *Learning and Instruction*, vol. 20(6), pp. 533–548. https://doi.org/10.1016/j.learninstruc.2009.09.001

Baenen, N., Ives, S., Lynn, A., Warren, T., Gilewicz, E., & Yaman, K. (2006). *Effective practices for at-risk elementary and middle school students* (E&R No. 06.03). Raleigh, NC: Wake County Public School System.

Baleni, Z. (2015). Online formative assessment in higher education: its pros and cons. *Electronic Journal of e-Learning*, vol. *13*(4), pp.228-236.

Bamiro, A.O. (2015). Effects of guided discovery and think-pair-share strategies on secondary school students' achievement in chemistry. *Sage Open*, vol. *5*(1), p.2158244014564754.

Bandura, A. (1986a). *Social foundations of thought and action: a social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Baran, E., Canbazoglu Bilici, S., and Mesutoglu, C. (2016). Moving STEM beyond schools: students' perceptions about an out-of-school STEM education program. *International Journal of Education in Mathematics, Science and Technology*, vol. 4(1), pp. 9.

Barber, T.D. (2017). *The Relationship Between MAP Assessment and PASS Results for Eighth Grade Students* (Doctoral dissertation, Walden University).

Barkley, E. F., Cross, P. K., & Mayor, C. H. (2005). *Collaborative learning techniques: Handbook for college faculty*. San Francisco: Jossey-Bass.

Barrett, M. (2006). Practical and ethical issues in planning research. Available at: https://www.corwin.com/sites/default/files/upm-binaries/9902_040472ch2.pdf

Bartell, T. (2012). Learning to teach mathematics for social justice: negotiating social justice and mathematical goals. *National Council of Teachers of Mathematics*, vol. 44 (1), pp. 129–163.

Bartholomew, S., Strimel, G., & Yoshikawa, E. (2018). Using adaptive comparative judgment for student formative feedback and learning during a middle school design project. *International Journal of Technology and Design Education*, vol. 29 (2), pp. 363-385. [Accessed 23 March, 2019].

Beck, L. (2018). *The Impact of Choice on Normalization and Academic Achievement* (Doctoral dissertation).

Bell, B., Bell, N. and Cowie, B. (2001). *Formative assessment and science education*, vol. 12. Springer Science & Business Media.

Beesley, A.D., Clark, T.F., Dempsey, K. and 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.

Belet Boyaci, Ş. D., & Güner, M. (2018). The impact of authentic material use on development of the reading comprehension, writing skills and motivation in language course. *International Journal of Instruction*, vol. 11(2), pp. 351-368.

Bell, J. (2010). *Doing your research project*. McGraww Hill: Open University Press. Fifth Edition.

Benita, M., Roth, G., & Deci, E. L. (2014). When are mastery goals more adaptive? It depends on experiences of autonomy support and autonomy. *Journal of Educational Psychology*, vol. 106, pp. 258–267. doi:10.1037/a0034007.

Bennett, R. (2011). Formative assessment: a critical review. *Assessment in Education: Principles, Policy & Practice, vol. 18*(1), pp. 5-25. https://doi.org/10.1080/0969594X.2010.513678

Berry, R. (2008). *Assessment for learning*. Hong Kong: Hong Kong University Press.

Berry, R. (2011). 'Assessment reforms around the world', in: Berry R., Adamson B. (eds). *Assessment Reform in Education*. Education in the Asia-Pacific Region: Issues, Concerns and Prospects. Springer, Dordrecht, vol 14.

Bhagat, K.K., and Spector, J.M. (2017). Formative assessment in complex problem-solving domains: The emerging role of assessment technologies. *Journal of Educational Technology & Society*, vol. 20(4), pp.312-317.

Bibolov, A., Cakir, S., Garcia, P., Martinez, M., & Tamirisa, N. (2017). IMF Country Report No 17/219 United Arab Emirates [online]. [Accessed 27 January, 2020]. Available at: Washington, DC: file://Users/z9299/Downloads/cr17219%20 (2).pdf.

Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher Education*, vol. 32, pp. 1-18.

Biggs, J. (1996). Enhancing teaching through constructive alignment. *Higher Education*, vol. 32(3), pp. 347-364.

Biggs, J. (1999). What the Student Does: teaching for enhanced learning, *Higher Education Research & Development*, vol. 18(1), pp. 57-75. Available at: http://dx.doi.org/10.1080/0729436990180105

Biggs, J. (2003). Teaching for quality learning at university. Buckingham: Open University Press/Society for Research into Higher Education. (Second edition).

Biggs, J. (2012). What the student does: Teaching for enhanced learning. *Higher Education Research & Development*, vol. 31(1), pp. 39–55.

Biggs, J. (2014). Constructive alignment in university teaching. *HERDSA Review of higher education*, vol. 1(1), pp.5-22.

Biggs J., and Tang, C. (2007). Teaching for quality learning at university, Society for research in higher education, Buckingham, Open University Press.

Bialik, M., Bogan, M., Fadel, C., & Horvathova, M. (2015). Education for the 21st century: What should students learn? Center for Curriculum Redesign, vol. 3 (4), pp. 415–420. Available at: www.curriculumredesign.org.

Birenbaum, M., DeLuca, C., Earl, L., Heritage, M., Klenowski, V., Looney, A., Smith, K., Timperley, H., Volante, L. and Wyatt-Smith, C. (2015). International trends in the implementation of assessment for learning: Implications for policy and practice. *Policy Futures in Education*, vol. *13*(1), pp.117-140.

Black, P., & Atkin, M. (2014). The central role of assessment in pedagogy. In N. G. Lederman & S. K. Abell (eds.) *Handbook on research in science education*, vol 2, pp. 775–790. Abingdon: Routledge.

Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice, vol. 5*(1), pp. 7–74. http://dx.doi.org/10.1080/0969595980050102.

Black, P., & Wiliam, D. (1998). Inside the black box: Raising standards through classroom assessment. Phi Delta Kappan, vol. 80(2), pp. 139–148.

Black, P., Wiliam, D., (1998a). Assessment and classroom learning. Assessment in Education, vol. 5(1), pp. 7–73.

Black P, Wiliam, D. (1998b). Inside the black box: Raising standards through classroom assessment. London: School of Education King's College.

Black P, & Wiliam, D. (2005). Lessons from around the world: How policies, politics and cultures constrain and afford assessment practices. *Curriculum Journal*, vol. 16(2), pp. 249-261.

Black, P. & Wiliam, D. (2006a). Assessment for learning in the classroom. In J. Gardner (Ed.), *Assessment and learning*, London: Sage, pp. 9-25.

Black, P., & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability (formerly: Journal of Personnel Evaluation in Education)*, vol. *21*(1), p. 5.

Black, P., & Wiliam, D. (2010). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan*, vol. 92(1), pp. 81–90.

Black P, Wiliam D. (2010). *Inside the Black Box: Raising Standards Through Classroom Assessment* (Online). Arlington, VA: Phi Delta Kappa. [Accesses 29 November 2019]. Available at: https://www.rdc.udel.edu/wp-content/uploads/2015/04/InsideBlack- Box.pdf

Black, P., & Wiliam, D. (2018). Classroom assessment and pedagogy, assessment in education: principles, *Policy & Practice*, vol. 25(6), pp. 551-575. doi: 10.1080/0969594X.2018.1441807

Bloom, B.S., Hastings, J.T., & Madaus, G.F. (1971). *Handbook on formative and summative evaluation of pupil learning*. New York: McGraw-Hill.

Boaler, J. (2016). Mathematical mindsets: unleashing students' potential through creative math, inspiring messages, and innovative teaching. San Francisco, CA: Jossey-Bass & Pfeiffer Imprints.

Borg, S., and Edmett, A. (2018). Developing a self-assessment tool for English language teachers. *Language Teaching Research*, vol (23)5, pp.655-679

Boston, C. (2018). The concept of formative assessment, ERIC Digest (Online). College Park, MD: ERIC Clearing house on Assessment and Evaluation. https://files.eric.ed.gov/fulltext/ED470206.pdf

Boud, D. (2000). Sustainable assessment: rethinking assessment for the learning society. *Studies in Continuing Education,* vol. 22(2), pp.151-167.

Boud, D. (2013). Enhancing learning through self-assessment. New York, NY: Routledge Falmer, Taylor & Francis Group.

Box, C. (2019). 'The power of formative assessment', *Formative Assessment in United States Classrooms* (pp. 25-48). Palgrave Macmillan, Cham.

Box, C., Skoog, G., & Dabbs, J. M. (2015). A case study of teacher personal practice assessment theories and complexities of implementing formative assessment. *American Educational Research Journal*, vol. 52(5), pp. 956-983. https://doi.org/10.3102/0002831215587754.

Bowen, G. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, vol. 9(2), pp. 27-40.

Brace, N., Kemp, R. & Snelgar, R. (2009). *SPSS for psychologists: a guide for data analysis using SPSS for Windows.* Great Britain: Palgrave Macmillan.

Bremer, I., Andersson, C., and Carlsson, E. (2013), "Effective tacit knowledge transfer: a leadership perspective: the case of the "Toyota way".

Brewer, J., & Hunter, A. (1989). Multimethod research: a synthesis of styles. Newbury Park, CA: Sage.

Broadbent, J., Panadero, E., & Boud, D. (2018). Implementing summative assessment with a formative flavour: a case study in a large class. *Assessment & Evaluation in Higher Education*, vol. 43(2), pp. 307-322. doi:10.1080/02602938.2017.1343455

Brookfield, SD. (2015). *The skillful Teacher: On Technique, Trust, and Responsiveness in the Classroom*. Hoboken, NJ: Wiley, Jossey-Bass.

Brookhart, S.M. (2013). *How to Create and Use Rubrics for Formative Assessment and Grading*. Alexandria, VA: Association for Supervision and Curriculum Development.

Brookhart, S.M., Guskey, T.R., Bowers, A.J., McMillan, J.H., Smith, J.K., Smith, L.F., Stevens, M.T., & Welsh, M.E. (2016). A century of grading research: Meaning and value in the most common educational measure. *Review of Educational Research*, vol. *86*, pp. 803–848.

Brookhart, S.M. (2017). *How to give effective feedback to your students*. ASCD. http://perino.pbworks.com/f/Effective+Feedback.pdf

Brooks, J. G., & Brooks, M. G. (1993). *In search of understanding: The case for constructivist classrooms.* Alexandria, VA: Association of Supervision and Curriculum Development.

Brown, C. and Militello, M. (2016). Principal's perceptions of effective professional development in schools. *Journal of educational administration*, vol. *54*(6), pp.703-726.

Brown, J.E., (2014). *Investigating the validity of using NWEA's MAP results to predict PSAE and ACT results* (Doctoral dissertation).

Brozo, W. G., Sulkunen, S., Shiel, G., Garbe, C., Pandian, A., & Valtin, R. (2014). Reading, Gender, and Engagement: Lessons From Five PISA Countries. *Journal of Adolescent & Adult Literacy*, ol. 57(7), pp. 584-593. doi:10.1002/jaal.291

Bryan, C. and Clegg, K. (2019). *Innovative Assessment in Higher Education: A Handbook for Academic Practitioners*. Routledge.

Bryman, A. (2012). *Social research methods.* 4th edn. Oxford: Oxford University Press.

Bülent, A., Mehmet, E., & Nuran, E. (2014). The investigation of science process skills of elementary school teachers in terms of some variables. *Asia-Pacific Forum on Science Learning and Teaching, vol. 15 (*1), pp. 1-28.

Buldu, M. (2010). Making learning visible in kindergarten classrooms: Pedagogical documentation as a formative assessment technique. *Teaching and Teacher Education*, vol. *26*(7), pp.1439-1449.

Bulunuz, N., Bulunuz, M., Karagoz, F., & Tavsanli, Ö. F. (2016). Achievement levels of middle school students in the standardized science and technology exam and formative assessment probes: a comparative study. *Journal of Education in Science, Environment and Health (JESEH), vol. 2*(1), pp. 33-50.

Burkam, A. S. (2013). Alignment analysis of the common core state standards integrated pathway: Mathematics II to the common core state standards. Portland: Walch Education.

Burton, M., Silver, E., Mills, V., Audrict, W., Strutchens, M.E. and Petit, M. (2018). Formative assessment and mathematics teaching: Leveraging powerful linkages in the US context. In *Classroom Assessment in Mathematics*, Springer, Cham, pp. 193-205.

Burris, S. & Garton, B.L. (2007). Effect of instructional strategy on critical thinking and content knowledge using problem-based learning in the secondary classroom. *Journal of Agricultural Education*, vol. 46(1), pp. 106-116.

Carnegie Corporation of New York & Institute for Advanced Study. (2007). *The opportunity equation: Transforming mathematics and science education for citizenship and the global economy*. Available at: http://opportunityequation.org/uploads/files/oe_report.pdf

Caruth, G. D. (2013). Demystifying mixed methods research design: A review of the literature. Melvana International Journal of Education, vol. 3(2), pp. 112-122.

Casas, M. (2006). Implementing constructivist web-based learning and determining its effectiveness on a teacher preparation course. *The Journal of Educators Online*, vol. 3(2), pp. 1-17.

Case, B. J., Jorgensen, M. A., & Zucker, S. (2004). Alignment in educational assessment. New Jersey: Pearson Education.

Cassidy, S. (2006). Developing employability skills: Peer assessment in higher education. *Education and Training*, vol. 48 (7), pp. 508-517.

Catarina, A. & Torulf, P. (2017). *Characteristics of improved formative assessment practice*, Education Inquiry, vol. 8(2), pp. 104-122, DOI: 10.1080/20004508.2016.1275185

Cauley, K., & McMillan, J. (2010). Formative Assessment Techniques to Support Student Motivation and Achievement. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, vol. 83*(1), pp. 1-6. https://doi.org/10.1080/00098650903267784

Chapman, J., & Aspin, D. (2013). A problem-solving approach to addressing current global challenges in education. *British Journal of Educational Studies, ol. 61*(1), *pp.* 49-62. doi: 10.1080/00071005.2012.756166.

Chappuis, J. (2014). Seven strategies of assessment for learning.2nd ed. Pearson.

Chen, Q., Kettle, M., Klenowski, V., & May, L. (2013). Interpretations of formative assessment in the teaching of English at two Chinese universities: A sociocultural perspective. *Assessment & Evaluation in Higher Education*, vol. 38(7), pp. 831–846.

Cherryholmes, C. H. (1992). Notes on pragmatism and scientific realism. *Educational Researchers*, vol. 14, pp. 13-17.

Chong, K.K.K. (2009). Whither school-based coursework assessment in Singapore? Paper presented at the 35th IAEA Conference-Assessment for a Creative World. Available online at http://www.iaea.info/documents/paper_4d73afd.pdf.

Christman, J. B., Neild, R. C., Bulkley, K., Blanc, S., Liu, R., Mitchell, C., & Travers, E. (2009). *Making the most of interim assessment data: Lessons from Philadelphia*. Philadelphia, PA: Research for Action.

Christenson, S. L., Reschly, A. L., & Wylie, C. (2012). *The Handbook of Research on Student Engagement.* New York: Springer Science. https://doi.org/10.1007/978-1-4614-2018-7

Clarke, B. (2006). Breaking through to reluctant readers. *Educational Leadership, vol. 63*(5), pp. 66–69.

Clark, I. (2011). Formative assessment and motivation: Theories and themes. *Prime Research on Education*, vol. *1*(2), pp.27-36.

Clark, I. (2012). Formative assessment: Assessment is for self-regulated learning. *Educational Psychology Review*, ol. 24, pp. 205–249. doi:10.1007/s10648-011-9191-6.

Clark, I. (2015). Formative assessment: translating high-level curriculum principles into classroom practice. *The Curriculum Journal, vol. 26*(1), pp. 91-114. https://doi.org/10.1080/09585176.2014.990911

Clinchot, M., Ngai, C., Huie, R., Talanquer, V., Lambertz, J., Banks, G., & Sevian, H. (2017). Better formative assessment. *The Science Teacher*, vol. 84(3), p. 69.

Cisterna, D. and Gotwals, A.W., (2018). Enactment of ongoing formative assessment: Challenges and opportunities for professional development and practice. *Journal of Science Teacher Education*, vol. *29*(3), pp.200-222.

Cizek, G. J., & Gierl, M. J., (Eds.). (2016). *The eighteenth mental measurements yearbook*. Lincoln, NE: Buros Center for Testing.

Cizek, G.J., Andrade, H.L., and Bennett, R.E. (2019). Formative Assessment. *Handbook of Formative Assessment in the Disciplines*. Routledge. https://www.crcpress.com/Handbook-of-Formative-Assessment-in-the-Disciplines/Andrade-Bennett-Cizek/p/book/9781138054363

Clark, I. (2011). Formative assessment and motivation: Theories and themes. *Prime Research on Education*, vol. *1*(2), pp.27-36.

Cohen, L., Manion, L., and Morrison, K. (2007). *Research methods in education*. London: Routledge Falmer.

Cohen, L., Manion, L., & Morrison, K. (2013). Research methods in education. Milton Park. *Abingdon, Oxon,[England]: Routledge.*

Cohen, D., & Sasson, I. (2016). Online quizzes in a virtual learning environment as a tool for formative assessment. *Journal of Technology and Science Education*, vol. (3), pp. 188-208.

Collins, A., Brown, J.S., Newman, S.E. (1989). Cognitive apprenticeship: teaching the craft of reading, writing and mathematics. In: Resnick LB, ed. Knowing, Learning, and Instruction: Essays in Honor of Robert Glaser. Hillsdale, NJ: L. Erlbaum Associates.

Conklin, W. (2011). *Higher-order thinking skills to develop 21st century learners*. California, United States of America: Shell Education Publishing Inc.

Constantinou, M., & Kuys, S. (2013). Physiotherapy students find guided journals useful to develop reflective thinking and practice during their first clinical placement: a qualitative study. *Physiotherapy, vol. 99*(1), *pp.* 49-55. doi: 10.1016/j.physio.2011.12.002

Corbin, J., & Strauss, A. (2008). Basics of qualitative research: techniques and procedures for developing grounded theory (3rd ed.). Thousand Oaks, CA: Sage.

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.* (NCEE 2013–4000).

Cordray, D., Pion, G., Brandt, C., Molefe, A. and Toby, M. (2012). The Impact of the measures of academic progress (MAP) program on student reading achievement. Final Report. NCEE 2013-4000. *National Center for Education Evaluation and Regional Assistance*.

Cordray, D. S., Pion, G. M., 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*.

Cortright, R. N., Collins, H. L., & DiCarlo, S. E. (2005). Peer instruction enhanced meaningful learning: Ability to solve novel problems. *Advances in Physiology Education, vol. 29*, pp. 107-111

Cotton, N. (2019). Using an Interdisciplinary Approach with Problem-Based Learning for Gifted Learners. *Learning to Teach*, vol. (1).

Council, N., Education, D., & Assessment, B. (2014). *Developing Assessments for the Next Generation Science Standards*. Washington: National Academies Press.

Craig, C. (2014). Speaking from Different Positions: Framing African American College Male Literacies as Institutional Critique. Composition Forum, 30

Creswell, J. W. (2007). *Research design: qualitative, quantitative, and mixed methods approaches* (2nd ed.). Thousand Oaks, CA: Sage.

Creswell, J.W. (2008). *Research design: qualitative, quantitative, and mixed methods approaches*. 2nd ed. London: Sage Publications Inc.

Creswell, J.W. (2009). *Research design, qualitative, quantitative, and mixed methods approaches*: 3rd ed. California. Sage Publications Inc.

Creswell, J.W. (2012). *Educational Research: Planning, Conducting, And Evaluating Quantitative And Qualitative Research*. 4th ed. Boston: Pearson Education Inc.

Creswell, J.W. (2013). *Qualitative inquiry & research design: Choosing among five approaches*. 3rd ed. USA: Sage Publications. Inc.

Creswell, J. W. (2013). *Research design: qualitative, quantitative, and mixed methods approaches.* Sage publications

Creswell, J.W. (2014). *Research design: qualitative, quantitative, & mixed method approaches*. 4th ed. California. Sage Publications Inc.

Creswell, J.W. (2015). A concise introduction to mixed methods research. Thousand Oaks, CA: Sage Publications.

Creswell, J. (2015). *30 essential skills for the qualitative researcher*. Los Angeles, CA: SAGE.

Creswell, J. W., & Plano Clark, V. L. (2007). Choosing a mixed methods design. Designing and conducting mixed methods research, pp. 58-88.

Creswell, J.W., and Plano Clark, V. (2011). Designing and conducting mixed methods research (2nd ed). Sage.

Cronbach, L. (1963). Course improvement through evaluation, *Teacher College Record, vol. 64*, pp. 672-683.

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.

Crown Prince Court. (2011). *United Arab Emirates: Forty years of progress*. [Online]. [Accessed 25 January 2020]. Available at: https://www.cpc.gov.ae/SiteCollectionDocuments/40%20years%20book%20English.pdf.

Croy, S.R. (2018). Development of a group work assessment pedagogy using constructive alignment theory.

Czarnocha, B., and Baker, W. (2018). Assessment of the depth of knowledge acquired during the aha! moment insight. *Journal of Mathematics Education*, vol. *11*(3), pp.90-104.

Dani, A. and Nasser, R. (2016). Use of Intelligent Tutor in Post-Secondary Mathematics Education in the United Arab Emirates. *Turkish Online Journal of Educational Technology-TOJET*, vol. *15*(4), pp.152-162.

Danili, E. and Reid, N. (2006). Cognitive factors that can potentially affect pupils' test performance. *Chem. Educ. Res. Pract.*, vol. 7(2), pp.64-83.

Dantes, N. (2014). Landasan pendidikan: tinjauan dari dimensi makropedagogis. Singaraja: Undiksha.

Darling-Hammond, L., Herman, J., Pellegrino, J., Abedi, J., Aber, J., Baker, E., & Steele, C. (2013). *Criteria for High-Quality Assessment. Stanford, CA: Stanford Center for Opportunity*. [Accessed 13 February 2019].

Daro, P., Mosher, F., & Corcoran, T. (2011). Learning trajectories in mathematics: a foundation for standards, curriculum, assessment, and instruction (Research Report No. RR-68). Consortium for Policy Research in Education. Available http://www.cpre.org/images/stories/cpre_pdfs/learning%20trajectories%20in%20math_ccii%20report.pdf

Das, S., Alsalhanie, K.M., Nauhria, S., Joshi, V.R., Khan, S. and 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.

Deci, E.L., Olafsen, A.H., and Ryan, R.M. (2017). Self-determination theory in work organizations: The state of a science. *Annual Review of Organizational Psychology and Organizational Behavior*, vol. 4, pp.19-43.

Deci, E.L., & Ryan, R.M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum.

Deci, E.L., & Ryan, R.M. (1991). A motivational approach to self: Integration in personality. In R. Dienstbier (Ed.), *Nebraska symposium on motivation:* vol. *38, Perspectives on motivation*, pp. 237-288. Lincoln: University of Nebraska Press.

Deci, E.L., & Ryan, R.M. (2000). The" what" and" why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, vol. *11*, pp. 227–268.

Deci, E. L., and Ryan, R.M. (2011). "Self-Determination Theory." In Handbook of Theories of Social Psychology, edited by P. A. M. Van Lange, A. W. Kruglanski and E. T. Higgins, pp. 416–37. London: Sage Publications.

Deci, E. L., and Ryan, R.M. (2012). "Motivation, personality, and development within embedded social contexts: an overview of self-determination theory.", in R. M. Ryan (eds). The oxford handbook of human motivation. Oxford: Oxford University Press, pp. 85–107. http://doi.org/10.1093/oxfordhb/9780195399820.013.0006.

Deci, E. L., Ryan, R. M., Gagné, M., Leone, D. R., Usunov, J., & Kornazheva, B. P. (2001). Need satisfaction, motivation, and well-being in the work organizations of a former Eastern Bloc country: a cross-cultural study of self-determination. *Personality and Social Psychology Bulletin, vol. 27*(8), pp. 930-942. doi: 10.1177/0146167201278002

DeLuca, C., Chapman-Chin, A.E., LaPointe-McEwan, D. and Klinger, D.A. (2018). Student perspectives on assessment for learning. *The Curriculum Journal*, vol. *29*(1), pp.77-94. DOI: 10.1080/09585176.2017.1401550

Demirci, C. and Düzenli, H. (2017). Formative value of an active learning strategy: technology based think-pair-share in an EFL writing classroom. *World Journal of Education*, vol. *7*(6), pp.63-74.

Denscombe, M. (2008). Communities of practice: a research paradigm for the mixed methods approach. *Journal of mixed methods research*, vol.2 (3), pp. 270-283.

Dessie, A. A., & Sewagegn, A. A. (2019). Moving beyond a sign of judgment: primary school teachers' perception and practice of feedback. *International Journal of Instruction*, vol. 12(2), pp. 51- 66. https://doi.org/10.29333/iji.2019.1224a

Dewey, J. (1934). *The Quest for Certainty Individualism Old and New Philosophy and Civilization: Art as Experience*. The Berkley Publishing Group. New York.

Dewey, J. (1944). *Democracy and education*. New York: Simon & Schuster, Inc.

Dewey, J. (1991b). *The Public and Its Problems*. Athens, OH: Ohio University Press.

Diamond, J. B., Randolph, A., & Spillane, J. P. (2004). Teachers' expectations and sense of responsibility for student learning: the importance of race, class, and organizational habitus. *Anthropology & education quarterly*, vol. 35(1), pp. 75-98.

Dilshad, M., Nausheen, M. and Ahmed, Z. (2019). Impact of students' motivation for learning English on their achievement at secondary level. *Pakistan Journal of Social Sciences (PJSS)*, vol. *39*(2), pp.689-696.

Dix, S. (2017). The effectiveness of formative assessment. *Teachers and Curriculum, vol. 6*(1), pp. 29-34. https://doi.org/10.15663/tandc.v6i1.202

Dixson, D.D., and Worrell, F.C. (2016). Formative and summative assessment in the classroom. *Theory into practice*, vol. *55*(2), pp.153-159.

Webb's Depth of Knowledge model. Available at: https://maverikeducation.com/blog/f/use-webbs-dok-levels-to-coach-not-critique-or-criticize

Duckor, B. (2016). Formative assessment in seven good moves. *On Formative Assessment: Readings from Educational Leadership*, pp.76-85.

Dwyer, C. (2013). *The future of assessment* (p. 7). New York: Routledge.

East, M. (2015). Coming to terms with innovative high-stakes assessment practice: Teachers' viewpoints on assessment reform. *Language Testing*, vol. 32(1), pp. 101–120.

Ebby, C.B., & Petit, M.M. (2018). 'Using learning trajectories to elicit, interpret and respond to student thinking', in E. A. Silver & V. L. Mills (eds.). *A fresh look at formative assessment in mathematics teaching.* Reston, VA; National Council of Teachers of Mathematics, pp. 81-101.

Ebby, C.B., Remillard, J. and D'Olier, J. (2019). Pathways for Analyzing and Responding to Student Work for Formative Assessment: The Role of Teachers' Goals for Student Learning1.

Ebby, C. B., & Sirinides, P. M. (2015). 'Conceptualizing teachers' capacity for learning trajectory-oriented formative assessment in mathematics', in J. A. Middleton, J. Cai, and H. Hwang (eds.). *Large-scale studies in mathematics education.* New York: Springer, pp. 159–176.

El Afi, A.D. (2019). The impact of professional development training on teachers' performance in Abu Dhabi Cycle Two and Three schools. *Teacher Development*, *23*(3), pp.366-386.

El Dor, R., (2019). *Reliability and Utility of Measures of Academic Progress (MAP) Test and Its Impact on Students' Learning: A Study in an American Curriculum School in Dubai* (Doctoral dissertation, The British University in Dubai (BUiD)).

Eleanore, H. (2012). Teachers' classroom feedback: still trying to get it right. Pedagogies: *An International Journal*, vol. 7 (1), pp. 1-15.

Elizabeth, N. (2017). From a culture of testing to a culture of assessment: Implementing writing portfolios in micro context. Revisiting EFL assessment: Critical perspectives, pp. 221–235. Cham: Springer.

Elliott, S.N., Kratochwill, T.R., Littlefield Cook, J. & Travers, J. (2000). Educational psychology: Effective teaching, effective learning (3rd ed.). Boston, MA: McGraw-Hill College.

Eltanahy, M. (2017). Assessment in the Context of Teaching: Investigating Teachers' Perceptions of Assessment Practices that Enhance the Learning Process. http://www.buid.ac.ae/BDRC-2017.

Eisner, E. W. (1991). The enlightened eye: Qualitative inquiry and the enhancement of educational practice. New York, NY: Macmillan.

Erduran, S., & Msimanga, A. (2014). Science curriculum reform in South Africa: Lessons for professional development from research on argumentation in science education. *Education as Change*, 18(sup 1), S33–S46.

Ervin, B., Wash, P. D., & Mecca, M. E. (2010). A three year study of self-regulation in Montessori and Non-Montessori Classrooms. *Montessori Life,* vol. 22(2), p.22.[online]. [Accessed 27 October, 2019].

Eva, K. W., & Regehr, G. (2007). Knowing when to look it up: A new conception of self-assessment ability. Academic Medicine, vol. 82(10), pp. S81–S84. doi:10.1097/ACM.0b013e31813e6755

Evans, D.J., Zeun, P., & Stanier, R.A. (2014). Motivating student learning using a formative assessment journey. *Journal of Anatomy*, vol. 224 (3), pp. 296-303.

Fahimi, Z., and Rahimi, A. (2015). On the impact of self-assessment practice on writing skill. *Procedia-Social and Behavioral Sciences*, *192*, pp.730-736.

Falchikov, N., & Boud, D. (1989). Student self-assessment in higher education: a meta-analysis, *Review of Educational Research*, vol. 59 (4), pp. 395- 430.

Fancsali, S.E., Zheng, G., Tan, Y., Ritter, S., Berman, S.R., and Galyardt, A. (2018). 'Using embedded formative assessment to predict state summative test scores', in *Proceedings of the 8th International Conference on Learning Analytics and Knowledge.* ACM, pp. 161-170.

Fandy, F.A. (2019). Information gap activities through think pair share cooperative learning model strategy to improve students speaking ability. *Language-Edu*, vol. *8*(1).

Faulconer, E., & Wood, B. (2019). Formative assessment techniques for lnline Learning. *The Teaching Professor*. [Accessed 12 October, 2019]. Available at: https://commons.erau.edu/publication/1328

Fautley, M., & Savage, J. (2008). Assessment for learning and teaching in secondary schools. British: Learning Matters Ltd

Fin, L.S., & Ishak, Z. (2012). A priori model of students' academic achievement: the effect of gender as moderator. *Procedia-Social and Behavioral Sciences*, vol. 65, pp.1092-1100.

Fitzallen, N., Brown, N., Biggs, J.B. and Tang, C. (2017). Students' perceptions of constructive alignment: validation of a data collection instrument. In *International Conference on Teaching and Learning in Higher Education 2017* (p. 19).

Fook, C. Y. & Sidhu, G. K. (2013). Promoting transformative learning through formative assessment in higher education. *Academic Journal for Teaching and Learning in Higher-education*, vol. 5(1), pp. 1-11.

Foster, D., & Poppers, A. E. (2011). How can I get them to understand? In P. E. Noyce & D. T. Hickey (eds), *New frontiers in formative assessment.* Cambridge, MA: Harvard Education Press, pp. 13–67.

Fraenkel, J.M., and Wallen, N.E. (2006). *How to design and evaluate research in education*. 1st ed. Boston [u.a.]: McGraw-Hill.

Fraenkel, J.M., & Wallen, N.E. (2012). *How to design and evaluate research in education*. 8th ed. Boston: McGraw Hill.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2014). *How to Design and Evaluate Research in Education.* McGraw Hill Education. New York.

Fraenkel, J., Wallen, N. & Hyun, H. (2015). *How to design and evaluate research in education.* 9th Ed. New York: McGraw-Hill education.

Fraser, J. M., Timan, A. L., Miller, K., Dowd, J. E., Tucker, L., & Mazur, E. (2014). Teaching and physics education research: Bridging the gap. *Reports on Progress in Physics*, vol. 77(3), pp. 1-17.

Frazer, S., & Bosanquet, A. (2006). The curriculum? That's just a unit outline, isn't it? *Studies in Higher Education,* vol. *31* (3), pp. 269-284.

Freeman, R. and Lewis, R. (1998). *Planning and Implementing Assessment*. London: Kogan Page.

Freeman, R., Fraenkel, J. R. Wallen, N. E. & Hyun, H. H. (2014). *How to Design and Evaluate Research in Education.* McGraw Hill Education. New York. and Lewis, R., (2016). *Planning and implementing assessment*. Routledge.

Frunza, V. (2014). Advantages and barriers of formative assessment in the teaching-learning activity. *Procedia - Social and Behavioral Sciences,* vol. 114, pp. 452-455. https://doi.org/10.1016/j.sbspro.2013.12.728

Fuad, N.M., Zubaidah, S., Mahanal, S., and Suarsini, E. (2015). Profil Hasil Belajar, Keterampilan Berpikir Kritis dan Kreatif Siswa serta Strategi Pembelajaran yang Diterapkan

Guru SMP di Kabupaten Kediri 'The profile of learning outcomes, critical and creative thinking skills students and teacher learning strategy applied SMP in Kediri', in *Proceeding of the National Seminar and Workshop on Biology and Its Learning Biology Department*, pp. 807-815.

Furtak, E.M., Heredia, S.C., and Morrison, D. (2019). Formative assessment in science education. *Handbook of Formative Assessment in the Disciplines*.

Galal, A., Welmond, M., Carnoy, M., Nellemann, S., Keller, J., Wahba, J., & Yamasaki, I. (2008). *The road not traveled: Education reform in the Middle East and North Africa MENA development report.* Washington, DC.

Gallagher, H. A., Arshan, N., & Woodworth, K. (2017). Impact of the National Writing Project's College-Ready Writers Program in high-need rural districts. *Journal of Research on Educational Effectiveness*, vol. 10, pp. 570–595.

Gallagher, K. (2019). *Education in the United Arab Emirates: Innovation and Transformation*. Springer.

Gan, Z., He, J. and Liu, F. (2019). Understanding classroom assessment practices and learning motivation in secondary EFL students. *Journal of Asia TEFL*, vol. *16*(3), p.783.

Gan, Z., Nang, H., & Mu, K. (2018). Trainee teachers' experiences of classroom feedback practices and their motivation to learn, *Journal of Education for Teaching*, doi: 10.1080/02607476.2018.1450956

Gardner, J. N. (2012). *Assessment and Learning*. Edited by J. N. Gardner. London: SAGE Publications Ltd.

Gareis, C. (2018). Collaborative Leadership: The Forgotten Art of Formative Assessment (Online). Williamsburg, VA: William and Mary School of Education. Available at: https://education.wm.edu/centers/ttac/resources/articles/assessment/forgottenart/index.php

Garrison, C., Ehringhaus, M. *Formative and Summative Assessments in the Classroom* [online]. Westerville, OH: AMLE. [Accessed 20 November 2019]. Available at https://www.amle.org/BrowsebyTopic/WhatsNew/WNDet/TabId/270/ArtMID/888/ArticleID/286/Formative-and-Summative-Assessments-in-the-Classroom.aspx.

Geissler, FM., Stickney, DM. (2018). A Flow Chart for Success: Connecting Assessment to Instruction [Online]. [Accessed 25 November 2019]. Williamsburg, VA: William and Mary School of Education. https://education.wm.edu/centers/ttac/resources/articles/assessment/flowchartsuccess/index.php

Gerritsen-van Leeuwenkamp, K.J., Joosten-ten Brinke, D., and Kester, L. (2019). Students' perceptions of assessment quality related to their learning approaches and learning outcomes. *Studies in Educational Evaluation*, vol. 63, pp.72-82.

Ghenea, Ş. V. (2015). John Dewey: Pragmatism and Realism. *Scientific Journal of Humanistic Studies*, vol. 7(12), pp. 15-19.

Gikandi, J.W., Morrow, D, & Davis N.E. (2011). Online formative assessment in higher education: a review of literature. Computers & Education vol. 57, pp. 2333-2351.

Gil-Flores, J., Rodríguez-Santero, J., & Torres-Gordillo, J. (2017). Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastructure. *Computers in Human Behavior*, vol. 68, pp. 441–449. doi:10.1016/j.chb.2016.11.057.

Glesne, C. (2011). Becoming qualitative researchers: An introduction. 3rd edn. Boston: Pearson.

Goethals, P. (2013). The pursuit of higher-order thinking in the mathematics classroom. Available at: http://www.westpoint.edu/cfe/Literature/Goethals_13.pdf.

Goertz, M., Oláh, L., & Riggan, M. (2009). *From testing to teaching: The use of interim assessments in classroom instruction.* CPRE Research Report. Philadelphia: Consortium for Policy Research in Education.

Gok, T. (2012). The impact of peer instruction on college students' beliefs about physics and conceptual understanding of electricity and magnetism. *International Journal of Science and Mathematics Education,* vol. 10, pp. 417-436.

Gok, T. (2013). A comparison of students' performance, skill and confidence with peer instruction and formal education. *Journal of Baltic Science Education,* vol. 12(6), pp. 747-758.

Gok, T. (2015). An investigation of students' performance after peer instruction with stepwise problem-solving strategies. *International Journal of Science and Mathematics Education,* vol. *13*(3), pp. 561-582.

Gok, T. (2018). The evaluation of conceptual learning and epistemological beliefs on physics learning by think-pair-share. *Journal of Education in Science, Environment and Health (JESEH),* vol. 4(1), pp. 69-80. DOI:10.21891/jeseh.387489

Gorghiu, G., Drăghicescu, L.M., Cristea, S., Petrescu, A.M., and Gorghiu, L.M. (2015). Problem-based learning-an efficient learning strategy in the science lessons context. *Procedia-social and behavioral sciences*, vol. 191, pp.1865-1870.

Gottfried, A.E. (2019). Academic Intrinsic Motivation: Theory, Assessment, and Longitudinal Research. *Advances in Motivation Science,* vol. *6*, p.71.

Government ae. (2018a). *Government's efforts to eradicate illiteracy*. [Online]. [Accessed 25 January, 2020]. Available at: https://government.ae/en/information-and-services/education/governments-efforts-to-eradicate-illiteracy.

Graham, S., & Harris, K. R. (1993). Self-regulated strategy development: Helping students with learning problems develop as writers. *Elementary School Journal*, vol. 94, pp. 169–181.

Grant, M. M. (2011). Learning, Beliefs, and Products: Students' Perspectives with Project-based Learning. *Interdisciplinary Journal of Problem-Based Learning,* vol. 5(2). https://doi.org/10.7771/1541-5015.1254

Gray, L., *Feedback and Feedforward* [Online]. [Accessed 20 November 2019]. Available at https://www.jisc.ac.uk/guides/feedback-and-feed-forward.

Greene, J. C. (2007). *Mixed methods in social inquiry.* San Francisco: Jossey-Bass.

Greenstein, L. (2010). What teachers really need to know about formative assessment. Moorabbin, Vic.: Hawker Brownlow

Gresham, F. (2007). Handbook of response to intervention: The science and practice of assessment and intervention. New York, NY: Springer, pp. 10 – 24. doi:10. 1007/978-0-387-49053-3_2.

Griffith, S. F., & Grolnick, W. S. (2014). Parenting in Caribbean families: A look at parental control, structure, and autonomy support. *Journal of Black Psychology*, vol. 40 (2), pp. 166–190. doi:10.1177/0095798412475085.

Guadu, Z. & Boersma, E. (2018). EFL Instructors' Beliefs and Practices of Formative Assessment in Teaching Writing. *Journal of Language Teaching and Research*, vol. 9 (1), p. 42.

Guay, F., Ratelle, C. F., & Chanal, J., (2008). Optimal learning in optimal contexts: The role of self-determination in education. *Canadian Psychology,* vol. 49(3), pp. 233-240. doi: 10.1037/a0012758

Guay, F., Stupnisky, R., Boivin, M., Japel, C., and Dionne, G. (2019). Teachers' relatedness with students as a predictor of students' intrinsic motivation, self-concept, and reading achievement. *Early Childhood Research Quarterly,* vol. 48, pp.215-225.

Gul, R. B., Tharani, A. J., Lakhani, A., Rizvi N. F., & Ali, S. K. (2016).Teachers' perceptions and practices of written feedback in higher education. *World Journal of Education,* vol. 6 (3), pp. 10-20.

Gunn, C.L. (2013). *Enhancing teaching and learning in higher education in the United Arab Emirates: Reflections from the classroom*. Cambridge Scholars Publishing.

Gynnild, V., Leira, B.J., Myrhaug, D., Holmedal, L.E., and Mossige, J.C. (2019). Constructive Alignment in Science and Engineering: From Principle to Practice.

Hambleton, R. K., & Swaminathan, H. (2013). *Item response theory: Principles and applications*. Springer Science & Business Media.

Hallam, S. (2019). The Influence of Assessment on Learning and Teaching. *The Oxford Handbook of Philosophical and Qualitative Assessment in Music Education,* p.167.

Hamzeh, M., (2014). Teaching strategies used by Mathematics teachers in the Jordan public schools and their relationship with some variables. *American Journal of Educational Research*, vol. *2*(6), pp. 331-340.

Hanauer. D.I., and Bauerle. C. (2012). Facilitating Innovation in Science Education through Assessment Reform, *Liberal Education series*, pp. 34-41.

Hancock, D.R., & Alozzine, B. (2006). *Doing case study research: A practical guide for beginning researchers*. New York, NY: Teachers College Press.

Harris, L.R. and Brown, G.T. (2018). *Using self-assessment to improve student learning*. Routledge. *Frontiers in Education*. Available at: https://www.frontiersin.org/article/10.3389/feduc.2019.00087

Harrison, C. (2014). Assessment of inquiry skills in the SAILS project. *Science Education International*, vol. 25, pp. 112-122

Harlen, W., & James, M. (1997). Assessment and Learning: differences and relationships between formative and summative assessment. Assessment in Education: Principles, Policy & Practice, vol. 4(3), pp. 365-379. doi:10.1080/0969594970040304

Hattie, J. & Timperley, H., (2007). The power of feedback. *Review of educational research*, vol. 77(1), pp. 81-112.

Hawe, E. and Dixon, H. (2017). Assessment for learning: a catalyst for student self-regulation. *Assessment & Evaluation in Higher Education*, vol. 42(8), pp.1181-1192.

Heitink, M., Van der Kleij, F., Veldkamp, B., Schildkamp, K. & Kippers, W. (2016). A systematic review of prerequisites for implementing assessment for learning in classroom practice. *Educational Research Review*, vol. 17, pp. 50-62.

Hellwig, K., Morhart, F., Girardin, F. & Hauser, M. (2015). Exploring Different Types of Sharing: A Proposed Segmentation of the Market for "Sharing" Businesses. *Psychology & Marketing*, vol. 32 (9), pp. 891-906.

Heritage, M. (2008). *Learning progressions: supporting instruction and formative assessment.* Washington, DC: Chief Council of State School Officers.

Hess, K. (2012). Center for Assessment, National Center for the Improvement of Educational Assessment, Inc. Available at: www.nciea.org

Herman, J. L., Osmundson, E., & Dietel, R. (2010). Benchmark assessments for improved learning (AACC Policy Brief). Los Angeles, CA: University of California.

Hess, K. (2006). Applying Webb's depth-of-knowledge (DOK) levels in science. *Accessed November*, *10*.

Hmelo-Silver, C.E. (2004). Problem-based learning: What and how do students learn?. *Educational psychology review*, vol. 16(3), pp.235-266.

Ho, C. M., Leung, A. W. C., Mok, M. M. C. & Cheung, P. (2013). Informing learning and teaching using feedback from assessment data: Hong Kong teachers' attitudes towards Rasch measurement. In M. Mok (Ed.), *Self-directed learning oriented assessments in the Asia-Pacific*, vol 18, pp. 311–334). Dordrecht, Netherlands: Springer.

Hoerr, T.R. (2016). *The formative five: Fostering grit, empathy, and other success skills every student needs*. ASCD.

Hogan, D. (2014). Why is Singapore's school system so successful, and is it a model for the West? *The Conversation Academic Rigour, Journalistic Flair* [online]. [Accessed 9 November 2019]. Available at: http://theconversation.com/why- 65 is-singapores-school-system-so-successful-and-is-it-a-model-for-the-west22917

Hondrich, A., Hertel, S., Adl-Amini, K. & Klieme, E. (2015). Implementing curriculum-embedded formative assessment in primary school science classrooms. *Assessment in Education: Principles, Policy & Practice*, vol. 23 (3), pp. 353-376.

Hoover, A. and Krishnamurti, S. (2010). Survey of college students. MP3 listening: Habits, safety issues, attitudes, and education. American Journal of Audiology, vol. 19, 7pp. 3-83.

Horn, I. S. (2007). Fast kids, slow kids, lazy kids: Framing the mismatch problem in mathematics teachers' conversations. *The Journal of the Learning Sciences*, vol. 16(1), pp. 37-79.

Hoshmand, L.T. (2003). Can lessons of history and logical analysis ensure progress in psychological science? Theory & Psychology, vol. 13, pp.39-44.

Hu, B., Fan, X., Yang, Y., & Neitzel, J. (2017). Chinese preschool teachers' knowledge and practice of teacher-child interactions: The mediating role of teachers' beliefs about children. *Teaching and Teacher Education*, vol. 63, pp. 137–147. doi:10.1016/j.tate.2016.12.014.

Hugerat, M. (2016). How teaching science using project-based learning strategies affects the classroom learning environment. *Learning Environments Research*, vol. 19(3), pp.383-395.

Hui, S., Brown, G., & Chan, S. (2017). Assessment for learning and for accountability in classrooms: The experience of four Hong Kong primary school curriculum leaders. *Asia Pacific Education Review*, vol. 18(1), pp. 41-51. https://doi.org/10.1007/s12564-017-9469-6

Huisman, M. (2018). Formative assessment and the impact on student learning. http://network.bepress.com/hgg/discipline/796?utm_source=nwcommons.nwciowa.edu%2Feducation_masters%2F86&utm_medium=PDF&utm_campaign=PDFCoverPages

Ibrahim, A. S., Al-Kaabi, A., & El-Zaatari, W. (2013). Teacher resistance to educational change in the United Arab Emirates. *International Journal of Research Studies in Education*, vol 2(3), pp. 25-36.

Ibrahim, A. and Mahmoud, S. (2017). Principals' communication styles and school performance in Al Ain government schools, UAE. *International Journal of Research Studies in Education*, vol. *6*(1), pp.29-46.

Izci, K. (2016). Internal and External Factors Affecting Teachers' Adoption of Formative Assessment to Support Learning, World Academy of Science, Engineering and Technology, International Science Index 116. *International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering*, vol. 10(8), pp. 2800-2807.

Irons, A. (2008). Enhancing learning through formative assessment and feedback. New York: Routledge.

Jackson, S. (2016). *Based Teaching Strategies: Improve Engagment, Student Achievement and Promote Lifelong Learners* (Doctoral dissertation, City University of Seattle).

Jackson, K., Gibbons, L., & Sharpe, C. J. (2017). Teachers' Views of Students' Mathematical Capabilities: Challeng.

Jacoby, J., Heugh, S., Bax, C. and Branford-White, C. (2014). Enhancing learning through formative assessment. *Innovations in Education and Teaching International*, vol. 51(1), pp.72-83.

Jailani, & Retnawati, H. (2016). The challenges of junior high school mathematic teachers in implementing the problem-based learning for improving the higher-order thinking skills. *The Online Journal of Counseling and Education*, vol. 5 (3), pp. 1–13.

Jain, C.R., and Utschig, T.T. (2016). Leveraging Elements of Process Education to Extend Biggs' Model of Constructive Alignment for Increasing Learner Achievement. *International Journal of Process Education*, vol. 78(2), pp.49-59.

Jaiswal, P. (2019). Using Constructive Alignment to Foster Teaching Learning Processes. *English Language Teaching*, vol. 12(6), pp.10-23.

James, W. (1907). *Pragmatism: A New Name for some Old Ways of Thinking*, Cambridge, MA: Harvard University Press, 1975.

Jamhari, M., and Sipahutar, H. (2018). 'The effects of visual mapping and science-related attitudes on students' problem solving skills', in *3rd Annual International Seminar on Transformative Education and Educational Leadership*. Atlantis Press, (AISTEEL 2018).

Jang, E. E., and Wagner, M. (2013). 'Diagnostic feedback in the classroom', in A. J. Kunnan (eds.). *The Companion to Language Assessment*, pp.1-20. doi:10.1002/9781118411360.wbcla081

Jang, H., Kim, E.J., and Reeve, J. (2016). Why students become more engaged or more disengaged during the semester: a self-determination theory dual-process model. *Learning and Instruction*, vol. 43, pp.27-38.

Jax, J., Ahn, J.N. and Lin-Siegler, X. (2019). Using contrasting cases to improve self-assessment in physics learning. *Educational Psychology*, vol. 39(6), pp.815-838.

Jerzembek, G., & Murphy, S. (2013). A narrative review of problem-based learning with school-ages children: implementation and outcomes. *Educational Review*, vol. 65(2), pp. 206–218. https://doi:10.1080/00131911.2012.659655

Johnson, B., & Christensen, L. (2012). *Educational research: quantitative, qualitative and mixed approaches*. 4th ed. Thousand Oaks, CA: Sage Publications.

Johnson, B., & Christensen, L. (2014). *Educational research: quantitative, qualitative and mixed approaches*. 5th ed. Thousand Oaks, CA: Sage Publications.

Johnson, R. B., and Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. Educational Researcher, vol. 33(7), pp. 14-26.

Johnson, R.B., Onwuegbuzie, A.J., & Turner, L.A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, vol. 1(2), pp. 112-133.

Johnson, R.B., Onwuegbuzie, A.J., and Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, vol. 1(2), pp. 1 – 22.

Johnsosn, R. B., & Turner, L. A. (2003). 'Data Collection strategies in mixed methods research', in A. Tashakkori, and C. Teddlie (eds.). Handbook of mixed methods in social and behavioral research. Thousand Oaks, CA: Sage, pp. 297-319.

Johnson, Y. (2019). *The impact of data-driven mnstruction on measures of academic progress scores in an Urban elementary charter school* (Doctoral dissertation, Trevecca Nazarene University).

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).

Kaddoura, M. (2013). Think pair share: a teaching learning strategy to enhance students' critical thinking. *Educational Research Quarterly*, vol. *36*(4), pp.3-24.

Kalina, C. & Powell, K.C. (2009). Cognitive and social constructivism: Developing tools for an effective classroom. *Education*, vol. 130(2), pp.241-250.

Kang, H., Thompson, J., & Windschitl, M. (2014). Creating opportunities for students to show what they know: The role of scaffolding in assessment tasks. Science Education, vol. 98(4), pp. 674–704.

Karami, M., Pakmehr, H., & Aghili, A. (2012). Another view to importance of teaching methods in curriculum: Collaborative learning and students' critical thinking disposition. *Procedia - Social and Behavioral Sciences*, vol. 46, pp.3266-3270. doi: http://dx.doi.org/10.1016/j.sbspro.2012.06.048.

Karatas, I., and Baki, A. (2017). The effect of learning environments based on problem solving on students' achievements of problem solving. *International Electronic Journal of Elementary Education*, vol. 5(3), pp. 249-268.

Karelina, A., & Etkina, E. (2007). Acting like a physicist: Student approach study to experimental design. *Physics Education Research*, vol. 3(2), pp. 1–12. doi:10.1103/PhysRevSTPER.3.020106

Karpinski, A.C., D'Agostino, J.V., Williams, A.E.K., Highland, S.A., and Mellott, J.A. (2019). 'The relationship between online formative assessment and State test scores using multilevel modeling', in *Advanced Methodologies and Technologies in Modern Education Delivery*. IGI Global, pp. 767-778.

Kartono, K., Arumsasi, P.D., and Mariani, S. (2019). Analysis of students' mathematical reflective thinking on problem based learning (PBL) based from learning styles. *Unnes Journal of Mathematics Education*, vol. 8(1), pp.34-41.

Karuguti, W.M., Phillips, J., and Barr, H. (2017). Analysing the cognitive rigor of interprofessional curriculum using the Depth of Knowledge framework. *Journal of interprofessional care*, vol. 31(4), pp. 529-532.

Kazemi, E., & Franke, M. L. (2004). Teacher learning in mathematics: Using student work to promote collective inquiry. *Journal of Mathematics Teacher Education*, vol. 7(3), pp. 203-235.

Kettler, R.J., Reddy, L.A., Glover, T.A. and Kurz, A. (2019). Bridging the Gap: Classroom Strategies Assessment System–Observer Form. *Assessment for Effective Intervention*, vol. 44(2), pp.120-122.

"Khalifa approves the new 12th cabinet of the United Arab Emirates." (2016). "Emirates News Agency." [Online]. [Accessed 1 December 2019]. Available at: http://www.wam.ae/en/news/emirates/ 1395291431106.htm

Kingston, N. M., & Nash, B. (2011). Formative assessment: a meta-analysis and a call for research. *Educational Measurement: Issues and Practice*, vol. 30(4), pp. 28–37.

Kingston, N. M., & Nash, B. (2015). Erratum. *Educational Measurement: Issues and Practice*, vol. 34(1), p. 55.

Kippels, S. and Ridge, N. (2019). The growth and transformation of K–12 education in the UAE. In *Education in the United Arab Emirates*. Springer, Singapore, pp. 37-55.

Klaeijsen, A., Vermeulen, M., and Martens, R. (2018). Teachers' innovative behaviour: the importance of basic psychological need satisfaction, intrinsic motivation, and occupational self-efficacy. *Scandinavian Journal of Educational Research*, vol. 62(5), pp. 769-782.

Klein, M. (2019). Self-determination theory: basic psychological needs in motivation, development, and wellness. *Sociologicky Casopis*, vol. 55(3), pp. 412-413.

Klenowski, V. (2009). Assessment for learning revisited: an Asia-Pacific perspective. *Assessment in Education: Principles, Policy and Practice*, vol. 16, pp. 263–268. doi:10.1080/09695940903319646

Kliebard, H. M. (1989). Problems of definition in curriculum. *Journal of Curriculum and Supervision*, vol. 5(1), pp. 1-5

Klinger, D. A., Volante, L., & DeLuca, C. (2012). Building teacher capacity within the evolving assessment culture in Canadian education. *Policy Futures in Education,* vol. 10, pp. 447–460. http:// dx.doi.org/10.2304/pfie.2012.10.4.447

Klute, M., Apthorp, H., Harlacher, J., & Reale, M. (2017). Formative assessment and elementary school student achievement: A review of the evidence. (REL 2017–259). Washington, DC: U.S. *Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Central*. Available at: http://ies.ed.gov/ncee/edlabs.

Koh, K., Delanoy, N., Thomas, C., Bene, R., Chapman, O., Turner, J., Danysk, G. and Hone, G. (2019). The role of authentic assessment tasks in problem-based learning. *Papers on Postsecondary Learning and Teaching*, vol. 3(1), pp.17-24.

Koh, K., Lim, L., & Habib, M. (2010). *Building teachers' capacity in classroom-based formative assessment*. Paper presented at the meeting of the 36th International Association for Educational Assessment Conference, Bangkok, Thailand.

Koh, K., Lim, L., Tan, C. and Habib, M. (2015). Building teachers' Capacity in Formative Assessment: the Singapore example. *Stanisław Juszczyk*, p.211.

Komba, W. L. M. (2007). Teacher professional development in Tanzania: Perceptions and practices. *Papers in Education and Development,* vol. 27, pp. 1-27.

Konopasek, L., Norcini, J., & Krupat, E. (2016). Focusing on the Formative. *Academic Medicine*, vol. 91(11), pp. 1492-1497.

Kothari, C.R. (2004). *Research Methodology*. Second Edition. New Delhi: New Sage

Kothiyal, A., Majumdar, R., Murthy, S. and Iyer, S. (2013). Effect of think-pair-share in a large CS1 class: 83% sustained engagement. In *Proceedings of the ninth annual international ACM conference on International computing education research.* San Diego, CA: USA. (pp. 137-144). ACM.

Kotrlik, J. & Higgins, C. (2001). Organizational research: Determining appropriate sample size in survey research appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal*, vol. 19(1), pp. 43-50.

Krahenbuhl, K.S. (2016). Student-centered education and constructivism: challenges, concerns, and clarity for teachers. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, vol. 89(3), pp.97-105.

Kumar, K. K., Jain, K. K., and Tiwary, R. K. (2013), "Leadership activities and their impact on creating knowledge in organizations".

Kuo. E., & Wieman, C. E. (2016). Toward instructional design principles: Inducing Faraday's law with contrasting cases. *Physical Review Special Topics - Physics Education Research,* vol. 12(010128), pp. 1-14.

Kvale, S. (2007). Doing interviews. London: Sage.

Kvale, S. & Brinkmann, S. (2009). *Inter Views: Learning the Craft of Qualitative Research Interviewing*, Thousands Oak, CA., SAGE Publications.

Kwok, A.P., and Lau, A. (2015). An exploratory study on using the think-pair-share cooperative learning strategy. *Journal of Mathematical Sciences*, vol. 2, pp.22-28.

Kyaruzi, F., Strijbos, J., Ufer, S., & Brown, G. (2018). Teacher AfL perceptions and feedback practices in mathematics education among secondary schools in Tanzania. *Studies in Educational Evaluation*, vol. 59, pp. 1-9. https://doi.org/10.1016/j.stueduc.2018.01.004

Kyaruzi, F., Strijbos, J.W., Ufer, S. and Brown, G.T. (2019). Students' formative assessment perceptions, feedback use and mathematics performance in secondary schools in Tanzania. *Assessment in Education: Principles, Policy & Practice*, pp.1-25.

LaForce, M., Noble, E. and Blackwell, C. (2017). Problem-based learning (PBL) and student interest in STEM careers: The roles of motivation and ability beliefs. *Education Sciences*, vol. 7(4), p.92.

Lamb, K. (2019). The effects of reflection and feedback on student self-efficacy and achievement. (Master dissertation, Goucher College).

Landers, M., & Reinholz, D. (2015). Students' reflections on mathematics homework feedback. *Journal of Developmental Education*, vol. 38(3), pp. 22-24.

Larkin, H., and Richardson, B. (2013). Creating high challenge/high support academic environments through constructive alignment: student outcomes. *Teaching in Higher Education*, vol. 18(2), pp.192-204.

Lawrence, J.E. (2019). Designing a Unit Assessment Using Constructive Alignment. *International Journal of Teacher Education and Professional Development*, vol. 2(1), pp. 30-51.

Leahy, S., Lyon, C., Thompson, M., & Wiliam, D. (2005). Classroom assessment minute by minute, day by day. *Educational Leadership,* vol. 63(3), pp. 18-24.

Lee, I. (2008). Understanding teachers' written feedback practices in Hong Kong secondary classrooms. *Journal of Second Language Writing*, vol.17, pp. 69–85.

Lee, I. (2017). Classroom writing assessment and feedback in L2 school contexts. Singapore, Springer.

Lee, V.H., Pomeroy, B. and Schneider, B.L. (2018). Formative assessments in anatomy: two-year quality improvement study of self-assessment resources for didactic material. *The FASEB Journal*, *32*(1_supplement), pp. 507-3.

Le Thai Hung, L., & Ha, L. (2019). Applying formative assessment techniques to promote students' learning outcomes and interest.

Le Hebel, F., Montpied, P., Tiberghien, A. and Fontanieu, V. (2017). Sources of difficulty in assessment: example of PISA science items. *International Journal of Science Education*, vol. 39(4), pp.468-487.

Leigh, J., Rutheford, J., Wild, J., Cappleman, J., and Hynes, C. (2012). The Patchwork Text Assessment – An Integral Component of Constructive Alignment Curriculum Methodology to Support Healthcare Leadership Development. *Journal of Education and Training Studies*, vol. 1(1).

Leonor, J.P. (2015). Exploration of conceptual understanding and science process skills: A basis for differentiated science inquiry curriculum model. *International Journal of Information and Education Technology*, vol. *5*(4), p.255.

Limbach, B., & Waugh, W. (2010). Developing higher level thinking. *Journal of Instructional Pedagogies*, vol. 3, pp. 1-9. Available at: https://aabri.com/manuscripts/09423.pdf.

Lin, B. & Hsieh, C. (2001). Web-based Teaching and Learner Control: A Research Review. *Computer & Education*, vol. 37(3-4), pp. 377-386

Lin-Siegler, X., Ahn, J. N., Chen, J., Fang, F. F. A., & Luna-Lucero, M. (2016). Even Einstein struggled: Effects of learning about great scientists' struggles on high school students' motivation to learn science. *Journal of Educational Psychology*, vol. 108(3), pp. 214–328. doi:10.1037/ edu0000092.

Lin-Siegler, X., Shaenfield, D., Elder, A. (2015). Contrasting case instruction can improve selfassessment of writing. *Education Technology Research and Development*, vol. 63(4), pp. 517–537. doi: 10.1007/s11423-015-9390-9

Litz, D., Juma, Q.A. and Carroll, K.S. (2016). School leadership styles among educators in Abu Dhabi. *International Journal of Comparative Education and Development*, vol. 18(2), pp.81-99.

Lombard, F. E., & Schneider, D. K. (2013). Good student questions in inquiry learning. *Journal of Biological Education*, vol. 47(3), pp. 166–174. http://dx.doi.org/10.1080/00219266.2013.821749.

Long, M., Wood, C., Littleton, K., Passenger, T., and Sheehy, K. (2011). The Psychology of Education. London, Great Britain: Routledge.

Looney, J. W. (2011). *Integrating formative and summative assessment: Progress toward a seamless system?* OECD Education Working Papers, No. 58, OECD Publishing. http://dx.doi. org/10.1787/5kghx3kbl734-en

Looney, A., Cumming, J., van Der Kleij, F., & Harris, K. (2017). Reconceptualising the role of teachers as assessors: teacher assessment identity. *Assessment in Education: Principles, Policy & Practice*, pp. 1-26.

Lopez, E. L., Nandogopal, K., Shavelson, R. J., Szu, E., & Penn, J. (2013). Self-regulated learning study strategies and academic performance in undergraduate organic chemistry: An investigation

examining ethnically diverse students. *Journal of Research in Science Teaching*, vol. 50(6), pp. 660–676. doi:10.1002/tea.21095

López-Pastor, V., & Sicilia-Camacho, A. (2015). Formative and shared assessment in higher education. Lessons learned and challenges for the future. *Assessment & Evaluation in Higher Education*, vol. 42(1), pp. 77-97.

Lord, F. M. (1980). *Applications of item response theory to practical testing problems*. Routledge.

Losier, G. F., Perreault, S., Koestner, R., & Vallerand, R. J. (2001). Examining individual differences in the internalization of political values: Validation of the self-determination scale of political motivation. *Journal of Research in Personality*, vol. 35(1), pp. 41-61. doi: 10.1006/jrpe.2000.2300

Lyman, F. (1981). The Responsive Classroom Discussion. In A. S. Anderson (eds), Mainstreaming Digest. College Park, MD: University of Maryland College of Education, pp. 109-113.

Maarof, N., Yamat, H., & Lili, K. (2011). Role of teacher, peer and teacher-peer feedback enhancing ESL students' writing. *World Applied Science Journal*, 15. Innovation and Pedagogy for Life Long Learning, pp.29-35. ISSN 1818-4952.

Maba, W. (2017). The implementation of education national standard in the instrument of school accreditation of Bali province education authority. *International Research Journal of Engineering, IT & Scientific Research* (IRJEIS), vol. 3(4), pp. 1-6.

Maba, W., & Mantra, I. (2018). 'The primary school teachers' competence in implementing the 2013 curriculum', in SHS Web of Conferences, vol. 42, p. 00035. EDP Sciences.

Maba, W., Perdata, I., Astawa, I., and Mantra, I. (2018). Conducting assessment instrument models for teacher competence, teacher welfare as an effort to enhance education quality. *International research journal of management, IT and social sciences*, vol. *5*(3), pp.46-52.

Mackenzie, S.H., Son, J.S. and Eitel, K. (2018). Using outdoor adventure to enhance intrinsic motivation and engagement in science and physical activity: an exploratory study. *Journal of outdoor recreation and tourism*, vol. *21*, pp.76-86.

Mahdawi, W. (2019). *The aspects of the formative assessments on improving the inquiry skills in science classes for middle and high school students in Al-Ain City, UAE* (Doctoral dissertation, The British University in Dubai (BUiD).

Makransky, G., Dale, P. S., Havmose, P., & Bleses, D. (2016). An Item Response Theory–Based, Computerized Adaptive Testing Version of the MacArthur–Bates Communicative Development Inventory: Words & Sentences (CDI: WS). *Journal of Speech, Language, and Hearing Research*, vol. *59*(2), pp. 281-289.

Maldonado, S., and Andrade, R. (2018). After the Press Release on Mathematics Achievement: The Alignment of Formative Assessments and Summative Standardized Tests for Students from Minoritized Language Backgroundsdized tests for students from minoritized language backgrounds. *RASE: Revista de la Asociación de Sociología de la Educación*, vol. 11(3), pp. 421-432.

Mansour, N. (2009). Science-technology-society (STS): a new paradigm in science education. *Bulletin of Science, Technology and Society*, ol. 29 (4) pp. 287-297.

Mantra, I. (2016). Promoting primary school teachers' competence through dynamic interactive workshop and partnership. *Journal of College and University*, pp. 2455- 8028.

Mantra, I., & Maba, W. (2018). Enhancing The EFL Learners' Speaking Skill Through Folktales Based Instruction. In SHS Web of Conferences. EDP Sciences, vol. 42, p. 00017.

Maree, K. (2007). *First steps in research*. Van Schaik Publishers.

Marshall, B., & Jane Drummond, M. (2006). How teachers engage with Assessment for Learning: lessons from the classroom. *Research Papers in Education*, vol. 21(2), pp. 133-149. https://doi.org/10.1080/02671520600615638

Marshall, J.C., Smart, J.B. and Alston, D.M. (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 Jr, J. (2018). *Predicting success with local benchmark assessments: a correlational study.* (Doctoral dissertation, Northcentral University).

Mat Daud, Nur Shidrah, Gilmore, Alison & Mayo, Helen E. (2013). Exploring the Potency of Peer Evaluation to Develop Critical Thinking for Tertiary Academic Writing. *World Applied Science Journal*, vol. 21, pp. 109-116.

Maulana, A. (2019). The Effect of Using Think Pair Share on Students Reading Ability. *Language-Edu*, ol. *8*(2).

McCaslin, M. (2004). 'Coregulation of opportunity, activity and identity in student motivation: Elaboration on Vygotskian themes', in *big* theories revisited: research on socio-cultural influences on motivation and learning. Information Age Publishing, vol. 4, pp. 249 – 274.

McDonald, R., and Van Der Host, H. (2007). Curriculum alignment, globalization and quality assurance in South African education. *Journal of Curriculum Education.* Vol. 39(1), pp.1-9.

McMillan, J. H. & Schumacher, S. (2010). *Research in education: evidence-based inquiry*. 7th ed. Pearson Education, Inc.

Meador, D. (2018). "How Depth of Knowledge Drives Learning and Assessment." Thought Co, thoughtco.com/how-depth-of-knowledge-drives-learning-and-assessment-3194253.

Medford, R. S. (2014). *An Analysis of Teachers' Classroom Instructional Activities Based on NWEA" Measures of Academic Progress"(MAP) Data*. Gardner-Webb University.

Melihan, U., and Sirri, A. (2011). The effect of cooperative learning method on the students" success and recall levels of the 8th grade students learning in permutation and probability subject. *Journal of Kirsehir Education Faculty*, vol. 12, pp. 1-16.

Melles, G. (2005). Beyond the romantic impulse for authentic data to construction of meaning in interview-based educational research. *Qualitative Research Journal*, vol. *5*(2), p.21.

Menéndez, I.Y.C., Napa, M.A.C., Moreira, M.L.M. and Zambrano, G.G.V. (2019). The importance of formative assessment in the learning teaching process. *International journal of social sciences and humanities*, ol. *3*(2), pp.238-249.

Meriläinen, R., Isacsson, A. and Olson, S.J. (2019). Secondary Vocational Education in Finland. In *Workforce Education Forum (WEF)*, vol. 39(1), pp. 43-51. Workforce Education Forum (WEF).

Merriam, S.B. (2009). *Qualitative research: a guide to design and implementation*. San Francisco, Jossey-Bass.

Merri, J., Lee, M., Rillero, P., & Kinach, B. M. (2017). Problem-based learning in K–8 mathematics and science education: a literature review. *Interdisciplinary Journal of Problem-Based Learning*, ol. 11(2).

Mertens, D. M. (2010). *Research and evaluation in education and psychology: Integrating diversity with quantitative, qualitative, and mixed methods*. 3rd ed. USA. Sage Publivation, Inc.

Mihaela, V., & Alina-Oana, B. (2015). When teachers' pedagogical beliefs are changing? Procedia - social and behavioral sciences, vol. 180, pp. 1001–1006. https://doi.org/10.1016/j.sbspro.2015.02.191

Miller, N. (2019). Formative assessment as a method to improve student performance in the sciences. *Honors Projects*. Available at: https://scholarworks.bgsu.edu/honorsprojects/461

Ministry of Education (2009). *Report of the Primary Education Review and Implementation Committee*. Singapore: Author.

Ministry of Education (2013). International OECD study shows that Singapore students are ready to thrive in the 21st century [online]. [Accessed 25 August, 2019]. Available at: http://www.moe.gov.sg/media/press/2013/12/international-oecd-study-shows-that-singapore-students-are-ready-to-thrive-in-the-21st-century.php.

Ministry of Education (2015). *The Ministry of Education Strategy 2010 -2020* [online]. [Accessed 25 August 2019]. Available at: https://www.moe.gov.ae/English/SiteDocuments/MOE%20_Strategy.pdf

Ministry of Education (2017). "Ministry of Education, ADEC Reveal Details of the Standardised Educational System." *[Online]*. [Accessed 2 of December, 2019] Available at: https://www.moe.gov.ae/En/MediaCenter/News/ Pages/MOE-AD-det.aspx

Ministry of Education (2019). *The Ministry of Education Strategic plan 2017-2021* [online]. [Accessed 23 January, 2020]. Available at: https://www.moe.gov.ae/En/AboutTheMinistry/Pages/MinistryStrategy.aspx

Missett, T., Brunner, M., Callahan, C., Moon, T., & Price Azano, A. (2014). Exploring Teacher Beliefs and Use of Acceleration, Ability Grouping, and Formative Assessment. *Journal for the Education of the Gifted*, vol. 37(3), pp. 245-268. https://doi.org/10.1177/0162353214541326

Mohd Noor, N. H., Hajar, S. A., and Idris, M. A. (2015), "The determinant of nonprofit external and internal effectiveness: the role of knowledge sharing, collaborative culture, and beneficiary participation", *Human Service Organizations: Management, Leadership & Governance*, vol. 39(5), pp. 459-474.

Mok, M. M. C. (2013). 'Assessment reform in the Asia-Pacific Region: The theory and practice of self-directed learning oriented assessment', in M. Mok (ed.). *Self-directed learning oriented assessments in the Asia-Pacific. Education in the Asia-Pacific region: issues, concerns and prospects*. Dordrecht, Netherlands: Springer, vol 18, pp. 3–22.

Mok, M., & Lee W. O. (2017). 'Paradigm shifts in assessment for learning: A secondary analysis of the international civic and citizenship study (ICCS) 2009', in R. Maclean (eds). Life in schools and classrooms. *Education in the Asia-Pacific region: issues, concerns and prospects*. Singapore: Springer, vol 38, pp. 527–552.

Mokhtar, M., Tarmizi, R., Ayub, A., & Nawawi, M. (2013). Motivation and performance in learning calculus through problem-based learning. *International Journal of Asian Social Science*, vol. 3 (9), pp. 1999–2005. Available at: http://www.aessweb.com/pdf-files/Ijass-si-3(9)-1999-2005.pdf.

Morgan, D. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*, vol. 1(1), pp. 48-76.

Morgan, C. and Ibrahim, A. (2019). Configuring the low performing user: PISA, TIMSS and the United Arab Emirates. *Journal of Education Policy*, pp.1-24.

Morgan, C. (2018). "The Spectacle of Global Tests in the Arabian Gulf: A Comparison of Qatar and the United Arab Emirates." *Comparative Education*, vol. 54 (3), pp. 285–308. doi:10.1080/ 03050068.2017.1348018.

Morgan, D. L. (2014). Integrating qualitative and quantitative methods: a pragmatic approach. Sage Publications, Inc.

Morrell, P.D. & Carroll, J.B. (2010). *Conducting educational research: a primer for teachers and administrators*. Rotterdam: Sense Publishers.

Moss, C. M., & Brookhart S.M. (2009). Advancing formative assessment in every classroom. ASCD, Virginia.

Moss, C.M., and Brookhart, S.M. (2019). *Advancing formative assessment in every classroom: a guide for instructional leaders*. ASCD.

Mujtaba, T., Sheldrake, R., Reiss, M.J. and Simon, S. (2018). Students' science attitudes, beliefs, and context: associations with science and chemistry aspirations. *International Journal of Science Education*, vol. 40(6), pp.644-667.

Muijs, D. (2011). Doing quantitative research in education with SPSS. 1st ed. Los Angeles [Calif.]: SAGE.

Mullis, I.V.S., Martin, M.O., Gonzalez, E.J., Gregory, K.D., Garden, R.A., O'Connor, K.M., Chrostowski, S.J., & Smith, T.A. (2000). TIMSS 1999 international mathematics report: findings from IEA's repeat of the third international mathematics and science study at the eighth grade. Chestnut Hill, MA: Boston College.

Mutakinati, L., Mudzakir, A., and Supriyanti, F. (2015). Cooperative Learning Think Pair Share (TPS) for Improving Students' Problem Solving Skills in Buffer Solution Concept. *Journal of Social Science Education*, vol. 29(9), pp.11-14.

Nagle, B. (2013). Preparing high-school students for the interdisciplinary nature of modern biology. *CBE Life Science Education*, vol. 12, pp. 144–147.

Nakhaee, J. and Arab Nasrabadi, M., (2019). Strategies for research-centered education of architectural designing by examining the research-centered activities of the top universities. *Journal of Humanities Insights*, *3*(02), pp.50-56.

National Research Council. (2001). Classroom assessment and the National Science Education Standards. Washington, DC: National Academies Press. Available at: http://www.nap.edu/catalog/9847/ classroom-assessment-and-the-national-scienceeducation-standards.

Nasr, M., Bagheri, M., Sadighi, F. & Rassaei, E. (2018). Iranian EFL teachers' perceptions of assessment for learning regarding monitoring and scaffolding practices as a function of their demographics. *Cogent Education*, vol. 5 (1).

National Association of State Boards of Education (NASBE). (2009). *A call for balanced systems of assessment and accountability. NASBE Study Group on Assessment Systems for the 21st Century Learner*. [Accessed 20 August, 2019]. Available at: http://www.k12.wa.us/assessment/ClassroomAssessmentIntegration/pubdocs/NASBEAssessmentReport_ExecSumry.pdf

National Authority for Qualification and Quality Assurance of Education and Training: Directorate of Government Schools [online]. [Accessed on 3 December 2019]. Available at: http://www.qqa.edu.bh/en/Reports/Pages/default.aspx

National Council of Teachers of Mathematics (NCTM) (2000). *Principles and standards for school mathematics*. Reston VA: National Council of Teachers of Mathematics.

National Research Council. (2007). *Taking science to school*. Washington, DC: National Academies Press.

Navdar, P. (2016). "Dubai's Private Schools Improve PISA Scores, while UAE Averages Fall." *Education Journal*, Dec. 7. http://www.educationjournalme.com/news/dubai%27s-privateschools-improve-pisa-scores%2C-while-uae-averages-fall_111389

Navy, S., Edmondson, E., Maeng, J., Gonczi, A., and Mannarino, A. (2019). How to Create Problem-Based Learning Units. *Science and Children*, *56*(5), p.68.

"Next Generation Science Standards". [Accessed 12 August 2019]. Available at: https://www.nextgenscience.org/

Neyrinck, B., Lens, W., & Vansteenkiste, M. (2005). Goals and regulations of religiosity: A motivational analysis. In M. L. Maehr & S. Karabenick (eds), *Advances in motivation and achievement.* Greenwich, CT: Jai Press, (pp. 77-106).

Nichols, P.D., Meyers, J.L., and Burling, K.S. (2009). A framework for evaluating and planning assessments intended to improve student achievement. Educational Measurement: Issues and Practice, 28(3), 1423.

Niglas, K. (2004). *The combined use of qualitative and quantitative methods in educational research*. Ph.D. Thesis. Tallinn Pedagogical University.

Ninomiya, S. (2016). The Possibilities and Limitations of Assessment for Learning: Exploring the Theory of Formative Assessment and the Notion of "Closing the Learning Gap". *Educational Studies in Japan*, vol. 10 (0), pp. 79-91.

Norman, G. (2009). Problem-solving skills, solving problems and problem-based learning. *Medical Education,* vol. 22(4), pp. 279-286.

Northwest Evaluation Association (2003). Technical manual. Lake Oswego, OR: Author.

Northwest Evaluation Association (2004). Reliability and validity estimates: NWEA achievement level tests and Measure of Academic Progress *[online]*. [Accessed 30th 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. (2012). Measures of academic progress (MAP): basics overview. *Portland, OR: Northwest Evaluation Association*.

Northwest Evaluation Association. (2012). Glossary of terms. Portland, OR: NWEA.

Northwest Evaluation Association. (2013). RIT stability through the transition to common core-aligned MAP tests. How using MAP to measure student learning growth is reliable now and in 2014. *Northwest Evaluation Association.*

Northwest Evaluation Associates. (2018b). MAP Skills: Response to intervention. Available at: https://www.nwea.org/mapskills/

Núñez, J.L., and León, J. (2015). Autonomy support in the classroom: A review from self-determination theory. *European Psychologist*, *20*(4), p.275.

Ogunyebi, T.H. (2018). Enhancing Science Performance through Think-Pair Strategies among College of Education Students in Integrated Science in Ekiti State, Nigeria. *International Journal of Education and Evaluation*, vol. 4(4), pp.59-66.

Olson, A. (2007). Growth measures for systemic change. *School Administrator, 64*(1), 10.

Onwuegbuzie, A. J. & Johnson, R. B. (2006). The validity issue in mixed research. Research in the schools, vol. 13(1), pp. 48-63.

Orlich, D.C., Harder, R.J., Callahan, R.C., Trevisan, M.S., Brown, A.H., Miller, D. (2013). *Teaching Strategies: A Guide to Effective Instruction*. 10th edn. USA: Cengage Learning.

Orlich, D., Harder, R., Callahan, R., Trevisan, M., & Brown, A. (2010). Teaching strategies: a guide to effective instruction. Boston, MA: Wadstworth.

Organisation for Economic Co-operation and Development, (OECD). (2005). *Formative Assessment: Improving learning in secondary classrooms*. Centre for Educational Innovation and Research. Paris: OECD.

Ornstien, A.C., & Hunkins, F.P. (2014). *Curriculum Foundations, Principles, and Issues.* Pearson New International Edition. 6th ed.

O'Sullivan, K. (2015). Education Reform in the UAE-Bringing Private Schools into the Fold. *Journal of Teaching and Education*, 04(01):pp.311–320.

Oyinloye, O.M., and Imenda, S.N. (2019). The Impact of Assessment for Learning on Learner Performance in Life Science. *EURASIA Journal of Mathematics, Science and Technology Education, 15*, p.11.

Ozan, C., & Kıncal, R.Y. (2018). The Effects of Formative Assessment on Academic Achievement, Attitudes toward the Lesson, and Self-Regulation Skills. *Educational Sciences: Theory & Practice*, vol. 18 (1), pp.85-118.

Palmer, M. (2016). Reflections on assessment in higher education 1998-2016. *AISHE-J: The All Ireland Journal of Teaching and Learning in Higher Education*, vol. 8(3).

Panadero, E., Brown, G. L., and Strijbos, J.W. (2016a). The future of student self-assessment: A review of known unknowns and potential directions. *Educational Psychology Review* vol. 28, pp. 803–830. doi: 10.1007/s10648-015-9350-2

Panadero, E., Tapia, J. A., & Huertas, J. A. (2012). Rubrics and self-assessment scripts effects on self-regulation, learning and self-efficacy in secondary education. *Learning and Individual Differences*, ol. Pp. 22(6), 806–813. doi:10.1016/j.lindif.2012.04.007

Panasan, M., & Nuangchalerm, P. (2010). Learning outcomes of project-based and inquiry-based learning activities. *Online Submission,* vol. 6(2), pp. 252-255.

Pantiwati, Y., & Husamah, H. (2017). Self and peer assessments in active learning model to increase metacognitive awareness and cognitive abilities. *International Journal of Instruction,* vol. 10(4), pp. 185-202. https://doi.org/10.12973/iji.2017.10411a.

Papinczak, T., Young, L., Groves, M., & Haynes, M. (2007). An analysis of peer, self, and tutor assessment in problem-based learning tutorials. *Med Teach*, vol. 29(5), pp. 122-132. https://doi.org/10.1080/01421590701294323

Pasick, R.J., Burke, N.J., Barker, J.C., Joseph, G., Bird, J.A., Otero-Sabogal, R., Tuason, N., Stewart, S.L., Rakowski, W., Clark, M.A., Washington, P.K., & Guerra, C. (2009). Behavioral Theory in a diverse society: like a compass on Mars. *Sage Journals.*

Patton, M. Q. (1987). Qualitative evaluation and research methods. Newbury Park, CA: Sage.

Patton, M. Q. (1990). Qualitative evaluation and research methods. 2nd ed. Newbury Park. CA: Sage.

Peirce, C.S. (1905). “What Pragmatism Is.” In *The Essential Peirce*, vol 2., ed. The Peirce Edition Project. (Bloomington IN: Indiana University Press), pp. 331-345.

Pennington, R. (2017). Abu Dhabi teacher licensing in brought forward. The National. [Accessed 27 January, 2020]. Available at: https://www.thenational.ae/uae/abu-dhabi-teacher-licensing-is-brought-forward-1.22894.

Prahl, K. (2017). Best practices for the think-pair-share active-learning technique. *The American Biology Teacher*, vol. 79(1), pp. 3-8.

Park, J. and Lee, J. (2014), “Knowledge sharing in information systems development projects: explicating the role of dependence and trust”, *International Journal of Project Management*, vol. 32(1), pp. 153-165.

Patten, K.P., and Harris, M.A. (2016). Evaluating Student Learning in an IT Curriculum Using Bloom's--Webb's Curriculum Taxonomy. In *Proceedings of the 17th Annual Conference on Information Technology Education*. ACM, pp. 111-114.

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd ed.). Thousand Oaks, CA, US: Sage Publications, Inc.

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

Pearson, H. (2005). Achieving student progress with scientifically based formative assessment: a white paper from Pearson. No longer available at www.pearsoned.com

Pecore, J. L. (2013). Beyond Beliefs: Teachers Adapting Problem-based Learning to Preexisting Systems of Practice. *Interdisciplinary Journal of Problem-Based Learning*, vol. (2). https://doi.org/10.7771/1541-5015.1359

Penuel, W., & Shepard, L. (2016a). ‘Assessment and teaching’, in D. H. Gitomer&C. A.Bell (eds). *Handbookof researchonteaching.* Washington, DC: American Educational Research Association, (5^{th} ed., pp. 787–850).

Per, D. (2004). *School development: Theories and strategies*. Portland: Continuum International Publishing Group.

Persky, A., and McLaughlin, J. (2017). The flipped classroom–from theory to practice in health professional education. *American journal of pharmaceutical education*, vol. 81(6), p.118.

Persky, A.M., & McLaughlin, J.E. (2017). Troubleshooting the flipped classroom in medical education: common challenges and lessons learned. *Medical Science Educator*, vol. 28 (1), pp. 235-241.

Persky, A.M., and McLaughlin, J.E. (2017). The flipped classroom–from theory to practice in health professional education. *American journal of pharmaceutical education*, vol. 81(6), p.118.

Peters, E. & Kitsantas, A. (2010). Self-regulation of student epistemic thinking in science: The role of metacognitive prompts. *Educational Psychology*, vol. 30(1), pp. 27–52. doi:10.1080/01443410903353294

Phellas, C. N., Bloch, A., & Seale, C. (2012). *Structured Methods: Interviews, Questionnaires and Observation*. In C. Seale (ed.), Researching Society and Culture. London: Sage, pp. 182-205.

Pierce, R., Fox, J. (2012). Vodcasts and active-learning exercises in a "flipped classroom" model of a renal pharmacotherapy module. *Am J Pharm Educ*. Vol. 76(10): Article 1.

Pietarinen, T., Vauras, M., Laakkonen, E., Kinnunen, R. and Volet, S. (2019). High school students' perceptions of affect and collaboration during virtual science inquiry learning. *Journal of Computer Assisted Learning*, vol. 35(3), pp.334-348.

Pither, J. and Morris, N. (2019). Country Profile: Finland. PCET: *Learning and teaching in the post compulsory sector*, p.263.

Plake, B., & Wise, L. (2014). What is the role and importance of the revised AERA, APA, NCME Standards for Educational and Psychological Testing? *Educational Measurement: Issues and Practice*, vol. *33*(4), pp.4-12.

Popham, W. (2008). *Transformative assessment*. Alexandria, VA: Association for Supervision and Curriculum Development.

Popham, W. (2011b). Exposing the imbalance in "balanced assessment." *Better: Evidence-based Education*, 14-15.

Popham, W.J. (2018). Transformative Assessment [Online]. Alexandria, VA: ASCD. http://www.ascd.org/publications/books/108018/chapters/Formative-Assessment@-Why,-What,-and-Whether.aspx.

Potgieter, A., Potgieter, M.J., and McCabe, R.V. (2019). The use of hand puppets to increase intrinsic motivation during science learning of 6th and 7th grade learners in Dikgale, Limpopo

Pradana, O.R.Y., Sujadi, I. and Pramudya, I. (2017). Think Pair Share with Formative Assessment for Junior High School Student. In *Journal of Physics: Conference Series*, vol. 895(1), p. 012032. IOP Publishing.

Prashanti, E. and Ramnarayan, K. (2019). Ten maxims of formative assessment. The American Physiological Society. Adv Physiol Educ vol. 43(99), p. 102. doi:10.1152/advan.00173.2018.

Province, South Africa: a case study. *International Journal of Educational Development*, vol. 4(1), pp.1-18.

Poulos, A., & Mahony, M.J. (2008). Effectiveness of feedback: the students' perspective. Assessment & Evaluation in Higher Education, vol. 33(2), pp. 143–154.

Pourdavood, R. G., Wachira, P., & Pitre, S. (2015). A case study of a secondary mathematics teacher's beliefs and practices relative to NCTM principles: Implication for teacher education, curriculum change, and school reform. *Global Journal of Mathematics*, vol. 6(2), pp. 592–600.

Pradana, O.R.Y., Sujadi, I. and Pramudya, I. (2017). Think Pair Share with Formative Assessment for Junior High School Student. *Journal of Physics: Conference Series*, vol. 895(1), p. 012032. IOP Publishing.

Prashanti, E. & Ramnarayan, K. (2019). Ten maxims of formative assessment. *Advances in Physiology Education*, vol. 43 (2), pp. 99-102.

Puente, S. M. G., & Swagten, H. J. M. (2012). Designing learning environment to teach interactive quantum physics. *European Journal of Engineering Education,* vol. 37(5), pp. 448-457.

Purnomo, Y. (2017). The complex relationship between teachers' mathematics-related beliefs and their practices in mathematics class. *New Educational Review*, vol. 47 (1), pp. 200–210. doi:10.15804/ tner.2017.47.1.16.

Quamruzzaman, A., Rodríguez, J., Heymann, J., Kaufman, J. S., & Nandi, A. (2014). Are tuition-free primary education policies associated with lower infant and neonatal mortality in low and middle-income countries? Social Science & Medicine, vol. 120, pp. 153–159. doi:10.1016/j.socscimed.2014.09.016.

Raba, A.A.A. (2017). The influence of think-pair-share (TPS) on improving students' oral communication skills in EFL classrooms. *Creative Education*, vol. 8(01), p.12.

Richards-Babb, M., Curtis, R., Georgieva, Z. and Penn, J.H. (2015). Student perceptions of online homework use for formative assessment of learning in organic chemistry. *Journal of chemical Education*, vol. 92(11), pp.1813-1819.

Radhwan, M.G. (2016). *Investigating the impact of using cooperative learning strategies on promoting students' science learning in private schools in UAE* (Doctoral dissertation, The British University in Dubai (BUiD).

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 (JREPT), v*ol 2(1), pp. 57-79 ISSN 2616-6828

Rahi, S. (2017). Research Design and Methods: A Systematic Review of Research Paradigms, Sampling Issues and Instruments Development. *International Journal of Economics & Management Sciences*, vol. 06 (02). pp. 1-5

Rahim, M. A. (2014), "A structural equations model of leaders' social intelligence and creative performance", *Creativity and Innovation Management*, vol. 23(1), pp. 44-56.

Rakoczy, K., Pinger, P., Hochweber, J., Klieme, E., Schütze, B., and Besser, M. (2019). Formative assessment in mathematics: Mediated by feedback's perceived usefulness and students' self-efficacy. *Learning and Instruction*, vol. 60, pp.154-165.

Ramaprasad, A. (1983). On the definition of feedback. *Syst Res Behav Sci* vol. 28, pp. 4–13. doi:10.1002/bs.3830280103.

Reams, P., & and Twale, D. (2008). *The promise of mixed methods: discovering conflicting realities in the data.* United States: University of Dayton.

Redish, E. F., & Saul, J. M., & Steinberg, R. N. (1998). Student expectations in introductory physics. *American Journal of Physics*, vol. 66(3), pp. 212-224

Reinhardt, J. (2018). Utilizing NWEA Map data to create scaffolded and differentiated instruction that advances student mastery of literary standards and deepens student understanding of literary

texts. *School of Education Student Capstone Projects*. 158. https://digitalcommons.hamline.edu/hse_cp/158.

Reeve, J. (2012). 'A self-determination theory perspective on student engagement', in S. L. Christenson, A. L. Reschly and C. Wylie (eds). *The Handbook of Research on Student Engagement.* New York: Springer Science, pp. 149 – 172. https://doi.org/10.1007/978-1-4614-2018-7_7

Reeve, J., Ryan, R., and Deci, E. (2018). Sociocultural influences on student motivation as viewed through the lens of self-determination theory. *Big theories revisited,* vol. 2, pp.15-40.

Regier, N. (2012). Book two: 60 formative assessment strategies. *Regier Educational Resources.*

Reilly, D., Neumann, D., & Andrews, G. (2018). Gender differences in reading and writing achievement: evidence from the national assessment of educational progress (NAEP). *American Psychologist*. Advance online publication. http://dx.doi.org/10.1037/amp0000356

Retnawati, H., Hadi, S., & Nugraha, A. (2016). Vocational high school teachers' difficulties in implementing the assessment in curriculum 2013 in Yogyakarta Province of Indonesia. *International Journal of Instruction*, vol. 9 (1), pp. 33–48. doi:10.12973/iji.2016.914a.

Retnawati, H., Kartowagiran, B., Arlinwibowo, J., & Sulistyaningsih, E. (2017). Why are the mathematics national examination items difficult and what is teachers' strategy to overcome it? *International Journal of Instruction,* vol. 10 (3), pp. 257–276. doi:10.12973/iji.2017.10317a.

Rico, R., & Ertmer, P. A. (2015). Examining the role of the instructor in problem-centered instruction. *Tech- Trends*, vol. 59(4), pp. 96–103. https://doi.org/10.1007/s11528-015-0876-4

Rifa'i, A., and Lestari, H.P. (2018). The effect of think pair share (TPS) using scientific approach on students' self-confidence and mathematical problem-solving. *Journal of Physics: Conference Series*. IOP Publishing, vol. 983(1), p. 012084).

Ritchhart, R., Church, M., & Morrison, K. (2011). *Making thinking visible: How to promote engagement, understanding, and independence for all learners*. San Francisco, CA: Wiley.

Roskos, K., & Neuman, S. (2012). Formative Assessment: Simply, No Additives. *The Reading Teacher*, vol. 65 (8), pp. 534-538. [Accessed 10 December, 2019].

Rossman, G. B. & Wilson, B. L. (1985). Numbers and words: Combining quantitative and qualitative methods in a single large-scale evaluation study. *Evaluation Review*, vol. 9(5), pp. 627-643

Rotgans, J., & Schmidt, H. (2011). The role of teachers in facilitating situational interest in an active-learning classroom. *Teaching and teacher Education,* vol. 27(1), pp. 37-42.

Russo, A. (2002). Mixing technology and testing. *School Administrator,* vol. 59(4), pp. 6–12.

Rust, C. (2002). The Impact of Assessment on Student Learning: How Can the Research Literature Practically Help to Inform the Development of Departmental Assessment Strategies and Learner-Centered Assessment Practices?. *Active Learning in Higher Education*, vol. 3(2), pp.145-158.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist,* vol. 55(1), pp. 68-78. doi: 10.1037/0003- 066X.55.1.68

Ryan, R. M., & Deci, E. L. (2002). 'Overview of self-determination theory: an organismic dialectical perspective', in E. L. Deci & R. M. Ryan (eds). *Handbook of self-determination research.* Rochester, NY: University of Rochester Press, pp. 3-33.

Ryan, R. M., & Deci, E. L. (2009). 'Promoting Self-Determined School Engagement; Motivation, Learning and Well-Being', in K. R. Wentzel, & A. Wigfield (eds). *Handbook of Motivation at School*. New York: Routledge, pp. 171 – 196.

Ryan, R., & Deci, E. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. New York, NY: Guilford Press.

Ryan R.M., Grolnick, W.S. (1986). *Origins and pawns in the classroom: Self-report and projective assessments of individuals' difference in children's perception*s. J. Personality Soc. Psychol. p. 50, pp. 550-558.

Ryder, J., Banner, I., & Homer, M. S. (2014). Teachers' experiences of science curriculum reform. *School Science Review*, vol. 95(352), pp. 126–130.

Sabah, S., & Du, X. (2018). University faculty's perceptions and practices of student centered learning in Qatar: Alignment or gap?. *Journal of Applied Research in Higher Education*, vol. 10(4), pp. 514-533. https://doi.org/10.1108/JARHE-11-2017-0144.

Sabah, S., Fayez, M., Alshamrani, S., & Mansour, N. (2014). Continuing Professional Development (CPD) Provision for Science and Mathematics in Saudi Arabia: Perceptions and Experiences of CPD Providers. *Journal of Baltic Science Education*, vol. 13(3), pp. 91-104.

Sabel, J.L., Forbes, C.T., and Zangori, L. (2015). Promoting prospective elementary teachers' learning to use formative assessment for life science instruction. *Journal of Science Teacher Education,* vol. 26(4), pp.419-445.

Sadler, D.R. (1989). Formative assessment and design of instructional systems. *Instructional Science*, vol. 18, pp. 119-144. doi:10.1007/BF00117714.

Sadler, D. R. (1998). Formative Assessment: revisiting the territory. *Assessment in Education: Principles, Policy & Practice*, vol. 5 (1), pp. 77-84.

Sadler, D. R. (2010). Beyond feedback: Developing student capability in complex appraisal. *Assessment & Evaluation in Higher Education*, vol. 35(5), pp. 535–550.

Sahlberg, P. (2015). *Finnish Lessons 2.0 What can the world learn from educational change in Finland?* (2nd Ed.) New York: Teachers College Press.

Saido, G., Siraj, S., Nordin, A., and Al-Amedy, O. (2017). Teaching strategies for promoting higher order thinking skills: A case of secondary science teachers. *MOJEM: Malaysian Online Journal of Educational Management,* vol. *3*(4), pp.16-30.

Sampsel, A. (2013). Finding the effects of think-pair-share on student confidence and participation. *Honors Project, 28.*

Sandelowski, M. (2000). Combining Qualitative and Quantitative Sampling, Data Collection, and Analysis Techniques in Mixed-Method Studies. *Research in Nursing & Health*, vol. 23 (3), pp. 246-255.

Santiago, H. (2011). Visual Mapping to Enhance Learning and Critical Thinking Skills Santiago: *Optometric Education*, vol. 36 (3), pp. 125-129.

Saroyan, A., & Trigwell, K. (2015). Higher education teachers' professional learning: Process and outcome. *Studies in Educational Evaluation*, vol. 46, pp. 92–101

Savery, J.R. (2015). Overview of problem-based learning: Definitions and distinctions. *Essential readings in problem-based learning: Exploring and extending the legacy of Howard S. Barrows*, vol. 9, pp.5-15.

Savin-Baden, M., and Major, C.H. (2013). Qualititaive Research: The Essential Guide to Theory and Practice. *Qualitative Research: The Essential Guide to Theory and Practice. Routledge*.

Seidman, I. (2013). *Interviewing as qualitative research: A guide for researchers in education and the social sciences*. New York: Teachers college press.

Seifert, K. and Sutton, R. (2009). Educational Psychology. Saylor Foundation. (Chapter 12). Retrieved 30 August, 2020 from https://open.umn.edu/opentextbooks/BookDetail.aspx?bookId=153

Schettino, C. (2016). A framework for problem-based learning: teaching mathematics with a relational problem-based pedagogy. *Interdisciplinary Journal of Problem-Based Learning*, vol. 10(2). https://doi.org/10.7771/1541-5.

Schildkamp, K. (2018). Challenges and Opportunities in Implementing Formative Assessment. *Teacher Learning with Classroom Assessment: Perspectives from Asia Pacific*, p.177.

Schneider, M.C. and Johnson, R.L. (2018). *Using Formative Assessment to Support Student Learning Objectives*. Routledge.

Schneider, M.C. and Johnson, R.L. (2018). *Using Formative Assessment to Support Student Learning Objectives*. Routledge.

Schunk, H. (2008). *Learning theories: An educational perspective*. Upper Saddle River: Pearson Education Inc.

Schunk, D., & DiBenedetto, M. (2016). Self-efficacy theory in education, in K. Wentzel & D. Miele (Eds.), *Handbook of Motivation at School*. Abingdon: Routledge, pp. 34-50.

Schwab, J. (1969). *College Curriculum and Student Protest.* Chicago: University of Chicago Press.

Schwartz, D.L., Tsang, J. M., & Blair, K. P. (2016). The ABCs of how we learn. New York, NY: Norton & Company, Inc.

Scott, L. (2017). 21st century skills early learning framework. Partnership for 21st Century Skill (P21). Available at: http://www.p21.org/storage/documents/EarlyLearning_Framework/ P21_ELF_ Framework_Final.pdf.

Scriven, M. (1967). The methodology of evaluation. Perspectives on Curriculum Evaluation (AERA Monograph Series – Curriculum Evaluation) (Chicago, Rand McNally and Co).

Seung, E. (2013). The process of physics teaching assistants' pedagogical content knowledge development. *International Journal of Science and Mathematics Education, 11*, 1303-1326.

Shanghai Municipal Education Commission. (2010). *Shanghaishi zhongchangqi jiaoyu gaige he fazhan guihua gangyao* (2010–2020) [Synopsis of Shanghai's middle and long term education reform and development plan (2010–2020)]. [Accessed 14 December, 2019]. Available at: http://www.shmec.gov.cn/html/xxgk/201009/301122010002.php

Shanghai Municipal Education Commission. (n.d.). *Shanghaishi putong zhongxiaoxue kecheng fangan shixinggao shuoming*. Explanation of the draft curricular plan for mainstream primary and secondary schools in Shanghai city [Online]. [Accessed 16 December, 2019]. Available at: www. shmec.gov.cn/attach/article/72.doc.

Sharma, R., Jain, A., Gupta, N., Garg, S., Batta, M. and Dhir, S.K. (2016). Impact of self-assessment by students on their learning. *International Journal of Applied and Basic Medical Research*, vol. 6(3), p.226.

Shepard, L.A. (2019). Classroom assessment to support teaching and learning. *The ANNALS of the American Academy of Political and Social Science*, vol. 683(1), pp.183-200.

Shepard, L., Davidson, K., & Bowman, R. (2011). *How middle school mathematics teachers use interim and benchmark assessment data*. CSE Technical Report 807. Los Angeles, CA: National Center for Research on Evaluation, Standards, and Student Testing (CRESST).

Shepard, L.A., Penuel, W.R., & Pellegrino, J.W. (2018). Using Learning and Motivation Theories to Coherently Link Formative Assessment, Grading Practices, and Large-Scale Assessment. *Educational Measurement: Issues and Practice*, vol. 37 (1), pp. 21-34.

Shumow, L., & Schmidt, J. A. (2015). Teaching the value of Science. Educational Leadership, vol. 72(4), pp. 62–67

Silva, W.F., Redondo, R.P., and Cárdenas, M.J. (2018). Intrinsic Motivation and its Association with Cognitive, Actitudinal and Previous Knowledge Processes in Engineering Students.

Simamora, R.E., Sidabutar, D.R., and Surya, E. (2017). Improving Learning Activity and Students' Problem Solving Skill through Problem Based Learning (PBL) in Junior High School. *International Journal of Sciences: Basic and Applied Research (IJSBAR)*, vol. 33(2), pp.321-331.

Smith, M. K., Wood, W. B., Adams, W. K., Wieman, C., Knight, J. K., Guild, N., & Su, T. T. (2009). Why peer discussion improves student performance on in-class concept questions. *Science*, vol. 323, pp. 122-24.

Simon, M. (2011). *Dissertation and scholarly research: Recipes for success* (2011 ed). Seattle, WA: Dissertation Success, LLC.

Şimşek, P., & Kabapınar, F. (2010). The effects of inquiry-based learning on elementary students' conceptual understanding of matter, scientific process skills and science attitudes. *Procedia-Social and Behavioral Sciences*, vol. 2(2), pp. 1190-1194.

Skinner, R.R., & Feder, J. (2014). Common Core State Standards and Assessments: Background and Issues. *Congressional Research Service [Online]*. [Accessed 16 December, 2019]. Available at: http://fas.org/sgp/crs/misc/R43711.pdf

Slavin, R. (2012). *Educational Psycology: Theory and Practice*. 10th ed. New Jersey: Pearson Education Inc.

Slavin, R. E. (2012). *Educational psychology: Theory into practice (10th Ed.).* Boston: Allyn & Bacon.

Slavin, R. (2014) Educational Psychology: Theory and Practice. (Ninth Edition). Boston, MA: Pearson.

Sliogeriene, J. (2019). Is ESP standardized Assessment Feasible?. *Journal of Teaching English for Specific and Academic Purposes*, pp.525-534.

Small, F., and Attree. K. (2015). "Undergraduate student responses to feedback: expectations and experiences." *Studies in Higher Education*. Advance online publication. doi: 10.1080/03075079.2015.1007944.

Spector, J.M., Ifenthaler, D., Sampson, D., Yang, J.L., Mukama, E., Warusavitarana, A., Dona, K.L., Eichhorn, K., Fluck, A., Huang, R., and Bridges, S. (2016). Technology enhanced formative assessment for 21st century learning.

Spector, J. M., Ifenthaler, D., Sampson, D., Yang, L. J., Mukama, E., Warusavitarana, A., & Bridges, S. (2016). Technology enhanced formative assessment for 21st century learning. *Journal of Educational Technology & Society*, vol. 19(3), p. 58.

Spector, J. (2016). Building strong futures: literacy practices for developing engaged citizenship in the 21st century. *Australian Journal of Language and Literacy, The*, vol. 39(1), p.86.

Spector, J. M., & Yuen, H. K. (2016). *Educational technology program and project evaluation*. New York, NY: Routledge.

Spiller, D. (2014). Assessment: Feedback to promote student learning. Retrieved 8 December, 2017 from https://www.waikato.ac.nz/__data/assets/pdf_file/0008/352871/Assessment_-Feedbackto-Promote-Student-Learning.pdf.

Stange, K.C. (2006). Mixed methods and diverse perspectives. *The Annals of Family Medicine*, vol. 4 (4), pp. 290-291.

Steffe, L.P., & Gale J.E., (1995). *Constructivism in Education*. Lawrence Erlbaum Associates.

Stiggins, R. J., & Chappuis, J. (2008). Enhancing student learning. District Administration, vol. 44, pp. 42–44.

Subedi, D. (2016). Explanatory sequential mixed method design as the third research community of knowledge claim. *American Journal of Educational Research*, vol. 4(7), pp. 570-577.

Sugiharti, G., and Hamid, K. (2019). Application of PBL using laboratory and mathematical thinking ability to learning outcomes of general chemistry course. *International Education Studies*, vol. 12(6), pp.33-38.

Sumekto, D.R. (2018). Investigating the influence of think-pair-share approach toward students' reading achievement. *Lingua Cultura*, vol. 12(2), pp.195-202.

Sumsion, J., and Goodfellow, J. (2004). Identifying generic skills through curriculum mapping: a critical evaluation. *Higher Education Research & Development*, vol. 23(3), pp.329-346.

Sungar, S., & Tekkaya, C. (2006). Effects of problem-based learning and traditional instruction on self-regulated learning. *The Journal of Educational Research*, vol. 99(5), pp. 307–318. https://doi.org/10.3200/JOER.99.5.307-320

Supardi, U.S., and Zukarnain, I. (2016). The effect cooperative learning model resolution of mathematics problem solving and students' mathematics communication. *Journal of Educational Research and Review*, vol. 3(4), pp. 44-53.

Supovitz, J. A., Ebby, C. B., & Sirinides, P. M. (2013). *TASK: A Measure of Learning Trajectory-Oriented Formative Assessment.* Philadelphia: Consortium for Policy Research in Education.

Suskie, L. (2018). *Assessing student learning: a common sense guide*. John Wiley & Sons.

Susuwele-Banda, W.J. (2005). *Classroom Assessment in Malawi: Teachersâ Perceptions and Practices in Mathematics* (Doctoral dissertation, Virginia Tech).

Swaffield, S. (2011). Getting to the heart of authentic assessment for learning. *Assessment in Education: Principles, Policy & Practice*, vol. 18, pp. 433–449. http://dx.doi.org/10.1080/0969594X.2011.582838

Szpyrka, D.A. (2002). Exploration of instruction, assessment, and equity in the middle school science classroom (Doctoral dissertation, University of Central Florida).

Sztajn, P. (2003). Adapting reform ideas in different mathematics classrooms: Beliefs beyond mathematics. *Journal of Mathematics Teacher Education*, vol. 6(1), pp. 53-75.

Taba, H., (1962). *Curriculum development, theory, and practice*. New York: Harcourt, Brace, and World, pp. 118-119.

Talbert, E., Hofkens, T., and Wang, M.T. (2019). Does student-centered instruction engage students differently? The moderation effect of student ethnicity. *The Journal of Educational Research*, vol. *112*(3), pp.327-341.

Tam, M. (2000). Constructivism. Instructional Design, and Technology: Implications for Transforming Distance Learning. *Educational Technology & Society*, vol. 3(2), pp. 50-60.

Tamim, S.R., and Grant, M.M. (2013). Definitions and uses: Case study of teachers implementing project-based learning. *Interdisciplinary Journal of Problem-Based Learning*, vol. 7(2), p.3.

Tan, A. L., & Leong, W. F. (2014). Mapping curriculum innovation in STEM schools to assessment requirements: Tensions and dilemmas. *Theory Into Practice*, vol. 53(1), pp. 11–17.

Tan, C. and Ng, C.S. (2018). Assessment Reform in Shanghai: Issues and Challenges. *International Journal of Educational Reform*, vol. *27*(3), pp.291-309.

Tan, F.D., Whipp, P.R., Gagné, M., and Van Quaquebeke, N. (2019). Students' perception of teachers' two-way feedback interactions that impact learning. *Social Psychology of Education*, vol. *22*(1), pp.169-187.

Tashakkori, A., and Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches*. Sage Publications, Inc, Thousand Oaks, CA, vol. 46.

Tashakkori, A., & Teddlie, C. (2010). Handbook of Mixed Methods in Social & Behavioural Research (2nd ed.). Thousand Oaks, CA: Sage. London: Sage Publications Ltd. http://dx.doi.org/10.4135/9781506335193

Taştan, S.B., Davoudi, S.M.M., Masalimova, A.R., Bersanov, A.S., Kurbanov, R.A., Boiarchuk, A.V., and Pavlushin, A.A. (2018). The impacts of teacher's efficacy and motivation on student's academic achievement in science education among secondary and high school students. *EURASIA Journal of Mathematics Science and Technology Education*, vol. *14*(6), pp.2353-2366.

Tavakol, M. & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, vol. *2*, pp. 53.

Tay, H.Y. and Tan, K. (2019). Assessment Leadership. In *School Leadership and Educational Change in Singapore* Springer, Cham, pp. 51-68.

Teddlie, C., and Tashakkori, A. (2003). Major issues and controveries inthe use of mixed methods in the social and behvioral sciences. *Handbook of mixed methods in social & behavioral research*, pp.3-50.

Teddlie, C., & Tashakkori, A. (2009). The foundations of mixed methods research: Integrating quantitative and qualitative techniques in the social and behavioral sciences. Thousand Oaks, CA: SAGE.

Teijlingen, E. & Hundley, V. (2005). Pilot studies in family planning and reproductive health care. J Fam Plann Reprod Health Care, vol. 31(3), pp. 219-221.

Thacker, S., & Cuadra, E. (2014). The road traveled: Dubai's journey towards improving private education. *In A World Bank review: MENA development report*. [Accessed 27th January 2020]. Available at: https:// openknowledge.worldbank.org/handle/10986/23963

Thitima, G., & Sumalee, C. (2012). Scientific Thinking of the Learners Learning with the Knowledge Construction Model Enhancing Scientific Thinking. *Procedia - Social and Behavioral Sciences*, vol. 46(0), pp. 3771-3775. doi: http://dx.doi.org/10.1016/j.sbspro.2012.06.144.

Thomas, S., & Jose, A.K. (2018). Importance of identifying and fostering positive character strengths in early years for a bright future as emerging adults. *Indian Journal of Positive Psychology*, vol. *9*(2), pp.306-310.

Thompson, T. (2008). Mathematics teachers' interpretation of higher-order thinking in Bloom's taxonomy. *International Electronic Journal of Mathematics Education*, vol. *3* (2), pp. 1–14. Available at: https://www.researchgate.net/publication/26579694%0AMathematics.

Thum, Y.M. and Hauser, C.H., (2015). *NWEA 2015 MAP norms for student and school achievement status and growth*. NWEA Research Report. Portland, OR: NWEA.

Thuraisingam, T., Chiew, G. E., & Singh, P. K. H. (2019). Impact of Peer Assessment Intervention on Student Motivation and Learning in Composition Classes. *Journal of Education, Psychology and Counseling*, vol. 4(30), pp. 225-236.

Tint, S.S., and Nyunt, E.E. (2015). Collaborative learning with think-pair-share technique. *Computer Applications: An International Journal (CAIJ)*, vol. *2*(1), pp.1-11.

Tomlinson, C.A. and Imbeau, M.B. (2010). *Leading and managing a differentiated classroom*. ASCD.

Torrance, H., & Pryor, J. (2001). Developing formative assessment in the classroom: Using action research to explore and modify theory. *British Educational Research Journal*, vol. 27(5), pp. 615–631.

Torrance, H. (2012). Formative assessment at the crossroads: Conformative, deformative and transformative assessment. *Oxford Review of Education*, vol. 38(3), pp.323-342.

Torres, R.A. (2019). *The Effect of the I-Ready Reading Program on Student Scores on the Northwest Evaluation Association (NWEA®) Measures of Academic Progress (MAP) Reading Assessment* (Doctoral dissertation, Cleveland State University).
Trent, K. S. (2013). *The effects of the peer instruction technique think-pair-share on students' performance in chemistry.* Unpublished master's thesis, Nicholls State University, Thibodaux, Louisiana. https://digitalcommons.lsu.edu/gradschool_theses/2606

Trauth-Nare, A. and Buck, G. (2011). Assessment for learning: Using formative assessment in problem-and project-based learning. Vol. 78(1), pp. 34-39.

Tsay, M., and Brady, M. (2010). A case study of cooperative learning and communication pedagogy: Does working in teams make a difference?. *Journal of the Scholarship of Teaching and Learning*, vol. 10, pp.78-89.

Tuckman, B. & Harper, B. (2012). *Conducting educational research*. 6th ed. Lanham: Rowman & Littlefield Publishers.

Turiman, P, Jizah, O, Adzliana M D, Kamisah, O. (2011). Fostering the 21st Century Skill through Scientific Literacy and Science Process Skills. *Procedia – Social and Behavioral Science*, vol. 59, pp. 110-116.

Tyler, B., & Britton, T. (2018). *Developing district plans for NGSS implementation: Preventing detours and finding express lanes on the journey to implement the new science standards*. San Francisco, CA: WestEd.

UAE Centennial Vision 2071. Available at: (https://nmc.gov.ae/en-us/E-Participation/Lists/Publications/Attachments/6/UAE%20Book%20-%20en%20-%20New.pdf)

UAE Ministry of Cabinet Affairs. n.d. "UAE Vision 2021." Available at: https://www.vision2021.ae/en/ national-priority-areas/first-rate-education-system

Umam, K., Suswandari, N.A., Wibowo, I.T. and Rohim, S. (2017). The Effect of Think-Pair-Share Cooperative Learning Model Assisted With ICT on Mathematical Problem Solving Ability among Junior High School Students. In *Paper disajikan dalam Proceedings of the 26rd International Conference on Computers in Education (ICCE 2018), Christchurch, New Zealand*, pp. 94-98.

UNESCO. (2016). Leading better learning: School leadership and quality in the Education 2030 agenda. Paris: UNESCO.

Van Lare, M. (2016). Obviously, that worked: Examining links between data use and classroom instruction. *Journal of School Leadership,* vol. 24, pp. 756-782.

van Uden, J.M., Ritzen, H. and Pieters, J.M. (2013). I think I can engage my students. Teachers' perceptions of student engagement and their beliefs about being a teacher. Teaching and Teacher Education, vol. 32, pp. 43 – 54.

Veenman, M. V. J., (2011). Learning to self-monitor and self-regulate. In R. Mayer & P. Alexander (eds). *Handbook of research on learning and instruction*. New York, NY: Routledge, pp. 1197–1218.

Verger, A., Altinyelken, H.K., & De Koning, M. (2013). Global Managerial Education Reforms and Teachers: Emerging Policies, Controversies and Issues in Developing Contexts. Brussels: *Education International Research Institute IS Academic Program*. pp. 4-5.

Vidergor, H.E., & Krupnik-Gottlieb, M. (2015). High order thinking, problem based and project-based learning in blended learning environments. In H. E. Vidergor & C. R. Harris (Eds.), *Applied Practice for Educators of Gifted and Able Learners*. Rotterdam: Sense Publishers, pp. 217–232. doi:10.1007/978-94-6300-004-8_11.

Vygotsky, L.S. (1962). Thought and language. Cambridge, MA: MIT Press (original work published in 1934).

Vygotsky L.S. (1978). Mind in society: The development of higher mental processes. (E. Rice, Ed. & Trans.). Cambridge: Harvard University Press.

Walker, M. (2009). An investigation into written comments on assignments: do students find them usable? *Assessment & Evaluation in Higher Education*, vol. 34(1), pp. 67-78.

Wang, L., & Du, X. (2016). Chinese language teachers' beliefs about their roles in the Danish context. System, vol. 61, pp. 1- 11. https://doi.org/10.1016/j.system.2016.06.009

Warner R. (2017). 'The Future of E-assessments in the UAE: Students' Perspectives', in: Al-Mahrooqi R., Coombe C., Al-Maamari F., Thakur V. (eds). *Revisiting EFL Assessment. Second Language Learning and Teaching*. Springer, Cham.

Warner, R. (2018). Education Policy Reform in the UAE: Building Teacher Capacity. Edarabia. [Accessed 5 December, 2019]. Available at: https://www.edarabia.com/education-policy-reform-uaeteacher-capacity/

Waters-Adams, S. (2006). *Action Research in Education* [online]. [Accessed 8 Nov, 2019]. Available at: http://www.edu.plymouth.ac.uk/resined/actionresearch/arhome.htm

Weay, A.L., Masood, M. and Hawa, S.H. (2016). Systematic Review of Revised Bloom Taxonomy, SOLO Taxonomy and Webb's Depth of Knowledge (DOK) in Assessing Students' Historical Understanding in Learning History. *Malaysian Journal of Higher Order Thinking Skills in Education*, pp.1-27.

Webb, N. L. (1997). Criteria for alignment of expectations and assessments in mathematics and science (Council of Chief State School Officers and National Institute for Science Education Research Monograph No. 6). Madison: University of Wisconsin–Madison, *Wisconsin Center for Educational Research*.

Webb, N. L. (1997). Criteria for alignment of expectations and assessments in mathematics and science education. Washington, DC: Council of Chief State School Officers.

Wei, W. (2017). A critical review of washback studies: Hypothesis and evidence. Revisiting EFL Assessment: Critical Perspective. Cham: Springer, pp. 49–67.

Weiss, I.R., Gellatly, G., Montgomery, D.L., Ridgway, C.J., Templeton, C., and Whittington, D. (1999). Local Systemic Change Through Teacher Enhancement: Year four Cross-site Report. *Horizon Research, Chapel Hill, NC*.

Wertsch, J.V. (1997). Vygotsky and the formation of the mind. Cambridge, MA.

Wicaksono, R.S., and Susilo, H. (2019). Implementation of Problem Based Learning Combined With Think Pair Share In Enhancing Students' Scientific Literacy and Communication Skill Through Teaching Biology in English Course Peerteaching. *Journal of Physics: Conference Series*. IOP Publishing, vol. 1227(1), p. 012005.

Widiastuti, I. A. M. S., Mukminatien, N., Prayogo, J. A., & Irawati, E. (2020). Dissonances between Teachers' Beliefs and Practices of Formative Assessment in EFL Classes. *International Journal of Instruction*, vol. 13(1), pp. 71-84. https://doi.org/10.29333/iji.2020.1315a

Wiggins, G., and McTighe, J. (2005). *Understanding by design*. Alexandria, VA: Association for Supervision and Curriculum Development.

Wiliam, D. (2008). Improving learning in science with formative assessment. *Assessing science learning: Perspectives from research and practice*, pp.2-20.

Wiliam, D. (2010). Standardized testing and school accountability. Educational Psychologist, vol. 45(2), p. 107122.

Wiliam, D. (2011). *Embedded formative assessment.* Bloomington, IN: Solution Tree Press.

Wiliam, D., Lee, C., Harrison, C., & Black, P. (2004). Teachers developing assessment for learning: Impact on student achievement. *Assessment in Education: Principles, Policy & Practice*, vol. 11(1), pp. 49-65.

Wiliam, D. (2011). What is assessment for learning? *Studies in Educational Evaluation*, vol. 37, pp. 3–14. doi:10.1016/j.stueduc.2011.03.001

Wiliam, D., and Thompson, M. (2017). Integrating assessment with learning: What will it take to make it work?. *In The future of assessment*. Routledge, pp. 53-82.

Wiliam, D. (2018).How can assessment support learning? A response to Wilson, and Shepard, Penuel, and Pellegrino. *Educational Measurement: Issues and Practice*, vol. *37*(1), pp.42-44.

Williams, G. C., & Deci, E. L. (1996). Internalization of biopsychosocial values by medical students: A test of self-determination theory. *Journal of Personality and Social Psychology*, vol. 70(4), pp. 767-779. doi: 10.1037/0022-3514.70.4.767

Willoughby, J. (2012). Differentiating instruction: meeting students where they are [Online]. [Accessed 5 November, 2019]. Available at: http://www.glencoe.com/sec/teachingtoday/subject/di_meeting.phtml

Wilson, B.G. (1998). Constructivist learning environments: case studies in instructional design. *Educational Technologies Publications*.

Wilson, M. (2018). Making Measurement Important for Education: The Crucial Role of Classroom Assessment. *Educational Measurement: Issues and Practice*, vol. 37 (1), pp. 5-20.

Wilson, P. H., Sztajn, P., Edgington, C., Webb, J., & Myers, M. (2017). Changes in teachers' discourse about students in a professional development on learning trajectories. *American Educational Research Journal*, vol. *54*(3), pp. 568-604.

Winne, P. H. (2005). Key issues in modeling and applying research on self-regulated learning. Applied psychology: an international review, vol. 54(2), pp. 232–238. doi:10.1111/j.1464-0597.2005.00206.x

Woolfolk, A. (2004). Educational psychology (9th edn) Boston, MA, Pearson.

Wride, M. (2017). Guide to self-assessment [online]. [Accessed 13 September 2019]. Available at: https://www. tcd. ie/CAPSL/assets/pdf/Academic% 20Practice% 20Resources/Guide% 20to% 20Student% 20Self% 20Assessment. pdf.

Wright D., Clark J., Tiplady L. (2018) Designing for Formative Assessment: A Toolkit for Teachers. In Classroom Assessment in Mathematics. Springer, Cham, pp. 207-228.

Wuest, D. A., & Fisette, J. L. (2012). *Foundations of physical education, exercise science, and sport* (17th ed.). New York, NY: McGraw-Hill.

Wylie, C., Bauer, M., Bailey, A.L. and Heritage, M. (2018). Formative assessment of mathematics and language: Applying companion learning progressions to reveal greater insights to teachers. In *Language, Literacy, and Learning in the STEM Disciplines*. Routledge, pp. 143-168.

Yeh, S. (2010). Understanding and addressing the achievement gap through individualized instruction and formative assessment. *Assessment in Education: Principles, Policy & Practice*, vol. 17(2), pp. 169-182. https://doi.org/10.1080/09695941003694466

Yerushalmy, M. and Hess-Green, R. (2018). Challenges teachers face when designing their resources: the case of technology-based formative assessment. *K-12 Mathematics Education In Israel: Issues And Innovations*, vol. 13, p.335.

Yin, X. and Buck, G.A. (2015). There is another choice: an exploration of integrating formative assessment in a Chinese high school chemistry classroom through collaborative action research. *Cultural Studies of Science Education*, vol. 10(3), pp.719-752.

Young, J. E., & Jackman, M.G.A. (2014). Formative assessment in the Grenadian lower secondary school: teachers'perceptions, attitudes and practices. *Assessment in Education: Principles, Policy & Practice*, vol. 21(4), pp. 398-411. https://doi.org/10.1080/0969594X.2014.919248

Zainuddin, Z., and Perera, C.J. (2019). Exploring students' competence, autonomy and relatedness in the flipped classroom pedagogical model. *Journal of Further and Higher Education*, vol. 43(1), pp.115-126.

Zakaria, M.Y., Malmia, W., Irmawati, A., Amir, N.F. and Umanailo, M.C.B. (2019). Effect mathematics learning achievement motivation on junior high school students 1 Namlea. *Int. J. Sci. Technol. Res*, vol. *8*(10).

Zhao, H. H., Seibert, S. E., Taylor, M. S., Lee, C., and Lam, W. (2016), "Not even the past: the joint influence of former leader and new leader during leader succession in the midst of organizational change", *Journal of Applied Psychology*, vol. 101(12), p. 1730.

Zimmerman, B. J., (2002). Becoming a self- regulated learner: An overview. *Theory into Practice*, vol. 41(2), pp. 64-70.

Zimmerman, B. J. (2006). 'Development and adaptation of expertise: The role of self-regulatory processes and beliefs', in K. A. Ericsson, N. Charness, P. J. Feltovich, & R. R. Hoffman (eds). *The Cambridge handbook of expertise and expert performance*. Cambridge, MA: Cambridge University Press, pp. 705–722.

Zhang, J. (2018). *The impact of formative assessment on young English learners' motivation and achievement in China* (Doctoral dissertation, University of Sheffield).

Zhao, Q. (2019). Study and Practice of Formative Assessment Based on Metacognitive Strategy. In *2019 International Conference on Management, Education Technology and Economics (ICMETE 2019)*. Atlantis Press.

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. doi:10.3102/0002831207312909

Zimmerman, B. J., & Campillo, M. (2003). Motivating self-regulated problem solvers. In J. E. Davidson and R. J. Sternberg (eds), *The Psychology of Problem Solving*. UK: Cambridge University Press, pp. 233–262.

Zulfiqar, M.S. & Alvi, S.T. (2019). Cooperative Learning: Effects on Mathematics Students' Achievement in Private Schools. *International Conference on Statistical Sciences*, vol. 33, pp. 347-352.

Appendices

Appendix A: Consent Form

الجامعة البريطانية في دبي
The British University in Dubai
www.buid.ac.ae

Wednesday, 20 March 2019

To whom it may concern

This is to certify that **Ms Mina Ghassan Radhwan** with ID number **20170030** is a registered student on the **Doctor of Education** programme in **The British University in Dubai** since **September 2017**.

Ms Radhwan is currently collecting data for her research.

She is required to gather data through interviews, questionnaire and document analysis for her research titled **"The Impact of Using Formative Assessment Strategists on Students' Achievement in MAP Exams in the United Arab Emirates".**
Further support provided to her in this regard will be highly appreciated.

Any information given will be used solely for academic purposes.

This letter is issued on Ms Radhwan Ali's request.

Yours sincerely,

Ahmed Abu Shaaban
Senior Student Administrator

الجامعة البريطانية في دبي
الإدارة الطلابية
The British University in Dubai
Student Administration

PO Box 345015 - Block 11 Dubai International Academic City Dubai U A E - T +971 4 279 1400 - F +971 4 279 1490
FB.com/BUiD.Team BUiD_Team youtube.com/BUiDadmin @BUiD_Team BUiD

Appendix (B): Teachers' Questionnaire

Consent Form for Teachers

Dear Sir/Ms.,

I am contacting you asking for your voluntary participation in a study in science education. Please let me introduce myself, and my research.

My name is Mina Ghassan Radhwan and I am a doctoral student in the leadership and management Department at the British University in Dubai in Education working under the supervision of Professor Sufian Forawi. The study forms the basis of my doctoral dissertation on "*The Effect of Using Formative Assessment Strategies on Students' Results in MAP Exams in American Private Schools in the United Arab Emirates*". I am conducting a research study to investigate the effect of using different formative assessment strategies on the results of grade 8 science students in the MAP exams. In addition, the extent of the change occurred in students' learning will be investigated. The head of the science department, team of the lead science teachers, and teachers of the whole school will know that they are being asked for their input about their perceptions and practices of the acceptance in participating in this study.

The participation in this questionnaire will involve answering questions relating to your demographic background and questions related to your perceptions and practices about the implementation of various formative assessment strategies.

Your participation in this study is voluntary. If you choose not to participate or withdraw from the study at any time, there will be no penalty. The information collected from this questionnaire is anonymous and confidential.

Thank you for being part of this research. I truly appreciate your time and effort in answering the questionnaire for my research. If you have any questions concerning this research study, please contact me on the following email: mina.radhwan@yahoo.com.

Sincerely,

Mina Radhwan

Teacher Questionnaire

Purpose of the Questionnaire

The purpose of this questionnaire is to investigate the impact of using formative assessment strategies on students' results in MAP exams in the United Arab Emirates.

How to Answer each Question

The questionnaire is categorized by sections: Section 1 involves demographic information; Section 2 is Likert-scale items that involves working collaboratively, teacher's constructive alignment, motivation, Think-Pair-Share Strategy, Constructive Feedback Strategy, Problem-Based Learning (PBL) Strategy, Self-Assessment strategy, and the uses of formative assessment results; Section 3 is about the academic level of your students; and Section 4 involves three open-ended questions.

The questionnaire will take 10-15 minutes. The information collected from this questionnaire is anonymous and confidential. Thank you for being part of this research. Your cooperation is highly appreciated.

There are no correct or incorrect answers and all responses will be kept confidential.

Section 1: Teachers' demographic information.

School		Nationality	
Name		Subject	
Average number of students in your classes	Less than 20 ( )	21-29 students ( )	30 & more ( )
Gender	Male ( )	Female ( )	
Teaching experience	1-4 years ( )	5-10 years ( )	More than 10 years ( )
Grade level taught	Elementary school ( )	Middle school ( )	High school ( )
Academic qualifications	Bachelor ( )	Diploma ( )	Master ( )
Professional development training	Yes ( )	No ( )	

Section 2: To what extent do you believe that each of the following practices and strategies is essential as a part of the formative assessment process?

- For all sections, please mark the choice that matches your perception. Use the following rating scale for the questions below. Choose the most applicable choice to you.

5=strongly agree Use it always	4= Agree Use it frequently	3= Not decided Use it occasionally	2= disagree Use it seldom	1=Strongly disagree Never use it

Assessment for learning	5	4	3	2	1
Formative assessment "Ongoing assessment"					
Implemented Formative Assessment Strategies					
1. I encourage my students to assess themselves					
2. I encourage my students to talk, share ideas, and working cooperatively through Think-Pare-Share strategy.					
3. I provide students with different problem solving questions for each topic.					
4. I use Exit-Ticket strategy at the end of each topic					
5. I use various questioning strategies in each lesson.					
6. I'm aware of what learners should know or be able to do and how will they learn.					
7. My lesson plan is aligned with the required curriculum.					
8. I plan and/or modify the lesson with differentiated tasks according to the needs of all students from different academic level.					
9. I use a variety of teaching strategies for each topic.					
10. I use different websites for assessing the skills of my students					
11. My lesson progress based on students' responses.					
12. I plan my teaching instructions based on students' MAP results.					
13. I assess students' understanding according to their abilities in the 4 Cs					
14. I analyze the results of students' assessments.					
15. I use various motivational tasks so students can gain competence, relatedness, and autonomy.					
16. I ask students to connect between the topic's new information and their current knowledge.					
17. I provide a consistence constructive feedback for each student.					
18. I use students' graded work as a feedback about their level.					
19. I use critical thinking questions in every topic.					
20. I provide students with different open-ended problems that is related to real life situations.					
21. I encourage my students to work independently in every lesson.					
22. I encourage students to decide their needs for further improvement.					
23. I ask students to decide their strengths and weaknesses without guidance.					
Effect of Using Formative Assessment Strategies					
1. To enhance students' academic attainment.					
2. To assess the teaching process and modify it accordingly.					

3. To evaluate students' progress.					
4. To group students for differentiated activities.					
5. To prepare students for national and international exams.					
6. To improve students' skills.					

Section 3: Circle the level where you believe that most of your students are able to do. **(Choose one only)**

A. Level (1): Basic recall of information (Identify, recall, use, and measure).

B. Level (2): Complete multiple steps to find a solution (Classify, organize, estimate, and collect & display data).

C. Level (3): Reasoning, planning, using evidence, or a higher level of thinking (Justify, explain, draw conclusions).

D. Level (4): Complex reasoning, developing, or thinking over a period of time (Relate and make connections).

Section 4: Answer the following questions:

1. Which formative assessment strategy/strategies best help to achieve your objectives in the science classrooms? Why? Give example

_____

_____

_____

_____

2. How do middle school teachers implement formative assessments in preparing students for the MAP exams?

_____

_____

_____

_____

Appendix (C): Science Leaders' Interview

Interview Protocol for Heads of the Science Departments and Lead Science Teachers Consent Form

Dear Sir/Ms.,

I am contacting you asking your voluntary participation in a study in science education. Please let me introduce myself, and my research.

My name is Mina Ghassan Radhwan and I am a doctoral student in the leadership and management Department at the British University in Dubai in Education working under the supervision of Professor Sufian Forawi. The study forms the basis of my doctoral dissertation on "*The Effect of Using Formative Assessment Strategies on Students' Results in MAP Exams in American Private Schools in the United Arab Emirates*". I am conducting a research study to investigate the effect of using different formative assessment strategies on the results of grade 8 science students in the MAP exams. In addition, the extent of the change occurred in students' learning will be investigated. The head of the science department, team of the lead science teachers, and teachers of the whole school will know that they are being asked for their input about their perceptions and practices of the acceptance in participating in this study.

The participation in this interview will involve answering questions relating to your perceptions and practices about the implementation of different formative assessment strategies.

Your participation in this study is voluntary. If you choose not to participate or withdraw from the study at any time, there will be no penalty. The information collected from the interview is anonymous and confidential.

Thank you for being part of this research. I truly appreciate your time and effort in answering the questions for my research. If you have any questions concerning this research study, please contact me on the following email: mina.radhwan@yahoo.com.

Sincerely,

Mina Radhwan

Interview's Questions

Purpose of the Interview

The purpose of this interview is to investigate the impact of using formative assessment strategies on students' results in MAP exams in the United Arab Emirates.

Answer the following questions:

1. How do middle school teachers implement formative assessment strategies in preparing students for the MAP exams?

_____
_____
_____

2. To what extent is MAP science exam data being used to drive FA strategies in science classrooms?

_____
_____
_____

3. What are the factors that you/ your teachers depend on in order to select the FA strategies that should be implemented in science classrooms?

_____
_____
_____

4. What do you use to monitor/evaluate the progress of your students?

_____
_____
_____

5. Which formative assessment strategy/strategies best help to achieve your objectives in the science classrooms? Why? Give example.

_____
_____
_____

6. In case of implementing effective strategies but there was no/weak development in students' results, what are the reasons behind that?

_____
_____
_____