



**Student Engagement in Technology Education Classes:
Perspectives of High School Teachers and Students in Abu
Dhabi's International Private Schools**

مشاركة الطلاب في فصول تعليم التكنولوجيا: وجهات نظر معلمي وطلاب
المدارس الثانوية في المدارس الدولية الخاصة في أبو ظبي

by

SHEHLA KUNHALAN ARIF

**A thesis submitted in partial fulfilment
of the requirements for the degree of
DOCTOR OF PHILOSOPHY IN EDUCATION
at
The British University in Dubai**

November 2024



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Abstract

In the last 20 years, technology has advanced ubiquitously around the world finding its way into education. While it is assumed that technology can engage the digital natives, literature review from first-year computer science university students worldwide shows otherwise. This study used a mixed method approach to look at the perspectives of 500 high school students and 12 technology education teachers from private schools in Abu Dhabi in order to explore student engagement in technology education lessons. The major findings show that although these students are quite adept in using technology informally, they display varied engagement when learning about technology at schools and there are many factors that contribute to their engagement in these lessons which include the students' as well as the teachers' attitudes, the significance of technology education as a subject in the school and the subject curriculum, the learning environment and the school technology education infrastructure. Further studies that investigate teachers' qualifications, their professional experiences and also perspectives from public schools are recommended to get a better understanding of what engages high school students in technology education lessons.

Keywords: digital natives, student engagement, technology education

المخلص

في السنوات العشرين الماضية، تقدمت التكنولوجيا في جميع أنحاء العالم ووجدت طريقها إلى التعليم. في حين أنه من المفترض أن التكنولوجيا تجذب المواطنين الرقميين، فإن مراجعة الأدبيات الخاصة بطلاب السنة الأولى الجامعيين والذين يدرسون علوم الكمبيوتر في أنحاء مختلفة من العالم تظهر خلاف ذلك. استخدمت هذه الدراسة منهجًا مختلطًا للنظر في وجهات نظر خمسمائة طالب من طلاب المدارس الثانوية واثنى عشر معلمًا في مجال التعليم التكنولوجي من مدارس خاصة في أبو ظبي، وذلك من أجل استكشاف مدى مشاركة الطلاب في دروس التعليم التكنولوجي. تظهر النتائج الرئيسية أنه على الرغم من أن هؤلاء الطلاب ماهرون جدًا في استخدام التكنولوجيا على المستوى غير الرسمي وبعيد عن الصفوف الدراسية، إلا أنهم يظهرون تفاعلًا متنوعًا عند التعلم عن التكنولوجيا في المدارس، وهناك العديد من العوامل التي قد تساهم في مشاركتهم في هذه الدروس والتي تشمل اتجاهات الطلاب وكذلك المعلمين، ومدى أهمية التعليم التكنولوجي كمادة دراسية في المدرسة، وبيئة التعلم والبنية التحتية الخاصة بتعلم التكنولوجيا في المدرسة. يوصى بإجراء مزيد من الدراسات التي تبحث في مؤهلات المعلمين وخبراتهم المهنية وكذلك وجهات نظر المدارس العامة للحصول على فهم أفضل لما قد يساهم في إشراك طلاب المدارس الثانوية في دروس تعليم التكنولوجيا .

الكلمات المفتاحية: المواطنون الرقميون، مشاركة الطلاب، التعليم التكنولوجي

Dedication

I dedicate this thesis to my late father, who had instilled in me to be the best in what I choose to do or be in life; to my mother who has always supported me with her strength and unconditional love; to my children, Anoshah, Ashna and Armaan, who are my best friends and loudest cheerleaders; to my husband Arif, who stood by my side as I pursued this milestone, and to all my students who inspire me every day to be the teacher they deserve, someone who imparts knowledge, offers unwavering support, and embodies the attitude of lifelong learning; with the hope that they continue to seek knowledge, question the world, and create a brighter future.

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Chapter 1 - Introduction

Technology plays a major part in people's daily lives now, involving nearly every profession of the modern economy. According to Hootsuite (2022), more than 4.5 billion people worldwide use the internet for approximately 7 hours daily. It facilitates effective involvement in personal relations, education, and society in general (Bergdahl et al., 2020). In the digital age that exists currently, knowledge of information and communication technology skills is added to the typical knowledge of reading, writing and maths (Claro et al., 2018). It was rightly claimed that technology and society are dynamically connected through education by Cronje (2016) as technology became ubiquitous and permeated into education, promoting the concept of learning anywhere and anytime, catering to all learning styles, giving the learner autonomy of his/her learning and allowing for communication and collaboration. To state it simply, technology has changed how teachers teach and students learn. In the last 20 years, as different kinds of media, technologies and technology platforms, including social media, have become omnipresent in the world, it has also gradually changed the landscape of education (Kearney & Maakrun, 2020). Technology has become an important component in the teaching and learning experience that isn't limited to the four walls of a classroom or even the educational campus. However, the ones who teach belong to the generation of *Digital Immigrants* who have adopted the technology lifestyle with its literacy and skills (Alaleeli & Alnajjar, 2020) and the ones taught are known as *Digital Natives* a term created by Marc Prensky (2001) for those born into or have grown up with technology around them. He claimed that they formed a generation who were all engaged and intuitively competent with all kinds of technology. While it is known that technology can engage students highly, it remains to be seen if it can engage students to learn, as there is ambiguity in research regarding engagement in learning with technology (Kearney & Maakrun, 2020). There are many

doubters in the education field regarding technology, however, its significance became apparent recently, when students around the world could continue studying by switching to online learning overnight, owing to social distancing norms brought about suddenly by the COVID-19 pandemic.

1.1 Background

Since technology has changed how people work together, it is necessary to understand how these new interactions affect students and their learning in schools (Kearney & Maakrun, 2020). Not only technology in education, but technology education itself, is of particular significance, especially in middle and high schools (Brown & Brown, 2010), where it is usually introduced to the former with a focus on design, problem-solving and workplace safety; and in the latter, students are taught to appreciate advanced computing and to identify with work-based skills incorporating creativity, critical thinking and problem-solving and also to transform complex ideas into actions by communicating value and implementing design. Ng (2012), who referred to the current middle and high school students as *digital natives* in her study, claimed that they know much about the technologies they use regularly but are unaware of others and their benefits. However, her study showed that they can learn to use new technologies easily and can be taught *digital or technology literacy*, which the National Academy of Engineering and the National Research Council (NAE & NRC, 2002 cited in Brown & Brown, 2010) defined as having a broad understanding of technology and not just being able to work with certain types of technology only. Digital Literacy is understood by some as mere practical skills needed to manage hardware or software systems or control a device (Murray & Pérez, 2014, cited in Alaleeli & Alnajjar, 2020); and by others as intellectual, mechanical, collaborative and expressive skills (Ng, 2012; Ferrari, 2012).

In her analysis of frameworks to understand digital competence in actual practice, Ferrari (2012) indicated that the European Commission 2006 had recommended digital competence or literacy as one of the 8 key skills for lifelong learning, which was accepted for the Europe 2020 strategy. Technology education gives students opportunities to thoroughly explore value, design and practice technology within the society (Oliver, 2016). It instils in students the 21st-century skills, the co-curricular skills required for an unknown future workforce, those required to solve unforeseen problems with technologies that do not yet exist (OECD, 2018). This resonates with the study of Gagel (1995, cited in Brown & Brown, 2010), who connected technology to society much earlier, stating that technology literacy will fluctuate and will have value only if it advances or reflects according to the changing world and its traditions. Research that has been done to discover the range and depth of technology's impact on users and communities has unanimously conceded that basic digital literacy is not only necessary but has to be constantly upgraded to keep pace with global technology advancements (Alaleeli & Alnajjar, 2020). Ferrari (2012) assessed digital literacy as tool-dependent but not restricted to just understanding the hardware and software aspects. She related it to other literacies such as internet literacy, media literacy and information literacy associated with the quickly advancing technology situation and asserted that if people were to efficiently function in the modern society, digital literacy was a necessity that must be demanded from governments.

High school students are constantly engaged with technology outside their schools, using it to get information, to pay for tickets or food, to entertain themselves with music and movies. It is significant for the educators to be aware that the constant use of technology by these students, being digital natives can cause rewiring of the brain or its evolution by this new

experience with technology over many years of their lives by virtue of neuroplasticity (Arden, 2010 & Doige, 2007 in Alaleeli & Alnajjar, 2020). With increased attention of students to high digital exposure, a decrease in focus on events around them can be noted, making them open-minded on one side but rigid on the other, all the while rendering them exhausted with the constant images and information pushed onto them, nonetheless, addicted to the same. While it can be assumed that technology can be easily used to engage these digital natives, schools must develop their technology education curriculum, keeping up with the emerging technologies as well as those familiar to the students, and this appears to be an overwhelming task.

1.2 Significance of the Study

Bergdahl et al, (2020) noted that in many countries in the world, there has been a focus on Computer Science (CS) or Information and Communication Technology (ICT) curriculums in schools to counter the regression of students applying for the CS programs in universities which was causing the scarcity of CS professionals in the job market including the gaming companies in the current technology world. In addition, in their literature review, they discovered that many students did not have the required basic digital skills when they reached university, despite the students having taken a technology education course in their high school. All institutions as well as the governments were keen about the computer science courses in schools to provide the students with digital skills and experiences to flourish in their future courses and careers (Bilkstein, 2018) with their focus on the content of the course, the readiness of the students and the pedagogy involved to teach these students. In the UAE, despite the government investing much in technology education and schools also buying the latest technologies to teach the students, they do not consider technology education as a core subject like English, maths and sciences. This results in teachers, students and parents not

valuing the subject as the other subjects and leads to disengagement. Students give importance to the subject when they can understand the logic behind the activities they do and the use of their learning to their future, even if they do not understand them completely (Autio, 2011).

Chris Stephenson, Head of Computer Science Education Strategy at Google called Computer Science a “...dynamic field in which change is a constant” as technology advances constantly and rapidly and he also called it “...a young field, and as such, it lacks the extensive and comprehensive body of educational research that other academic disciplines possess” (p.3) as there is a scarcity of research in this field compared to other subjects such as science and maths. Regarding pedagogy, research is also scarce regarding teachers possessing the abilities to teach technology to students, which results in fewer reference points available to teachers and schools to extend the abilities of their students by planning and implementing effective learning activities in order for them to participate efficiently in an evolving digital society (Claro et al, 2018).

In the United Arab Emirates (UAE), however, the focus was mainly because the government is looking for high-tech startups and professionals to design embedded systems (MOE, 2015). In order to achieve this, students must be taught to use more than just software that tends to be obsolete with emerging technologies. They must know how computers work as networking controls their lives with respect to communication, power, finance, scheduling, as well as their social and political activities, and they must also know how to create applications in addition to just creating content for social presence. Universities in the UAE began to offer digitally integrated courses as early as 1998 in Abu Dhabi, with Zayed University progressing into a laptop university with digital resources and laptops for students and faculty, with other universities following a similar commitment to the use of digital technologies in education (Martin, 2013). However, for the students to be interested in

choosing and excel in these courses, they had to be familiar with their usage from earlier years at school, which was not the case at the time due to many reasons such as lack of infrastructure, teacher training, time, recognition, support, etc. Soon, with enormous support from the government in the UAE (MOE, 2015; World Governments Summit, 2024), which was carefully planning an evolution from the oil economy to a knowledge economy by assigning significant budgets to education with emphasis to software development and latest educational technologies, schools joined this cause by purchasing these technologies and training teachers with workshops and training sessions to be on board as quickly as possible to engage the students inside technology classes and outside, in the form of competitions: national and international. However, studies have shown that students do not use technology for complex learning and experiences despite their significant interaction with it (Alaleeli & Alnajjar, 2020). Furthermore, students in different situations are known to have varied experiences with identical technology environments, and many of them have not engaged as expected, and some even responded negatively after the initial excitement died down (Musawi, 2011). Students having higher digital skills try to engage more proactively in technology education classes, but that is not to say that students who are disengaged in these lessons are only those with low digital skills, as those having different levels of skills in technology can also be disengaged, according to Bergdahl et al (2020). There seem to be other conditions that affect the engagement of these students. One of the many is the distractions caused by the devices in the classroom resulting in their limited engagement for the lesson even if its not by their own choice as it could be notifications from social media or others nearby using their devices for off task purposes (Shirky, 2014; Bergdahl et al., 2020). Although the overall education system may be overseen by laws of the country and the schools by the education system, the educational and social consequences of the country are

eventually affected by the experiences and views of the students (Appleton et al, 2008). In order to understand student experiences, it is important to understand how different learners experience different technologies; how technology makes their learning more resourceful, individually and collectively; how it makes their learning experiences special and how it allows them to collaborate and communicate better. Also, teachers may not have committed sincerely to this change due to a lack of confidence, training or support. Listening to their voices will enable us to see their perspectives and start a conversation to work out strategies to get them on board.

Learning experiences are related to engagement, which is complicated as it is multifaceted and understood differently depending on contexts. However, it is a feature of education which is essential for all students to learn (Fredericks et al, 2004), it plays a crucial role for learning not only during school but even during one's lifetime (Kearney & Maakrun, 2020) and it is the apparent indicator of motivation (Reese 2013, cited in Bergdahl et al, 2020). Campbell & Jane (2012) verified this in their study, in which teachers agreed that students find practical tasks very enjoyable as they observe, interpret, and judge their own and others' experiences, resulting in modifying and improving their tasks and eventually taking ownership of their learning experiences. These feelings of motivation, one of the basic elements in student engagement, can be extrinsic or intrinsic. Extrinsic motivation is related to one's environment; for example, little children are motivated by encouragement, praise, rewards, etc., whereas adolescents are motivated by their goals and career aspirations, which are personal but predominantly based on external reasons (Buckmaster & Carroll, 2008). Students who are intrinsically motivated are curious, seek information and self-improvement, complete their assigned tasks and achieve personal satisfaction from them (Campbell & Jane, 2012), while those who are uninterested, unenthusiastic and indifferent are also disengaged

from the school community as a whole. It becomes evident that the perspectives and experiences of students have a significant effect on the products of the education as well as the community, as mentioned earlier (Appleton et al., 2008).

Student engagement follows either type of motivation, but unlike it, as mentioned earlier, can be observed and measured using a range of indicators, as it is the drive and work put into action. Bond et al (2020) reviewed much literature and identified these indicators as interest, enjoyment, confidence, attitudes and good relationships with teachers and peers. They comprehensively defined *student engagement*, in their study, as the visible effort and vigour put forth by students during learning, influenced by interactions, activities and learning environment. Also, the engaged students feed this vigour back into their learning, thereby causing more engagement. On the other hand, if students are not supported in their learning environments with no choices in their activities or they find them beyond their capacity or cannot relate to them, they will not be intellectually or physically motivated, resulting in disengagement (Ryan & Deci, 2000). This is also related to the flow that students get into once their competency matches the difficulty level of the activities, and the lack of which is a challenge to student engagement (Shernoff et al, 2017).

Student engagement is significant with respect to dedication, academic performance and learning with joy (Fredricks et al., 2004; Kuh et al., 2007). This was confirmed later by Finn & Zimmer (2012, cited in Bergdahl et al, 2020), who stated that the higher the student engagement, the better the achievement and vice versa, leading to non-attendance and dropping out of school. Schindler et al (2017) defined student engagement as the expected outcome of students that reflects their attitudes, understanding and behavior, with respect to learning, resulting in a flow between the student and the school, where the student puts in the time and effort and the school facilitates the learning with the proper curriculum, resources

and activities. To support this, they must be given real-world practical learning experiences that enthrall them in designing and problem-solving processes (Brown & Brown, 2010).

Academic achievement, student dedication and student fulfilment have been linked to student engagement (Henrie, 2016). Along with educational activities that foster engagement, its effective measurement, which must be accessible, economical and least disruptive, is also necessary to identify those students needing help.

Francis (2017), in his study, claimed that using technology in education is known to increase student motivation. Engagement, which comes with active learning or learning-by-doing, results in deeper learning, which can occur along with increased interest and motivation when authentic technology uses are brought into the classrooms (Usher, 2012). Use of technology is an important facet of the student learning experience nowadays; therefore, its influence on student engagement is a subject of special interest (Selwyn, 2016). Technology education, which allows for constructive, creative and collaborative experiences where students can develop genuine artefacts in a social activity, helps promote motivation. In technology education classes, activity-based learning that keeps students engaged with intellectual and hands-on education is usually used, in order to promote thinking critically, solving problems and making sound decisions (Brown & Brown, 2010). Studies have proclaimed that technology increases engagement (Neuman et al., 2009, cited in Kearney & Maakrun, 2020); however, other studies report unsatisfactory engagement in first-year computer science university courses (Sinclair et al, 2015; Morgan et al, 2018a). It is critical to motivate and engage the students in their final years in school to learn programming, technology knowledge and management (Wang, 2020). ITEA(2005, cited in Brown & Brown, 2010) advises that students must be trained to view technology concepts from many perspectives, which involves affective components, not found usually in technology education

curriculum and according to de Vries (2016), if absent, students will end up possessing random fragments of technical knowledge and skill with no clear understanding. Also, while it is clear that better learning can result from engagement, it still remains to be seen if technology can actually engage students and improve their learning as it is claimed as specific challenges that come along with higher use of technology also increases which may affect the learning negatively (Kearney & Maakrun, 2020). It must be understood that academic accomplishments cannot be improved by just increasing the ICT facilities (Livingstone, 2012, cited in Martin, 2013). Bond et al (2020), after their review of the literature, added that expensive technology in schools with no sound pedagogy and planning would disengage students, hinder their learning and render these gadgets as just fancy toys. On the other hand, good pedagogy with thorough planning and suitable resources is vital to student engagement, as OECD (2015) rightfully claimed that “technology can amplify great teaching, but great technology cannot replace poor teaching” (p.4).

The education sector in the UAE recognised that the students today needed to understand how to solve problems in their current technologically advancing world by appreciating the computer science discipline in schools and decided to use international standards in the ICT curriculum in K-12 schools (MOE, 2015). These standards focused on computational thinking to understand algorithms, cryptography, artificial intelligence, searching, heuristic reasoning and recursive thinking. The current high school students who are *digital natives* by nature must learn these adaptable technical skills for future workplaces and soft skills for other aspects of life, which can make them informed global citizens, guide them to be lifelong learners and also successful in all endeavours. However, some students may be on track while others may be falling through the gaps if they are not identified and given the timely and required assistance to work harder and achieve their objectives. The

benefit of using technology outshines its challenges, and its appropriate use can open up a variety of academic skills for students, including soft skills necessary for them to thrive in their future. Kearney & Maakrun (2020) suggested that technology should only be used if it increases student engagement. Otherwise, it must be avoided, as engagement is the most important factor in teaching and learning, but technology education can only be taught with technology.

Henrie et al. (2015) claimed that exploring how students are engaging with the lessons will allow educators to gauge their efforts in attaining their academic and social goals. This, in return, gives the educators, curriculum designers and teachers sufficient data to evaluate the course, activities and tools. The significance of this study is to augment the thin body of research around the world on student engagement in technology education classes while also focusing on high school students and in private schools in a country in the Middle East where research on this topic and this sample is not only limited, but almost nonexistent. This study was conducted to collate student and teacher perspectives on student engagement in these classes in order to comprehend their experiences, their feelings and their suggestions when studying about and with technology. The results from this research can inform a wide audience, ranging from the Ministry of Education all the way to the technology teachers in the computer labs.

1.3 Statement of the Problem

Schools in the United Arab Emirates (UAE) that follow the international curriculum have developed their technology literacy curriculum using recognised standards from around the world. Computer Science, Computing, Technology or Digital literacy are all used interchangeably for curricula used in UAE schools, but for the purpose of this study, the term *Technology Education* will be used to encompass all courses related to studying technology.

The Ministry of Education (MOE, 2015) recognises that the youth must be well-versed in the latest technologies and that technology education will enhance their future careers, regardless of their eventual career choice. Technology can be integrated into all school subjects and is used extensively in universities; therefore, the knowledge of using it efficiently is a necessary skill. However, with its many prospects, technology comes with problems too (Cronje, 2016). Students are continuously connected and learning on the go, but there is great disparity when it comes to digital literacy with respect to the students and teachers, as some are early adopters while others are idlers. Also, if students just learn to use it in school with integration in all subjects but do not learn to solve problems and create content with it, they will become passive consumers of others' ideas and not active creators of their own.

Research that studied engagement in technology-enhanced classrooms determined that it differed from engagement in classes using no technology at all (Henrie et al., 2018, cited in Bergdahl et al, 2020). It is assumed that technology can be used easily in teaching and learning as it is predicted to have the potential of increased student engagement (Rashid & Asghar, 2016), which is not the case as it involves much work in the form of curriculum, infrastructure, resources, teacher training and tech-support as pillars of the course. Similar to students around the world (Morgan et al, 2018b), who are constantly absorbed with technology during their after-school hours, students here in the UAE, also are not engaged to learn the latest educational technologies such as robotics, drones and other programmable kits, supplied by proliferating EdTech companies in the region to meet the international standards in schools. As early as 2003, Bybee recognised that people knew and understood very little about technology in spite of it prevailing all around in society. ITEA 2006 (cited in Brown & Brown, 2010) warned of a gap that was broadening between the creators of innovative technology, the users of technology and everyone else. Schindler et al (2017) perceived that

institutions cannot keep up with the barrage of new technologies coming out every year, leading to a limited shelf life of already bought devices and their software, which hinders them from being implemented effectively, in addition to opposing institutional policy and practice to teacher beliefs and skills. Castaneda and Selwyn (2018) alluded that technology learning related theories were just narratives of online communications and information-seeking processes. Studies about educational technology did not deliberate about the essential pedagogies involved, which is significant as these varied and ever-evolving technologies, when used in education, are influenced greatly by those involved as well as the learning environments. Another interesting point discovered by Brown & Brown (2010) in their reviewed literature was that, while a comprehensive technology understanding and literacy were believed to be helpful when living in a technological society, the subject of technology education itself did not seem to have a proper curriculum in most schools. Schools must make necessary changes to motivate and engage students to engage with technology, which will also teach them the 21st-century skills to prepare them for an unknown future workforce, as technology is rapidly advancing and new jobs are being created.

In summary, the significance of technology education can be appreciated with its latent capacity to engage students, as well as its many aspects that fail to engage and also the technology-related jobs expected to grow multifold by the next decade (Wolf et al, 2020). This necessitates exploring the perspectives of high school teachers and students to study the causes for low levels of student engagement in learning technology in schools, in spite of the current students being around technologies all their lives. Research about technology education centres mostly relates to new technologies in the market, not to their values or learning (Oliver, 2016; Castañeda and Selwyn, 2018) and is not particular to student engagement (Henrie et al., 2015). Those that discussed engagement, related it to academic performance

(Henrie, 2016) or linked it to just participating or even logging into the learning system to simply confirm one's presence in the class and not to the real essence of engagement in learning which is a process that enriches learning (Kearney & Maakrun, 2020). The minimal literature available about technology and learning that orbits around the idea of student engagement only come from universities (Brown & Brown, 2010; Castañeda and Selwyn, 2018) and that too with troubling findings of low student engagement in technology education classes (Sinclair et al; 2015; Butler et al, 2016; Selwyn, 2016). Martin (2013) had submitted a PhD thesis exploring the engagement of the youth with technology in the UAE, however, this was conducted with students in higher education and not in schools and also, it was one to explore these students' engagement with different technologies including the internet, and not a study related to formal education. Lastly, her study only included the Emirati youth and not students of all nationalities. As one can notice, there is much international literature in student engagement and also in technology education separately but a dearth in studies relating to both and in schools and in the Middle East region, which is a melting pot of teachers and students of many nationalities and cultures with frequent turnover that brings about diversity as well as disparity.

The research problem identified in this study involves the decline of applications to computer science programs in universities, which may ultimately lead to a shortage of experts in this field, as well as studies reporting student disengagement in first-year computer science university programs. With respect to UAE, this study primarily intended to fill the gaps in global academic literature with respect to student engagement in technology education classes in high schools in the Middle East region and then based on the researcher's experience required to explore problems leading to the disengagement of high school students in these classes despite the UAE government's vast investment and focus on the subject in the last

decade. Understanding the perspectives of both students and teachers in these classes was the most important motivation for the researcher to find solutions to these problems.

1.4 Purpose of the Study

This study hopes to address these gaps in literature and also address the academic, emotional and social practices that promote or challenge student engagement by providing schools with teacher and student perspectives, in order to inform policies and practices with genuine understanding of current best practices in technology education, which will consequently help develop suitable interventions to better engage the diverse population of students in the UAE, in terms of schools' policies, practices and professional development. The schools and universities around the world including the UAE have been coerced to invest in technology but the confidence, abilities and experience of the teachers who are directly responsible to teach with these educational technologies may vary and it is necessary to check with the primary stakeholders such as the students today if their needs are being met and accordingly support the teachers (Martin, 2013). The purpose of this study was to explore the perspectives of the students and their teachers regarding their engagement in technology education classes, to identify their issues and needs as digital natives with teachers as digital immigrants teaching them, in order to design curriculum and activities based on these findings to improve student engagement. It would further provide indicative information of similar schools in the country and of high school students in the Middle East, as well, with English not as their first language, who have experienced similar development in culture and society and sudden increased internet connectivity (Martin, 2013). It will inform a diverse range of audiences such as MOE, ADEK (for curriculum design and implementation plans), school boards (for operations and infrastructure implementations), ICT/IT departments (for professional development and networking) and ICT teachers (for lesson plans, instructions and

class activities). All will benefit from such research regarding the engagement of students with digital technologies in a formal setting, with the purpose of aligning curriculum with technology and effective modern pedagogy. Finally, in addition to referring to the gap in literature about the engagement of students in technology education classes in high schools in the Middle East region, this study sets some groundwork for research to cover a wider area, thereby contributing to global research in the field of student engagement and technology education in high schools. This research is an attempt to appropriately represent the current high school students in the UAE and their teachers in order to benefit the future society dealing with technological advances.

1.5 Research Questions

This is a mixed methods research study that will collect quantitative data using adapted international surveys and qualitative data using observations, interviews and document analysis to answer the following research questions:

1. *How do high school technology teachers and their students in Abu Dhabi private schools define and thereby understand the term 'student engagement'?*
2. *What are high school students' perspectives of their own engagement in technology education classes?*
3. *What are high school teachers' perspectives of student engagement in technology education classes?*
4. *To what extent should schools and teachers be working on challenges and developing strategies in order to promote and create engaging learning environments for technology education?*

This study used an explanatory sequential approach but was qualitatively driven and used the philosophy of pragmatism due to the nature of the research, which involves an evolving process to investigate teachers' and students' perspectives regarding student engagement in technology education classes. An interpretative approach was used for the data analysis, which best brings in the perspective of the researcher into the study along with the participants' perspectives and thereby presents the essence or wholesome experience of the participants. The analysis was reported thematically in a descriptive style, so as to provide rich information regarding the "what" and the "how" of the experiences of the participants (Creswell, 2007). The study proposed only minimal ethical issues with respect to permissions from the university research review board, consent from the schools for interviews and observations, and minor disturbance to the participants. Sampling was convenient and purposeful, consisting of high school students attending technology education classes, who were interviewed and observed along with high school technology specialist teachers. To answer the research questions, surveys were collected from teachers and students, and technology classes were observed. Teachers and students as focus groups were interviewed to validate the observations. In addition, document analysis of policy statements and curricula was done to understand the school climate regarding the technology education courses offered in the schools. Student achievement records in technology education were collated to correlate with achievement in the classes. As Selwyn (2009) suggested, in order to understand how students use technology, it is necessary to understand their learning environments and events in the classrooms.

1.6 Structure of the Thesis

Chapter 1 - Introduction – introduced the study, set the United Arab Emirates context as its background, briefly familiarised the key concepts, presented the significance, identified

the problem, defined the purpose of the study and specified the research questions. The following chapters address the research questions that were proposed in Chapter 1.

Chapter 2 - Literature Review - is a review of the relevant literature that includes prior research in student engagement and technology education around the world, which is critical to understanding how to appreciate the former within the realm of the latter. It also reviews theories and concepts related to both that will inform this study and help form the research questions. In addition, it explains the digital native concept and reviews the technology development by the government, specifically in schools in the United Arab Emirates region.

Chapter 3 - Methodology - describes the structure of the study based on the reviewed literature and the purpose of this study. It presents the main qualitative methods, including observations, followed by focus group student interviews and teacher interviews, and finally, the analysis of documents for a better understanding. Statistical analysis, using surveys for the teachers and students, is also presented in this chapter for the quantitative part of the study. Sampling and participation are also explained in detail here.

Chapter 4 - Results - reports and collates the findings from the four types of data, namely, surveys, observations, interviews and document analysis.

Chapter 5 - Discussion - compares, explains and interprets the main themes that emerged from the current study findings based on the literature reviewed.

Chapter 6 – Conclusion - summarises the findings with respect to the research questions, and discusses the pertinent implications. Limitations of this study are presented here along with future recommendations for research.

Chapter 2 - Literature Review

Learning to not only use technology but also to create software applications that manage the hardware, in addition to being able to analyse the myriad of information that is pushed onto the screens of one's digital devices, are critical skills that students must acquire in schools before they leave to university and the workplace. In order to learn these skills, one needs to be experienced in using technology tools and interact with them with ease, interest and understanding, and this can only happen with meaningful engagement with technology in schools.

This chapter will create a conceptual framework with the two most significant concepts in this study such as technology education and student engagement followed by a theoretical framework that will explore the theories to explain these concepts such as social theory, constructionist theory and connectivism theory for technology education and self-determination theory, expectancy-value theory, self-regulation theory and flow theory for student engagement, all of which will converge to the social constructivism theory that explains both the concepts. Finally, it will look into factors that affect technology education in schools and also into a few things to consider when exploring student engagement, specifically in technology education classes.

2.1 Conceptual Framework

2.1.1 Technology Education

It is significant to learn about technology or its psychology before defining technology education so as to function with a certain understanding and proficiency in an ever-evolving technological world (de Vries, 2016). Marc Prensky (2001) introduced the belief that Digital Natives will be adept in using technology when compared to the previous generations (Bergdahl et al, 2020), however, this idea is not supported by research which states that digital

natives only appear to be technologically literate while they are not capable academically (Ng, 2012). Alaleeli & Alnajjar (2020) were also aware of the claims that the Net Generation or Digital Natives are known to instinctively understand and be able to navigate through any technology, while digital immigrants, who were born before the technology era, had to adapt to it and adopt digital skills which come naturally to the natives. However, they reviewed many studies that challenged these assertions and discovered that in spite of being immersed in technology, the self-reported skills of the digital natives were significantly varied and could not be used for learning and also, their digital competency did not match the skills expected from them. Using technology in education must be seen as something more than an interesting tool or a fancy communication device. While it can herald apparent benefits in teaching and learning, it must be understood that they come with many challenges as well, such as cost-effectiveness, teacher training, existing infrastructure, student and teacher readiness, etc.

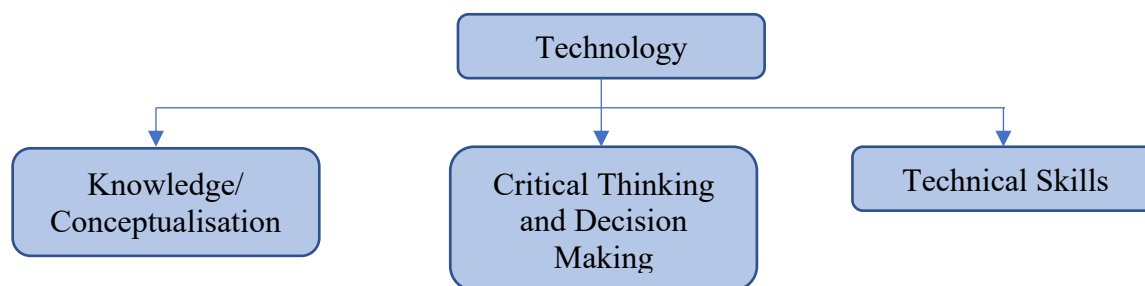
In the field of education, technology has three major roles, namely, medium/resource, management and delivery role (Musawi, 2011). Technology can be used as a *tool or medium* by the teachers who determine the space and pace for its integration, in addition to being a source of information for teachers and students alike. Mobile devices such as phones, tablets and laptops allow for enhanced student engagement beyond formal learning environments with increased connectedness, communication and collaboration. The *management* role involves administrative and teaching support, and the *delivery* role involves the instructional and communicative processes in the institution, which allows flexibility, feasibility, accessibility and collaboration. Evidently, there are immense advantages to using technology in the field of education. This study is mainly concerned with **technology education**, where technology is considered a medium or resource. When students possess a holistic awareness of technology, they can make informed decisions regarding the variety of technologies they will

come across throughout their lives. Students' understanding of the working of algorithms in their society and social media is vital for their future, and the absence of which will result in them being easily influenced as customers or citizens and also render them incapable of participating effectively in their future civic duties (Blikstein, 2018). The awareness of technology can be conceived in terms of understanding processes, standards or products (Oliver, 2016) and, to be able to identify its standing in society and to understand and appraise any future technology (ITEA 2000 cited in Brown & Brown, 2010) is the goal as well as the likely outcome of technology education and this is called *technology literacy*. Also known as digital literacy or skills and defined by UNESCO, (2017) as "*a range of different abilities, many of which are not only 'skills' per se, but a combination of behaviours, expertise, know-how, work habits, character traits, dispositions and critical understandings*" (p.4). Digital literacy is taught by technology education teachers by making students apply technology to real-life situations using curriculum and activities based on technology standards (ITEA, 2000, cited in Harris & Rogers, 2008). The National Academy of Engineering (NAE) and the National Research Council (NRC) defined it as the ability to understand the bigger picture of the world of technology, more than being able to work with particular technologies (NAE & NRC, 2002). They have identified three dimensions to it, namely, knowledge or conceptualisation; critical thinking and decision making; and skills, which will allow people to utilise, operate, assess and understand technology (ITEA 2006 cited in Brown & Brown, 2010). The European Parliament and the Council (2006, cited in Ferrari, 2012) defined digital skills as the use of technology in an assertive and judicious manner for the purpose of work, entertainment and communication. This includes using computers to save, recall, evaluate, create, organise and share information, and to communicate and collaborate over the internet. With technology education in high schools, students can also develop soft skills which are

required in engineering and technology university education when they are made to work as groups, communicate with each other, use critical thinking to solve problems, present their results and assess themselves (Harris & Rogers, 2008). Ferrari (2012) further explained these as basic know-how, skills, and mindsets needed to work with technology, knowing its functions as well as the consequences of virtual communication, the authenticity of available information and the standards when using these digital tools.

Figure 1

Technology Literacy Dimensions



Note. based on NAE & NRC (2002)

Technology education in high schools includes not only programming but also transferable concepts and content related to computations, algorithms, program design and problem solving with topics that can be integrated into science, technology, engineering and maths (STEM subjects) to solve technical problems (Wolf et al, 2020). Technology education, therefore, caters to many individual, social and educational values as it is assumed to engage students in learning. Castañeda and Selwyn (2018) asserted that learning with technology is an activity that deeply and progressively involves human emotions and is a socially interactive activity; it includes complexities such as “*identity, responsibility and accountability*” (pg. 4) with respect to the students as well as the faculty. They believed that it was not just the spread

of information between them, but technologies moulded their emotions and inclinations with respect to ethics, beliefs and conduct and also, vice versa, where technologies were designed based on human affective nature, such as joy, monotony, tiredness, etc. They stated that while teaching with technology, it is necessary to focus on pedagogy so as not to risk its effect on learning, as it must be designed and adapted based on those involved and also the influencing factors. Harris & Rogers (2008) much earlier had noted the significance of the affective component and suggested soft skills development, which are key competencies required by universities, be integrated into high school technology education classes with teachers designing lessons and activities involving planning/organisation, teamwork, communication, problem-solving, presentation, evaluation and writing skills. Real-life authentic situations can also be incorporated into the lessons to get students to think laterally, unlike the usual task-oriented activities (Hoffman et al, 2019).

Technology education in schools has great capacity to bring about innovation, opening up new kinds of ways for the students to view, process and display information; new methods of testing and new and different spaces for learning, thus allowing for collaboration and comprehensive learning experiences that connect to real life (Blikstein, 2018). However, this involves moving away from the traditional styles of teaching and also a prerequisite of students having a complete understanding of the working of computers but with the rapid advancement in technology, it becomes difficult to continuously develop new pedagogies as it is known that student learning and assessments in technology education cannot be compared to that in other subjects. Nonetheless, it allows for conceptual integration of computing with other subjects and also for students to creatively express themselves in ways that are connected to their society and culture, thereby making it meaningful to them. In his survey, Blikstein's (2018) interviewees stated that the scope of people and problems that the

technology products and services provided for, were very small, thereby, indicating that the creators came from a specific digital community, who were only exposed to these people and problems, which further pointed to the digital divide in the technology education provided in different sections of the society, with private schools having complex technology education programs related to real life situations and public schools providing just the basics.

Technology in education, as much as it may seem to work for students, may not work for all students in the same manner (Castañeda & Selwyn, 2018).

Technology in Education in the United Arab Emirates

Alaleeli & Alnajjar (2020) in their study have acknowledged that there is only literature regarding the digital natives in the UAE focusing on the workforce, while there is a paucity of literature in the academic setting, and the few available studies were more about the technology used than the digital natives themselves. Martin (2013) noted that the youth in the United Arab Emirates had more access to technology than those from other parts of the world but they began to engage with them only in universities and that too at a very basic level with most of them not having access to digital devices or even the internet before. She mentioned that the few researchers who studied digital technology in schools reported low internet connectivity and a lack of sufficient computer hardware (cited in Almekhlafi & Almeqdadi, 2010). Her quantitative study provided only a glimpse of tertiary students' engagement with technology in the United Arab Emirates, and she recognised the need to study further, the attributes of these students as digital natives constantly engaging with multiple different digital devices confidently and skillfully. The students in Sabbagh et al's (2012) study reported that while they were using technology outside their classroom for personal purposes confidently and skillfully, they believed their advanced technology skills were not very good. This alluded

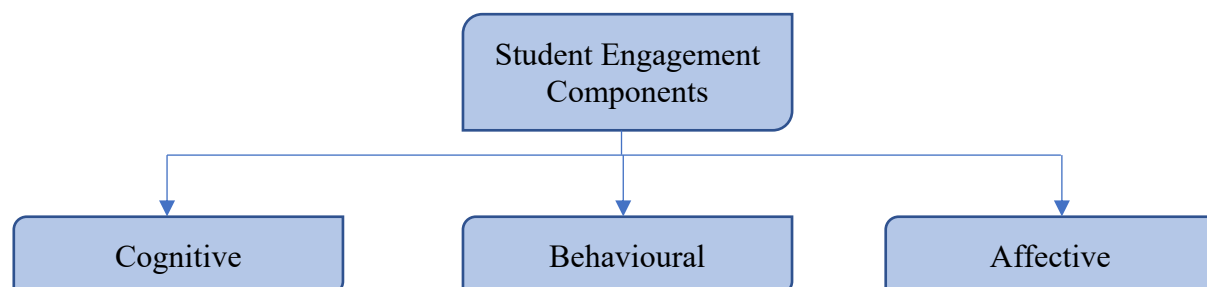
to Arab youth only conforming to some characteristics of the digital native narrative. Also, the study claimed that they lacked social skills, with their experience of the digital space somewhat shaping what they believed to be their social world. Almekhlafi & Almeqdadi (2010) in their study, described lack of technology resources; lack of support, guidance and time for teachers; and lack of importance to technology by schools, teachers and parents as major factors that got in the way of technology education and integration in schools. The government has acknowledged these barriers and worked on new and enriched objectives and policies to tackle them. They have organised multiple national and international technology-related competitions and sponsored technology kits in public as well as private schools to encourage technology education, in addition to providing workshops for teachers teaching the subject.

With the aspiring ambition of preparing its people strategically for a digitally skilled nation in the future (MOE, 2015), the United Arab Emirates introduced sudden and significant changes in its education system with the revision of the Computer Science and Technology Standards (CST) (World Governments Summit, 2024) in 2015 to train its students to be active and to engage and participate in a digital economy. This was reiterated with the Computing Creative Design and Innovation (CCDI) curriculum, with the integration of technology subjects in 2019. The UAE is collaborating currently with Code.org to counter the initial stumbling blocks related to curriculum and resources, and the Australian Council for Educational Research (ACER) to bring its current computer science curriculum on par globally, and has also invested billions of US dollars in education, focusing on technology (World Governments Summit, 2024). It is one of the few countries with technology education compulsory in high schools, and it is working towards the “*We the UAE 2031*” vision by leading globally in digital literacy (p.8).

2.1.2 Student Engagement

Researchers refer to student engagement as a vague meta-construct that works in equally vague ways and define it differently and ambiguously (Hart et al, 2011). Engagement in schools was defined in a study earlier by Natriello (1984, cited in Appleton et al, 2008) simply as the participation of students in activities offered by the school while attempting to understand the term from their disengagement. Fredericks et al (2004) had reviewed many constructs, such as motivation, compatibility, school environment, etc., that interact with each other to facilitate engagement. Regarding learning environments and motivation, Autio (2011), in his study, mentioned class infrastructure with good space and sufficient working devices, along with a suitable school curriculum, as important factors for high motivation leading to high engagement. Kuh et al (2007) asserted that students are said to be engaged when they participate inside and outside the classroom in learning activities, the results of which can be measured. In contrast, HEFCE (2008, cited in Trowler, 2010) defines *engagement* as the practice of schools and policy-making organisations to methodologically influence the learning experiences of the students in order to interest and inspire them. Motivation is significant to operate in not only the present educational settings of the students but also for their future academic outcomes (Shernoff et al, 2003) and it is one of the many viewpoints to identify the interests of the students, their engagement and challenges in learning (Gilman & Anderman, 2006 in Autio, 2011). Skinner & Pitzer (2012) described *engagement* as motivation that is visibly displayed and “...the active verb between the curriculum and actual learning” (p. 23). While motivation includes important goals that students work towards that may not be clear initially and subjected to change with experience, it is still a target for them to achieve but this requires actions such as effort with planning, critical thinking, problem solving and evaluation etc. as well as sustenance of the actions

(Autio, 2011). Campbell & Jane (2012) agreed that engagement follows motivation, but unlike it, can be observed and measured using a range of indicators and defined it as energy and labour that is put into action. In a recent study, Bond et al (2020) reviewed a variety of literature and identified these indicators as interest, enjoyment, confidence, attitudes and good relationships with teachers and peers. The authors asserted that *student engagement* has more to do with just the students and defined it in their study as the visible effort and vigour put forth by students during learning, influenced by interactions, activities and learning environments, which feeds back more energy and thereby, more engagement. This had been documented earlier by Axelson & Flick (2011), who stated that students are said to be engaged when they are engrossed in their learning and feel bonded to their classes, institutions and peers. Appleton et al (2008), who studied the conceptual and methodological issues of engagement in schools, were convinced that the construct was multidimensional and related to three main components namely the cognitive, behavioral and affective components and they reported that every definition of engagement addressed the behavioural component, while many included the emotional or affective component and only very few spoke of the academic or cognitive component.

Figure 2*Student Engagement Components*

Note. based on Fredericks et al (2016)

More recently Fredericks et al (2016) classified this multidimensional construct of student engagement into three different, yet connected dimensions, namely, the *cognitive* component, where the learner sets personal goals to understand concepts and processes; the *behavioural* component, which refers to participation, perseverance and interest of the learner in academic tasks and the *affective* component, which refers to students' relations with teachers and peers as well as their values and beliefs in the learning objectives. Bergdahl et al (2020) had put forward that disengagement can also be connected to these components, specifically with technology. Therefore, it is significant to understand the causes of disengagement, such as distractions, ordeals and discouraging aspects that students encounter in their learning environments, in order to identify ways to avoid it. Kearney & Makroun (2020), in their study, questioned whether technology in education is ideal and whether to learn with technology is the best way to learn. UAE has come a long way from just having more computer labs in government schools than in private schools, as mentioned in Martin's (2013) study, with only one computer lesson per week, usually with no extensive internet connectivity to the current private schools, engulfed in technology in terms of devices, educational technologies, network and internet connectivity. These technology improvements

were to prepare students for the new tertiary education being offered to them, which was Western-oriented and involved 21st-century skills, such as solving problems and thinking critically. However, the tertiary students, who were interviewed in her study, were sceptical about these improvements in high schools, predicting the distractions that it brought about. Technology has been promoted as the key to developing 21st-century skills, however, it is the very cause of distraction for the students, as the devices they are using in the classrooms have multiple ways to distract them from engaging and also, when they are multitasking in many spaces, it limits their intellectual engagement in all these spaces. These distractions are not choices made by the students but are elements that come along with the use of technology, attracting its users via multiple channels such as Facebook, Google, Instagram and others, while teachers have to measure up to them to get the students' attention in classrooms (Shirky, 2014). Bergdahl et al (2020) stated that the cognitive component allows for distraction, with notifications from the technology or being inundated with too much information all the time, and the behavioural component is related to either using technology illegally or indifference to it due to its restricted access. With respect to the affective component, they noted the use of technology to counter boredom or frustration while using it in education. They also mentioned a fourth component, namely the social engagement component, previously identified by Appleton et al (2008), as personal or contextual factors which can be facilitators of student engagement that can influence the strength of the above three main dimensions. This component is related to the engagement of students when they communicate with their peers and teachers using technology, which can be preferred by them or on the other hand, they can be disengaged as they find it distressing, irrelevant or wanting for continuous assistance.

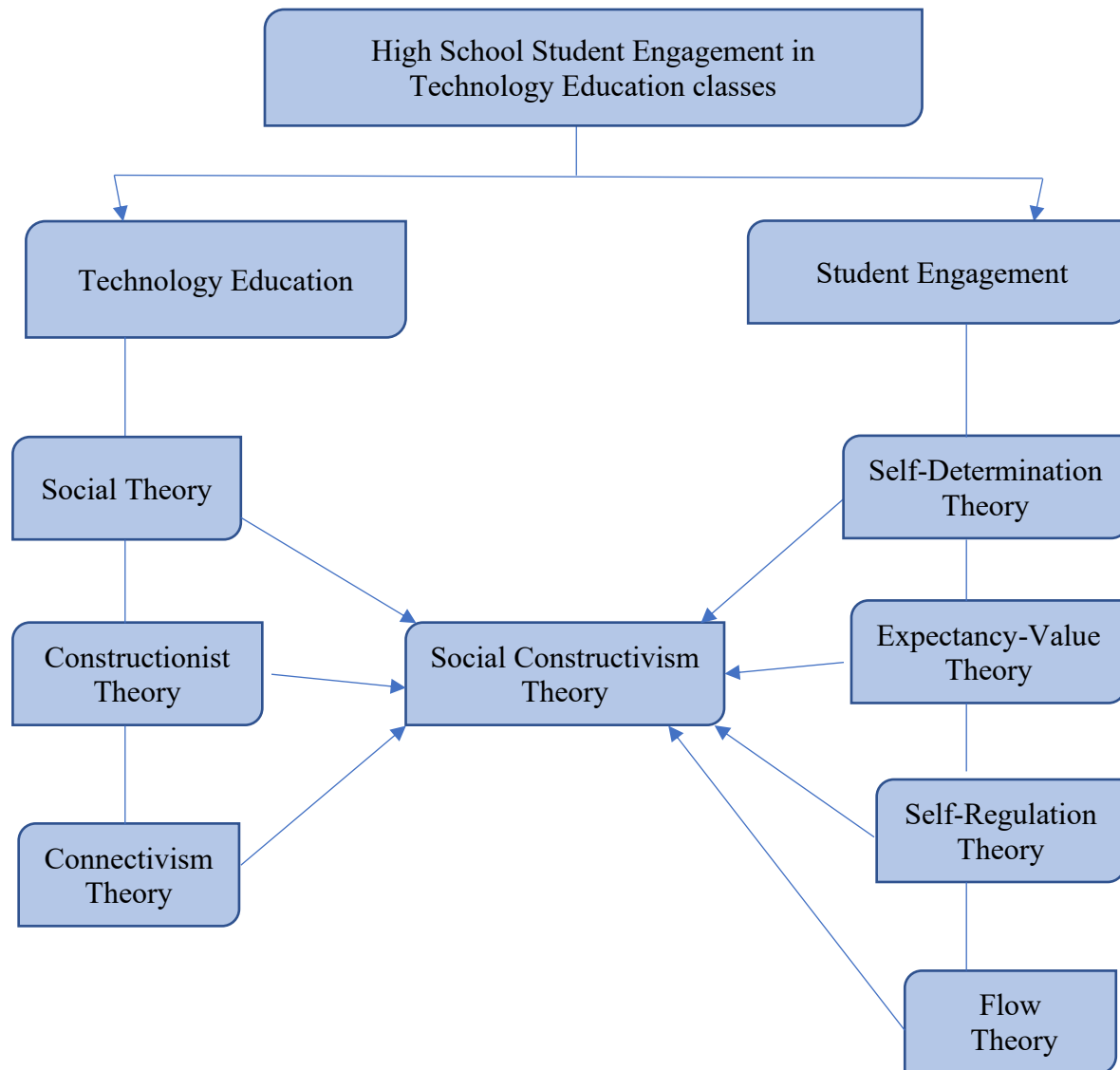
Appleton et al (2008) had reviewed literature (Connell & Wellborn, 1991; Fredericks et al, 2004), which suggested that the cognitive aspect of engagement was dependent on the

students' perceptions of independence, ability and belonging (psychological needs) in their social context and resulted in outcomes based on their engagement or disinterest. Reschly & Christenson (2006), when studying student needs for school completion, offered four components to the engagement construct, namely, related to education or academic, related to intellect or cognitive, behavioural and emotional components. Academic engagement was indicated by academic credits, completing homework tasks, etc., while classroom participation, attendance, etc., were indicators of behavioural engagement. Cognitive and emotional engagement were gauged through values, goals or autonomy and feelings of belonging or social relationships, respectively, as they were not explicitly visible. Considering all the definitions and explanations of student engagement, Liem & Chong (2017) said it best when they defined student engagement as the suitability of the students with their school environment, which must be interpreted over the progression of the students' entire school life. It can be understood that the understanding of all these components will lead to fewer disruptions and frustrations, while contributing greatly to the sustenance of student motivation and, thereby, their engagement in technology education classes.

2.2 Theoretical Framework

Figure 3

Theoretical Framework of Student Engagement Study in High School TE Classes



Note. Created by Author

2.2.1 Theories related to Technology Education

A study (Selwyn, 2012) based on *sociological theory* considering young people, technology and education, related that when technology was gaining pace in society initially,

it was seen only as a medium to enhance learning with no relation to its social aspect but the author asserted that in order to understand the structures, activities, processes and interactions that characterise the use of technology in learning environments, it is crucial to recognise the *social theory* as a major factor and consider sociological approaches that emphasise the social nature of technology in education. He explained different views such as the *technological determinist* perspective, which addressed only the constant impact of technology irrespective of context and ignored the aspects of social interactions and change; the *soft determinist* view, which considered impact of technology in social environments but still placed much importance to artefacts and then moved on to *anti-essentialist* view in which technology can only be understood according to one's interpretation, thereby giving it only a social perspective and finally the *anti-determinist* view that considered the events and relations that are routine, random and local between people and technologies. These perspectives seem suitable for different settings and do not portray the social aspects of technology consistently. However, they will help to interpret the complicated social settings and interactions in technology education classes today. They are relevant in the current study because while the product /artefact or the technological impact is important, the process or change in students' perspectives due to social interactions and context is equally impactful with respect to student engagement, resulting in an effective outcome of technology education.

Seymour Papert (1928-2016), as early as the sixties, had imbued activity into learning when he created the first programming language called LOGO. He believed that students must learn to program computers and not just use them, which is the basic principle in his *constructionist theory*, related to constructing conceptual models and physical objects (Hoffman et al, 2019). An earlier interesting case study by Hill & Smith (1998) looked at authentic learning in technology education classes and identified that Vygotsky's (1896-1934)

social constructivism theory encompassed the intellectual, affective and social aspects in these student-centred classes that involved cooperative and meaningful learning with process- and product-based community projects. This theory asserts that knowledge not only involves understanding, based on one's mental capabilities, but also on the context of learning that must be socially and culturally interesting in order to motivate the learners (Morchid, 2020). This calls for teachers to assume different roles to guide the students in their learning process by providing maximum opportunities to interact and collaborate, which, when practised in technology education classes as in any other classes, would increase student engagement.

McCormick (2006) claimed that modern theories of learning look into two basic points of view, namely, the individual and the social, that relate learning to knowledge and, in his study, he addresses how these views look at knowledge and relates this to technological knowledge. He proposed the social view as *situated learning*, which comes from socio-cultural beliefs, where students create and share meaning, referring to Piaget's (1896-1980) stance that peer interaction can change one's understanding of an idea by causing cognitive conflict. McCormick asserted that situated learning is best understood when students are engaged in authentic cultural activities that involve collaboration and problem solving by understanding the nature and working of things, as it involves participation, which in turn integrates the knowledge with the activity along with its devices, symbols and skills. This will result in increased student engagement which was affirmed by Mattar (2018) in a more recent study, who explained the relevance of constructivist related theories such as situated cognition (context and interaction), anchored instruction (immersion in authentic situations), experiential learning (planned educational experiences), authentic (authentic contexts, activities and tests) and activity (activities that construct knowledge) theories to promote motivation and interest in using technology in education. He discussed the theory of *connectivism*, one appropriate for

the technology age, which was initially introduced by George Siemens and Stephen Downes and based on Vygotsky's *Zone of Proximal Development* but more flexible allowing for delegation of learning onto and support when needed from technological tools and social networks, which are considered more efficient than humans in performance. This has advanced further in current times with the popularity of Artificial Intelligence, used fervently by students and teachers alike in education and otherwise.

Connectivism

This theory deserves a special mention in this study as it is the theory for the 21st century, as teaching and learning environments completely differ from those when previous theories were proposed (Sahin & Safieh, 2012). Technology has completely absorbed the youth of today, with a future indicating daily advancement and variety. The way they live, communicate and learn has all been influenced by technology, while the institutions they study in were structured for the previous generations. A variety of social media greatly influences them, with information constantly being pushed through their multiple devices, and the schools need to match this knowledge flow and the regular, rapid advancement in technologies. Herlo (2016) was also of the same opinion and reasoned that since everyone is connected to each other and to the immense amount of knowledge, institutions must also allow a constant flow of content, with learning environments and experiences that cater for the students. People learn from connections and experiences, which implies that, with the coming of the internet, they can learn from connecting to others across the globe and their experiences (Stephenson, 2012, cited in Sahin & Safieh, 2012). Students need to develop specific skills in these learning environments for an unclear future in the technology age, such as communication, evaluation, critical thinking and problem-solving skills, in addition to positivity, responsibility, adaptability, safety, collaboration and cooperation skills. Until now,

intellectual development was given utmost importance, but this needs to be coupled with social skills in order to connect the students to others as well as to information available with technology to ensure benefits in the economy and society (Herlo, 2016).

According to the connectivism theory (Siemens, 2005), a learning community is made up of a network of learners who keep adding knowledge to the community. New knowledge keeps making routes through these learners, and new connections are made between ideas in this community. This new knowledge is assessed based on existing beliefs and understanding and categorised accordingly. Siemens' supporter Downes (2012, cited in Herlo, 2016) agreed that knowledge passing through these learners is not only shared but also understood and transformed by them constantly within the network around the world. He used "*knowledge, learning and community*" as perspectives to describe connectivism and explained that these perspectives worked as a cycle as "*Knowledge informs learning; what we learn informs community; and the community in turn creates knowledge. And the reverse: knowledge builds community, while community defines what is learned, and what is learned becomes knowledge.*" (p. 332). Therefore, connectivism validates one's lifelong learning using one's networks, surroundings and ecosystems in addition to organising one's thoughts and ideas individually (Sahin & Safieh, 2012). In this way, learners are making sense of the information passing through them and they are expanding their personal network or expertise in their discipline (Herlo, 2016). Connections are made between pieces of information that seem unrelated outwardly in order to understand the whole picture, thereby making more connections for continuous learning, which is a core skill in the present time, where new information is fast and flowing continuously. When proposing the theory of *connectivism*, Siemens (2004) disapproved of the conventional learning theories such as *behaviourism*, *cognitivism* and *constructivism*, which were the most commonly used, in relation to

instructional learning situations. He asserted that with the advent of technology came exponential growth of knowledge and that these theories cannot be further used in the age where technology has impacted how we learn just as much as it has impacted how we live and communicate. He related some important trends in learning with technology in education, such as learners changing careers multiple times during their life, the significance of informal learning experiences, the process of learning lifelong, the ways the devices one used shape one's thinking, using technology to offload much of what used to be stored in one's memory and the significance of knowing where to find information over knowing what and knowing how. He claimed that knowledge is continuously transforming, and with the coming of the internet, learning occurs by means of connected sources of information, which need not necessarily be humans. Herlo (2016) explained that *nodes* that have information form the links or intersections in a network, and these nodes can be one person or a group, a device or a viewpoint. When there is a shift in information in any of the nodes, the connected nodes in the network make changes according to their understanding.

Sahin & Safieh (2012) in their literature review, mentioned studies (Siemens, 2004; Verhagen, 2006; Giesbrecht, 2007) that concur that connectivism is more a pedagogy theory than a learning theory, where teachers can create environments and influence learners to form communities, who can connect and collaborate using the internet and various social media tools, which allow them to learn and participate beyond the classroom and have authentic experiences with each other. Schools must ensure that these experiences form a balance between the needs of the learner as well as the school. Learners can exchange knowledge using information and communication technologies to collaborate with each other; however, they must be able to evaluate this incessant flow of information. The current students, as digital natives, are familiar with being seamlessly connected all the time for work as well as

for entertainment, making this theory relevant when addressing student engagement in technology education classes. Teachers must design the learning activities and the learning environment, with the understanding that technology has influenced everyone's daily lives, thereby causing changes to the way everyone learns as well (Siemens, 2006, cited in Herlo, 2016).

It is worth noting that there are some negative aspects to this theory. First of all, information is fast and always moving on the internet, with new information constantly developing, which results in the likelihood of today's information being wrong tomorrow (Sahin & Safieh, 2012). In connectivism theory, educators must always ensure that all learning activities must be dealing with updated information. Secondly, connectivism works better with informal than with formal classroom learning, as using internet-connected devices in classrooms will distract students from the actual lessons. Thirdly, learners must always be updated with the latest devices in the market, as not being so will render them illiterate with the constant advancements in technology. Then, connectivism theory works best for individuals who are self-motivated to learn and who can make connections quickly between ideas and information. Lastly, there is the concern of the addiction to being connected to virtual reality always and being aloof to actual reality, thereby tending to be asocial, which must be taken into consideration by the educators.

2.2.2 Theories Related to Student Engagement

Engagement is a multi-faceted construct that seems intangible, developing and more importantly, difficult to confine to one or more theories (Eccles, 2016). It connects many disciplines and theories, and it is perceived differently by different people. Student engagement is related to many aspects such as educational, behavioural, cognitive and affective aspects (Liem & Chong, 2017), thereby, it is related to multiple theories in education,

which will be considered in this study. Liem & Chong (2017) emphasise that fulfilment of these aspects is a worldwide order for intrinsic motivation, and motivation is believed to be a predecessor of student engagement. Students are said to enjoy school and learning when they are intrinsically motivated by being curious, persistent and exposed to new and challenging tasks (Gottfried 1990, cited in Autio, 2011). One of the most important theories related to motivation is the *self-determination theory*, which posits that when students' autonomy, competence and relatedness, considered to be basic human needs, are supported in learning environments, they function physically and psychologically well, adding to their motivation in learning (Ryan & Deci, 2000; NRC, 2004). It becomes significant for people involved in education to recognise that outwardly requirements of students are internalised and conceptualised with their other needs. It is necessary to understand here that when students' interests are developed at their own leisure, their understanding and beliefs have lifelong effects, unlike when they are stimulated unexpectedly, causing the learning that comes with it to be short-lived (Hidi & McLaren, 1990, cited in Autio, 2011). Evidently, educators can play an important role based on this theory, by using all school resources within their control to provide motivating and engaging learning environments for the students, as according to the *self-determination theory*, expectations from one's environment can result in increased independent performance (Appleton et al, 2008). Byman (2002, cited in Autio, 2011) claimed that if tasks are simple and students are competent in them, they are motivated to show off their competence; however, if they do not feel proficient, then they can be motivated to engage in the activities only with external rewards. This was also noted by Ryan and Deci (2000), who claimed that, usually, in education, the external motivating factors are just as significant, if not more, than the mere innate motivation of the students. The theorists declared that students from different cultures require these needs to be met, though every culture may have

different means to fulfil them, and this is significant in the UAE as it is a melting pot of many cultures, with respect to students as well as teachers. Student self-determination can be enabled with tasks that appear motivating due to good relationships with teachers or peers; that are set up with good support to achieve success; and that allow for choice and autonomy.

Autio (2011) in his study discovered that choice and product were the most motivating factors for his participants, while talent and student interests only motivated those who were interested in related careers. He claimed that the element of choice was especially significant for high school students. Students are engaged in classes when their engagement-stimulating psychological needs are sustained by teachers encouraging autonomy, thereby resulting in more effort, perseverance, detailing and lower anxiety (Jang et al, 2012; Ryan & Deci, 2017). Collaborative learning preferences were also connected to students' autonomous motivation, since they do not feel disengaged with supportive peers during challenging tasks (Zhou & Ren, 2017). Autio (2011) claimed that the learning environment with teacher and peer interaction plays an important role, but indirectly, as it only influences student motivation by facilitating all the other motivating factors involved.

Another theory, the *expectancy-value theory*, relates motivation to the students' opinions of their own expectations and values, and that of their parents, teachers and peers regarding their academic achievements (Martin et al, 2017). Students can be expected to be engaged in technology education classes if they perceive value in the subject and also if the school and their parents regard technology education as a core subject and have expectations similar to other core subjects, such as science or maths. Teachers can add value to unexciting learning tasks by explaining the logic of the tasks as well as the justification of the learning itself with respect to its use in their future, which cannot be understood by them presently (Autio, 2011). The *self-regulation theory* is one which focuses on metacognition, planning and

time management (Hedeshi, 2017) and helps schools and teachers design curricula, infrastructure and lesson plans, so as to keep students engaged continuously in technology education classes. Finally, the *flow theory*, proposed by Mihaly Csikszentmihalyi (1934–2021), which addresses students’ motivation in relation to their focus, interest and pleasure in learning (Shernoff et al, 2017), can contribute significantly to student engagement and achievement.

In summary, the number of theories in each construct depicts their complexity, especially in the case of student engagement. With respect to technology education, the *social* theory speaks of the social nature of learning technology and the *constructionist* theory accentuates the need for hands-on experience in building products and the integration of both these theories is emphasised with the *social constructivism* theory, which confirms the benefits of enjoying the learning process with peers, resulting in better understanding and motivation. Lastly, regarding technology education, the *connectivism* theory, which is ideal for the current digital native environment, highlights using technology for support as the students are always connected to the internet and each other, thereby proving once again the significance of the theory of social constructivism in technology education. With regard to student engagement, the *self-determination* theory boosts motivation with the feeling of control and competence in one’s learning, in addition to feeling related to the environment, which is compatible with high school students, who are digital natives, comfortable and adept in using technology as part of their daily lives. The *expectancy-value* theory promotes the motivation of these students with the high expectations and value given by others and themselves for the subject and their learning. The *social constructivist* theory also plays an important role here, as it describes how the students value themselves from the perspectives of others, while working alongside them, which is highly motivating, thus leading to engagement during learning. The *self-regulation*

theory and the *flow* theory explain how students understand what they know and how they know as they learn with focus and interest, thereby nurturing motivation and, in turn, engagement.

2.3 Technology Education

2.3.1 Technology Education Curriculum in Schools

One of the significant aspects regarding student engagement in technology education is its status in K-12 schools compared to core subjects. In an important early study of the technology education curriculum in schools (Gal-Ezer et al, 1995) known as computer science (CS) then, when it was just declared as a separate sciences discipline with concepts that were believed to affect other sciences, a curriculum was developed to show its evolving significance from just teaching basic literacy to actually learning to code. Another study that looked into school curriculum ten years later (Bell et al, 2010) in New Zealand stated their technology education curriculum needed a change as it just focused on general applications and skills; was combined with other subjects with no graded assessments; was not a subject on its own nor given a high educational status and therefore, did not attract students' interest. Twenty-five years later, although all current schools in the United Arab Emirates have established technology education as an autonomous subject, it still does not enjoy the core status of the other sciences. Gal-Ezer et al (1995) wished to see this discipline on par with other science subjects, and in their proposal for a high school curriculum for computer science, they observed that permanency was an important principle for core subjects, which was difficult to expect for technology education, as technology is rapidly evolving. However, they stressed that the curriculum must focus on understanding concepts, information, and skills with scope and adaptability, but independent of particular computer models and software. Schindler et al (2017) more recently also acknowledged that institutions cannot keep up with the barrage of

new technologies coming out every year, added to the limited shelf life of already bought devices and their software, resulting in the curriculum being implemented ineffectively, in addition to opposing institutional policy and practice to teacher beliefs and skills. It can be understood that under such circumstances, the subject will fail to engage the students.

2.3.2 Professional Development of Technology Education Teachers

In view of the above-mentioned issue regarding the rapidly evolving technology, technology education teachers need to constantly update themselves depending on the latest educational technology use in schools. Computing was universally taught just to use as a tool without a curriculum in most countries (Ragoni, 2007, cited in Bell et al, 2010). In the United States, computer science was considered non-core along with physical and vocational education and different states could implement as they wished, so there were multiple computer science programs and soon organisations such as CSTA or Computer Science Teachers Association, ISTE or International Society for Technology in Education and NAEP or National Association for Educational Progress developed technology or computer standards for the country that are followed by different countries around the world including the United Arab Emirates. In most schools, following the American international curriculum now in Abu Dhabi, high school technology education courses are offered once or twice a week that include website authoring, coding with Python, programming using blocks to create mobile apps, animations or robots and productivity applications like WORD, EXCEL, POWERPOINT and ACCESS and also computer science fundamentals such as history of computers, working of computers, data representation in computers and networking. In high school, one or two teachers are employed to teach many grade levels and many curricula simultaneously every year. Depending upon the latest available software and technology, every year the curricula for these different grade levels are also bound to change, which is definitely an issue with the

teachers having to be trained for the constantly updated courses, resulting in their limited content and pedagogical knowledge of these new and upcoming technologies. This problematic professional development of teachers teaching technology was foreseen as early as 1995 by Gal-Ezer et al (1995), and it exists to date as teachers need to be trained on a regular basis on the latest curricula in order to be able to engage students efficiently with the new educational technologies.

2.3.3 Assessment in Technology Education

In the United Arab Emirates, random yearly changes in curriculums for technology education is considered normal as there are no standardised exams with a set syllabus as compulsory requirements for the high school diploma, which causes students, their parents and even teachers to not take the subject seriously and thereby, leading to the lack of student engagement in these classes. Schools do not consider technology education grades in the total average to affect grade promotion throughout primary, middle and even high school, again adding to the lack of seriousness for the subject. Schools select their own assessment standards, related to local relevance and assets, involving simple practical skills and debugging assessments with appropriate support for the design aspects, for the weaker pupils (Bell et al, 2010). Assessments must be taken into account by schools for the students and their parents to take them seriously, and they must be in varied forms, such as group or individual, simple or extended, theory or practical, oral, written or online, etc., so as to involve and thereby engage all kinds of students.

2.3.4 Technology Education and Careers

In order for some students to be engaged in technology education classes, they must be convinced that these classes will actually benefit them in their future careers. This is no easy task as Richard Riley, former US Secretary of Education, acknowledged when he stated as

early as 2004 during a hearing in the House of Representatives that students must be prepared for jobs in the future that never existed before, using the technologies not invented so far to solve problems that they don't even know about yet (Savenko, 2011). Accurately, the careers that exist now were not even thought of then, and while high school technology curriculum programs were changed to include understanding computer science concepts, design and processes of constructing programs to assist students make informed career choices (Bell et al, 2010), not much has improved from then to what is being offered today in the United Arab Emirates, where many schools follow the US curriculum as mentioned earlier. However, the perceptions of the subject and curriculum has seen a shift over the years as concepts such as computing, algorithms and logic that form the basis of programming are not only perceived as transferable to other academic fields but also expected to enable students to understand the ever-evolving technological world around them, which will make them creators of digital artefacts and not just passive consumers of information and technology. The International Technology Education Association (ITEA) 2000 & 2006, had asserted that the goal of technology education was to make students *technologically literate*, that is, to be able to understand technology conceptually, so that they may learn to use, manage and appraise new and upcoming technologies (Brown & Brown, 2010), in order to be informed and contribute to the society at all times (ITEA, 2003 cited in Brown & Brown, 2010; OECD, 2015). The universal language of computer science has shown promise to go beyond borders and cultures to empower students with 21st-century skills such as critical thinking, problem solving and collaboration to become global citizens in this high-tech era. In technology education classes, when students work as teams to compare and confirm, rationally arrive at feasible solutions with perseverance, in addition to honing their interpersonal skills to question, listen and develop articulate written accounts, it will go further than the programming languages learnt in

high school. These skills, in addition to resolving conflicts while socialising and co-existing, are as significant as technical skills in workplaces and all of these can be taught effectively, within the realm of computer science or technology education (Wolf et al, 2020). If technology teachers are not professionally trained to create engaging lessons and schools do not take initiatives to support these teachers and to promote engaging learning environments, students will fail to benefit from learning these technical and other 21st-century skills required for their future workplaces.

2.3.5 Demographics and Other Significant Factors Related to Technology Education

In recent years, the internet and technology have been used equally by both genders for learning and other purposes (Henderson et al, 2017). In the current study, no difference between genders is expected regarding student engagement in technology education classes. Gal-Ezer et al (1995), while developing their program for high school computer science, proposed that well-equipped labs that are spacious with good lighting, ergonomic seating and good network connections will allow qualified teachers to teach concepts with practical skills and embed abstract concepts into concrete ones, which are relevant considerations even to this day. A significant difficulty faced in their pilot study was the digital divide amongst the students, with some having more experience and encouragement to use digital devices at home than others. Over the years, some studies (Bergdahl et al, 2020) have reported mixed findings relating digital skills knowledge and technology use in schools, but Ng (2012) confirmed that informal technology use differs from use of the same for learning purposes. Therefore, it is expected that students of different socio-economic levels may not be engaged differently in technology education classes. However, some other factors, such as large class sizes with teachers having no technical assistance in classrooms and the inclusion of differently abled

students in mainstream classes with no formal teacher training, may pose problems with respect to student engagement in technology education classes.

2.4 Student Engagement and Technology Education

2.4.1 Engagement

Engagement, which is related to learning and achievement, presents optimistic evidence of being influenced by school and teacher practices; therefore, it becomes a concept that high schools usually focus on, specifically in school improvement programs (NRC, 2004; Hart et al, 2011). Trowler (2010) claimed that student engagement ensues from a collaboration of work, time and significant resources, involving students and institutions to enhance learning experiences and outcomes. It is a complex construct, as it is evolving and involves the participation of many, such as students, teachers, courses and institutions, with their facilities and support (Kahu, 2013).

2.4.2 Student Engagement in Technology Education

Student engagement is different in technology education classes when compared to that in normal classroom settings (Halverson, 2016; Bergdahl, 2020). Brown & Brown (2010) have related student engagement in technology education to personal, social and academic values; and assessments. On a personal level, knowledge of technology enables students with problem-solving, interpersonal skills, career awareness, the ability to choose appropriate products for one's needs, in addition to the ability to use and maintain technology (ITEA, 2000). Socially, it enables them to choose and assess technology, be informed citizens, recognise social and environmental impacts of technology and evaluate technology. On the academic front, the students will be able to integrate technology with other subjects and apply theory to practical knowledge. Assessment also plays a pivotal role in student engagement, as when students understand how they will be assessed, they will engage themselves in different

ways while learning about the technology. ITEA (2003) recommended three elements in assessment, namely, *cognitive*, which allows for description and application of one's knowledge; *psychomotor*, to display one's demonstrative knowledge and skills; and lastly, the *affective* element to demonstrate one's knowledge regarding impacts, consequences and critical views of technology. It can be noted that without significant engagement, students tend to lose out on many aspects during technology education classes as well as in the future.

It is necessary to review data related to the above elements of engagement to understand the concept better in relation to technology education. Sinclair et al (2015) reviewed quantitative data from key international student engagement surveys from universities such as National Survey of Student Engagement in US and Canada (NSSE), Student Engagement Survey in UK (SES) (also referred to as UKES) and University Experience Survey in Australia (UES), relating to technology education or computer science, only to discover it performing badly on various international standards, which instigated them to question the student interpretation of the surveys and survey suitability to the subject and suggested collecting qualitative data for deeper understanding. Computer education as part of STEM pedagogies shows evidence of less integration, reflection or intense learning experiences in their curriculum (Laird et al, 2011, cited in Sinclair et al, 2015). Furthermore, Morgan et al (2018a) studied computer science teachers' understanding of student engagement and students' responses to the surveys and reported poor ratings for student-teacher interaction, student support and teaching practices compared to other courses. The study informed that teachers focus mostly on the behavioural aspects of engagement, but as Trowler (2010) commented, it is not suggestive that students are engaged simply because they attend classes. On the other hand, disengagement can be understood to be more than mere lack of engagement (Wang et al, 2017) as it can include distractions due to online activities, poorly

designed educational activities or even shared devices between many students (Bergdahl et al, 2020). Most teachers felt that it was the students' responsibility to be interested and that engagement was not a mutual contract between the student and the institution. Also, they indicated many limitations in their capacity to motivate students, such as content and methods, specific to computer science studies.

These data are from survey instruments, which are self-reports and the worldwide method used to gauge engagement, but they also emphasise only the behavioural aspect and not the cognitive or the affective aspects of student engagement (Sinclair et al, 2015). They cannot really measure such a multi-dimensional concept or provide a holistic understanding of the same; therefore, additional quantitative and qualitative data must be collected to assess its length and breadth, individually and as groups (Fredericks et al, 2004; Fredericks et al, 2016). There is a lack of studies from high schools regarding engagement in computer education classes specifically, and these aforementioned studies were from teachers and first-year students pursuing computer science courses in universities. It is a cause for concern that they lack engagement even after choosing it as a career, so it is imperative to identify the issues in high school itself and work on interventions, so as to give students a clear picture of the subject itself and make informed career decisions. Students' perspectives, teaching methods and the survey instruments must be investigated further to get a better picture of student engagement in technology education classes. Hart et al (2011) addressed the school student engagement survey called the SESQ or Student Engagement in Schools Questionnaire, that looked at similar components to the NSSE, UKES and UES surveys such as affective, behavioral and cognitive engagement related to schools, motivational beliefs, society and outcomes (*Please refer to Appendices Fa, Fb, Fc*); and TERF-N or the Teacher Engagement Report Form – New, that looked at teacher perspectives of student engagement in schools,

confirmed their utility for school intervention for students at risk and general prevention programs (*Please refer to **Appendix H***). They also proposed detailed students', teachers' and parents' reports to acquire multiple perspectives of student engagement. The involvement of parents can have special relevance currently, as they, along with the students, have experienced online learning and may provide special insight regarding student engagement. Morgan et al (2018b) suggested using multiple different methods to gather data that include student and teacher surveys, interviews, observations and experience sampling methods. In their study to align teachers' and students' perspectives on student engagement, they looked at international surveys that had the common themes of academic learning, learning environments, support from institutions, teacher quality, skills development and extracurricular activities for the students. For the teachers' perspectives, they looked at student engagement during different teaching methods, workloads, teacher attitudes to learning, teacher-student interactions, and class time management. They reported poor performance of computer science over the past few years, with the future also looking bleak, especially in areas related to skills transfer, analysis and knowledge application, in addition to disinterested academic staff. Students' perspectives differed from those of teachers, as they believed that both students and teachers were responsible for their engagement. The students preferred practical and work-related content and emphasised the importance of qualified and accessible teachers. An interesting finding in this study was that, students could not connect content or skills from other subjects, which was alluded to, in an earlier study by McCormick (2006), who stated that technology teachers assume students have conceptual knowledge from other disciplines for the topics they plan to teach, as the constructivist view tells us that students can apply the general knowledge they learn anywhere. This is tricky in high schools for teachers and students as concepts explained by a subject specific teacher may be from a different

perspective than a technology education teacher, and especially in the United Arab Emirates, where students migrate from many schools and countries and are on different knowledge levels and therefore, pose difficulties in teaching and learning. Qualified teachers with knowledge of the philosophy of technology can explain topics in relation to other subjects, in addition to shaping the curriculum, creating ideal learning environments, and with their conceptual understanding of technology, they can respond aptly during unexpected situations in class (de Vries, 2016). Also, teaching concepts with meaningful activities related to students' daily lives is a good way for them to connect them to individual or community values (Hoffman et al, 2019). Students who think logically or who cannot be creative in solving problems will be drawn in when real-life scenarios are incorporated into technology lessons, thereby building on their soft skills development (Harris & Rogers, 2008). Evidently, it is significant to involve teachers in the designing and implementation of curricula in addition to providing them with timely and relevant professional development.

With this review of relevant literature in the field of technology education and student engagement, a concerning picture from an international perspective has been depicted with the surveys from the first year university students pursuing computer science, highlighting the issue of disengagement in technology education classes in high schools resulting in poor understanding of the subject and thereby, choosing the wrong majors or not being able to follow basic CS courses in university. Major contradictions have also been brought to light in this literature review, with some suggesting that technology and technology education will engage the digital natives as they are accustomed to technology, but others indicate that there is lack of evidence proving the same with different students interacting with technology differently ranging from positive to negative and also indifferent reactions.

This review clearly highlights the limited research worldwide on student engagement and technology education, as well as the complete absence of research in the Middle East on this topic in universities and schools. While this review has provided a glimpse of the local United Arab Emirates scene, based on personal experiences of the researcher and informal discussions of the researcher with peers, it also gives us a hopeful message in terms of student engagement pliability with change in policies, practices and relationships, which remains to be explored with research within the UAE context. Quantitative and qualitative data looking at students' and teachers' viewpoints were collected and analysed in an unbiased manner to look into students' experiences and attitudes; teachers' experiences, attitudes, training, professional development; and suitable policies with respect to school attitude, infrastructure and curriculum. These data will allow to appreciate the perspectives of the students and the teachers, who are the primary stakeholders in this study and understanding their challenges and suggestions for solutions will help answer the research questions posed in the introduction chapter. It will also address the gaps in the literature with respect to student engagement in technology classes in high schools and in the Middle East. A methodology chapter follows, discussing the approach and methods in detail that were used to answer these questions.

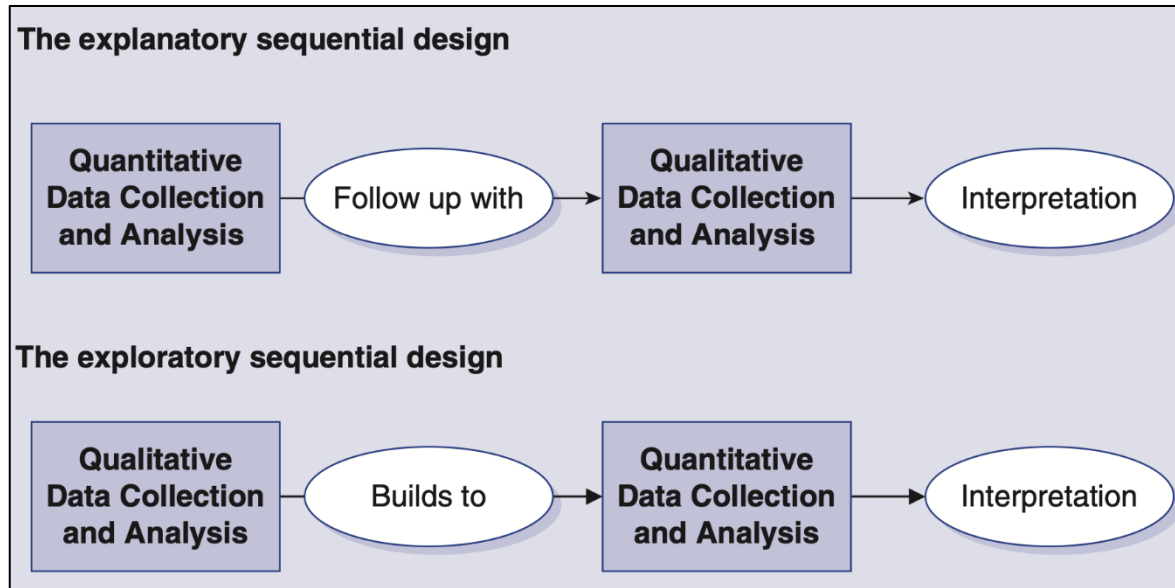
Chapter 3 - Methodology

3.1 Research Approach

The three main research approaches include the quantitative approach, the qualitative approach and the mixed methods approach, which combines the former two (Johnson & Christenson, 2014). Before getting into a detailed discussion regarding the mixed methods approach used in this study, it seems necessary to briefly explain the approaches it combines. The *quantitative approach*, also known as the *confirmatory* approach, consists of experimental research, which is used to identify if a particular action impacts a consequence and uses real experiments with random sampling or less precise experiments known as quasi-experiments with nonrandom sampling; and non-experimental methods such as surveys that study a sample of a population to compare groups and find causes that have occurred or to describe and measure relationships between variables and also examine trends with longitudinal studies, all of which can be used to generalise to the population studied (Creswell & Creswell, 2018). *Qualitative or exploratory approach* works inductively to explore or discover situations or phenomena to understand people's perspectives and experiences and to develop theories or hypotheses based on open-ended observations (Johnson & Christenson, 2014). Such an approach requires in-depth, unobtrusive and extensive studying of natural settings of human behaviour that change dynamically, using observations, interviews and documents as data and resulting in rich, descriptive and detailed reporting, but analysis cannot be generalised beyond the sample being studied.

Considering the nature of the current research study, the *mixed methods approach* was ideal to collect and evaluate various types of data rather than using just one of the above approaches (Fraenkel & Wallen, 2009). This approach, which as mentioned before, is a combination of the qualitative and quantitative approaches based on two dimensions; namely, *time orientation*,

which indicates whether the qualitative and quantitative methods work *concurrently or sequentially* in the research approach; and the *approach emphasis*, which refers to whether the qualitative or quantitative methods are given equal emphasis to answer the research questions and interpret the findings; or whether one approach has more importance than the other. In the mixed methods research approach, quantitative and qualitative methods, means, processes, perceptions and other features are combined to produce a research design that will enhance their strengths and diminish their weaknesses. There are two sequential designs, namely the *explanatory sequential design*, which collects and analyses the quantitative data first followed by collecting the qualitative data, which is based on the results of the quantitative data and the *exploratory sequential design*, which starts with collecting qualitative data and based on these results, conducts a quantitative study to confirm them (Creswell & Clark, 2006). The current study followed the explanatory sequential mixed method design with a quantitative non-experimental survey design to study the relationship between achievement and student engagement in technology education lessons in high schools, and followed by a qualitative phenomenological design with interviews, observations and document analysis, to describe student and teacher classroom experiences and explore both their perspectives regarding student engagement in technology education classes. The qualitative part of the research has more emphasis, therefore, it is also a qualitative driven mixed methods design, as it aims to gain validity using triangulation of the qualitative methods, in addition to complementing and developing the quantitative results of levels of engagement with qualitative data to identify reasons for engagement and disengagement, following it up with teachers' and students' suggested strategies to alleviate causes of disengagement.

Figure 4*Two Types of Sequential Research Designs*

The quantitative approach works on the philosophy of *post-positivism*, which guides scientific methods of research and challenges the traditional idea of positivism that states there is absolute truth in knowledge, stating that this is not completely possible when studying human behavior and actions; while the qualitative approach works on the philosophy of *constructivism and social constructivism* along with *interpretivism* to develop subjective understanding of ones' experiences within their own reality with many, different and complex interpretations related to history, culture and society (Johnson & Christenson, 2014). The mixed methods approach, however, works on the philosophy of *pragmatism*, which follows the pluralistic approach that allows the combining of research components to solve the research problem and answer the research questions in particular research situations. The current study followed this philosophy, which places no antecedent restrictions on quantitative and qualitative assumptions, methods, data collection and analysis techniques to meet the

purpose and obtain deeper insights into the research problem. Its proponents assert that whatever methods work must be employed to answer the imminent research questions (Fraenkel & Wallen, 2009). Pragmatism emphasises that research is always contingent upon its various contexts, such as social, political, historical, etc., contexts and thereby, it acknowledges different perspectives and methods to get a complete picture (Creswell & Creswell, 2018). This philosophy guided the current study in the technology education context, where students as digital natives are surrounded by technology, and teachers use the ever-evolving technologies and related curricula to engage them. This study explored the engagement of high school students in technology education classes, and the pragmatic worldview seems the ideal choice to first identify the relationship between student engagement and performance in these classes and then review the personal experiences of the students and their teachers with respect to their engagement in the technology education classes. Quantitative surveys are disruptive to use in active learning, so in this study, it was used to measure student engagement only after the actual activity had occurred, while qualitative observations were used during active learning, but only at a distance; however, it was not easy to measure. Using either the quantitative or the qualitative approach on their own will not provide a holistic picture to understand the context and experiences of the students and their teachers in their specific settings.

3.2 Research Methods

3.2.1 Site/Context

The UAE Ministry of Education published the Computer Science Standards for K-12 in 2015 which acknowledged that computing and programming were essential skills for success in life (Wang, 2020). Students in high school (Grades 9-12), it said, must be able to

use technology to develop enhanced understanding of other subjects, their environment and the world, in addition to being able to integrate technology into their everyday learning and lives. They must also be able to appreciate the capabilities of different technologies and recognise their use in lifelong learning and in different fields of work, so as to plan their careers to suit 21st-century workplaces. Such a policy and implementation will work to enhance access to technology education, but a lack of engagement in the classes will cause problems, as this subject will be considered boring, and these policies without effective implementation do not guarantee student success.

This study was conducted in five private schools in Abu Dhabi following the school-based International/American curriculum with and without international external examinations such as the International General Certificate of Secondary Education (IGCSE) to explore high school students' and teachers' perspectives on student engagement in technology education classes. Even though permissions to conduct this study were granted by the researcher's university in December 2021, data could be collected from June 2022 to May 2023, as the schools had only started to function with face-to-face classes that academic year following the Covid-19 pandemic and were allowing outsiders inside after several precautionary measures.

In the wake of the COVID pandemic, schools began having face-to-face classes; however, they were only gradually opening classrooms that were used by multiple groups of students, such as art rooms, music rooms, science and technology labs. During data collection, technology education classes in most of the schools studied were running in the regular classrooms with students having access to their own devices, and the curriculum was adjusted to suit this kind of setting. Previously, students used to have these classes in technology labs with networked personal computers. One school, where the researcher used to work, was more advanced in teaching technology as they offered courses in robotics, 3D printing, Arduino and

other innovative software to high school students, but this was before the COVID-19 pandemic. During the pandemic, however, this school offered technology education as an elective along with physical education, music and art subjects when classes were online and later too, when they went hybrid for a term and students could choose to be at school or at home.

3.2.2 Population, Sampling & Participant Selection

A total of 516 high school students and 12 technology education teachers participated from five private schools in Abu Dhabi, UAE. In order to maintain the anonymity of the participants in this research, the names of the schools and the student and teacher interviewees will be identified with pseudonyms such as SAC1, SAC2, SAC3, etc. and SIG1, SIG2 for the schools following the international/American and IGCSE curriculum, respectively. School SAC1 follows the international/American curriculum with formal and summative assessments based on the school policies. 125 students and 2 teachers from this school participated, with 72 students from grade 9, 25 students from grade 10 and 30 students from grade 11. 90 students and 2 teachers from school SAC2 participated with 36 students from grade 9, 35 students from grade 10 and 19 students from grade 11. This school also follows the international/American curriculum, and the school decides the topics based on international standards for the subject in grade 9 with internal assessments and in grade 10, some students may continue with internal assessments for their high school diploma while others may choose to follow a standardised international syllabus and opt to sit for external examinations such as the AP exams in grade 11 or 12. 160 students and 4 teachers from school SAC3 participated with 57 students from grade 9, 34 students from grade 10 and 69 students from grade 11. This school follows the international/American Curriculum with no external examinations or a set curriculum for the high school diploma. In this setting, the school decides the curriculum, centered on

international standards for the subject, with formal and summative assessments based on the school policies. Grade 9 and 10 in this school have technology education as a mandatory subject, while in grade 11, students can either choose their streams for the high school diploma with technology education or choose to do the IB diploma program, which does not offer technology education. 71 students and 1 teacher from school SIG1 participated, with all students only from grade 9. No students from grade 10 were able to participate from this school as their external exams were going on when the researcher was given permission to conduct her study. This school is training the students from grades 9 and 10 for external exams, and they follow the IGCSE ICT curriculum from Cambridge in these grade levels, and most opt to sit for the external examinations in grade 10. Some students study this standardised curriculum but may decide not to sit for the exam. 68 students and 3 teachers from school SIG2 participated, with 39 students from grade 9 and 29 from grade 10. This school offered two courses, namely ICT IGCSE from Edexcel Pearson and Computer Science from Oxford AQA. This school is training the students from grades 9 and 10 for external exams in these grade levels, and most opt to sit for the external examinations in grade 10. As mentioned before, some students may study this curriculum but decide not to sit for the exam.

A convenient, purposive and comprehensive sampling selection was done from these five schools, from a population of 20,000 high school students and teachers in private schools in Abu Dhabi from grades 9, 10 and 11, where grade 9 students either following the school based international/American curriculum or opting to do the IGCSE exams in grade 10; grade 10 students either following the school based international/American curriculum with no external exams or appearing for external exams such as IGCSE or AP; and grade 11 students following the school based international/American curriculum and have opted for a stream including technology with no external exams were selected. Purposive sampling is the

intentional selection of participants who experience the concept being studied (Fraenkel & Wallen, 2009) and this study uses this sampling because these high school students and teachers from private schools can provide the required information needed, to check if factors such as external assessments such as International General Certificate of Secondary Education (IGCSE) or choice (choosing the subject from many others) among other factors, influence student engagement in Technology Education classes. The sampling is also comprehensive as all relevant factors, such as the technology teachers, the technology lab settings, the network infrastructure, the IT support, the curriculum, etc., will be studied in the research in order to obtain a complete picture. The sampling design follows an identical, sequential orientation, where the same participants participate in the quantitative phase and also in the qualitative phase for observations. For the teacher interviews and student focus group interviews in the qualitative phase, convenience and purposive sampling were used from the same grades, depending on their availability and consent.

3.2.3 Data Collection Tools

Many methods, such as surveys, interviews, observations, and focus group interviews, were employed to collect data that help provide answers to the research questions. This will allow for triangulation of data collection methods, thereby increasing validity.

Quantitative Data Collection Method

Teacher and Student Surveys

Surveys are a popular and convenient quantitative data collection method that provides information about teaching and learning environments as well as students and teachers (Morgan et al, 2018b). They can be used to study the unseen factors as reported by the students regarding their engagement during learning, such as their emotional experiences, their intellectual energies and strategies (Appleton et al., 2006). Surveys would be disruptive if tried

during activity, and although surveys are the convenient option to get information about students studying afar, they are not completely reliable, as either students may not understand the survey questions correctly, or their responses may not correspond to their experiences in real time (Henrie et al., 2015). Also, changes in student engagement throughout the duration of the activity cannot be determined with surveys.

The teacher and student surveys used in this study were adapted from the online surveys developed by the Innovation and Technology in Computer Science Education (ITiCSE) Working Group in 2018, which were created to obtain perspectives regarding the low computer science scores on international engagement surveys such as the National Survey of Student Engagement or NSSE in North America, the United Kingdom Engagement Survey or UKES and the Student Experience Questionnaire or SEQ in Australia from first year students in universities (*please refer to **Appendices Fa, Fb and Fc***). The Faculty Survey of Student Engagement (FSSE) was also developed for teachers in North America to gather their perspectives (*please refer to **Appendix G***). These surveys were approved by the university research ethics committees of Monash and Massachusetts Amherst universities, and the researchers of that study have tested their validity (Morgan et al, 2018b). For the current study, the surveys were adapted to suit high schools and the UAE culture. The surveys for students and teachers were implemented first in the study which include a demographic part to obtain age, gender, nationality etc., a numerical rating scale ranging from 0 (completely disengaged) to 10 (completely engaged) in order to identify the level of engagement in the technology education classes (the extent students feel engaged or disengaged) and an open-ended qualitative part based on the conceptual framework, to explore their understanding of the construct of student engagement and factors influencing their levels of engagement. Student grades were collected from their technology education teachers to check for any correlation

between them and their self-reported engagement levels in these classes. Academic achievement correlates with student engagement, and if engagement can be used to foresee achievement, then performance can also be an implied assessment of engagement (Henrie et al, 2015). However, students may also perform well due to other reasons and not because they are engaged in the lesson.

Students' names were collected in the surveys in order to contact them for consented subsequent focus group interviews with the promise that their names would not be published anywhere (*please find attached the current student and teacher surveys as **Appendices A and B***).

Pilot Study

A pilot study for the survey design was conducted in the researcher's school itself, with one specialist technology education Head of Department (HOD) who is also a grade 12 technology education teacher; one high school technology education teacher and ten grade 9 students to gain construct validity. Construct validity is the extent to which a high-order construct, such as student engagement, is denoted in the study (Johnson & Christenson, 2014). This can be understood using *operationalism*, where the construct can be explained as a set of operations or measures. The draft tool was reviewed by these teachers to comment on the relevance of the study and ensure content validity, which is to check if all relevant and possible questions have been asked. Some questions were altered, and others were removed or added, all to be more significant to the study as well as to ensure a clear understanding by the students. The comments of the pilot study participants helped provide clarifications before the final study, and the pilot study itself was helpful to predict the timeline for the final study and also to know the frequency of site visits required.

Qualitative Data Collection Methods

Qualitative methods use direct or video observations of students in classes, individual or focus group interviews, document/recording analysis and sort these data according to existing frameworks or themes (Henrie et al, 2015). These measures aid in studies exploring a multi-construct, such as student engagement, from an inductive point of view. However, these methods are extensive in terms of collecting data, measuring and analysing.

Student Focus Group interviews

Interviews provide rich information regarding the perspectives of teachers and students and also aid in explaining their responses in the surveys. In this study, focus group recorded interviews were hoped to be done with groups of homogenous students from each grade level (9-11) to dig deeper into their level of engagement in technology education classes. The homogenous groups were to be either highly engaged or highly disengaged students, as self-reported in the surveys. However, in four schools, due to school restrictions, it was difficult to assemble students from many different classes. Therefore, the groups were heterogeneous, with highly engaged and highly disengaged students sitting together. The researcher, however, positioned them separately and posed the questions to them as two separate groups in one setting. In the fifth school, the researcher was unable to conduct the focus group interview as it was the end of the academic year, and students had exams by the time the researcher got permission for entry into the school. The researcher tried to get permission again the following academic year, but as it had changed, the previously surveyed and observed students had moved to the next grade level, and the school claimed that it was difficult to get these students together for interviews as they were in different classes now. The school had asked the researcher to collect the interview questions as a document and email them to the students through the school for them to directly reply to the researcher, who can then email the students

any follow-up questions. However, the researcher received no responses from the students even after four months of constant reminders to the school administration.

In this study, the interviews explored the perspectives of the students regarding their reasons for engagement as well as disengagement in technology classes and strategies to increase their engagement. The interviews were recorded (with IRB approval and informed consent from the students). Open ended questions along with probes, included in the focus group interview protocol, that are related to the teacher and student surveys were asked in these interviews. The interview questions were divided into two main sections. The first section included questions relating to the students' understanding of the term *student engagement*, activities in technology education classes that engage or disengage them, initiatives they believe their school or teachers take to promote their engagement and any specific characteristics they believe that may be related to the subject or students opting for the subject. The second section discussed class activities, personal attitudes, learning skills, teacher attitudes, teacher support, and transfer of skills to other subjects (*please find attached the Student focus group interview guide protocol as **Appendix C***).

Sometimes, the comments used to go beyond the scope of the interview, and the researcher had to bring back the focus to the question asked. Some students had a lot to say, while others were either quiet or just agreed with what others said. Overall, these interviews were very informative and gave insight into the perspectives of these students as they were engaging with each other, the teacher and the lesson in technology education classes. They complemented the other data collection methods to provide further information; however, the results cannot be generalised due to small samples.

Teacher Interviews

Interviews in qualitative studies are in-depth interviews with probes for greater clarity from the interviewees. A semi-structured interview guide was used to interview technology teachers to explore specific topics identified in the teacher and student surveys with open-ended questions. These interviews were also recorded (with IRB approval and informed consent from the teachers). An interview guide protocol was used, but the questions were not asked in the same order as the protocol, and were followed with prompts to obtain the required data, which resulted in an evolving activity with openness and fluidity. As these interviews followed the surveys, they explored the perspectives of the teachers regarding their reasons for students engagement/disengagement in technology education classes, their thoughts on the student survey responses, their personal strategies to increase engagement and any specific characteristics they believe that may be related to the subject or students opting for the subject (*please find attached the Teacher interview guide protocol as **Appendix D***).

Observations

In a qualitative research approach, the researcher is also a data collection tool. Observations in this study allowed the researcher to validate data obtained from the surveys and interviews. A significant advantage of observations in research is its capacity to assess student engagement as it takes place in the technology education classes without any disruption or assessing it later, as with surveys (Henrie et al, 2015). Such a qualitative method is ideal to use for data collection in order to explain the kind of engagement during any activity for a short period of time, while the frequency of occurrences and variance in engagement over time can also be noted. In this study, the researcher assumed two roles, one of the *observer-as-participant* and the other as a *participant-as-observer*. In both roles, the participants are aware they are being observed, but in the former role, observations are few

and brief to maintain the objectivity of the study. However, not much information will be gathered regarding the students' perspectives. On the other hand, as the latter *participant-as-observer* role, information can be recorded as it occurs as the researcher is more involved as a participant and spends more time at the site, however participants may behave differently as they are aware of being observed (Hawthorne effect) but this can be solved once the researcher develops a good rapport with them (Baxter & Babbie, 2003; Johnson & Christenson, 2014). In the school where the researcher previously worked, this role was assumed easily; however, in the other four schools, the researcher did notice the students being initially conscious of the researcher's presence in the class.

The researcher observed the students during their technology education lessons as they were interacting with each other, their learning resources/devices and their teachers. As mentioned earlier, most of these lessons were held in regular classrooms and not technology labs, with students' own devices such as laptops or tablets. The researcher documented student and teacher behaviour as field notes from observations in different grades in the schools using the observation checklist and protocol, which was transcribed as soon as possible, so as to identify even the nuances that occurred during the lessons. A basic observation checklist and protocol were developed initially but amended based on the surveys and the pilot study. As the observer-as-participant, the key observations included the start and end of the lesson with student responses and the middle of the lesson noting the variations in student engagement and student responses, while the researcher as the participant-as-observer looked at students' attitudes towards the activities; their interactions with each other and the teacher; and their distractions/frustrations related to the activities, teacher or resources/devices, if any (*please find attached the basic observation checklist/protocol as Appendix E*).

Documents

School (Information & Communication Technology) ICT Policy & Curriculum

For this study, the School ICT policy and ICT curricula were reviewed and used to support the primary data collected using interviews and observations. The policy will elaborate on the suitability of the school infrastructure to technology education, teacher qualifications, professional development, IT support, network capacities, technology lab layout, firewall, etc. The curriculum will give an idea of the range and scope of the topics covered by the high school grade levels, learning resources and assessment methods used to evaluate student performance.

Student Achievement Records - Grades in technology education

Term averages of student survey participants from all five schools were collected to identify any correlation between their levels of engagement and their performance in technology education. This will help predict if low levels of engagement result in low performance and high levels result in high performance.

3.3 Data Analysis

3.3.1 Quantitative Analysis

Survey data between the self-reported levels of engagement and the document data regarding student achievement will be plotted to check if linear, which will ensue the computation of the *Pearson Correlation Coefficient*, and if this coefficient is much different from zero, it is considered statistically significant. However, many other unrelated variables, such as familiarity with technology at home, career preferences, background, etc., may also cause the perceived relationship, and it becomes essential to follow up with qualitative data and analysis to obtain a holistic picture of students' experiences in technology education classes.

3.3.2 Qualitative Analysis

In this study, many strategies such as coding, theme generation and pattern exploration were used to analyse the data. Data, which is *transcribed* from the field notes in observations and interview recordings and also the qualitative part of the survey data, was reviewed to identify significant statements; and meanings were interpreted, which were sent back to the participants for *member checking*. Patterns emerged during the data collection itself, and the data analysis was done simultaneously. Patterns were *coded*, and the researcher looked for common *themes* in the interpreted data and described features experienced commonly by all participants, which were also sent for member checking. A rich descriptive report of the teachers' and students' experiences in the technology education classes follows this section for the analysis of a phenomenological qualitative study, where the patterns can be described from the participants' perspectives and explained enough for readers to understand the essence of this experience.

3.4 Ethical Considerations

Participants' rights, values and needs were respected at all times during the current study. According to the BUiD research ethics manual, the researcher is responsible for conducting ethical research at all times and focus on key principles such as voluntary participation, research that has maximum benefit with minimal risk to participants, informed participation, anonymity and confidentiality of participants respected, integrity maintained and research without any conflicts of interest. The research ethics form was submitted to the university research review committee for approval, with information regarding the purpose of and rationale for the research, the selection of participants, research design, data collection methods and analysis, risks and benefits involved, methods to maximise benefits and minimise

risks, methods to ensure researchers' protection, procedures for informed consent, anonymity and confidentiality, expected outcomes and potential conflicts of interests with others. All ethical considerations were discussed with the research supervisor prior to the submission of this form, and risk levels were identified, according to the guidelines of the British University in Dubai. Once reviewed and approved, informed consent letters were sent to the schools with full disclosure of the study with its purpose, methods, data use and data access details mentioned along with the participants' rights, their acknowledgement of its protection and agreement to participate. The letters also included a declaration of maintaining the participants' anonymity and confidentiality, in addition to their right to withdraw from the study without any consequences. Since this research imposes low to minimal risk owing to its participants being students and only minor inconvenience with respect to surveys, observations and interviews, it was approved by the university committee and the schools, and the participants consented to it.

To maintain the internal validity, this study used *triangulation* of data from surveys (to enhance reliability) and interviews, observations and focus groups which is also known as methodological triangulation, where the same research questions can be answered using different methods and data types (Denzin, 1978 & Jick, 1979, cited in Fraenkel & Wallen, 2009). In addition to this, *member checking* (to ensure interpretive validity), which is the sending back of the researchers' interpretations of the interviewees' statements to them to ensure true meanings; and acknowledging the *researcher's bias* and practice of *reflexivity* to *bracket* one's biases to gain essence of the study (Creswell & Creswell, 2018; Johnson & Christenson, 2014), contributed to internal validity of the study. External validity and reliability were ensured by providing a rich and detailed descriptive report of the data collection methods and analysis. With mixed methods, *meta-inferences*, which integrate the

quantitative and qualitative inferences was also made, as in this study, the researcher provides the outsider or the *etic* viewpoint along with the teachers' and students' insider or *emic* viewpoint, thereby, having both perspectives and resulting in rich descriptions and explanations of the study (Johnson & Christenson, 2014).

Chapter 4 - Results

Overview

This chapter looks into results from the quantitative and qualitative aspects of the surveys, in addition to those from the qualitative focus group students' and individual teachers' interviews, observations of technology education lessons and documents such as subject curricula, school ICT policies and student achievement records. The quantitative surveys provide the students' self-reported engagement ratings in technology education classes, which are used to select students for the homogeneous focus group interviews, and also some qualitative data, which are used to formulate the interview questions for students and teachers in line with the student responses.

This overview explains the participating schools, the number of participants in students and teachers, their references, the types and number of samplings conducted. The surveys were collected initially, which yielded valid results from 516 high school students, of which 277 students were from grade 9, 124 students from grade 10 and 117 students from grade 11, in addition to 12 high school technology education teachers from five different private schools in Abu Dhabi. Between March 2022 and May 2023, a total of 29 observations in all these five schools preceded the eight follow-up focus group interviews with high school students from grades 9, 10 and 11. However, these interviews were conducted in only four of these schools due to time and permission constraints owing to post-COVID-19 policies. During this same duration, only ten follow-up teacher interviews were also conducted, as two teachers refused to participate later. Documents such as school ICT policies, curricula and student achievement records were also accumulated for analysis from these five schools. In order to maintain the anonymity of the participants in this research, the names of the schools and the student and

teacher interviewees will be identified with pseudonyms such as SAC1, SAC2, SAC3 etc. and SIG1, SIG2 for the schools following the American and IGCSE curriculum respectively; FTAC910, FTIG911, etc. for female teacher interviewees and MTAC910 and MTIG9 for their male counterparts teaching American or IGCSE curriculums. Students will be mentioned as male or female students along with their grade levels.

The results from the quantitative aspect of the surveys will be discussed in section 4.1, which will be followed by the results of the qualitative methods in section 4.2. The quantitative aspect in the survey is the self-reporting of their engagement in technology education classes by the students to investigate if it correlates with their achievement in the subject. It can be assumed that the better the engagement, the higher the achievement. This, in turn, endorses the study to further explore the factors that enhance the engagement of students in these lessons through their own perspectives and those of their teachers. The students' and teachers' perspectives mentioned in the qualitative aspect of the survey were further explored using qualitative methods such as observations, focus group interviews, teacher interviews and documents. The recurring ideas and topics were coded as follows:

- Student and teacher reasons for high and low student engagement
- Technology education topics and activities
- Technology teachers' attributes
- School initiatives for student engagement in technology education
- Other issues related to student engagement in technology education.

And these codes were grouped into the following themes:

- **Factors influencing engagement**, which included the codes: student and teacher reasons for high and low student engagement, and other issues related to student engagement in technology education.
- **Curriculum** for topics and activities
- **Influence of teachers on engagement** for teacher attributes and
- **Institutional support for** school initiatives for student engagement in technology education.

4.1 Quantitative Results

4.1.1 General Information from the Surveys

This section provides an understanding of the schools that participated in this study; the gender, years of experience and grade levels of the teachers; and the gender, grade levels and ethnicity of the students who also participated.

Schools

The five schools that participated included private schools that were situated in different parts of Abu Dhabi city. Permissions were sought from the schools' managements, and all required documents, including the ethical guarantee from the university, the self-introductory form and the police clearance certificate of the researcher, were submitted. These schools worked under the supervision of the Ministry of Education of Abu Dhabi but were allowed to follow their own curricula, implementation, and assessment methods. These schools had just started to function normally after one year of online and another of hybrid learning, following the COVID-19 pandemic. Computer lessons were conducted in classrooms in some of these schools, with students using their own devices, as computer labs have students from many classes using the same school's personal computers.

Teachers

Table 1

Data of High School TE Teachers Surveyed/Interviewed for the Study

Teacher Code	Gender	Years Of Experience	Interviewed (I) Surveyed(S)	Teacher Of Grade	School Code
FTIG910(ICT)	Female	13	I/S	9/10	SIG1
MTIG9	Male	5	I/S	9	SIG2
FTIG910(CS)	Female	16	S	9/10	SIG2
MTIG10	Male	18	I/S	10	SIG2
FTAC911	Female	1	I/S	9/11	SAC1
FTAC10	Female	12	I/S	10	SAC1
FTAC1011	Female	10	I/S	10/11	SAC2
FTAC910	Female	10	S	9/11	SAC2
FTAC1112	Female	17	I/S	11/12	SAC3
FTAC9	Female	5	I/S	9	SAC3
MTAC91011	Male	3	I/S	9/10/11	SAC3
FTAC1011	Female	15	I/S	10/11	SAC3

Table 1 displays the data of the high school teachers who participated in this study, their gender, years of experience, the grade levels they teach, along with their teacher and school codes. Out of the 12 teachers, 75% were female and 25% were male. 67% of these teachers had 10 or more years of experience, and 33% had less than 6 years of experience. 67% of these teachers taught the international American curriculum with in-school teacher-made assessments, and 33% of teachers taught the IGCSE curriculum with external board exams.

Students

The following tables display the demography of the students from their survey responses in terms of grade levels, gender, ethnicity and economic status.

Table 2*Number of Students Surveyed Per High School Grade Level*

Grade Level	Number of students
Grade 9 – American	164
Grade 9 – IGCSE (external exams)	111
Grade 10 – American	95
Grade 10 – IGCSE (external exams)	29
Grade 11 – American (streamed)	117
Total	516

Table 2 displays the number of student participants based on their grade levels in the survey with respect to their curriculum. There was a total of 516 high school students surveyed from 5 private schools in Abu Dhabi. There were 164 grade 9 students following the international curriculum with American standards (also referred to as American curriculum), with in-school teacher-made assessments, and 111 students from the same grade level following the 2-year IGCSE curriculum with external exams in grade 10, which is 53% of the total participants. There were 95 grade 10 students following the international curriculum with American standards and in-school teacher-made assessments, and 29 students from the same grade level following the 2-year IGCSE curriculum with external exams in the current year, which is 24% of the total participants. There were 117 grade 11 students following the international curriculum with American standards and in-school teacher-made assessments, which is 23% of the total participants. 73% of students followed the international curriculum with American curriculum, with teacher-made in-school evaluations, and only 27% of students followed the IGCSE curriculum with external board exams.

Table 3

Number of Girls and Boys Surveyed Per High School Grade Level

Grade Level	Girls	Boys
Grade 9	108	167
Grade 10	64	60
Grade 11	49	68

Table 3 compares the number of boys and girls surveyed from these schools. 57% of the students were boys and 43% were girls.

Table 4

Number of Students Sharing Their Devices at Home Per High School Grade Level

Grade Level	Sharing	Non-sharing
Grade 9	48	229
Grade 10	21	103
Grade 11	20	97

Table 4 compares the number of students sharing their devices at home with those not sharing, surveyed from these schools. The number of non-sharers is higher in all grades.

4.1.2 Pearson's Correlation Coefficient

The results from the quantitative aspect of this study are reported in this section, where Pearson's Correlation Coefficient is calculated for each grade level of students in the two curricula, namely the IGCSE and the international American curriculum, to identify the relationship between their engagement in technology education classes and their achievement or final term average in the subject.

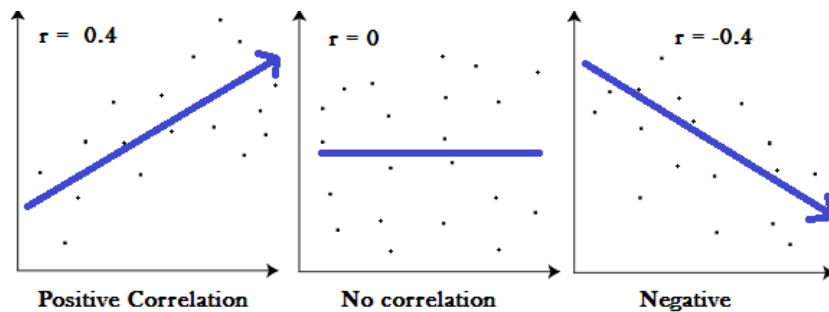
A correlation between two sets of data shows their linear relationship and determines how strongly related they are. In statistics, the most commonly used measure is the Pearson

Correlation Coefficient, and it is represented by the letter r (Berman, 2016). The coefficient formula returns a value between -1 and +1:

- a strong positive relationship is indicated by +1 (A correlation coefficient of 1 indicates an increase of a fixed proportion in one variable for every increase in the other)
- a strong negative relationship is indicated by -1 (A correlation coefficient of -1 indicates a decrease of a fixed proportion in one variable for every increase in the other), and
- zero indicates no relationship at all (zero indicates any increase in one variable does not result in an increase or decrease of the other, and the two variables are not related).

Figure 5

Graphs for a correlation of -1, 0 and +1



Note. based on Berman (2016)

The higher the absolute value of the correlation coefficient, the stronger is the relationship between the variables. However, the Pearson coefficient has its flaws as it cannot

differentiate between independent and dependent variables. Therefore, one must be cognizant of the kind of data being input and its eventual analysis (Berman, 2016).

The formula to calculate the Pearson's Correlation Coefficient (represented by r) is

$$r = \frac{\sum ((x - \bar{x}) (y - \bar{y}))}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

where,

x is the x variable sample

$\bar{x}$ is the mean of the values in the x variable

y is the y variable sample

and

$\bar{y}$ is the mean of the values in the y variable

The following paragraphs report the Pearson's Correlation Coefficient for grades 9, 10 and 11 in schools following the international curriculum and grades 9 and 10 in schools following the IGCSE curriculum. Before performing the correlation, the data was cleaned to remove errors and checked for outliers. The variables, namely the rating for the student level of engagement (1-10) and the final term grades for technology education assessments (0-100), were measured on a continuous scale (interval), which met the assumption for level of measurement for the correlation coefficient.

*Please refer to **Appendix N** for detailed calculations of Pearson's correlation coefficients.*

Grade 9

From the schools following the international American curriculum, the survey results of 158 grade 9 students rendered the Pearson's correlation coefficient of 0.09. This indicates a **weak but positive relationship** between the student self-reported engagement level and their achievement in grade 9 high school students following the international American curriculum in Abu Dhabi private schools with $r(156) = .09, p = .27$.

From the schools following the IGCSE curriculum, 70 grade 9 students' survey results rendered the Pearson's correlation coefficient of 0.34. This indicates a **weak to moderate but positive relationship** between the student self-reported engagement level and their achievement in grade 9 high school students following the IGCSE curriculum with external exams in Abu Dhabi private schools, with $r(68) = .34, p = .003$.

Grade 10

From the schools following the international American curriculum, 91 grade 10 students' survey results rendered the Pearson's correlation coefficient of 0.14. This indicates a **weak but positive relationship** between the student self-reported engagement level and their achievement in grade 10 high school students following the international curriculum in Abu Dhabi private schools, with $r(89) = .14, p = .18$.

From the schools following the IGCSE curriculum, 18 grade 10 students' survey results rendered the Pearson's correlation coefficient of 0.62. This indicates a **moderate to strong positive relationship** between the student self-reported engagement level and their achievement in grade 10 high school students following the IGCSE curriculum with external exams in Abu Dhabi private schools, with $r(16) = .62, p = .005$.

Grade 11

From the schools following the international American curriculum, 115 grade 11 students' survey results rendered the Pearson's correlation coefficient of 0.27. This indicates a **weak to moderate but positive** relationship between the student self-reported engagement level and their achievement in grade 11 high school students following the international curriculum in Abu Dhabi private schools, with $r(113) = .27, p = .003$.

4.1.3 Quantitative Results – Summary

These results from the surveys confirm that there is always a positive relationship between the students' self-reported engagement levels and their achievements. This is irrespective of the curricula they follow and whether they are choosing the subject or choosing to do external exams in the subject.

Amongst those students who have decided to take the external exams for the IGCSE curriculum, grade 9 students, who are in the first year of the two-year course, it is seen there is a weak to moderate relationship between their self-reported engagement levels and their achievements, but in the grade 10 students, who are in their second year of the two year course and going to attempt their external exams in the same year, it is seen that there is a moderate to strong relationship between their self-reported engagement levels and their achievements.

Grade 11 students in the American curriculum show a weak to moderate relationship between the student self-reported engagement levels and their achievements. Grade 9 and Grade 10 students in the American curriculum show only a weak relationship between the students' self-reported engagement levels and their achievements.

4.2 Qualitative Results

4.2.1 Students' Survey Data

In this section, the qualitative data collected from the students' surveys are categorised based on the questions asked. It provides a snapshot of the students' perspectives of the topics that were considered important by the researcher based on review of literature, experience and discussion with peers and specialists. Interview questions for participating students and teachers were subsequently generated from these survey results.

The qualitative data collected in the surveys can be categorised into:

- a. Students' understanding of the term 'Student Engagement'
- b. Reasons for high self-reported levels of engagement in technology education classes
- c. Highly engaging lesson activities and highly disengaging lesson activities
- d. Teacher attributes that engage and disengage
- e. Other issues for disengagement and students' expectations from teachers and schools for optimal engagement

a. Students' understanding of the term 'Student Engagement'

Most students used the word 'participation' or 'involvement' when asked to explain the term, student engagement. The other words that came up largely were 'attention' and 'focus'.

Grade 9 male: *"To participate in class."*

Grade 11 female: *"The amount of attention/energy/interest that people show when they are learning or being taught."*

Grade 11 male: *"This term means that the students focus and participate during the lesson."*

Grade 10 male: *"How a student is focused and interested they are in this lesson."*

Grade 10 female: *"The amount of determined focus a student has and how much participation they have in the lesson."*

Many students also used the words ‘interest’ and ‘passion’ to express their understanding of the term, student engagement. In addition, the phrases ‘interacting with teachers and students’ and ‘asking questions’ were used by many students.

Grade 11 female: *“The passion a student shows when learning.”*

Grade 10 male: *“The degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught.”*

Grade 11 female: *“Student engagement is when students show interest by asking questions, doing the work properly and asking for challenges.”*

Grade 11 male: *“When you start answering and asking questions constantly.”*

Grade 10 female: *“To me, student engagement means to interact with each other and learn from one another.”*

Grade 11 female: *“When a student interacts with the teacher or with their classmates.”*

Grade 10 male: *“It means when students interact with each other and with their teachers.”*

Many students also claimed that being engaged means being active in the class. Some referred to it as enjoyment in the class.

Grade 10 female: *“Students being active and learning in class.”*

Grade 9 female: *“Incorporating ideas from different perspectives and collaborating with others.”*

Grade 9 male: *“Enjoyment and eager to work.”*

Grade 9 female: *“I have good feelings for it.”*

b. Reasons for self-reported levels of engagement in Technology Education or TE classes

One of the questions in the student survey was to state reasons for one's engagement, whether high or low, in technology education classes. The students' answers varied from subject and topic preferences to teacher attitudes and career foresight.

Grade 9 International American curriculum responses:

Out of 168 respondents,

a. Responses that indicated low student engagement are as follows:

33% of students reported a lack of interest in the TE subject itself, and 8% of students believed that the subject was difficult. 7% of students attributed their low engagement in these classes to their TE teacher, citing bad classroom management or quality of teaching. Only 2% did not recognise the importance of the subject for their future or career.

b. Responses that indicated high student engagement are as follows:

20% of students stated they were interested in the subject, while 12% of students said the subject was easy, fun or that they enjoyed coding and gaming. 5% of students claimed they were engaged in TE classes as they were interested in getting good grades in the subject. Only 4% of students reported the subject being important for their career or future, and another 4% of students owed their high engagement to their teacher.

A total of 50% of students reported low engagement, while a total of 45% of students reported high engagement. 5% of students lacked clarity in their responses about engagement in TE classes.

Grade 10 International American curriculum responses:

Out of 95 respondents,

a. Responses that indicated low student engagement are as follows:

21% of students claimed they were not interested in the TE subject. 16% of students found it difficult or complicated, and 1% of students stated they did not see the subject as important for the future.

b. Responses that indicated high student engagement are as follows:

31% of students asserted that TE was interesting and easy. 4% of students foresaw its significance in their careers.

A total of 38% of students reported low engagement, while a total of 35% of students testified to high engagement. 27% of students claimed they were only engaged sometimes, depending on the topics, their moods, and the class events.

Grade 11 International American curriculum responses:

Out of 117 respondents,

a. Responses that indicated low student engagement are as follows:

13% of students found the subject uninteresting. 6% of students found the subject difficult or complicated. 2% of students asserted its uselessness in their future.

b. Responses that indicated high student engagement are as follows:

36% of students stated the subject was interesting and fun, and 8% of students recognised the significance of the subject for their careers and future.

A total of 21% of students reported low engagement, while a total of 44% of students reported high engagement. 35% of students reported that they were only engaged sometimes, depending on the topics, their moods, and the class events.

Grade 9 IGCSE curriculum responses:

Out of 111 respondents,

a. Responses that indicated low student engagement are as follows:

29% of students reported that they were not interested in the TE subject or found it boring. Around 1% of students found the subject difficult, and less than 2% of students blamed the quality of the teacher for their disengagement.

b. Responses that indicated high student engagement are as follows:

23% of students found the subject interesting and enjoyable. 3% of students recognised the importance of the subject for their careers and the future. 3% of students related their high engagement to the quality of their teacher.

A total of 31% of students reported low engagement, while a total of 29% of students reported high engagement. 40% of students reported that they were engaged only sometimes or depending on the topic.

Grade 10 IGCSE curriculum responses:

Out of 29 respondents,

a. Responses that indicated low student engagement are as follows:

7% of students did not enjoy the subject, and 7% of students found the subject difficult.

b. Responses that indicated high student engagement are as follows:

38% of students found the subject interesting, fun or logical. 14% of students claimed that the teacher was good, and 7% of students recognised its significance for their future.

A total of 14% of students reported low engagement, while a total of 59% of students reported high engagement. 27% of students reported that they were engaged only sometimes or depending on the topic.

c. Highly engaging lesson topics/activities and highly disengaging topics/lesson activities

The student survey explored highly engaging activities and those that were highly disengaging in technology education classes. The students mentioned the actual activities and also the methods used to conduct these activities in their responses.

Grade 9 International American curriculum responses:

Out of 168 respondents,

a. Responses for highly engaging lesson activities

33% of students reported high engagement when learning to code with Python, robots, to make games and apps. 26% of students enjoyed interactive activities such as *Kahoot*, *Blooket*, etc. Only 3% of students preferred to work with relevant software such as Photoshop, etc. Only 2.4% were engaged when learning the Microsoft Office tools. With reference to the methods of the activities, only 2.4% claimed they were interested in listening to PowerPoint presentations, and only 2.4% preferred to engage in group activities, and less than 1% looked forward to answering the teachers' questions.

b. Responses for highly disengaging lesson activities

23% of students did not enjoy coding with Python or HTML. 9% of students claimed they were disengaged during lectures and discussions. 7.7% of students did not want to engage when activities became too difficult, or when they were being assessed. 4% of students disliked project-based learning, and 3.6% were bored with learning Microsoft Office tools such as Excel. With respect to the methods with which these activities were conducted, only 1.8% disengaged when individual work was given and less than 1% in collaborative activities.

6% of students reported that nothing was engaging in the TE classes, and an equal number reported that everything was engaging.

Grade 10 International American curriculum responses:

Out of 95 respondents,

a. Responses for highly engaging lesson activities

39% of students found coding activities very engaging, which included Java/Python programming, robotics, HTML, etc. 22% of students claimed they were engaged during interactive or game-like activities such as *Kahoot*, *Blooket* or *Quizziz*. 10.5% of students felt engaged doing worksheets or assignments. Only 2% of students enjoyed video editing, and 2% of students enjoyed listening to an explanation using a PowerPoint presentation. 8.4% of students asserted their engagement in TE classes was high during group activities.

b. Responses for highly disengaging lesson activities

14% of students conveyed that they were disengaged when passively listening to a PowerPoint presentation. 16% of students did not enjoy learning to code. 15% of students were disengaged during theory lessons. 5% of students claimed they were disengaged from learning Microsoft Office software, such as Excel and Access. 7% of students disengaged when they were doing worksheets and assignments.

4% of students reported that nothing engages them, and 18% of students said that everything is engaging in TE classes.

Grade 11 International American curriculum responses:

Out of 117 respondents,

a. Responses for highly engaging lesson activities

8.5% of students responded that they actively engaged in the TE lessons when they were presenting their created websites or creating models using 3D printing. 15% of students claimed high engagement with game-like or interactive activities such as

Kahoot, Blooket, etc. 37% of students enjoyed coding in the form of Robotics, Python and creating websites using HTML, while only 6% of students were interested in theory lessons about data representations. 8.5% of students asserted they were engaged when doing relevant real-life activities such as Excel and Photoshop. Only 2% claimed they were engaged when the teacher was lecturing from the PowerPoint slides, and only 2% were interested in class discussions.

b. Responses for highly disengaging lesson activities

8.5% of students claimed they disengaged in TE classes when the teacher just lectured to them at the front of the class. 16% of students did not enjoy coding, and 11% were not interested in the theory lessons. 17% of students asserted their disengagement during Microsoft Excel lessons.

2.5% of students claimed that nothing engaged them in TE classes, while 5% of students declared that all TE lessons were engaging.

Grade 9 IGCSE curriculum responses:

Out of 111 respondents,

a. Responses for highly engaging lesson activities

With respect to activities in TE classes, 15% of students said they enjoyed only practical lessons, and they mentioned MS Office packages such as PowerPoint, Excel, Access, and Word, and equally, 15% of students stated they enjoyed theory topics. 21% of students asserted their interest in programming or coding, which includes Python programming, making games, robotics, etc., although they do not learn them during this year in this curriculum. Some students reported their engagement with the methods used in these activities. 20% of students said they were engaged when doing collaborative group work. 11% enjoyed project-based activities, and 3% liked doing

presentations in class. 3% mentioned they felt engaged only when tasks were challenging. 7% required classes to be fun and competitive to be engaged. Less than 1% felt engaged while answering the teacher's questions.

b. Responses for highly disengaging lesson activities

38% of students were not engaged in practical lessons at all. 23% of students mentioned they were not engaged during the theory lessons. As far as methods used for these activities, 7% of students reported they disengaged when it was only a lecture going on. 5% of students did not approve of individual work, and 2% of students disengaged when the work was too challenging.

7% of students said nothing in TE classes was interesting, while 3% said they found everything engaging in the subject, and 1% said it depends on the topic.

Grade 10 IGCSE curriculum responses:

Out of 29 respondents,

a. Responses for highly engaging lesson activities

17% of students felt engaged while solving past papers to prepare for the external exams. 38% of students enjoyed practical activities such as HTML programming and working with Microsoft Office software, such as Access and Excel. Only 7% were engaged when the teacher asked questions, and only 7% enjoyed playing educational games.

b. Responses for highly disengaging lesson activities

14% of students mentioned a lack of prior knowledge to understand new material as a reason for disengagement in all activities in TE classes. 14% of students were disengaged during theory lessons, while 24% of students felt the same about practical

lessons. 7% of students felt disengaged when activities were too easy, with no extended tasks to follow.

Only 14% of students reported high engagement during all activities in the TE classes.

d. Teacher Attributes (Attitude and Pedagogy)

The survey asked questions regarding their technology education teacher. The responses were mainly categorised into teachers' attitudes and teaching or pedagogy skills.

Grade 9 International American curriculum responses:

Out of 168 respondents,

a. Responses for highly engaging teachers' attributes:

58% of students pointed to their teachers' pedagogy skills for their high engagement.

21% of students spoke about their teachers' personalities, which included their sense of humour, helpful and mentoring nature.

b. Responses for highly disengaging teachers' attributes

54% of students claimed that their teachers' pedagogy skills, which include the activities they choose and the methods they use in these activities, were not engaging in the TE classes. 9% of students blamed the personality of the teacher for their low engagement.

4% of students reported that their teachers did nothing to engage them in TE classes. 2% claimed that the teachers are not the only ones responsible for their engagement.

Grade 10 International American curriculum responses:

Out of 95 respondents,

a. Responses for highly engaging teachers' attributes

61% of students conveyed that their teachers' pedagogy skills, which included their style of explanation, the activities they chose, the connection to real-life situations in the lessons, the choice and autonomy for students, etc., were greatly responsible for their engagement in TE classes. 29% of students claimed their engagement was due to the personality of their teacher, which included their energy in the class, their helpfulness, and their interaction with students.

b. Responses for highly disengaging teachers' attributes

41% of students identified their teachers' pedagogy skills, such as those mentioned above, for their low engagement levels in TE classes. 21% of students said they were disengaged owing to their teachers' personality, which included yelling at the students, having a boring or bad attitude and also pressurising them.

Only 1 student said that the teacher is always engaging, and 4 students claimed that their teacher does nothing that keeps them engaged.

Grade 11 International American curriculum responses:

Out of 117 respondents,

a. Responses for highly engaging teachers' attributes

56% of students claimed they were engaged with their teachers' pedagogy skills with varied and differentiated activities, real-life connections and autonomy for choice, creativity, and interest. 27% of students attributed their engagement in TE classes to the personality of their teacher, which included positive energy, helpful nature, encouraging attitude and good interaction among other attributes.

b. Responses for highly disengaging teachers' attributes

55% of students were not impressed with their teachers' pedagogy skills, with mentions of too much lecturing, unclear explanation, boring activities or too much irrelevant work. 7% of students asserted that their teachers' personality disengaged them, which included qualities such as being angry, being too strict, a lack of interaction and energy.

13% of students claimed that nothing their teacher did engaged them in TE classes. Only one student said that their teacher was always engaging.

Grade 9 IGCSE curriculum responses:

Out of 111 respondents,

a. Responses for highly engaging teachers' attributes

51% of students claimed that the pedagogy skills of their teachers in teaching TE were responsible for their engagement. 20% of students claimed their teachers' attitudes and charisma in TE classes kept them engaged, which included the teachers' motivation and guidance.

b. Responses for highly disengaging teachers' attributes

33% of students complained that the teachers were only lecturing during TE lessons.

7% of students asserted that the teachers' personalities caused them to disengage, mentioning attributes such as 'boring', 'distant', 'angry', and 'inconsiderate'.

Grade 10 IGCSE curriculum responses:

Out of 29 respondents,

a. Responses for highly engaging teachers' attributes

62% of students felt engaged due to their teachers' pedagogy skills that included varied activities, asking critical thinking questions, and ensuring closure of all gaps in

knowledge before moving forward. 17% of students attributed their high engagement to their teachers' personalities in the TE classes, including their ability to manage the classroom, be supportive and positive.

b. Responses for highly disengaging teachers' attributes

31% of students complained about their teachers' pedagogy skills when it came to their disengagement during the lesson and specified that the teachers just lectured or read from the slides and that they moved on to the next topic without making sure the students understood the current one. 24% of students claimed their teachers' personality caused them to disengage in TE classes, referring to the teachers being too strict, boring, or indifferent.

34% of students claimed their TE teachers were always keeping them highly engaged.

e. Other issues for disengagement and suggestions for engagement

In the survey, students were asked about any other issues which they believed affected their engagement in technology education classes. Their responses were related to the significance of the subject, subject curriculum and school infrastructure.

Grade 9 International American curriculum responses:

Students mentioned the following issues that may lead to their disengagement, other than topics, activities and teachers and also some suggestions for improvement:

Students in one school, SAC1, mentioned that there were at least three **different technology education teachers in the academic year** this study was conducted. They added that each teacher had their own teaching style, their methods for activities, in addition to their emphasis on different parts of the topics. All of this confused the students

as they were even assessed differently compared to their actual learning experiences. Students complained that they would get used to one teacher's teaching style and then he/she would leave. They would not have any teacher for some time before a new teacher would arrive with an entirely different teaching style, and then they had to adapt themselves, which really caused them to disengage during the lessons. Another issue mentioned by the students was related to **classroom management**. Surveys for this study were conducted during the years 2022-23, when some schools still had not resumed pre-COVID learning environments, and they were conducting technology education lessons in regular classrooms with chairs arranged in rows and students using their own devices. These classrooms were not as spacious as computer labs, and there were too many students. Students complained that there was no space for the teacher to come to them to check their work or give feedback, and they also found it difficult to walk through the aisles filled with backpacks to reach the teacher, who was always at the front of the class. The next point stated by the students was related to the **school infrastructure**, which included issues such as network problems, slow internet, outdated computers in the labs or personal laptop issues due to a lack of charging points in classrooms.

Students suggested that having teachers with better pedagogy skills would enhance their engagement in technology education lessons as they would be capable of using a variety of teaching methods and activities to engage all students with different levels of understanding. They also suggested that schools provide a technology education course with different difficulty levels to tackle knowledge gaps in students migrating from other schools or countries. Another suggestion from the students included offering the subject as an elective or as an after-school club activity. This would attract only those students who were genuinely interested in the course, thereby ensuring high student engagement.

Grade 10 International American curriculum responses:

Students mentioned the following issues that may lead to their disengagement, other than topics, activities and teachers and also some suggestions for improvement:

One issue that repeatedly came up among the students that affected their engagement negatively included bad **classroom management** by the teachers. Students mentioned that teachers were unable to engage others in the class, who were noisy and disruptive, which resulted in disengagement. Sometimes, there were students who took time to grasp the topic, and the teacher tended to repeat the concept so as to get them up to speed. However, this resulted in others who understood it easily becoming bored and thereby causing the disruption. **Classroom infrastructure** was also mentioned here as outdated hardware and software in the computer labs. With respect to **assessments**, students in school SAC1 complained that they learnt programming on computers, but they were assessed on paper. They added that they were unable to debug errors in their solutions on paper and claimed that this does not serve the purpose of the programming course. Another point of interest that was brought up by the students was about **gaps in knowledge** amongst them due to migration from other schools or countries, or even an inconsistent curriculum. Students felt disengaged as they were unable to go to the computer labs to learn technology (*the surveys were conducted just after schools re-opened from the COVID shutdown, and they were running on a hybrid schedule, with students in confined classrooms without using public spaces or labs*).

Students suggested that teachers with better pedagogy skills and knowledge of student psychology would enhance their engagement in technology education classes. They also requested better infrastructure with updated computers, better internet connection and network. They believed that they must be given choices in topics and activities, with topics

relevant to them and activities that are interactive and competitive. They also required access to videos and other media for continued reference beyond the classroom.

Grade 11 International curriculum responses:

Students mentioned the following issues that may lead to their disengagement, other than topics, activities and teachers and also some suggestions for improvement:

All students mentioned that they felt disengaged as they were unable to go to the computer labs to learn technology (*as mentioned before, the surveys were conducted just after schools re-opened from the COVID shutdown, and they were running on a hybrid schedule with students in confined classrooms without using public spaces or labs*). In addition to **classroom infrastructure** issues, such as slow internet and network glitches, they also asserted their discontent with the **curriculum**, elaborating upon the boring and abstract theory topics included. As mentioned in the previous grade group, these students also complained about their **assessments** as they learnt programming on computers, but they were assessed on paper, which did not allow them to debug errors in their solutions on paper. Lastly, all students unanimously agreed that neither they nor their school attributed much **significance to the technology education** subject as they did to the core subjects such as maths and the sciences.

Students suggested being given choices in topics and activities that are relevant to them, in addition to doing group projects in topics that are integrated with other subjects for a thorough understanding of the concepts. They requested highly qualified teachers who were capable of good classroom management and pacing the lessons efficiently according to the capabilities of the students.

Grade 9 IGCSE curriculum responses:

Students mentioned the following issues that may lead to their disengagement, other than topics, activities and teachers and also some suggestions for improvement:

Students mentioned **classroom infrastructure** as a primary cause for their disengagement in technology education classes, such as network problems, slow internet, outdated computers in the labs, old software and shaky chairs and tables. In relation to this, they also stated issues with **classroom management** with too many students and/or badly planned labs leading to disruption, thereby, poor engagement. Some students complained about having two continuous hours or block lessons for TE as they found it difficult to maintain focus and be engaged throughout; they suggested having breaks in between. Many students cited having **gaps in technology knowledge** due to migrations from other countries or schools as a significant cause.

Students suggested hiring teachers with better pedagogy skills to be able to assess and support students having gaps in knowledge to bring them up to standard, in addition to having a variety of activities to engage all the students who like to learn differently. They also proposed that the school review the curriculum to include topics that are interesting and relevant to them and organise competitions in school or send them to local, national or international competitions. In schools which had block lessons, students suggested having unofficial breaks in between the lessons.

Grade 10 IGCSE curriculum responses:

Students mentioned the following issues that may lead to their disengagement, other than topics, activities and teachers and also some suggestions for improvement:

Students mentioned **classroom management** with too many students and/or badly planned labs leading to disruption, thereby, poor engagement. **Classroom infrastructure**

was another cause cited for their disengagement in technology education classes, such as slow internet and outdated computers in the labs.

Students suggested reviewing the curriculum to include topics that are interesting and relevant to them. They also requested more technology education lessons per week. In schools SIG1, there were only three lessons per week, while school SIG2 had five lessons per week. Students also recommended having more formative assessments with thorough feedback so as to allow students to recover from gaps in knowledge and skills.

4.2.2 Teachers' Survey Data

In this section, the qualitative data collected from the teachers' surveys are categorised based on the questions asked. It provides a snapshot of the teachers' perspectives of the topics that were considered important by the researcher based on review of literature, experience and discussion with peers and specialists. Interview questions for participating teachers were subsequently generated from these survey results.

The qualitative data collected in the teacher surveys can be categorised into:

- a. Teachers' understanding of the term 'Student Engagement'
- b. Teachers' reasons for self-reported levels of engagement in technology education classes
- c. Highly engaging topics/lesson activities and highly disengaging topics/lesson activities
- d. Teacher efforts and school initiatives to engage
- e. Subject or course-specific issues related to student engagement

a. Teachers' understanding of the term 'Student Engagement'

Most teachers mentioned the interest of the students and their effort in the classroom when asked about their understanding of the term, student engagement.

FTAC911: *“How interested the students are in the material I'm teaching. Do they ask questions, try their best to follow along, etc.?”*

FTAC91112: *“The degree or level of involvement and attention a student has during a lesson, which can depend on the interest of the student in the topic, or how much responsibility and accountability a student possesses.”*

FTAC9: *“How interested are the students in your lesson? How much interest is shown towards an activity that a teacher sets for the students?”*

MTAC91011: *“Listening to lectures with interest, asking questions, working on activities, doing extra research.”*

Many teachers stated that students are engaged when they are participating in the class by asking questions and interacting with the teacher and peers.

FTAC10: *“It means that the students are actively participating in the learning process.”*

FTAC1011: *“Students should be fully aware of the concepts by participating, solving problems, asking questions, answering questions, helping peers, and having fun...”*

FTAC91011: *“Students being mentally present with their focus and interest in the subject and interacting with their learning environment.”*

MTIG9: *“Students interacting and being active in the lesson.”*

b. Teachers' reasons for high and low student engagement in technology education lessons

Technology education teachers were asked in their surveys about the reasons for high or low student engagement in their classes. The responses were mostly concerned with students' attitudes towards the subject, topics and activities, school and curriculum.

With respect to high engagement in technology education lessons in high school, teachers believed that students choosing **careers** related to technology or computer science are highly engaged when learning about advanced programming and are willing to persist when topics or activities are challenging. Some teachers commented that students with high aptitude and good discipline are engaged always, irrespective of topics, activities, marks or chosen careers, as they have an **interest** in learning. With respect to **topics and activities**, teachers noted higher engagement during practical lessons as students have hands-on activities with products as outcomes. This included programming, as students were able to see the results of their code in real-time. Interactive games, group activities, etc., were also engaging for the students, according to the teachers, as they enjoyed competing with their peers. Teachers teaching IGCSE or AP curriculum with students **appearing for external exams** stated that most of them were engaged, with only those who dropped the subject in the second year of the two-year course disengaged during that year. Lastly, teachers claimed that many students were only engaged as they wanted to score **high grades** in the subject to increase their final average in high school.

With respect to low engagement in technology education lessons in high school, teachers commented that students in higher grade levels have lower engagement generally than students in lower and middle grade levels. They voiced concerns that students who did not plan careers in computer science did not see the purpose of learning coding in schools, as they did not recognise the possibilities that would open for them in their future if they developed technology skills at school. Teachers noticed that students were

disengaged during theory topics such as the fundamentals of computer science. Teachers in schools SAC1 and SAC3 mentioned that their students were disengaged as they were taught by different teachers in the same academic year and were confused by different teaching styles. Another reason for disengagement, as cited by the teachers, was due to online learning during COVID-19, which resulted in gaps in knowledge and skills in the students, rendering them unable to grasp new concepts when they started face-to-face learning. Also, when returning to schools after COVID-19, students were not using public spaces such as labs, cafeterias or playgrounds and had to use their own devices, which resulted in distractions as the schools had no control over their use.

c. **Highly engaging topics/lesson activities and highly disengaging topics/lesson activities**

In the survey, teachers were asked about topics and activities in technology education that were engaging or disengaging for the students. A wide variety of topics and activities came up in the responses; however, it was interesting to note that the topics and activities that were engaging to some were disengaging to others.

The **activities** that were mentioned by the teachers as **highly engaging** mainly included interactive games such as *Kahoot*, *Nearpod*, *Blooket*, *Quizziz*, etc. Teachers noticed that students were engaged when they were given relevant topics with choices to research and present to their peers. Working together with their peers for activities was also cited by the teachers as engaging for the students. They recalled that students enjoyed coding activities if it was easy and did not require much thinking. Teachers observed that lecturing with PowerPoint presentations was **highly disengaging** for the students, in addition to coding activities that were complex, which required students to think deeply and debug errors frequently.

Teachers mentioned coding with Python, programming with robots, creating applications with App Inventor and web designing with HTML as some of the **highly engaging topics** for the students. They also mentioned that 3D designing and printing were highly engaging for the students as they were able to design, create and print an object. Some teachers observed that image editing was enjoyed by the students initially, although they quickly found it monotonous as they were accustomed to editing photos on their phones. Teachers teaching the IGCSE curriculum remarked that their students were engaged while working with Microsoft Access, as it was unfamiliar and therefore challenging. As for **highly disengaging** topics, all teachers unanimously agreed that theory topics were at the top of the list. They also noticed that many students were disengaged while coding with HTML, and some were disengaged, especially when the coding concepts became difficult. Teachers commented that many students did not enjoy Microsoft Excel, and when they had to learn difficult concepts, most students began to disengage.

d. Teacher efforts and school initiatives for high engagement

In the survey, teachers were asked about their efforts to encourage engagement in technology education classes and also what they believed must be done by the school to improve the same.

Teachers mentioned that they must explain the importance of learning specific topics and ICT skills and applications in the lives and careers of the students. Students need to know why they are learning anything, and with technology, they believe that they need to know only about social media now, so when they are being taught any concept or skill in technology, they must also be told the reason for learning the same. Teachers recognise

that they must ask critical thinking questions to the students for them to think deeper into the concept for better understanding, and this will bring about higher engagement. They agreed that they must incorporate ownership, authenticity, relevance and interest into learning objectives and activities. Many teachers asserted the importance of creating engaging presentations to attract and sustain the engagement of the students, in addition to multiple and varied activities, including interactive games, hands-on activities, and even theory and group activities and competitions with rewards as bonuses. Lastly, teachers believed that they must build relationships with students while supporting and motivating them to achieve their potential.

With respect to schools, all teachers unanimously demanded that schools give core importance to the subject by including it in official assessment calendars. As the TE subject is not core, students prefer to engage more and work harder for other core subjects, despite interesting topics and varied activities. Then they suggested that schools follow a consistent curriculum structure, as currently, the technology education curriculum changes yearly to keep up with technology advances in the world and teachers are given a single basic training session per course, making it difficult for them to develop engaging lesson plans and activities or even improve upon the ones made the previous year. Teachers requested that schools provide regular workshops and pedagogy training to them. This can be in relation to being trained in conducting differentiated activities to engage students with varied interests and aptitudes, and also, in managing classroom and technical issues. To handle classroom management issues, teachers suggested smaller class sizes as currently, most classes had more than 30 students; larger and purpose-built computer labs with adequate internet, electricity ports and network connections and software to monitor student screens; and lastly, support from supervisors to manage serious behaviour issues.

Some teachers requested a lab assistant, adept in networking and circuitry, to handle technical issues so that teachers need not spend teaching and learning time dealing with them. For a better understanding of technology beyond the classrooms to encourage higher engagement, teachers recommended conducting in-school hackathons, exhibitions and STEAM fairs and also sending students to participate in local, national, and international competitions such as First Lego League (FLL) and World Robotics Organisation (WRO). Lastly, teachers teaching the IGCSE curriculum claimed that when students opt out of taking the exams in the second year of the two-year ICT course, but they still have to attend the lessons, they tend to disengage and also disrupt the class or, at the very least, distract their peers, causing classroom management issues.

e. Subject or course-specific issues related to student engagement

Technology education teachers were asked in the survey regarding other issues related to their subject that affected the students' engagement in technology education classes. The responses were related to the significance given to the subject by the school, the subject curriculum and the school infrastructure.

One of the issues that most teachers believed was specific to their course or subject in general was that technology education as a subject is not given any significance in schools, as it's not considered a core subject; rather, it is considered an easy subject to boost the students' overall grade average. There were no final exams for technology education in most of the schools, where this study was conducted, and the assessments for it were not even mentioned in the assessment calendar. The subject was associated with the elective subjects such as art, music, drama and physical education. With respect to the curriculum, theory topics are boring and abstract for high school students to grasp, such as computer fundamentals, data representation, etc. Also, elaborate course material that needs to be

completed in a term with only a few (1-2 maximum) weekly lessons may not allow teachers to conduct engaging activities compared to other core subjects. Students who choose a specific stream in high school do not have the choice of opting out of the subject, and if they are not interested, they tend to be disengaged. Finally, regarding the infrastructure, the lab arrangements in schools are usually not purpose-built but converted classrooms, which may result in distractions as teachers cannot always monitor screens due to classroom seating arrangements and a lack of space. Even in computer labs, students working with their own devices and being connected to the internet always cause them to be easily distracted and disengaged from the lesson. In addition, technical issues in the labs, such as laptops with no charge and no ports to charge, login issues, slow internet, outdated hardware and software, etc., cause disruption and distraction, thus leading to disengagement in technology classes.

4.2.3 Student Focus Group Interviews

The questions of the students' interviews were based on the data collected from the surveys of the students regarding their perspectives on their own engagement in TE classes. The responses were categorised into their attitude towards the subject, topics and activities, teachers' attitudes and pedagogy skills and subject curriculum and school infrastructure. Also, since this study was done just after the COVID-19 epidemic, students' responses regarding online learning were also recorded.

High School Students in the International American Curriculum

Student Attitude and Engagement

Most participants recalled being engaged when they were learning easy concepts, doing simple activities or easy programming, while they became disengaged when concepts became complicated. Many participants recognised that they themselves must put effort and

be passionate about learning to be engaged in lessons. Many were engaged as they were interested in learning about technology and planning a career in the field. Very few realised that most of the jobs in the future would include technology in some form. Many students stated that they will not use any of the topics that they learn in TE classes in the future; others said that they do not plan to have a career in technology, so they are not interested in TE at all. They suggested having different TE courses for students with different interests/skill sets and plans for the future.

Grade 10 male: *“I know technology is only introduced in school, but I must be familiar with it to have more job opportunities in the future.”*

Grade 9 male: *“I am very interested in Python and website development, and I’m planning a career in Computer Engineering.”*

Grade 10 female: *“Computer is not something that I’m interested in, and I’m not planning a future with technology.”*

Few students claimed that they were engaged because they needed the grades to increase their overall average to get into good universities.

Grade 10 male: *“I’m only focusing in ICT class as I need the grades to increase my average.”*

Many students believed that although they recognised the significance of computer studies in their future, they were just not good at the subject. Many stated that they did not enjoy learning to program, while an equal number of students claimed that they were very engaged while programming, as the program came to life with a product at the end. A few

students stated that they enjoyed TE in middle school but not in high school. They claimed that everything became about technology, and the same ideas were repeated, and it did not appeal to them anymore. Some others mentioned that they do not like to learn about technology at school, as they use it only for social media and to watch videos on YouTube.

Grade 9 male: *“We were always staring at screens during COVID-19; now I do not like looking at computers even.”*

A few students believed that the teachers play a large role in keeping students engaged with their attitude and teaching style, although students must reciprocate by focusing, participating, and asking questions.

Grade 10 male: *“Everything is disengaging in computer class!”*

Role of Topics and Activities in Student Engagement

Most participants stated that they enjoyed TE classes as they were having fun while doing hands-on activities such as 3D printing, creating apps using App Inventor or programming with Python. These activities were specifically engaging only when students were able to bring in their own interests and preferences.

Grade 11 male: *“The stream that was doing 3D printing was the most engaged this year – it was something new and challenging.”*

While many found programming engaging, a large number also found it disengaging and said that it was difficult or boring and sometimes even frustrating.

Grade 10 female: *Python programming was difficult and frustrating as it would not work when there were tiny mistakes.”*

Grade 10 female: *Python was so boring as I did not understand what was going on.*”

Many participants mentioned they were engaged while creating websites using Google Sites or HTML about topics they were interested in. They claimed it was fun as well as easy. Their engagement increased when the teacher asked them to present their work to their peers.

Grade 9 female: *“Computer lessons are not interesting when everyone is following the same instructions and doing the same as others.”*

Most students were engaged while playing interactive games to learn, such as *Kahoot*, *Blooket*, etc. Some teachers gave bonus marks to students who got the most points in these games, which added to their engagement. Most students felt engaged when they were doing group activities in TE classes, as they shared ideas with each other and assigned tasks to members in their group who were appropriately skilled.

Only a few students claimed they enjoyed watching videos in TE classes. Most students claimed videos are boring and that they preferred the teacher explaining the concepts either completely or at regular intervals in the videos. Some others felt engaged when they needed to complete worksheets about key concepts after a topic, as they felt confident that they understood them; however, there were others who felt differently.

Grade 9 female: *“It usually depends upon the videos; mostly I zone out when watching videos.”*

Grade 10 male: *“We want to work on the computers rather than just do worksheets.”*

Many students mentioned that they were engaged when activities were challenging but not too difficult. Most students enjoyed topics that were connected to their current life situations. They recalled topics being connected to maths, physics and to mental health.

Grade 10 male: *“Teacher teaches us outdated material.”*

Regarding topics in TE lessons, many students were engaged during Microsoft Excel; however, a few mentioned they were disengaged when the concepts became complicated and difficult to follow. Some also mentioned that it was boring to just follow instructions and that they had been learning Excel since primary school. Regarding research activities in TE, most students stated that there was no clarity in what they were looking for, and they would just be copying/pasting information from the internet. A few students only enjoyed doing research in TE lessons.

Grade 10 male: *“We need to be able to choose the topics for computer classes.”*

Grade 11 male: *“When you are interested in a topic, you will want to learn and put more effort to understand it further.”*

Most students asserted that they were not engaged at all during theory lessons, such as the history of computers; there were no activities, and they did not understand, as it was all very abstract; they were just listening to their teacher explain from a presentation and were asked to memorise a lot of material. However, one student claimed she was interested to learn about the parts of the computer, but would also actually like to see these parts. Some students enjoyed learning about data representations in computers and felt engaged during activities about conversions in binary/decimal/hexadecimal number systems. They also mentioned that

they were engaged when learning about logic gates and circuits working inside the computer; however, they would have liked to actually work with circuits in the labs. Some other students found these topics very difficult to understand. Many students asserted that they felt disengaged when the same topic was repeated, and the activities were repeated for many weeks.

Grade 11 female: *“Coding is boring when we do it for the whole term.”*

Teacher Attitude and Pedagogy in Student Engagement

Most students commented on teachers’ moods in the class. They felt engaged when the teacher is cheerful, energetic and active in the class. Many students also asserted that when the teacher interacts and jokes with them, encourages and praises them, they become engaged and motivated to work. On the other hand, they do not engage when they sense that the teacher is bored or angry or not prepared for the lesson and does not wish to engage with the students or the lesson.

Grade 9 female: *“The teacher gets angry when we do not understand.”*

Grade 10 female: *“I am not comfortable asking questions to the teacher if they get upset when we do not understand.”*

Many students were disengaged when there was no clarity in the teacher's explanation, instructions or success criteria. They do not engage when a teacher is just reading from a presentation or lecturing for a long time. They felt that the teachers do not choose activities and topics based on students’ interests.

Grade 11 female: *“We had to learn Excel ourselves as the teacher would just read from the PowerPoint, and when we asked any questions, the teacher would not explain.”*

The students reiterated that the teacher explaining multiple times in different ways helps students with different learning styles to grasp the concepts and not be confused later when they get complicated. They recognised that feedback from the teacher was crucial to their learning and further engagement. However, many students commented that lessons get boring when they are repeated without moving on to newer concepts. A few students appreciated when the teacher started discussions and connected the concepts to the real world. Only a few felt engaged when the teachers chose random students to ask questions about the topic.

Grade 11 male: *“I feel very engaged during discussions in the class when the teacher extends our thinking beyond the class task.”*

Many students claimed that they are disengaged when their class is noisy, and the teacher is unable to manage class disruptions. This usually happens when teachers are paying attention to the students who are falling behind, and others are causing problems and disruption. Students who understand the concepts easily stated that they are bored when the teacher slows down for the few who do not. They also noted that much time is wasted when they sometimes finish their work with time to spare, with no extended work.

School Infrastructure and Curriculum related to Student Engagement

Most students stated that they enjoyed going to the computer labs, which was not happening when these interviews were conducted, as most of the schools were being cautious due to COVID-19 restrictions and having TE lessons in normal classrooms with students using

their own devices. They were aware that using the school PCs was less distracting than using their own laptops. Also, they recalled the lab environment being energetic and fun.

Many students claimed that they do not take the TE subject seriously. They stated that there is too much work in TE lessons, or that there are too many concepts taught in one lesson, and mostly, these concepts are difficult. They also do not appreciate any work that is assigned as homework.

Grade 9 male: *“We think ICT is a free lesson.”*

Grade 10 male: *“Why must we study about technology when everything is available in YouTube and ChatGPT?”*

Grade 9 female: *“We don’t take computer lessons seriously; we will pass anyway.”*

Grade 9 male: *“No one cares or knows when we have an ICT lesson until the period.”*

A few students mentioned that their class size is too large, and the classroom setting is not ideal as the teacher cannot see the screens of all students. Also, they complained that the school PCs are outdated, with slow or sometimes no internet connection at all. School SAC2 students mentioned that they did not have internet connection in the first period on Mondays when they have a TE lesson. They claimed that they were disengaged during this lesson as the teacher usually introduced a topic using worksheets and/or presentations. Consequently, for the second TE lesson of the week, they are disengaged again, as now they cannot connect to the previous lesson. Many students claimed that they were unable to engage if TE lessons were placed in the last period of the day.

Grade 11 female: *“We cannot engage when we are tired and hungry because we are in a bad mood, usually in the last period of the day.”*

Online learning vs. face-to-face learning

All students claimed that they were not engaged at all during COVID-19 online learning. They said that they were bored and very distracted by other family members and happenings at home. They were tired of looking at the screens for long periods of time. Materials and activities were confusing, and the teacher's explanations lacked clarity. Also, they experienced many technical issues with respect to their devices and internet connections at home. TE-specific issues include working with devices, which can always be distracting as they can open other websites or the camera very easily.

High School Students in the IGCSE curriculum

Student Attitude and Engagement

All students agreed that technology is important for the future as well as the present, as it relates to their daily lives. Most students stated that learning about technology is fun when they learn about topics they like. Students who chose computer science claimed that the class was relaxing, with enough time to think and code. Many asserted that programming and debugging programs were very satisfying, as one can see the output of the program. They stated that they opted for the subject as they are interested in it, aspired to have a career in technology, and they were willing to work hard to achieve their goals. However, many other students stated that they chose the subject as they believed that it was an easy subject to score good grades, while others chose it at the insistence of their parents or because they needed to choose a minimum number of subjects for their external exams, as a requirement for universities.

Grade 9 male: *“Everything is disengaging – I chose it because my parents forced me.”*

Many students claim that TE is boring, and they are not interested in learning about technology. They did not understand the significance of learning about technology as they did not connect it to anything outside their classrooms. Some students stated that the classes are repetitive and boring, with nothing new to learn.

Grade 9 female: *“What we learn about technology in school is not related to how we use technology out of school.”*

Grade 10 male: *“I do not believe that I am good in ICT as I have always got low marks.”*

Grade 9 male: *“I didn’t anticipate such difficulty in the subject.”*

Role of Topics and Activities in Student Engagement

Many students stated that they enjoyed doing activities in groups; however, some students claimed they focused better while working alone.

Many students were engaged during theory topics connected to real life, such as e-safety, hacking, etc. However, many others claimed that they already knew all the theory topics from before and therefore, it was boring, and the new topics, such as data representation and networking, were difficult and abstract. They complained that they had to memorise a lot of information, and they suggested that they would like to see the internal parts of the computer that they learn about in theory lessons.

Although many students claimed that they were engaged during programming with Python, many others mentioned that this was the case only when the concepts were easy and that they tended to disengage as soon as it started to get complicated. Many students asserted that their engagement was high during practical tasks with software such as Microsoft Excel, while many others were not interested in practical tasks and claimed that they found practical concepts in Microsoft Access too challenging.

Grade 10 male: *“Practical is interesting because we will use it in the future.”*

Grade 9 female: *“I was very engaged when we had to do research for theory lessons; we were asked to combine information from the internet as well as our textbooks.”*

Grade 10 female: *“Theory is easy, but practical is hard, so I dropped the subject.”*

Teacher Attitude and Pedagogy in Student Engagement

Most students agreed that they feel engaged when the teacher motivates and interacts with them in a friendly manner. They also mentioned they disengage when the teacher raises her voice and wastes too much time controlling the class when it is disruptive. Many said that they tend to disengage when they feel that the teacher does not care if they are focusing. Very few students believed that their teachers were concerned about their learning. On the other hand, when the teacher is helpful, cares for their exams and grades, they feel inclined to engage in class.

A few students claimed they were engaged when the teacher asked them questions about the topic. They also enjoy when their teacher connects their learning to real-life situations.

Grade 10 female: *“Discussing the program with our teacher was very engaging.”*

Grade 10 male: *“Starter questions activity to recap at the start of the lesson is very engaging.”*

Most students agreed that teacher effort in making interesting presentations and carefully seeking out videos that help students understand the concepts better makes a big difference in their engagement in class. Conversely, many students claimed they tend to

disengage when the teacher just reads from a presentation, does not allow any questions or gives feedback.

Grade 9 male: *“It is so boring to just listen to the teacher and follow the steps shown.”*

Students remembered the teacher integrating TE with maths while learning Microsoft Excel and programming; with physics when learning about magnetic fields in compact discs; with biology when learning health and safety with technology; and with geography when learning about different kinds of networks. They also recalled the teacher connecting TE with society issues such as hacking, cybersecurity and social media influence on politics and the environment; and their teacher showing them different perspectives when different students work out problems differently. Students mentioned that TE helped them understand some concepts better, such as how Microsoft Access identifies when wrong data is entered and about encryption.

School Infrastructure and Curriculum Related to Student Engagement

In school SIG1, TE classes were conducted as block periods of two lessons. Students agreed that they could not focus for so long as there was too much information or explanation to understand, and that they would prefer a break in between these lessons or the lessons on different days.

In school SIG2, although some students had dropped out of doing the external exam for the subject, they had to continue their learning in the class. Their peers complained that, as these students do not take the subject seriously anymore, they cause distractions, affecting the engagement of the entire class.

Grade 10 male: *“I do not feel engaged when the entire class seems disinterested.”*

Another major cause for disengagement in TE classes, as mentioned by most students, was being distracted by computers and being tempted to use the internet for games or searches during the lesson. Contrary to this, other students stated that in the computer labs, the computers are old, the internet is slow, and the software they use lags as they are outdated, which causes their work to be lost, and all of this frustrates them.

With respect to the curriculum, a few students found the subject too difficult when they reached high school and asserted that they could not engage when they did not understand what was going on.

Grade 10 female: *“When I don’t understand one concept, I cannot understand the next one also, and then I am disengaged.”*

4.2.4 Teacher Interviews

The questions of the teachers’ interviews were based on the data collected from the surveys and focus group interviews of the students regarding their perspectives on student engagement in technology education classes. Only ten out of twelve teachers who completed the surveys and whose classes were observed were interviewed; two were unavailable due to personal reasons.

Teachers teaching the international American curriculum

Student attitude and engagement

Most teachers agreed that many students were engaged when learning to code in Python or Java in high school grades 9 to 11. Students who are excited while learning to program feel a sense of accomplishment as they see a result of their work and therefore, become engaged. Teachers also claim that these students are confident in their problem-solving skills, in addition to their programming skills. They claimed that most Grade 11

students have decided on their courses in universities and are focused on achieving the required credits and grades. They usually choose the technology education subject either out of interest or requirement, or for high grades, assuming that the subject is easy. Students in all schools start to code in Grade 9, although they learn programming concepts in earlier years in the form of Robotics or with other programming software such as Scratch and App Inventor, which have drag/drop commands and readymade interfaces. Teachers also noted that a considerable number of students specifically do not enjoy coding. Some students can cope with coding when it is easy and simple, but tend to disengage when the concepts begin to get difficult. In the school SAC2, a participant related that the students in high school taking technology education were from the Humanities stream, those not interested in science or maths, so they were only able to grasp concepts when they were simple but found it difficult when they had to connect these simple concepts together or when learning about complex concepts.

FTAC1112: *“Students do not understand the abstraction in coding; they find it dull and prefer something more colourful or animated.”*

MTAC91011: *“Students must be convinced that all workforces require employees who are tech savvy, for them to be interested in technology education beyond just the marks.”*

FTAC1011: *“Students are always asking why they must learn programming. I tell them it’s to learn organisational thinking, critical thinking and problem solving, but they do not understand.”*

All teachers agreed that there exist knowledge gaps in all grade levels due to multiple reasons, which include student migrations, teacher changes in previous years, digital influences at home, online learning disparities during the COVID-19 pandemic, etc.

FTAC1011: *“Students migrate from different curricula, and there tends to be a knowledge gap among students – this causes low student engagement as they are unable to cope in high school.”*

All teachers recognised that most students do not take technology education seriously, as they know it is not a core subject and do not feel the need to practise reinforcing their skills and concepts. All teachers agreed that one of the biggest issues is that the subject is not given its due importance by the school, and even more so, as during official inspections, the technology education lessons were rarely visited. Furthermore, students do not understand the importance of learning technology skills in their lives despite being digital natives. Parents also regard the subject as an easy one where students can score high grades to raise their final grade average.

MTAC91011: *As a professor in my country I am aware that universities and technical schools are very focused on technology education and I am surprised that here in high schools it is regarded poorly – with no weekly or final exams, rather it is treated only as serious as elective classes such as Sport, Music or Art.”*

FTAC911: *“Students should know about the technology they use in real life, how it actually works in the background. Those who do not put in effort to engage are unaware of the hidden skills in learning to code and of the value of these skills in their resumes for their careers.”*

FTAC9: *“I tell them that everything around us has interfaces, and we must know how to work with technology.”*

All teachers believed that they cannot engage all the students all the time in a classroom, as some may be talented in programming, while others in web-designing or digital editing. They also noticed that student engagement decreases in technology education classes as students reach high school, as students of this age group generally associate technology only with social media like Instagram, TikTok, Snapchat, etc.

FTAC9: *“Students do not like Python as it does not have an interface where they can just click and drag.”*

One teacher asserted that student personality has an immense effect on their engagement in any class. In school SAC3, grades 9 and 10 have students based on high intelligence and good behaviour grouped into two sections. This teacher claims that while in the other sections of these grade levels, student engagement is quite challenging for the teachers, students in these sections are engaged irrespective of topic or activity. There is rarely a need to create a competitive spirit between the students, using activities or strategies, as they are innately competitive in nature. However, the teacher was not agreeable to this arrangement as he believed that all classes needed a mix of students of different abilities so as to motivate and engage each other.

MTAC91011: *“Discipline issues in high school cause disengagement - problems at home are usually reflected in school.”*

Role of Topics and Activities in Student Engagement

All teachers claimed that the students were most disengaged while learning theory topics that include the working of the computer and data representation in computers. However, these topics are necessary as students must appear for a standardised test based on United Arab Emirates national standards known as the EmSAT after high school, which includes computer science topics. These topics are mostly abstract and do not have many hands-on activities unless the school invests in labs such as networking labs and the like, which can be expensive.

MTAC91011: *“Hands-on activities make theory topics come alive, and it is time that high schools invest in labs to support these activities.”*

FTAC1112: *“Engagement depends a lot on interests and levels of intelligence, which may explain why different students enjoy different topics and activities.”*

FTAC1011: *“Sometimes I do not enjoy teaching theory topics, and I notice the students also are disengaged.”*

All teachers agreed that most students enjoy group activities. Although a few prefer to work alone, it is a necessary activity to teach collaboration and cooperation to train students in school to work with all kinds of people in the future. All teachers claimed that all students were highly engaged during game-like activities such as *Kahoot*, *Quizziz*, *Edulastic*, *Blooket*, *Nearpod* (Time to Climb), etc., which are casual yet competitive activities. Interestingly, most teachers claimed that the students ask for the same game to be repeated multiple times. One teacher mentioned that although most students appear disengaged when they are reading and explaining from a presentation, there are a few who expect this, as they are used to this kind of teaching and learning, being ESL students.

FTAC10: *“I can reinforce what I teach with games, the students are having fun learning it.”*

FTAC1011: *“I break down the difficult concepts into smaller bits and give activities in ‘Quizziz’. When students want feedback, I know they are engaged and learning.”*

All teachers concurred that students enjoy activities such as projects with authentic connections to their real life, where many skills can be assessed, and where they can choose their own topics. Competitions within the school with a reward system, such as one for the best app (App Inventor) or a one-minute film festival (video-editing), engaged most students, as do external competitions such as hackathons and robotics competitions, such as WRO and FLL.

Most teachers added that some students enjoy looking up information online to do research, and also noticed that when students were asked to present their projects to their peers, they were extremely engaged as they were proud to showcase their work. However, one teacher emphasised that the internet must be used as a resource that aids students to apply their knowledge and not just to copy information from.

All teachers agreed that differentiated activities, although quite challenging to accomplish in classes with many students, enhance student engagement. Students who are talented need their engagement sustained during the lesson with extended and challenging activities, whereas other students need their basic concepts reinforced before moving on to complicated ones. Teachers must plan lessons catering to the learning styles of all students in the class. Most teachers agreed that topics for the activities can be based on student interests, ensuring the same objectives are achieved.

FTAC9: *“I asked the students to choose their own topics to create apps by looking into the society, using the software ‘App Inventor’- and they came up with some interesting*

problems to solve based on their own interests, such as shopping catalogues and stock calculators. I knew they were engaged and learning the objectives.”

Most teachers agreed that integrating technology with other subjects helped students to understand topics better and increased their retention of concepts in both subjects. They recalled integrating technology topics by asking students to program in Python to find solutions to quadratic equations or volume or surface area of shapes given user input; create a BMI calculator and connect it to health in Biology; website designing with English topics; order of operations PEMDAS in programming with maths, logic circuits with physics, etc.

School infrastructure and student engagement

All teachers asserted that class sizes were too large, with around 30 students in each class, resulting in not being able to attend to all students during class time. They also agreed that it was difficult to manage such large classes, as students moving to the lab was itself highly energetic and chaotic. Adding to this, having lessons after recess and in the last periods when students were tired does not help in student engagement and in classroom management. Most teachers reported that they did not receive much support in managing such large classes in the computer labs. Two teachers mentioned that technology education classes were chaotic, and student engagement plummeted when there were changes in teachers during the academic year due to either administrative reasons or teacher migration, which is common in the United Arab Emirates. Also, the few students in a class who do not take the subject seriously can disengage the remaining students by causing disruption and wasting time.

MTAC91011: *“Admin must provide timely and decisive support with disruptive students to help teachers.”*

FTAC9: *“Teachers need to be motivated and supported in schools.”*

FTAC1011: *“It is impossible to cater to all students’ needs and address multiple technical issues that arise on a daily basis in a TE class with 30 students without an assistant.”*

Most teachers acknowledged that multiple issues exist specifically in the technology education classes that affect student engagement. One of the major issues mentioned by the teachers is the seating arrangement in the labs, which are not purpose-built but converted from other rooms. Another factor that was mentioned was that the computers and software are outdated, and the internet connection is also slow. Thirdly, in some schools, such as SAC2, students did not go to the labs as they were converted to classrooms after Covid-19, and students were in classrooms using their own devices. This results in issues such as running out of charge or not being able to connect to the school Wi-Fi, or when connected to individual data connections, the students being distracted by social media, shows or games, as all websites are accessible. Teachers reiterated that although the internet is essential for the students’ learning, personal devices in classrooms were a distraction rather than a productive tool.

MTAC91011: *“As teachers, we are fighting for student engagement against distraction, so schools must allow only certain websites for students to access so that they can use their devices efficiently. This will not only contribute to their learning but also take a huge load off the teachers.”*

School curriculum and student engagement

Few teachers mentioned that the curriculum for technology education is not consistent, as it changes every year. Teachers will be given only one workshop by the supplier of the software that is to be used for the term or year, and they will be left on their own to create lesson plans and activities for the term. This is a specific technology education issue as

schools want to introduce the latest educational technology to capture the interest of the students. However, students would not have enough time to master the skills in a particular software before another one is introduced in the following term.

Another issue noted by a few teachers was that the school did not allow students to fail in technology education at any grade level; students were always given make-up exams with a lot of assistance from teachers to achieve the minimum marks to pass. This allowed the students to be disengaged throughout the lessons during the term or year, as they knew that somehow, they would pass the subject in the end. Teachers from schools SAC1 and SAC2 said that their schools conducted the technology education and/or coding assessments on paper while the students learned to code on the computer; this disengages them as they are not able to actively learn from debugging their code. Teachers claimed that schools justify this procedure because students cheat when tests are given online, which is a specific technology education lesson issue.

In all the schools where this research was done that followed the international/American curriculum with no external exams, students were not given the choice to opt out of technology education, requiring all students to take the subject. In school SAC2, as mentioned earlier, only students from the humanities stream had technology education as part of their curriculum, while their peers in the science stream did not have to take the subject. These students from the humanities stream do not like sciences or maths, and when concepts in technology education were related to these, the students found it difficult and were highly disengaged. Few teachers from the school SAC3 mentioned that they had proposed about offering different courses within technology education to the students as choices, so that students who prefer to learn higher levels of programming will have the opportunity to do so

while others who do not may enjoy learning other technology skills such as networking, cybersecurity, or robotics. The school rejected this due to investment and logistical issues.

Teacher Attributes

No teachers recalled discussing technology-related societal issues with the students. Few teachers mentioned that they discuss different perspectives with the students; those who did stated that they pointed out when students did programs differently from others or what was shown to them. Most teachers used prior experiences to connect to the current learning of the students, such as calculations in Microsoft Excel, programming concepts taught in previous years or number systems when teaching the binary coding system. All teachers believed that they were helpful and approachable. However, they agreed that they cannot always be pleasant in the class owing to disruptions from uninterested students, lack of focus, short duration, and a number of lessons to finish the assigned curricula, etc. Most teachers were concerned for the students' learning, gave feedback or success criteria/instructions and advised them with strategies to learn and/or take quizzes.

FTAC1112: *“Teachers must try different strategies because one teaching style will not reach all students.”*

All teachers interacted with the students with personal talk, motivation, or their own life experiences. The teachers who did not interact or give learning feedback stated that they were unable to do so due to large class sizes or a lack of class time. Most teachers commented that they were not given regular professional development training for pedagogy skills. Two teachers stated they do not integrate, give feedback, or connect to prior experiences as they are new to teaching and unaware of these strategies. Two teachers stated that they only received

workshops to introduce educational technology from the retailers, and no further support. One teacher recalled not having any technical assistance and having to deal with multiple technical issues during lessons, resulting in teacher frustration and students' disengagement in the lab. Only one teacher stated that a few students interested in computer science careers discussed it with them.

Online vs. Face-to-Face learning

All teachers agreed that teacher effort in management during online education is minimal, but there is no certainty about student engagement or learning. However, there are issues such as technical problems of connecting or echoing, distractions from family, and sometimes outsiders joining the classes to disrupt. They stated that it can be used occasionally when schools cannot function normally due to weather or other emergencies. However, they do not deem it ideal for long-term teaching and learning.

Teachers teaching the IGCSE curriculum

Student attitude and engagement

Most teachers agreed that class dynamics matter in relation to student engagement, as students' attitudes affect each other in the classroom. All teachers said that some students who believe they are good at the subject enjoy the autonomy given by the teacher and do their work with confidence, and look forward to extension activities. When they see their own achievement, it results in further engagement, and each has a reciprocal effect on the other.

FTIG910(ICT): *"I do the same activities in two different class sections; however, one section is more engaged than the other."*

MTIG9: *"It depends a lot on the student, if they are willing to put in the work or no."*

Most teachers claimed that students believe they are not good at the subject, as they do not have enough time to develop their skills in a particular software. When students do not grasp the content and skills of one year, they tend to be disengaged in the following years, as there is a gap in knowledge.

FTIG910(ICT): *“As a school, we are part of the problem; we change the curriculum for the students in lower grades so often that they do not have time to practise and strengthen the core skills in any one software. We may revisit the software two years later, and it is like learning a new software for almost all the students; they hardly remember the main concepts or skills.”*

Most teachers stated that students do not engage as they do not have an interest in the subject, or they do not consider it significant for their career or future. Students opt for the subject assuming that it is easy and that it will get them good grades in the external exam. Very few students opt for the subject with a genuine passion for it or plan to take up a career in it.

MTIG10: *“Mostly students take it because they need to choose a minimum number of subjects in high school, but eventually, in the year when they have to actually take the external exam, they drop the subject for the exam. However, they are still required to attend the classes, thus there is low engagement from these students as they do not have an end goal.”*

All teachers claimed that some students require a minimum number of credits in the universities they plan to attend in the future, and they view technology education as an easy subject to take in high school for the same. One teacher claimed that students do not believe technology education will benefit them in their future lives, and they only consider it a subject

for attaining university credits. Only one teacher believed that some students who opt for computer science may be talented in logical thinking and programming.

Role of Topics and Activities in Student Engagement

All teachers agreed that students are engaged during topics and activities that are related to real life. Examples were given with reference to topics such as artificial intelligence, theory topics about input devices, such as cards used in theme parks and hotels, etc. They also claimed that activities in technology education classes that related to their prior experiences in life, such as visits to theme parks or hotels, or at school in previous years with programming or Excel, also resulted in high engagement.

All teachers were of the same opinion that every lesson must have varied activities to keep students engaged. According to them, activities such as research projects where students have to search online for information and present to their peers in the class, rendered high engagement in the students. Most teachers agreed that videos only captured the students' attention span if it was relatable to the students and had to be followed up with a critical thinking question-answer session.

FTIG910(ICT): *“Videos and other media have to be seamlessly incorporated into the lesson with activities before and after to keep the flow of the lesson and thereby the students engaged.”*

All teachers agreed that theory topics are disengaging for the students in high school, as there are no hands-on activities. Also, it involves abstract thinking and memorisation, which do not engage the students.

FTIG910(ICT): *“As per the school curriculum, students only learn practical topics in lower and middle school, so they find it boring to learn about computer parts and how computers work in high school.”*

MTIG9: *“Theory is only interesting for those students who are innately curious.”*

All teachers claimed that most students enjoy group activities. However, they assert that the external exam system requires that students do their work individually and must be trained as such.

One teacher said that online interactive activities were highly engaging, such as *Quizziz* and *Kahoot*. Other teachers stated that although they would like to do a variety of activities, the external exam curriculum is such that they rarely have enough time to cover the entire curriculum with the students.

MTIG10: *“I use a starter activity which gets the students warmed up for the session, and as a plenary, I use an online interactive game-like activity which the students look forward to at the end of the lesson.”*

All teachers related that when connections are made to other subjects, such as economics by relating effects of technology to world economics or Microsoft Excel to maths, students tend to be engaged. Sometimes, however, it does not work as anticipated, as one teacher stated that students are engaged until they have to work with complex functions in Microsoft Excel.

MTIG9: *“Students not talented in maths may be disengaged while learning Microsoft EXCEL, also, as it has many complicated math concepts.”*

This was reiterated by another teacher who claimed that students who chose the ICT course and not computer science were disengaged when topics became more complicated.

MTIG10: *“Students do not like when they have to add the code to Microsoft Expression as it is slightly more complicated.”*

School infrastructure and student engagement

All teachers claimed that computer labs were designed inadequately, as they were not purposefully built but were actually normal classrooms rearranged. The seating arrangements resulted in screens facing away from the teacher, and students would be easily distracted by being connected to the internet during the lesson without the teacher’s knowledge. This would then cause other students, who sat nearby, to also be distracted, and eventually, everyone will be disengaged. Most teachers also stated that the computer labs were far away from students’ classrooms, which caused many to walk in late, causing a lot of disruption during the first part of the lesson.

Technology education in school SIG1 were conducted as blocks with double periods during the week, and the participants from that school claimed that teachers could not sustain student engagement for the entire duration of the block.

FTIG910(ICT): *“I am able to cover more objectives in one period than in two continuous periods, as the students could not sustain their engagement for such a long period of time”*

The teacher also claimed that one year, the school suddenly reduced the weekly number of periods from three to two for the technology education class, and that year, she had to cover the curriculum in haste, which rendered the students mostly disengaged in her lessons. Another teacher in school SIG2 stated that students are tired when the technology

education class is kept in the last period, and they cannot be engaged during this lesson, irrespective of engaging topics or activities.

All teachers agreed that in their schools, the class sizes were large, and it is difficult to give attention to each student in every lesson and that it is possible that teachers will be unaware of some students not grasping concepts and skills.

Finally, most teachers agreed that the computer labs are unsatisfactory with old models of computers, outdated software, slow network, and no functional software to monitor students' work from the teacher's desk. One teacher complained that the tables and chairs in the lab were uncomfortable for the students.

MTIG10: *"My lab is so crowded with the tables and chairs that I do not have space to walk around to check on student work."*

School curriculum and student engagement

All teachers agreed that the schools do not consider technology education as a core subject like maths and science. This affects the mentality of the teachers, parents and the students alike.

FTIG910: *"Students take the subject lightly and give it less importance than other core subjects; therefore, they assume they do not have to be engaged in class."*

School curriculum during the year requires multiple assessments; most teachers claimed they were teaching for these assessments, which stressed the students and made them disengaged during lessons.

Teacher Attributes

All teachers believed that they were helpful and approachable to the students. They said they were concerned about the students' learning and provided the students with strategies for studying and provided them with timely and effective feedback. Only one teacher mentioned that the students discussed their careers or their academics with them. Only one teacher provided an example of discussing with the students about the application of technology to solve problems in society; another mentioned that he used the theory topic in the curriculum about the applications of technology and connected it to students' lives. Only one teacher provided an example of discussing different perspectives using technology with the students by showing them how they can have different programs to get the same solution. Most teachers received professional development training twice a year as they were teaching towards external exams.

Online vs. Face-to-Face learning

All teachers agreed that during online education, there are no behaviour issues, but student engagement and learning are doubtful. They all reiterated that face-to-face sessions were better for student learning.

4.2.5 Observations

The researcher conducted 29 observations in 5 private schools in Abu Dhabi in different sections of grades 9, 10 and 11 technology education classes over two academic years.

Table 5

Number of Observations, Schools, Curriculum, and Grade Levels

Number of Observations	Schools	Curriculum	Grade Level
8	SAC1, SAC2, SAC3	AC	11
5	SAC1, SAC2, SAC3	AC	10
7	SAC1, SAC2, SAC3	AC	9
4	SIG2	IG	10
5	SIG1, SIG2	IG	9

Table 5 shows the number of observations conducted in each of the different schools.

Observations of Classes doing the International American Curriculum

School: SAC1	Grade 11	Topic: Revision of Functions in Python
Room: Classroom	Overcrowded large room with no place for teacher to walk around Projection on the board: a Python program TE class issues: font on the board is too small and not bright	
Students Gender: Mixed Class-size: 31 students	Individually seated facing the board with own devices Few students responding to teacher questions Most students working out the example shown by teacher	
Teacher FTAC911	Standing next to the board/ Sitting at the desk next to the board Reading and explaining the program from the board Asking students questions. Gave examples for students to work on	

School: SAC1	Grade 11	Topic: Patterns in PHP
Room: Classroom	Large room with place for teacher to walk around. Projection on the board: None TE class issues: None	
Students Gender: Mixed Class-size: 19 students	Individually seated facing the board with own devices Allowed to work together as groups	

	Few students asking teacher questions. Most students working with only few disengaged (off-task discussions and sleeping)
Teacher FTAC911	Reading and explaining student mistakes from teacher laptop Walking around and answering student questions

School: SAC1	Grade 11	Topic: Java Programming
Room: Classroom	Average room with place for teacher to walk around Projection on the board: links of tasks for students to do, including extended tasks TE class issues: one student forgot his password	
Students Gender: Boys Class-size: 11 students	Individually seated facing the board with own devices Few answering teacher questions All but one student doing the tasks Only one disengaged (did not have password to log in)	
Teacher FTAC911	Started with connecting topic to previous lesson with some questions and giving time for students to think and respond. Walking around and checking if students are doing their work.	
Extra information:		

School: SAC2	Grade 11	Topic: Website Design and presentation
Room: Classroom	Average room with place for teacher to walk around. Projection on the smartboard: Student websites of own topic while they present it to their class. Objectives written on White board. TE class issues: Class PC is slow to connect to smartboard	
Students Gender: Girls Class-size: 11 students	Individually seated facing the board with own devices Students asking questions about the technical part of the website Students giving peer feedback. All students engaged.	
Teacher FTAC1011	Started with reminding students about peer feedback. Sitting at the table and giving constructive feedback	

Extra information:	Students very enthusiastic about their presentation and peer feedback. Teacher cannot see the PC screens of the students from front of class
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School: SAC3	Grade 11	Topic: Quiz feedback
Room: Classroom	Average room with place for teacher to walk around. Projection on the smartboard: Quiz Document TE class issues: none	
Students Gender: Mixed Class-size: 16 students	Individually seated facing the board with own devices Students reading the quiz questions – very few engaged; many off task doing unrelated work; some sleeping Students answering teacher questions – only those asked by the teacher	
Teacher MTAC91011	Started with asking students to read the questions from the board Asking students to answer these questions. Explaining the answers with examples	
Extra information:	No tasks were assigned to the students External distraction with student being called by the admin	

School: SAC3	Grade 11	Topic: Graded Assignment on Excel Functions
Room: Classroom	Large room with place for teacher to walk around. Projection on the smartboard: video of the assignment instructions. TE class issues: none	
Students Gender: Mixed Class-size: 25 students	Individually seated facing the board with own devices Students watching video – some started doing assignment; some showing teacher the assignment; a few doing nothing	
Teacher MTAC91011	Started with asking students to watch video.	

	Walking around and checking the assignment; answering questions.
Extra information:	n/a

School: SAC2	Grade 11	Topic: Theory – Computer Parts
Room: Classroom	Average room with place for teacher to walk around. Projection on the smartboard: presentation with video. TE class issues: some devices ran out of charge	
Students Gender: Boys Class-size: 11 students	Individually seated facing the board with own devices Students answering questions (right and wrong answers) Students read from presentation, watching video – few disengaged. Students working on the worksheets – many disengaged. Starts playing Quizziz - all students engaged.	
Teacher FTAC1011	Started with asking critical thinking questions. Sitting at the table and asking students to read from the presentation. Explains the video in the presentation Teacher gives out worksheets to solve as pairs and walking around to check their work and answer any questions. Teacher starts Quizziz (interactive game) Teacher praises students who did well; gives feedback about wrong answers.	
Extra information:	Students very enthusiastic while doing Quizziz. Students were upset when they made mistakes and were asking each other for correct answers. Students were upset when lesson ended.	

School: SAC3	Grade 11	Topic: 3D printing – improvise on a box
Room: Computer Lab	Large room with place for teacher to walk around. Projection on the smartboard: Software for Teacher demonstration TE class issues: school PCs software taking time to load; software does not load; software crashes midway with student losing work	
Students Gender: Mixed Class-size: 23 students	Individually seated with school PCs Students answering questions with their ideas Students working as pairs – most engaged; some collaborating with other pairs for help; few students waiting for the teacher	
Teacher FTAC1112	Started with asking students ways to improve a box Giving examples related to real life Demonstrating steps to make a partition in the box Walking around and checking student work, helping with problems. Explaining common problems out loud	
Extra information:	Designs were not printed as 3D printer is in maintenance	

School: SAC1	Grade 10	Topic: Html activity
Room: Classroom	Medium room with no place for teacher to walk around. Projection on the board: Software for Teacher demonstration TE class issues: none	
Students Gender: Mixed Class-size: 26 students	Individually seated with own devices . Students working along with the teacher. Students working as pairs – most engaged; 1-2 off task	
Teacher FTAC10	Started with relating the objectives for the lesson. Reminding students about objectives in the previous lesson. Demonstrating the task on the board connecting to real life. Calls on a student to make some changes on the board. Ends with a review of the lesson	
Extra information:	Teacher was very energetic and moving around constantly as much as she could in the space available; one student was online	

School: SAC2	Grade 10	Topic: Theory – About the CPU
Room: Classroom	Medium room with place for teacher to walk around Projection on the board: Blooket game dashboard TE class issues: one student laptop has no charge	
Students Gender: Boys Class-size: 22 students	Individually seated with own devices – disorganized seating Students chaotic but engaged when the game starts; talking across the class to their peers – most engaged; few off task Students asking teacher to repeat the game once time ends	
Teacher FTAC910	Started with reviewing the topic. Posts the game on the board with the code for the students Walking around to check if students are playing the game Asking students what they got wrong Asking students to search internet for other parts of the CPU	
Extra information:	Some students are on their phones; some are eating in class Students are excited about the interactive and competitive game	

School: SAC2	Grade 10	Topic: Graded Assignment - Binary System
Room: Classroom	Medium room with place for teacher to walk around Projection on the board: None TE class issues: n/a	
Students Gender: Girls Class-size: 21 students	Individually seated with own devices – disorganized seating– no devices are used for the lesson. Students chaotic and upset about the assignment Students working on the worksheet as groups – most engaged; few distracted or just observing within groups	
Teacher FTAC1011	Starts with telling students about the assignment. Gives out worksheets for the students to solve as groups Walking around to check if students are working Answering students' queries	
Extra information:	n/a	

School: SAC3	Grade 10	Topic: Quiz Feedback
Room: Classroom	Medium room with place for teacher to walk around Projection on the board: the quiz document TE class issues: n/a	
Students Gender: Mixed Class-size: 21 students	Individually seated with own devices – no devices are used for the lesson Students just looking at the board and/or teacher occasionally; many disengaged – some on YouTube or other websites; others working on some other subject material 2-3 students answer the teacher's questions.	
Teacher MTAC91011	Starts with stating the objectives for the day. Asks students to read from the presentation Explaining key points; asking questions	
Extra information:	n/a	

School: SAC3	Grade 10	Topic: Graded Assignment – Python program
Room: Classroom	Large room with place for teacher to walk around Projection on the board: Presentation with assignment requirements TE class issues: none	
Students Gender: Mixed Class-size: 20 students	Individually seated with own devices Students start task immediately; mostly engaged – few talking to each other; few distracted with external interruptions	
Teacher MTAC91011	Starts with asking students to read from the presentation. Proceeds to give examples and states success criteria Teacher walking around checking student work	
Extra information:	Many external interruptions with students entering for some reason.	

School: SAC2	Grade 9	Topic: Term Project
Room: Classroom	Medium room with no place for teacher to walk around. Projection on the smart board: none TE class issues: Class smart board not working; student laptop did not have charge	
Students Gender: Girls Class-size: 26 students	Individually seated with own devices Students doing the task; many engaged – few doing other work; few doing nothing Students were confused whether it was pair work or individual	
Teacher FTAC910	Starts with explaining the task to the students. Walking around checking student work as much as possible; answering queries and motivating them about their skills Asking the students to generate questions from their project as they will be asked about it when they submit Asking to continue working at home and submit on deadline	
Extra information:	Teacher has an argument with a student about her work. All students doing the same project.	

School: SAC3	Grade 9	Topic: Binary and Alphanumeric systems
Room: Classroom	Large room with place for teacher to walk around. Projection on the board: Python program TE class issues: the activity slide took time to load	
Students Gender: Mixed Class-size: 22 students	Individually seated with own devices Some students raising hand to answer teacher questions. All excited and engaged during pair activity - interactive game	
Teacher FTAC91112	Starts with review of previous exercise. Calling some students to answer questions. Starts a pair activity – interactive game	
Extra information:	n/a	

School: SAC2	Grade 9	Topic: Build a login system in Python
Room: Classroom	Medium room with place for teacher to walk around. Projection on the smart board: Task document TE class issues: 4 students do not have devices; Smartboard projection very unclear	
Students Gender: Boys Class-size: 16 students	Individually seated with own devices Students all engaged in the beginning – then midsession many changed to YouTube, ChatGPT	
Teacher FTAC910	Starts with distributing the task sheets to the students and explaining the task. Asking questions and giving examples of functions to use in the program Asking to continue working next lesson	
Extra information:	Teacher/Class was being observed by the Head of Department during this lesson until midsession.	

School: SAC1	Grade 9	Topic: Python Dictionaries
Room: Classroom	Large room with place for teacher to walk around. Projection on the board: Python program TE class issues: many devices do not have charge	
Students Gender: Mixed Class-size: 21 students	Individually seated with own devices Some students engaged to work on the code on the board, some were trying it on their own device; many were distracted – playing games, talking, drawing; all excited to hear about Kahoot All engaged when Kahoot starts	
Teacher FTAC911	Starts with review of previous exercise and tells students about Kahoot. Reading from the presentation and calling some students to write the code on the board. Starts the game Kahoot.	
Extra information:	Ends class abruptly	

School: SAC1	Grade 9	Topic: Python Dictionaries
Room: Classroom	Large room with place for teacher to walk around. Projection on the board: Python program TE class issues: Class too bright for students to see projection	
Students Gender: Mixed Class-size: 31 students	Individually seated with own devices Some students engaged to work on the code on the board, some were trying it on their own device; many were distracted – playing games, talking, on YouTube; all excited to hear about Kahoot. All engaged when Kahoot starts	
Teacher FTAC911	Trying to settle the class which is chaotic. Reviews previous exercise first and tells students about Kahoot. Reading from the presentation, explaining the concepts and calling some students to answer questions. Starts the game Kahoot as groups.	
Extra information:	Ends class abruptly	

School: SAC3	Grade 9	Topic: Drawing Black and White images
Room: Computer Lab	Large room with place for teacher to walk around Projection on the smartboard: Objectives, Video, Demo activity TE class issues: few PCs did not connect to the network	
Students Gender: Mixed Class-size: 19 students	Individually seated with school PCs – using own devices Guesses the objectives about the topic All watching the video. All excited and engaged during demo and then activity	
Teacher FTAC9	Starts with writing the topic name on the board and asks them what they think they are going to learn today. Plays a video on all the PCs for students to watch. Does a demo of the task and asks students to do the task	
Extra information:	Many students were using their own devices for the task	

School: SAC3	Grade 9	Topic: Binary number system
Room: Computer Lab	Large room with place for teacher to walk around Projection on the smartboard: Objectives, Video TE class issues: none	
Students Gender: Mixed Class-size: 21 students	Individually seated with school PCs – using own devices Answering warm-up questions in chorus All watching the video – few disengaged Most engaged during task – few waiting for the teacher Few frustrated when getting to higher levels of the task	
Teacher FTAC9	Asks students questions about the topic as warm-up Plays a video on all the PCs for students to watch. Asks students to do an online task with levels Walking around checking student work and asking them to move onto next level in the task	
Extra information:	n/a	

Observations of classes following the IGCSE curriculum

School: SIG1	Grade 9	Topic: Create a PowerPoint presentation
Room: Computer Lab	Average U-shaped room with little place for teacher to walk around. Projection on the smartboard: Objectives TE class issues: none	
Students Gender: Mixed Class-size: 26 students	Individually seated with school PCs Answering questions – some disengaged All students engaged during the task	
Teacher FTEE910(ICT)	Asks students questions about previous lesson. Explains further to reinforce students. Explains today's objectives including research requirements. Asks students to do a task as groups with a time limit Teacher walking around to check students' work	

Extra information:	Students used to working in groups.	
School: SIG1	Grade 9	Topic: Create a PowerPoint presentation
Room: Computer Lab	Average U-shaped room with little place for teacher to walk. Projection on the smartboard: Objectives TE class issues: none	
Students Gender: Mixed Class-size: 27 students	Individually seated with school PCs Answering questions – all engaged Some students asking questions about the task All students engaged during the task	
Teacher FTEE910(ICT)	Asks students questions about previous lesson. Explains further to reinforce students. Explains today's objectives including research requirements Asks students to do a task as groups with a time limit Teacher walking around to check students' work	
Extra information:	Students comfortable working in groups.	

School: SIG1	Grade 9	Topic: Create a PowerPoint presentation
Room: Computer Lab	Average U-shaped room with little place for teacher to walk around. Projection on the smartboard: Objectives TE class issues: none	
Students Gender: Mixed Class-size: 19 students	Individually seated with school PCs Answering questions – some disengaged Many students engaged during the task – some disengaged (talking and disrupting the lesson; few on other websites)	
Teacher FTEE910(ICT)	Asks students questions about previous lesson. Explains further to reinforce students. Explains today's objectives including research requirements. Asks students to do a task as groups with no time limit. Teacher walking around to check students' work Teacher yells to stop disruptions.	

Extra information:	Students comfortable as groups; one wanted to work alone. Two continuous periods; teacher gave a 5-minute break in between.	
School: SIG2	Grade 9	Topic: Mail Merge
Room: Computer Lab	Large room with place for teacher to walk around Projection on the smartboard: presentation, video TE class issues: two PCs not working	
Students Gender: Mixed Class-size: 23 students	Individually seated with school PCs Most engaged while teacher talking and displaying the video – few disengaged (playing game, making a presentation for another subject, playing chess) Some students asking questions about the video All students engaged during the task	
Teacher MTIG9	Explains the need for mail merge followed by instructional video. Teacher walking around to check students' work	
Extra information:	Teacher cannot see the PC screens of the students from front of class	

School: SIG2	Grade 9	Topic: Microsoft Access – Create a query
Room: Computer Lab	Large room with place for teacher to walk around Projection on the smartboard: objectives, presentation TE class issues: one student lost his file	
Students Gender: Mixed Class-size: 15 students	Individually seated with school PCs Most engaged while teacher explaining – few disengaged (not doing anything, looking at a chemistry presentation) Most students engaged during the task – few disengaged (learning for chemistry test, playing chess)	
Teacher MTIG9	Reviews previous lesson from presentation. Explains one task and sets a time limit. When time finishes, explains the next task with a video and sets the next time limit. Teacher walking around to check students' work	

Extra information:	Teacher cannot see the PC screens of the students from front of class. One student just joined the class today	
School: SIG2	Grade 10	Topic: Python – Classes and tables
Room: Computer Lab	Large room with place for teacher to walk around Projection on the smartboard: program TE class issues: none	
Students Gender: Mixed Class-size: 5 students	Individually seated with school PCs Asking questions about the task for clarifications Many engaged - two disengaged (surfing online, just looking at task sheet and not doing anything)	
Teacher FTIG910(CS)	Explains the task and sets a time limit	
Extra information:	Teacher cannot see the PC screens of the students from front of class	

School: SIG2	Grade 10	Topic: Python – Create a program
Room: Computer Lab	Large room with place for teacher to walk around Projection on the smartboard: program TE class issues: keyboard not working	
Students Gender: Mixed Class-size: 13 students	Individually seated with school PCs Asking questions about the task for clarifications Most engaged - few disengaged	
Teacher FTIG10(CS)	Reviews previous lesson. Demonstrates the task in steps and asks questions about the task. Asks students to do the task	
Extra information:	Teacher cannot see the PC screens of the students from front of class	

School: SIG2	Grade 10	Topic: Practical activity in Theory - VLookUp
Room: Computer Lab	Large room with place for teacher to walk around Projection on the smartboard: Starter activity; task sheet TE class issues: none	
Students Gender: Mixed Class-size: 11 students	Individually seated with school PCs Those called upon answering teacher questions Many engaged with opening the presentation and answering the task sheet – few disengaged (doing other coursework)	
Teacher MTIG10	Calling students to answer questions about the starter activity Asking students to open a presentation to answer a task sheet	
Extra information:	Teacher cannot see the PC screens of the students from front of class Students who dropped from exam seated at the back are disengaged (playing online; on their phone)	

School: SIG2	Grade 10	Topic: Practical – Database activity
Room: Computer Lab	Large room with place for teacher to walk around Projection on the smartboard: Task TE class issues: few students cannot find the files	
Students Gender: Mixed Class-size: 21 students	Individually seated with school PCs Few students asking where to find their files Most students engaged – few disengaged	
Teacher MTIG10	Explains the task Teaching walking around to check student work	
Extra information:	Teacher cannot see the PC screens of the students from front of class Students who dropped from exam seated at the back are disengaged (not doing any work)	

4.2.6 Documents

Different documents were collected from the schools to have an understanding of their technology education curricula and their policies related to technology.

School ICT policies

School policies systematically use methods and resources driven by values and visions to achieve the objectives set by its stakeholders, such as the school, students, teachers and parents. Only one school from the five schools provided their school ICT policy for this research, which mainly spoke about the students', teachers' and the school's responsibilities with respect to technology use and online safety. Other schools did not provide their school ICT policies despite repeated requests (*please refer to **Appendix L** for the School SAC3 ICT policy*).

School ICT Curricula

From the five schools, three schools followed the international curriculum with American standards and used in-school assessments with no external exams. Each of these three schools followed a different American state standard. Schools choose their own topics based on these standards, which differ widely from school to school, as was seen in this study.

SAC1

This school adopts its curriculum and standards from the Virginia state computer science standards in the United States. In this school, Grade 11 students take three courses based on their choice between Java and PHP (*please refer to **Appendices K-a and K-b** for the Grade 11 curriculum*). Grade 10 and Grade 9 follow only one course in each level (*please refer to **Appendices K-c and K-d** for the grades 10 and 9 curricula, respectively*). All courses and assessments are teacher-created.

SAC2

This school adopts its curriculum and standards from the California state computer science standards in the United States. In this school, the science stream students do not take technology education in grades 11 and 12. Only the humanities stream students take technology education classes in these grades. Grade 10 and Grade 9 follow only one course in each level. All courses and assessments are teacher-created (*please refer to **Appendix J** for grades 9-12 curriculum*).

SAC3

This school adopts its curriculum and standards from the West Virginia computer science and technology literacy standards in the United States. In this school, grade 11 students take varied technology education courses depending upon the stream they have chosen, such as engineering, medicine, business, and liberal arts. Grade 10 and Grade 9 follow only one course in each level. All courses and assessments are teacher-created (*please refer to **Appendices I-a and I-b** for grades 9-12 curriculum*).

The other two followed the IGCSE curriculum for K-12, with students from grade 10 appearing for the external exams, one (SIG1) from Cambridge and the other (SIG2) from Edexcel Pearson (ICT) and Oxford AQA (Computer Science).

SIG1

*Please refer to **Appendix M** for the link that leads to the IGCSE ICT curriculum from Cambridge.*

SIG2

*Please refer to **Appendix M** for links that lead to the IGCSE curriculum from Edexcel Pearson (ICT) and Oxford AQA (Computer Science).*

Student Achievement Records

The students' achievement records were collected from the schools to use in the quantitative part of the study. *Please refer to Appendix N for*

- student end-of-term marks in technology education
- student self-reported engagement levels in technology education
- calculation of Pearson's correlation coefficient

4.2.7 Qualitative Results – Summary

Qualitative data in student surveys that looked at

a. Students' understanding of the term 'Student Engagement':

Students understood it as participation, focus, interest or even passion for the subject, interaction with each other and the teacher, being active and eager to work and learn, collaborating with others and joy of being in the class.

b. Reasons for high self-reported levels of engagement in technology education classes:

Students pointed to a lack of interest as a popular factor for engagement, followed by the subject difficulty, while also mentioning grades, teacher quality and the significance of the subject in their future.

c. Highly engaging lesson activities and highly disengaging lesson activities:

Students mentioned learning to code or creating artefacts like websites or 3D objects as the most engaging, followed by Microsoft tools relating to engagement, whether high or low. Interactive games were indicated as highly engaging, always with group activities, also being mentioned mostly for high engagement, and lectures on PowerPoint presentation were mentioned for low engagement. Difficulty levels of activities were also related to engagement. Practical activities, including photo and

video editing activities, were declared as highly engaging and theory lessons as highly disengaging by many students. Authentic activities connected to real life were also cited by students as highly engaging.

The IGCSE curriculum students' responses were more or less the same as the American curriculum students' responses, with only a few differences, one of which included the IGCSE curriculum students being more engaged when practising with past papers to prepare them for the external exams. Also, they claimed they were equally engaged or disengaged in theory and practical lessons.

d. Teacher attributes that engage and disengage:

Most students cited that the teachers' pedagogy skills were responsible for their engagement in class, followed by their personality. Very few students admitted that teachers were not responsible for their engagement.

e. Other issues for disengagement and students' expectations from teachers and schools for optimal engagement:

Most students in the international American curriculum mentioned migration of teachers, followed by classroom management, and then school infrastructure, which included the learning environment, as issues related to disengagement. Assessments were also cited as students claimed they were assessed differently from how they were taught, which did not allow them to exercise their learned skills in assessments. Yet another issue brought up by the students was that them having gaps in knowledge due to migration from other schools, countries or due to an inconsistent curriculum within their own schools and most recently, due to online teaching and learning during the COVID-19 pandemic. Finally, they pointed out that neither the school nor the students

considered technology education as a core subject that deserved much attention.

Students in the IGCSE curriculum experienced the same issues. However, they added that having continuous lessons was affecting their engagement in these lessons.

Students suggested hiring teachers with better skills in pedagogy as well as classroom management. They also suggested offering the TE course as an elective course or at least with different levels to attract interested students. Students advocated for choice and autonomy in topics and activities within the subject curriculum. They requested continuous access to study material to refer to after formal teaching and learning hours. Lastly, they believed students working together on projects on topics that integrate other subjects with technology would ensure better conceptual understanding. Students in the IGCSE curriculum requested for curriculum review in order to include topics that were interesting and relevant to them. They asked for non-continuous lessons or unofficial breaks between block lessons, and they believed that participating in technology competitions inside and outside schools would engage them better in technology education classes.

Qualitative data in teacher surveys that looked at

a. Teachers' understanding of the term 'Student Engagement':

Teachers have understood the term 'engagement' as the interest shown by the students and their curiosity about the topic with relevant questions. They also mentioned students' participation, interaction and being active in the class.

b. Teachers' reasons for the self-reported levels of engagement in technology education classes:

Teachers mentioned that the primary cause of student engagement in high school lies in their career choices. They claimed that students engaged in order to obtain the required grades for university acceptance. Interest in certain topics or activities was also cited by the teachers as a reason for engagement. Teachers in the IGCSE curriculum asserted that students following this curriculum were engaged as they were appearing for external exams, which gave the subject significance. Finally, teachers mentioned that gaps in knowledge due to migration from other schools or countries and lately, due to online teaching and learning during the COVID-19 pandemic, also affected student engagement in technology education classes. After the pandemic, when students returned to face-to-face learning, they were still not learning in computer labs but in normal classrooms, and they were using their own devices, which resulted in disruptions and distractions.

c. Highly engaging topics/lesson activities and highly disengaging topics/lesson activities:

Teachers recalled that the highly engaging topics included any topic that involved creating artefacts, such as coding with Python or programming robots, creating websites with HTML, mobile applications with App Inventor software, 3D design and printing, and even photo or video editing to some extent. As for disengaging topics, teachers noticed that many students were disengaged when any of the above topics progressed to difficult concepts. All teachers consistently agreed that all theory topics were disengaging for most students. They also mentioned that there were a significant number of students who did not enjoy coding with Python.

As for activities, teachers mentioned that interactive activities, such as online games that were competitive, were very engaging, as were group activities. They also claimed that students enjoyed working on relevant topics with choices, in addition to presenting their work to their peers. Finally, they claimed students were engaged when the difficulty levels matched their capabilities. Disengaging activities included, according to the teachers, PowerPoint presentations and any activity that required too much work and thinking from them.

d. Teacher efforts and school initiatives to engage:

Teachers believed they must explain to the students the significance of learning about technology and its applications in one's life. They asserted the importance of asking students critical thinking questions to set their curiosity in motion, following it up with authentic activities giving students choices in topics and activities. Lastly, they also believed that building relationships with students was significant in their engagement in technology education classes. With respect to school initiatives, teachers consistently agreed that technology education as a subject is required to be given the status of a core subject, in addition to having a consistent, standardised, progressive curriculum throughout the school years. They recommended that the school provide them with timely professional development relating to pedagogy as well as classroom management. They also suggested looking into school infrastructure relating to computer lab efficiency, lesson duration and frequency and technical issues. They also requested that the schools invest in student participation in technology competitions outside schools, so that students recognise the significance of technology outside their classrooms. IGCSE teachers pointed out that schools must find a solution for students opting out of external exams but still attending classes,

causing disruption and distraction, while wasting their own time, which they can use to learn things that interest them.

e. Subject or course-specific issues related to student engagement:

Teachers claimed that the technology education subject was not given significance by the schools, parents and students, in terms of assessments, subject period frequency and curriculum consistency. They added that students were not given choices regarding the subject in high school streams. With respect to school infrastructure, teachers complained about the computer labs as they were not purpose-built but converted classrooms with fewer or awkward spaces. With the post-COVID-19 arrangements, students using their own devices were causing their own set of problems, all affecting the engagement of the students in these classes.

Qualitative data in student focus group interviews that looked at

a. Student attitudes towards the subject:

Students took technology education seriously only if they were interested in technology or chose to follow careers in the same field. However, many students did not plan to have such careers and also did not recognise the significance of technology in any other careers or in their future. They declared that they were only engaged when the concepts were simple, and some students even acknowledged that their engagement involved their own effort and interest in the topic, along with the teacher's pedagogy skills and attitude.

b. Topics and activities:

Students claimed that they were engaged when they were creating artefacts or learning something innovative, like 3D designing and printing, or creating websites.

They also mentioned that being given choices on authentic and relevant activities was engaging. They preferred to do different tasks than their peers and enjoyed presenting their creations to the class. Students claimed they were engaged during interactive activities like playing competitive games and also during group activities. Many students acknowledged that they did not enjoy coding with Python at all; some commented that it was boring if done for the whole term, and others stated that it became disengaging when the concepts became more difficult. Very few enjoyed watching videos and doing research activities, stating that they either disengage due to boredom or just copy-paste from the internet due to a lack of clarity for these activities, respectively. Most students claimed they were disengaged during theory lessons, which they found to be very abstract and disconnected from their reality.

c. Teacher attitudes and pedagogy skills:

Students mentioned that they want to engage in the subject when the teachers are caring, motivating, pleasant and interacting with them. They mentioned they take the effort to engage when they realise that the teachers have taken the effort to find beneficial videos, make interesting presentations or even plan interactive activities that are relevant to them. They also cited that teachers who are engaging connect the topics and activities to real-life situations, society and other subjects for better understanding of the concepts.

d. Subject curriculum and school infrastructure:

There were two main areas of concern mentioned by the students that had more to do with infrastructure. Firstly, students complained that they had block or continuous periods for technology education during which they found it difficult to sustain their engagement. Secondly, students complained of peers who had dropped the

subject for the external exams but were still in the class, causing disruption and distraction. A few mentioned they were distracted as they were connected to the internet always, and others mentioned they were frustrated with the outdated computers that sometimes lost their work. With respect to curriculum, students mentioned that they were disengaged when they did not understand the topics, as they had never been introduced to them before.

e. Online vs. face-to-face learning:

Most students asserted that they did not engage during online technology education lessons. They missed the interaction between peers and the teacher, and also complained about the technical issues and distractions at home.

Qualitative data in teacher interviews that looked at

a. Student attitude and engagement:

Teachers teaching the international American curriculum believed that most students were engaged when learning to code with Python or Java in grade 11, as they are excited to see the results of their code, and also, because they have gained confidence to code as they have been learning different forms of programming from grade 9 onwards. They claim that students in grade 11 have chosen their career paths and need good grades for their university applications. However, they agreed that there were many students who did not enjoy coding and, in some schools, students in certain streams in grade 11 were forced to study technology education despite having no interest in the subject. Teachers commented that students and parents did not take the subject seriously as it was not given the significance of a core subject by the schools. In addition, they all agreed that migration from different countries or even schools

from the other emirates caused knowledge gaps in students, which affected their engagement in technology education classes. Teachers understood that students in these age groups did not recognise that technology skills were significant for their future careers and that they recognised technology mainly as social media for communicating and the internet for searching for information. They also realised that these students have different interests from each other and that it was important to have different and multiple activities to engage them all, which was not an easy task. One teacher stated that student discipline and upbringing had a huge role to play in engagement. IGCSE teachers mentioned that the whole classroom dynamics affect their engagement in technology education classes. They claimed that Students following the IGCSE curriculum enjoy autonomy and tend to perform better than expected. Also, teachers mentioned that students who have knowledge or skill gaps or those who believe they cannot perform well do not engage well in class. These knowledge gaps are either caused by an unsystematic curriculum in the same school or student migration from other schools. Teachers mentioned that only those students who choose it based on their career choices or with genuine interest in the subject, engage in the lessons, unlike the ones who choose it by parental force or assume it is easy or as a requirement for university.

b. Topics and Activities:

The international American curriculum teachers agreed that most students did not enjoy theoretical topics. With respect to activities, teachers mentioned that high school students enjoyed group activities as well as interactive and competitive games, which they liked to play repeatedly. They stated that students also enjoyed competitions within and outside schools, as it took technology outside of their

classrooms. They claimed that students enjoyed projects where they worked as groups and were able to choose their topics, which were relevant to them and showcase their learning to their peers. They recognised that students were engaged when the concepts were integrated into topics in other subjects. Teachers observed that students were engaged while doing research activities; however, many students did not make an effort to evaluate the information from the internet. Teachers claimed it was challenging to engage all the students all the time, as there will be highly talented ones, whose engagement needs to be sustained throughout the lesson, while also there will be ones who are barely managing with the basic concepts. Teachers teaching the IGCSE curriculum commented that students were engaged in technology education classes when activities were authentic or related to their real-life situations or prior experiences. They also experienced that students enjoyed research activities that required working online and eventually presenting their findings to their peers. With respect to videos, they observed that students did not engage unless presented with some follow-up work related to the video. All teachers pointed out that theory lessons were too abstract and lacking hands-on activities, when students need many and varied activities for high engagement. However, the IGCSE curriculum needs time to complete, which did not allow them to conduct activities as they wanted. Teachers claimed that students enjoyed group activities, but they also could not do many of them, as IGCSE exams required students to work individually. They all agreed that when the technology education topics were integrated with other subjects, students were highly engaged; however, many of them disengaged when concepts became more difficult.

c. School infrastructure and student engagement:

One of the main issues mentioned by the teachers teaching the international American curriculum for disengagement in technology education lessons were the number of students in the class which resulted in chaos, starting from when the students walk from their regular classrooms to the computer labs leading to engaging them all who have different interests, talents and learning styles. Teachers complained of not having enough support to manage these class sizes. Having classes after recess, when students are hyperactive or during the last period before going home, when they are tired, affects their engagement in these lessons. Frequent changes in teachers during the academic year due to teacher migration or lapses in quality hiring were also mentioned by some teachers as an issue for engagement. Teachers cited some issues specific to technology education that affected engagement such as poorly designed computer labs which were actually converted from normal classrooms; outdated hardware and software in these computer labs; issues in classrooms that were in use after COVID-19 pandemic as they did not have enough charging plug points or ideal internet or network connections for technology education use and finally, the use of own devices by the students allowing them uncontrolled internet access leading to their distraction and disengagement from the ongoing lessons. The IGCSE teachers complained that computer labs were converted from classrooms, rendering them less spacious with the computers and computer tables, which are badly arranged with screens away from the teachers and thereby unmonitored, leading to increased distractions. Secondly, teachers claimed that usually computer labs are situated far away from other classrooms, and some students tend to be tardy and chaotic as they enter, thereby disrupting and disengaging others who may have arrived on time.

Teachers in schools that have block periods or continuous periods asserted that they were unable to sustain the students' engagement for such long periods of time.

Teachers also mentioned that an appropriate number of periods is necessary to finish the IGCSE curriculum; otherwise, they tend to rush through the study material, resulting in low engagement from the students. Teachers mentioned that the timing of the lesson is crucial to engagement, as when it is during the last period of the day, students are very tired and cannot engage. They added that large class sizes did not allow them to attend to every student every day, and they were unsure of their engagement. Lastly, teachers claimed that the lack of updated computers, comfortable chairs and tables appropriate for students' ages also affected their engagement.

d. School curriculum and student engagement:

Teachers teaching the international American curriculum noted that unlike the curriculums for subjects like math, English etc., the curriculum for technology education changed every year with teachers receiving limited training and creating lesson plans and activities, which will not be used the following year when a new software would be introduced resulting in every year, the students not being skilled in any software and the teachers not being skilled in teaching the same. Another issue highlighted by the teachers, included assessments in technology education, where in some schools, students were assessed on paper what they learnt on computers on the pretext that it was done to prevent cheating, but this did not allow students to use the skills they learnt in the classroom to be used in their assessments causing students to disengage during technology education lessons. Schools did not allow teachers to fail students in this subject, thereby giving confidence to the students to disengage during these lessons, while assuring them success in their tests. Finally, the teachers

mentioned that students were forced to take the subject in high school within certain streams of study despite having no interest in it, which highly affected their engagement. The IGCSE teachers commented that the schools do not take technology education as a core subject, despite the external exams, which affected student engagement. Also, they complained that the schools required multiple assessments during the year, which was difficult for them to conduct as they had to complete teaching the curriculum and for the students, as they found it difficult to cope.

e. Teacher attributes:

The teachers teaching the international American curriculum did not recall discussing any society issues related to technology, and very few discussed different perspectives in understanding technology. However, they connected prior learning experiences to the current concepts and also integrated other subjects with technology concepts for better understanding. Most teachers believed they were helpful, motivating and compassionate; and that they cared about their students' learning enough to follow up and give timely feedback for assessments. Those who stated otherwise reported large class sizes, disruptive students and a lack of time to finish the assigned curriculum as valid reasons. Most teachers complained about not being trained in pedagogy and technical skills. Most technology education teachers commented that students rarely discussed their careers with them. Teachers teaching the IGCSE curriculum all believed that they were approachable, compassionate and motivating. They all claimed they cared about student learning and provided timely and effective feedback to their students; however, when questioned about specific actions, very few were able to give examples. Most teachers claimed they were given professional training twice a year as they were teaching towards external exams.

f. Online vs face-to-face learning:

All teachers teaching the international American curriculum agreed that they hardly needed to put effort into online classes during the COVID-19 pandemic. They also agreed that most students were not engaged and did not learn concepts as much as they would have in face-to-face learning with their peers and teachers. In addition, they mentioned distractions and disruptions in the home environment that affected the students' engagement and learning and proposed online learning for occasional instances but did not recommend it for long-term learning situations. Similar to the international American curriculum teachers, IGCSE teachers also agreed that during online education, there were no behaviour issues, but they were not confident about student engagement and learning. They all reiterated that face-to-face sessions were better for students learning towards external exams.

Observations

In the seven classrooms and one computer lab observed for technology education classes in **grade 11** of the International American Curriculum, three rooms including the lab were spacious for the teacher to move around, one was a large room but was too overcrowded with hardly any space for the large number of students themselves and four were ideal sizes for the class sizes. In all the rooms and the lab, students were individually seated with their own devices in the classrooms and individual PCs in the lab. In the overcrowded room with a large class size of 30-35 students, the teacher was forced to be at her desk and just explain material that was projected on the board, ask questions and assign work without being able to walk around and check student work or give feedback or ensure that students were engaged. In

the spacious rooms with ideal class sizes between 21-25, the teacher was able to move around and check student work, give feedback, answer questions and also assign group work with noticeably high engagement of students. In a class having a small size of 11-15 students, it was observed that the teacher was able to connect the topic to prior experiences, ask critical thinking questions and wait for students to discuss and think before answering. The teacher was able to move around and check student work with all students on task all the time. One teacher in a class with a small class size was able to engage as well as give each student the necessary attention despite being at the front of the class, and provide effective feedback as the activity was related to student website creation and presentation. In one observation, when the teacher was explaining at the front of the class with the students only reading from the presentation and a few answering the teacher's questions, it was noted that most students were disengaged. In another observation with the same teacher, when the instructions were on the board but with the teacher walking around and checking student work and providing feedback, most students were engaged. In another observation when the teacher was at the front of the class of small size explaining a presentation with a video followed by worksheets to solve as pairs with the teacher walking around to provide feedback and finally an interactive game, it was noted that while a few students were disengaged during the presentation and the worksheets but all the students were highly engaged during the game and were very upset when the period ended. In another observation in the computer lab, the teacher demonstrated the task at the front of a class of average size with 16-20 students and then walked around to check students working as pairs while also pointing out commonly made errors; all students were engaged. In all observations, technical issues included hardware issues such as projector blurriness and slow network connections, student issues such as forgetting passwords or

laptops running out of charge, and software issues such as software crashing and students losing their work.

All five observations were in classrooms ideal for the class sizes in **grade 10** of the International American Curriculum, with students individually seated with their own devices. In one classroom, the teacher was very actively moving around the class during explanation and demonstration, making connections to real-life and previous lessons and calling students to make changes on the board as required, and here most students were engaged with one or two only disengaged. In two classrooms, the seating was disorganised, and students were chaotic and moved around during the lesson. In one of these classrooms, the students were moving when the teacher was reviewing the topic, but most settled down and became engaged as soon as the teacher started a game activity and continued being engaged until the end of the lesson and were, in fact, upset then. The other class that was seated in a disorganised way did not use any devices, with the teacher explaining the assignment and then distributing the worksheets to the class of average-sized students in groups and then walking around to answer student queries. Most students were engaged but were also complaining about the assignment. Another observation included students not using their devices, where students were listening to the teacher at the front giving feedback about a quiz. The teacher was asking students to read the questions from the board, and only one or two students were engaged and answering the teacher's questions; all others were sleeping or doing some other coursework. In one observation, the teacher explained the graded assignment posted on the board and explained the success criteria with examples and walked around the class to check student work, and all students were on task immediately and engaged till the end. No technical issues were observed in any of the grade 10 classes observed, except for one incident of a student's laptop being out of charge.

Five classroom and two computer lab observations were done for **grade 9** students of the International American Curriculum. Out of the five classrooms, one was small for a large class size with no space for the teacher to move around, two were ideal for their class sizes, and two were spacious for their class sizes. In all these classes, students were seated individually with their own devices. In one observation, most students were engaged when the teacher previewed the previous lesson with questions, and all were engaged when the teacher started an interactive game, which was seen in two other observations too. In another classroom, the teacher explained the task at the front and asked students to work on a task, but some students did not have their devices, and soon all students lost focus mid-session and were off task. In the observation with the large class size, the teacher explained the task at the front of the class, but many students were confused regarding the instructions. Technical issues in the classrooms included the smart board not working or being blurry, the classroom being too bright for students to see, students without devices or student laptops running out of charge and a slow network. In the two lab observations, which were large for the average class sizes with students seated individually with their own or the school devices, the teacher was at the front asking warm-up questions, then showing a video or an example of the task, followed by assigning an online task and then walking around to assist students. All students were engaged during the question session and then during the task, with a few frustrated as the difficulty of the online task increased. The only technical issue seen here was the school's PCs taking time to connect to the network.

All five observations in the IGCSE curriculum were done in computer labs for **grade 9**. Three of these observations were done in a U-shaped lab set-up ideal for average and large class sizes of students, individually seated with school PCs and with space for teachers to walk around and monitor the students' screens. The teacher reviewed the previous lesson's topics,

asked questions and explained important points regarding them, then gave a task to work on as groups with a time limit and walked around to check students' work. Few students are disengaged initially, but they group and engage during the task immediately. In one of the above observations, the technology education lesson continued for two periods, and the teacher did not set a time limit. By the time the second session started, a few students had disengaged and disrupted the class until the teacher intervened. The other two observations were in large computer labs, large for average and small class sizes of students, individually seated with school PCs, with the teacher unable to see students' PCs if at the front of the lab. The teacher explains the task and shows an instructional video, and then walks around to check the students' work. Few were disengaged during instruction, but all were engaged during the task. Technical issues included school PCs not working and some students losing their work, causing stress and frustration. Teachers were unable to see the screens of the students when they were at the front of the lab.

All five observations in the IGCSE curriculum were done in computer labs for **grade 10**. All computer labs were large for observed classes, ranging from small to average sizes, with students individually seated with school PCs. In all observations, teachers were explaining tasks initially, then answering students' queries regarding the task and walking around to check their work. In one observation, the teacher set a time limit for task completion. In another observation, the teacher reviewed the previous lesson and asked questions about it before demonstrating the current task. In one observation, the teacher had posted a starter activity for students to answer as soon as they entered class and then proceeded to distribute the task sheet. In all these observations, most students were engaged and asking relevant questions about the task. Technical issues included the student keyboard not working and students not being able to locate their files. In one observation, few students

who had decided not to take the external exam were present in the class and were disengaged and also distracting others as they were off task, either on other applications on the PC or on their phones. Teachers were unable to see the screens of the students when they were at the front of the lab.

Documents

Documents such as school ICT policies, ICT curricula and student achievement records were collected. Only one school provided their ICT policy with a detailed account of students', teachers' and school's responsibilities regarding technology use and online safety. All the international American schools followed different American states' standards for ICT, and the two IGCSE schools also followed two different exam boards of IGCSE. Student achievement records were used with student self-reported engagement ratings to calculate the Pearson's correlation coefficient, which clearly showed that there is always a positive relationship between the two in this study. This was evident in the quantitative study in all the grades 9, 10, and 11. This endorsed the qualitative part of the study, which uncovered, through the perspectives of the students and teachers with observations, interviews and documents, the many factors that influence the engagement of high school students in these classes in private high schools in Abu Dhabi.

Chapter 5 - Discussion

The data collection for this research was carried out immediately after the COVID-19 pandemic, and when most schools were just beginning to function normally as before. It aimed to study students' and teachers' perspectives of student engagement in technology education classes in private schools in Abu Dhabi and the schools' and teachers' initiatives to promote and create engaging teaching and learning environments.

5.1 Quantitative Results

5.1.1 Pearson's Correlation Coefficient

The quantitative part of this study used the Pearson's correlation coefficient to find a relationship between students' engagement in technology education lessons and their achievement in the subject. The findings indicate that there is always a positive relationship between the student self-reported engagement levels and their achievement. For the students following the international American curriculum in grades 9,10, and 11, it is weakly positively correlated. However, for the students following the IGCSE curriculum, there is a weak to moderate positive correlation between achievement and levels of engagement in grade 9, which shows that students who chose the subject, irrespective of the reason for their choice, engage more and achieve more in the subject. Also, in grade 10, for the IGCSE students who will be appearing for their external exams in that year, it shows a moderate to strong positive relationship, which indicates that students put in extra effort to engage, giving the subject its due significance in order to prepare for the exams. This implies that the more the students engage in technology education lessons, the more their achievement, and it validates the purpose of this study. However, it is important to keep in mind that correlation does not imply causation, that is to say that one variable does not cause the other to happen, as the positive

correlation could be due to a third hidden causal variable associated with both the variables being tested, or maybe a just a random coincidence.

5.2 Qualitative Results

There were some key outcomes that surfaced from the qualitative data that were collected from five private schools in Abu Dhabi. In this chapter, these outcomes will be explored, with reference to the research questions primarily, in addition to the data collected, while also considering related literature.

Considering the first research question:

1. How do high school technology teachers and their students in Abu Dhabi private schools define and thereby understand the term ‘student engagement’?

5.2.1 Students’ and Teachers’ Understanding of ‘Student Engagement’

Students learn when they engage with the subject/topic or participate actively in the activities and are committed to their academic goals (Hoffman et al, 2019). They stated that out of the many domains of engagement, namely, cognitive, affective, and behavioural (Appleton et al., 2008), cognitive engagement is the aspect that teachers can instantly observe, and students consciously report. In this study, students and teachers were asked about their understanding of the term ‘student engagement’ to assess their familiarity and value of the term before their involvement in the study. From the data collected, it can be gathered that the students mostly recognised engagement as their active participation in the lesson, their focus during the lesson, their interaction with their peers and teachers and their interest or joy in the subject or topic. Teachers also agreed that student engagement was related to the interest shown by the students in the classroom and their effort to participate by asking questions and

working on the assigned activities with vigour. Students understood this vigour as their effort and involvement in the class by asking and answering questions, in addition to their feelings or interest towards the subject and also their interaction with others, including their teacher.

Teachers understood that their students were engaged when they were actively participating in all aspects of the lesson, including discussions and activities, which resulted from and were also due to their understanding of the concepts as well as skills. They used terms such as 'involvement', 'responsibility', 'accountability' and 'attention' when referring to students' engagement in the class. Interestingly, as per the results in this study, not a single teacher mentioned their own responsibility for the engagement of their students.

It has been noted that students in the present-day school environments, who are digital natives, can effectively engage only when they put in effort and actively participate in their learning process (Hoffman et al, 2019). As per the literature reviewed in this study, student engagement involves three components, namely cognitive, behavioural and affective components (Fredericks et al, 2016). Students are interested and curious about topics and activities which they perceive are related to their own reality, and it is the teachers who can use these realities as scenarios coupled with pedagogical strategies that include collaboration, cooperation, inquiry and problem-solving. In addition to students' effort, their learning environment, classroom interactions and events also contribute to their engagement (Bond et al, 2020). While students create products, the change in their perspectives with interactions and environmental factors has an impact on their engagement (Selwyn, 2012). It appears from the responses in the surveys and interviews that students in this study understood that engagement required their own effort in addition to other factors such as teachers' pedagogy skills, class interactions, topics and activities, while teachers attributed students' engagement to only the effort and interest of the students. This is in line with the literature review, where it

was noted in the teachers' surveys studying student engagement in technology education classes of first-year university students that there was minimal regard by the teachers with respect to student support, student-teacher interaction, and teaching methods; rather most teachers suggested that student engagement was solely the responsibility of the student, emphasising on the behavioural aspect of engagement, (Morgan et al, 2018a). Students, on the other hand, similar to the student participants in the same study, attributed their engagement to both themselves and their teachers, their teachers' pedagogy skills and attitude, in addition to subject content (Morgan et al, 2018b).

The following two research questions will be considered at the same time in order to bring about a joint understanding of student and teacher perspectives of student engagement in technology education classes.

2. What are high school students' perspectives of their own engagement in technology education classes?

3. What are high school teachers' perspectives of student engagement in technology education classes?

5.2.2 Factors Influencing Student Engagement:

General reasons for engagement

Interest and joy in the subject

Students, who claimed they were highly engaged in technology education classes in the surveys of this study, mostly cited the reason as their interest in the subject or enjoyment in the topic and activities, followed by their assumption that the subject was easy to score marks. This is in line with Csikszentmihalyi's Flow theory (1990) mentioned in the literature review of this study, which is based on a mutual relationship between the difficulty level of tasks and

the skill sets of a student, which complements it. When this balance is disturbed, students experience anxiety with high challenges and low skills, or boredom with low challenges and high skills. When students experience anxiety or relaxation, a timely change in the difficulty level of the task or words of motivation/feedback to enhance students' skills by the teacher may encourage them to return to the state of flow (Shernoff et al, 2003). Students will be able to sustain their engagement, and as they are enjoying it, they will be intrinsically motivated and will enjoy the process of learning. In one school (SAC2) that participated in this study, students in the high school humanities stream, which includes subjects like history, geography, psychology, etc., were compelled to take technology education. The students from this stream have no affinity towards maths and science subjects, and understandably were unable to grasp complicated concepts in technology education related to them, and eventually developed a distaste for the subject itself.

Digital divide in the classroom

Teachers elaborated in their interviews that students who believe they have the required skills, enjoy the autonomy and choice given by the teacher and look forward to challenges and their achievement feed into their continuous engagement. However, they also added that some students may not possess these skills, as in primary and middle school years, the unsystematic school technology education curriculum did not give them adequate time to develop them and moved on to other topics without ensuring student expertise, thereby creating gaps in knowledge and skills. These gaps may also be caused by student migration from other schools and countries, which is common in the United Arab Emirates. When this study requested school curricula for perusal, only two out of the three schools following the international American curriculum provided the researcher with the requested documents, and each one was following a different American state standard, namely California and Virginia.

The third school refused to provide their curriculum map, stating unclear reasons. However, they referred to the researcher that they were following the West Virginia state standards. The other two schools, following the IGCSE Cambridge and Edexcel curricula, had only their high school curricula available online, as students in these schools were following the school curriculum till grade 9. The data evidently highlights that a consistent school curriculum needs to be developed from the primary years up to high school in technology education for high student engagement.

Significance of the subject

Inconsistency of curriculum is related to another key issue, which is the lack of importance given to the technology education subject in schools in the UAE. The literature reviewed for this study, very rare from the United Arab Emirates and from a decade earlier, revealed that the youth here had more access to technology and used it skillfully for personal purposes compared to the other parts of the world but only in university level while in schools there was low connectivity and lack of hardware (Martin, 2013; Almekhlafi & Almeqdadi, 2010; Sabbagh et al, 2012). The UAE has advanced in leaps and bounds since these studies, where connectivity and lack of resources even in schools are no longer a problem. The Ministry of Education has spoken about the significance of technology in schools and has also dedicated funds to investments for the same. However, teachers claim that computer labs are rarely visited during school inspections or commented upon in school inspection reports. Consequently, schools give it only the importance of a non-core subject, and neither do they focus on the required infrastructure, curriculum development and teacher training, nor assign it any official status on school exam calendars, thereby giving the impression of insignificance to students and parents alike. Students in their interviews in this study stated that they usually do not remember when the technology education class is during the week until it is upon them,

as they do not feel the need for any preparation prior to it. They consider it a free lesson where they can relax, have fun and not strain themselves to learn anything, as they know they will pass the subject anyway. They assume that technology is a tool for passive information consumption, rather than active learning, and this attitude significantly affects students' engagement in technology education lessons, which they often carry into universities (Henderson et al., 2015).

Grades and career choices

Students, in this study, attributed their engagement to getting high grades, their future careers, and their teacher. Teachers, on the other hand, believed that student engagement in technology education lessons in high schools was related only to their career choices. They claimed during their interviews that students were not convinced that they would need technology knowledge if they chose careers that were not digital in nature, such as medicine or law. Students associated technology education only with computer science-related careers, such as computer science engineering or careers in cybersecurity and the like. Responses from the surveys and focus group interviews with the students in this study revealed that those who were genuinely engaged in technology education classes were indeed contemplating careers that involved technology, although most students believed that technology was not significant for all careers in the future. Teachers pointed out that students were unaware of the avenues that would open for them in any career they choose if they have technology proficiency. As discussed in the literature review, learning concepts like computing, algorithms and logic which are basics in school level programming transfer to other fields as well, in addition to understanding the rapidly advancing technologies around the students in the future, which can empower them to participate in the creation of information and technologies rather than just be passive users. Students need to possess an awareness of technology by understanding

processes, standards and products (Oliver, 2016), so they can make informed decisions about technology in their surroundings and also be able to evaluate new technologies in their future lives, which is the goal of technology education (Brown & Brown, 2010). Teachers mentioned that students do not understand why they are being taught coding or programming in high school, stating that they will never use it in their adult lives, and teachers claim that they explain to their students that learning to code teaches them to think logically and critically and also be adept at solving problems. In addition, these skills will teach students how to function virtually, how to evaluate information and the ethics of using technology in the future (Ferrari, 2012). However, for the students to be convinced, teacher explanations must be reinforced by the school giving the subject its due importance. Teachers teaching the IGCSE curriculum mentioned that students who were attempting the external exams were more inclined to be engaged in technology education lessons as they aspired for high marks in their exams. They added that these students sometimes do not choose the subject out of interest, but rather assume it is an easy subject to score marks and choose it to meet the university's minimum subject requirement. Some students even choose it at the behest of their parents or siblings, who attribute importance to the subject from their experience. Students in this system all agreed that learning about technology was very important for their future as well as for their present lives. Only one student said that he was not interested at all in the subject, and he was forced to choose it by his parents; therefore, he was always disengaged in technology education lessons. Evidently, as noted by Castañeda and Selwyn (2018) mentioned earlier in the literature review, technology did not seem to appeal to all students in high schools in Abu Dhabi and contrary to the expectations of digital expertise from digital natives, the skills of these high school students were notably varied (Alaleeli & Alnajjar, 2020).

Students' and teachers' responsibilities for student engagement

With respect to teacher responsibility for student engagement, it surfaced in the student surveys and their focus group interviews that some students believed it was their responsibility as well as their teachers to keep them engaged, while many others claimed that only they were responsible for their engagement in technology education classes. One teacher participant commented that student personality plays a huge role in their engagement in technology education classes. The teacher asserted that students who are well-behaved with good upbringing at home and adequate intelligence hardly need to be motivated and would be engaged in all subject lessons, including technology education. These students recognise their purpose in the school and will motivate themselves and compete with their peers irrespective of topics and activities. As seen in the literature, personal factors can affect the different components of student engagement namely, the cognitive component where the students put effort to understand concepts, the behavioural component which is related to student interest and participation in the class and the affective component, which refers to their feelings towards their peers and teacher and the learning objectives (Appleton et al, 2008). Most teachers in this study also commented on class dynamics and claimed that students' attitudes to the subject influence other students in the class. They added that most high school students only associated technology in their lives with social media and YouTube or TikTok videos. This goes against the definition of *technology literacy*, which is the ability to understand the bigger picture of technology rather than a few specific technologies (NAE & NRC, 2002). However, Ng (2012) had reported in her study that using technology informally is different from learning about technology. Interestingly, some boys claimed that post-COVID-19, they felt less inclined to engage with technology. However, that cannot be attributed only to them

being continually exposed to screens with online learning, as it also coincided with their development as they moved to high school from middle school.

Covid-19 Pandemic

Since this study commenced during the COVID-19 pandemic and progressed when schools were getting back to normal, or rather a new normal, it becomes essential to explore student and teacher perspectives regarding their online learning experiences, although it was not a part of the initial study. All students who were interviewed unanimously agreed that they were not engaged at all in the technology education online sessions conducted during the COVID-19 pandemic. They claimed they were distracted from happenings at home and used their phones to surf the internet or chat with friends during lessons, and were also fatigued as they were looking at screens for all the subjects during school time. Topics and activities were confusing, and teachers' explanations were unclear, as were the success criteria required from them. Many claimed they had technical issues with their devices and slow connections, as everyone at home was also using their respective devices for school or work purposes. Teachers agreed that technical difficulties and distractions from home were issues that were difficult to handle during online learning sessions, including disruptions in the calls from outsiders. Students mentioned that they longed for interaction with their peers as well as teachers. Teachers appreciated not having to deal with behaviour issues; however, they quickly added that student engagement and learning were doubtful in online sessions. They added that face-to-face sessions were clearly better for student engagement, while online sessions can be used occasionally when weather or other issues prevent students from attending regular school.

Other issues affecting engagement in TE classes

Many issues came up repeatedly in the students' and teachers' surveys and interviews regarding engagement in technology education classes.

School infrastructure

The main issues that students in all five schools mentioned during this study were related to the school infrastructure for technology education. First of all, they all reported outdated devices and software, in addition to slow internet connections in the school computer labs. Some students also complained about the tables and chairs in their labs, which were unacceptable for use. As early as 1995, Gal-Ezer had proposed that spacious, well-lit, well-equipped labs with ergonomic seating and good networking would allow teachers having good pedagogy skills to teach students about technology effectively. During this study, many schools were conducting their technology education lessons in classrooms and not computer labs due to Covid-19 restrictions. It is known that student engagement in computer labs differs from that in a regular classroom (Bergdahl et al., 2020). Teachers in their interviews commented that although labs were the better option of the two, they were situated very far away from the student classrooms, and students would be walking in intermittently during the first quarter of the lesson, stating many reasons for their tardiness, thus causing disruption to the lesson. Also, teachers noted that students coming into the lab made them energetic and therefore, chaotic, which was difficult for teachers to manage.

A related infrastructure issue that was cited was the timing of the technology education lessons during the day, their frequency and duration. Teachers in this study complained that students were agitated when their lesson followed recess or a physical education lesson, and were disinterested when it was at the end of the day. Students agreed that they were unable to

focus at the end of the day, when they were tired and hungry at 4 pm. Also, they complained that since only two lessons were assigned to technology education in a week, too many concepts were taught in each lesson, and that was difficult for them to take in. In addition, sometimes work was given to complete at home. In one school, SAC2, the internet was unavailable during the first period on Mondays, and technology education teachers who had classes during that period worked with worksheets about the topic or conducted lecture sessions with the students, which, as noted before, is disengaging for most students. Students from this school, in their interviews, commented that they did not follow the objectives in the following technology education period of the week, as they were disengaged during the first period lectures and now, they were completely behind in the topic, and this occurred every week. In another school, SIG1, where technology education lessons were conducted as two-period blocks, students found it difficult to stay focused for such a long period of time, and teachers claimed it was difficult for them as well to sustain student engagement. While technologies affect students' tendencies towards ethics, beliefs and values, it is also designed based on human nature such as joy, boredom and tiredness, therefore, using appropriate pedagogy skills to teach technology based on the students and other factors involved is crucial to student engagement and therefore, learning (Castañeda & Selwyn, 2018). One teacher (FTIG910) teaching IGCSE students complained that the school administration suddenly cut down the number of periods during the academic year, and she had to finish the curriculum in haste to prepare the students for their external exams. She was unable to incorporate any activities into her lessons or even build relationships with the students that year. The teacher claimed that she was convinced regarding the students' disengagement, but she did not want any hassle with the school administration and parents.

Yet another infrastructure issue, the students mentioned in this study, was the lack of classroom management with too many students in haphazard seating arrangements, as lessons were conducted in classrooms or with ineffective seating arrangements in computer labs that were badly designed or not purposefully built. Teachers added that, in addition to not being able to control such a large number of students, it was impossible to give every student their attention in every lesson. They stated that as they were unable to see the screens of the students, they could not control what students would be doing on them, and therefore, would not know if they were engaged or not. During observations, it was noted that some classroom sizes were indeed smaller compared to the class size, which not only confined the teacher to her desk but also inhibited the teacher from walking through the students to check their screens for off-task activities or to give feedback on their activities. Most teachers emphasised that they received no support from their schools to manage their classes, and this was very stressful for them.

Another issue that was related to the infrastructure had to do with student devices and Wi-Fi connectivity in the schools. As this study was done after the COVID-19 pandemic with students in classrooms or in labs using their own devices, a major concern was that the devices usually ran out of charge during the day as they were used in every lesson and there were not enough charging ports, neither in the classrooms nor in the labs. This caused frustrations in students, leading to their disengagement and eventually disruptions during lessons. In addition to this, in some of the schools, the Wi-Fi strength was not upgraded to match the large number of connections by student devices, due to which many students were unable to connect to the internet and work along with their peers during technology education lessons. These issues were witnessed during the observations in this study, and they disengaged the students, causing them to disrupt the class and lag in the topic. On the other hand, according to some

teachers, students always being connected to the internet on their devices was a menace, as all websites are open for their perusal during lessons, adding to their distraction.

Assessments

The next school-related issue that was alluded to in the student and teacher interviews was regarding assessments. In this study, students in some schools complained that student assessments differed from their learning, as tests were on paper while they learnt concepts and skills on the computer. They found this disengaging as they could not use the skills they learnt in class for their assessments. Some teachers justified these complaints, while others claimed that this was a solution to stop students from cheating from online resources and from other students. Teachers had some additional complaints on student assessments; they claimed that schools require multiple assessments during the term, with only two periods per week. Teachers claimed that they were usually teaching for the assessments, and it seemed like every other week, students were being assessed, and this stressed many students, which disengaged them. One more issue that came up in this study with regard to assessments was that students were not allowed to fail in technology education in any of the schools. Failing students were given make-up tests at the end of the term or year, and a minimum pass mark with a lot of assistance. In the literature review, it was discussed, with respect to technology education assessments, that schools decided on their own standards and tested students on simple practical skills and offered support for the weaker ones (Bell et al, 2010). As early as 2003, it was proposed that three aspects need to be present in technology education assessments, namely cognitive aspect to test for description and application of one's knowledge; psychomotor aspect to test for one's knowledge of required skills with demonstration and the affective element to test for one's analytical knowledge of the impact and consequences of technology (ITEA, 2003). When students become aware that they will be tested, based on

these aspects, their engagement in technology education classes and their understanding of the subject will take on a different course. On the other hand, students will be inclined to disengage during the entire year in these lessons, given the lack of significance of the subject and the confidence that they will pass it anyway.

Gaps in knowledge and skills

As mentioned earlier, students recognised that many among them had gaps in knowledge as they migrated from different countries or schools and were not on the same level of digital expertise, and this was a concern for engagement in the technology education lessons. Recently, student knowledge and skills have lagged due to the haphazard online learning sessions during the COVID-19 pandemic and now with post-COVID-19 issues, such as the distracting nature of using one's own devices in classes. Students from school SAC1 in this study stated that they had multiple technology education teachers in one academic year, which caused them to disengage during these lessons. The teacher (FTAC911) interviewed from that school, who had joined the school in the middle of the academic year and was the third teacher for the students that year, mentioned that the students were disengaged throughout the term as they did not know the basics in the topic, thereby creating gaps in knowledge/skills in the subject.

5.2.3 Curriculum: Topics and Activities

In this study, two curricula, namely the international American curriculum and the IGCSE curriculum, were considered; therefore, in this section, the two curricula and the topics and activities of both are discussed.

Curriculum

With respect to the schools following the **international American curriculum**, teachers complained in their interviews that the curriculum topics changed every year for

every grade level. They claimed that schools wanted to introduce the latest education technologies to engage their students. Therefore, teachers were expected to learn the fundamentals of these new education technologies with just one workshop from the retailer and subsequently required to create lesson plans and engaging activities for the rest of the term or year. The following year, a new topic or technology would be considered for the grade level, and teachers would not be able to reuse their previous lesson plans and activities but would have to create new ones for the new topic or technology. It is interesting to note here that these educational technologies are designed commercially, and the pedagogical underpinning of their design decides the teaching and learning in the classroom more than the actual pedagogical objectives of the teacher (Casteñeda & Selwyn, 2018). In this situation, students also have limited time to master the required skills, develop interest and fully grasp the concepts of the technology before they are introduced to another one the next term. This reinforces the earlier point about having a consistent curriculum in schools from primary to high school. This is also compatible with the definition of student engagement by Liem & Chong (2017), which connected students with their school environment and claimed that their engagement must be understood in relation to their advancement throughout their school life. Another issue related to the curriculum in high school was the subjects required once students choose streams in high school, and certain subjects are associated with specific streams. Usually, technology education is associated with the science stream, given its connections to logic and calculations. However, one of the schools, SAC2, as mentioned earlier, offered technology education as a subject in the humanities stream, which is taken by students who do not intend to pursue a career related to mathematics or the sciences. These students found it difficult and disengaging when concepts related to these subjects became complex during the course of the term or year. When teachers were asked during their interview about having

different technology education courses for different streams that would appeal to students with different interests, they stated that the schools deemed it expensive and also difficult to logistically organise. The **IGCSE curriculum** schools did not have any issues regarding consistency in the curriculum; however, during the observation in the IGCSE curriculum school SIG2, it was noticed that students who had dropped out of taking the external exams in the second year of the two-year course still had to continue taking the class. These students appeared to be disengaged as they no longer needed to focus to achieve high marks, which resulted in them distracting others in the class by using their devices to play games or use social media.

Engaging Topics – Practical vs Theory topics

While elaborating on topics that were engaging, students following the **international American curriculum** listed coding with Python/Java, website creation and designing, 3D designing and programming robots, games, and apps. However, a good number of students also claimed they did not enjoy coding or any kind of programming. Very few students expressed their interest to learn about photo-editing, video editing, word processing or spreadsheet software. Many students mentioned they were disengaged during theory lessons as they either knew all this information from before or could easily obtain it from the internet. This is related to the *connectivism theory* which is ‘*a learning theory for the digital age*’ (p.1), which recognises that most learning methods that were used to handle information before have now been transformed to the process of either passing the information on to or it being reinforced by technology and in this digital age, where one relies much on technology, it is more important to know where to find information than to actually know it (Seimens, 2005). Teachers also agreed that students were highly engaged when they were doing hands-on activities in practical lessons with products as outcomes, although many students were not too

keen to learn programming at all. This is in line with Papert's (1928-2016) *constructionist theory*, which was associated with adding activity to learning to construct models and physical objects by programming computers rather than just using them (Hoffman et al, 2019). They commented that whether students were engaged due to interest and joy or for high marks in exams, engagement was always higher during practical lessons over theory lessons with abstract topics. Teachers justified having to add these theory topics to the curriculum as in the United Arab Emirates, high school students need to prepare for EmSAT, which includes computer science fundamentals. These national standardised computer-based tests are required for grade 12 students seeking admission into universities in the United Arab Emirates. Also, these tests aim to aid the government and private schools in improving teaching and learning in the country. However, making changes in schools is not always simple. One teacher suggested building a networking lab to make theory topics "come alive", as students mentioned that they would like to see how things work inside computers instead of just memorising the process. This was turned down by the school, as it was too expensive.

Students following **the IGCSE curriculum** and attempting the external exams at the end of the two-year course claimed they engaged more in practical lessons like word processing, spreadsheets, and database management software rather than theory lessons. However, an equal number asserted their interest in theory lessons while being disinterested in practical lessons. In theory topics, students mentioned e-safety, hacking, etc., which were interesting. However, they claimed they knew most topics, and they also stated that some unfamiliar theory topics, such as data representation with logic gates and circuits, were very abstract and difficult to understand. They complained about having to memorise so much information without seeing anything in action. Teachers teaching this curriculum were also convinced that students do not enjoy these lessons as they involve abstract thinking and

memorisation. They also noted that although these students were engaged to learn as they aspired for high marks in their exams, they were more engaged during practical lessons than theory lessons. Many students in the latter year of the two-year course stated they were engaged when they were solving past papers that prepared them for the upcoming external exams. Many students mentioned programming as their topic of interest, while some added that this was the case only until the concepts were easy.

Engaging activities

With respect to engaging activities in the **international American curriculum**, many students mentioned game-like interactive activities such as *Kahoot*, *Blooket*, *Quizziz*, etc. In observations during this study, it was noted that all students were engaged during these game-like activities, which was surprising as the researcher assumed that such activities were only enjoyed by lower grade level students. Students were asking to repeat the same games as they enjoyed competing with their peers, and it was also noted that they were upset when these activities and the lesson during which these games were conducted ended. It is unclear, however, whether students learnt concepts due to their repetition in the activities or if they actually understood them; nonetheless, they were all engaged. Teachers were also of the same opinion that students were highly engaged during interactive and competitive activities in classes, especially with bonus marks as rewards. Teachers claimed this engagement will also be extended to in-school and external competitions, which, for the students, took technology education outside of their classroom. Teachers teaching the **IGCSE curriculum** also agreed regarding the increased engagement during game-like activities, but explained that while some activities were possible occasionally, these activities took too much from the already limited time available to finish the curriculum before the students appear for their external exams.

Lectures

Students from the **international American curriculum** called attention to their dislike for listening to lectures by teachers at the front of the class, reading from presentations, and playing on the smartboard. Teachers also recalled students getting disengaged when they were listening to them lecturing from a presentation, but claimed that some students, however, expect lessons to be lecture sessions with thorough explanations, as they are used to it since lower grade levels. Observations in this study revealed that many teachers could not move from their tables as the class sizes were too big and the room sizes were too small, in addition to the rooms being cluttered for the teacher to move between the students to check work or give feedback. In the **IGCSE curriculum**, only a few students confirmed their disengagement when classes were lecture sessions with no activities at all. Teachers here admitted to conducting most of their lessons as lecture sessions.

Activity methods – Group activities

As to how activities were conducted, many students in the **international American curriculum** claimed that they enjoyed collaborating as groups, which the teachers also noted and used to organise regularly. In observations of technology education lessons for this study, it was brought to light that when classes that had low class sizes were in spacious rooms that allowed for group seating arrangements, teachers encouraged collaborative activities and thereby, enhanced student engagement. This is related to Vygotsky's (1896-1934) *social constructivism theory*, already discussed in the literature review, which speaks about engagement in student-centered classes having cooperative and authentic learning experiences not only based on individual mental abilities (Hill & Smith, 1998; Morchid, 2020). Technology education is a social and interactive activity; therefore, it is evident that students enjoyed the interactive and competitive activities in addition to group activities (Castañeda &

Selwyn, 2018), as it connects to their individual, social and educational values. However, in this study, some students disagreed and stated that they focused better when working alone, a point also noted by teachers who still encouraged them to collaborate, as they believed students need to be trained to work as teams for their future workplaces. The literature review of this study reflected that in technology education classes, if students are taught to work effectively with others, it will also develop skills such as socialising, conflict resolution, and co-existence, which will be as important as their technical skills in workplaces (Wolf et al., 2020). Piaget (1896-1980) had asserted that when peers interact, they can change each other's understanding in situated learning with culturally relevant activities (McCormick, 2006). With respect to engagement, however, Shernoff et al (2003) in their study had noticed that in spite of the many benefits of learning in groups, the *flow theory* can be attributed to student learning when considering the advantages of working individually. Castañeda & Selwyn (2018) were also skeptical, stating that group activities may work for many but not for all students. With respect to the **IGCSE curriculum**, many students in this study claimed that they enjoyed group and project-based activities. However, since the IGCSE exams must be taken individually, teachers asserted that having group activities regularly was not appropriate.

Activity methods – Research activities

With respect to using research as an activity, the teachers teaching the **international American curriculum** in this study reported that it was very engaging for the students, especially when they had to present their research to their peers. However, they discovered that some students were using the Internet to just copy the information without any evaluation or verification. With the advent of ChatGPT and other artificial intelligence software, this will definitely be a cause for further concern and management. It was rightly stated by Castañeda

& Selwyn (2018) that learning with technology involves difficulties related to individualities, responsibilities, as well as accountabilities.

Relevance, Choice and Autonomy in Activities

An issue mentioned by a good number of students in the **international American curriculum** was that they lost interest when the activities or topics became progressively difficult, and teachers also commented that students needed to be motivated more during difficult coding activities, as they tended to disengage. Teachers noted that all students were engaged in activities that were relevant to their lives, and even more so when they were given choices of topics. Students agreed that they were engaged when creating apps and websites about topics that were interesting to them. They also mentioned that activities were not interesting when everyone was following the same instructions and creating the same product. It was observed in this study that all students in a technology education lesson were highly engaged when they created websites on topics of their choice and presented to their peers; students presenting as well as the student audience were engaged with those watching set to give feedback as well as to learn new ideas from the presenters. Teachers expressed their satisfaction that they managed to engage the students with autonomy and choice while also ensuring the required objectives were understood. In the literature review, it was seen that the *Self Determination Theory* proposes that students are motivated to learn when their autonomy is supported with choices (Ryan & Deci, 2000) and in collaborative activities with supportive peers (Zhou & Ren, 2017). In the **IGCSE curriculum**, teachers asserted that all students seem engaged when activities or topics involve real-life examples and within that domain, those that are relevant to their current lives. As discussed in the literature review, it became evident in this study also, that real -ife instances when merged into topics and activities get the students

to think differently from the usual skill-based ones by connecting to their daily lives and thereby, get them engaged in the technology education lessons (Hoffman et al, 2019).

Worksheets as activities

It was interesting to note that in the **international American curriculum**, some students mentioned that they enjoyed doing worksheets and assignments, as if it made them confident that they understood the concepts, while an equal number mentioned their dislike for them, citing that it was a boring task. However, during observations in this study, it was found that when students were asked to do worksheets, they first asked if they were graded and if they were, students were mostly engaged, which shows that students put effort into engaging when they assign value to the task, as explained in the Literature review, as the *Expectancy-Value Theory*.

Videos

Another interesting point that came up in this study with the students following the **international American curriculum** was that many students asserted they did not enjoy watching videos without teacher explanations, which was surprising for the teachers who carefully collated these self-explanatory videos, keeping in mind student interest and relevance. In the **IGCSE curriculum**, teachers noticed that students were totally disengaged when they were shown videos and added that relevant videos must be placed within the lesson at suitable times and followed by a critical thinking question-and-answer session for students to be engaged.

Integration in topics

In both curricula, teachers noticed most students were engaged when they integrated technology education topics with other subjects, as they then understood these topics better. Wolf et al (2020) stated that technology education can be connected to transferable concepts in

computations, algorithms, program design and solving problems, which can be integrated with science, maths and engineering. McCormick (2006) mentioned that teachers can teach integrated topics confidently with the belief that students can apply their conceptual knowledge from other subjects in technology education classes. However, Morgan et al (2018b) argued that this need not be the case always and as mentioned before in the literature review, subject teachers may explain concepts from a different perspective than that of a technology education teacher and in the United Arab Emirates, since teachers and students migrate from different schools and countries that may have different perspectives on concepts, this may result in ambiguities in student interpretations.

Challenge in activities

In all cases, as mentioned before in this study, when concepts become more difficult, students tend to disengage. Very few students were looking forward to challenging activities, while many also claimed they were disengaged when activities were too easy. This is related to the *Flow theory* alluded to earlier in the literature review, where activities and student capabilities must form a balance for students to be in a constant state of engagement. All teachers, in this study, were of the opinion that although challenging to plan and execute, differentiated activities are ideal to engage all students in a classroom. However, it also becomes impossible in classes with large sizes, which is a school infrastructure issue and will be discussed in detail later.

5.2.4 Teacher Influence: Attitude and Pedagogy

In this study, when questions regarding their teachers were asked in relation to their engagement in technology education classes, a theme started to appear with the students' answers, and it has been named teacher attributes, which include teachers' attitudes and pedagogy skills in class.

Teacher Pedagogy skills

Most students mentioned their teachers' pedagogy skills as the deciding factor for their engagement. They further explained that sometimes teachers' explanations either lacked clarity or they would just be reading from the presentation, and both were disengaging for them. Very few students claimed that they were engaged when teachers asked questions; however, during observations in this study, it was seen that when teachers asked questions in class, many students actually participated if meaningful and critical thinking questions were asked, and also if students were given time to think and respond. Many students believed that the teachers did not choose topics or activities that were relevant to their age and environment. They mentioned that they disengage when they just follow steps in an activity without giving any thought to it, and claimed they understood concepts better when teachers integrated technology education with other subjects, connected to their real-life situations, and also from different perspectives. In the review of literature, it was noted that teachers who are qualified and are given regular opportunities to develop professionally can connect technology education to other subjects, enhancing students' conceptual understanding (de Vries, 2016) and also connect concepts and authentic activities to the students themselves and to their community (Hoffman et al, 2019). Some students asserted that teachers must explain concepts multiple times in different ways and also not move on to the next topic before ensuring everyone understands the current one. However, others commented that it is boring when teachers stay on the same topic for a long time or even slow down for some students to catch up. Students mentioned in their survey and interviews that they appreciated their teachers when they answered their questions and gave feedback. Observations during this study revealed that few teachers were only giving feedback with respect to student mistakes in quizzes or assignments, either generally using a presentation or, if space and time permitted,

directly from the students' work on their devices. In a specific observation during this study, the teacher spent the whole lesson on quiz feedback and explained the correct answers for all the quiz questions using a presentation; however, it was found that most students were disengaged. Evidently, students prefer individual feedback specific to their errors and needs, which, noted by the researcher, was difficult for teachers teaching classes with large numbers. Some teachers in their interviews mentioned that they gave students different perspectives on their learning by highlighting how their peers do the same activity in different ways. Mattar (2018) expanded upon this as seen in the literature review, using the *connectivism theory*, where students use technology and social networking to understand various perspectives to support their learning. Connectivism is very relevant for the current times and digital natives as it is based on connections with networking, surroundings and ecosystems where students are expected to be in a continuous state of learning (Sahin & Safieh, 2012). Therefore, enabling students to make these connections by integrating topics and showing different perspectives is a pedagogy skill that teachers need to employ in order to enhance student engagement and learning.

Teacher Attitude

The teachers' personalities were given equal importance as their pedagogy skills for high student engagement by the students in this study, which included their positive, interactive, helpful, and motivating nature. Students elaborated in the interviews that they are likely to engage better in the class when the teacher is cheerful and active rather than when he/she is angry or evidently unprepared for the lesson. They appreciated their teachers interacting with them and having a sense of humour instead of being serious all the time. Students felt inclined to put effort into their learning if their teachers were genuinely concerned about it. During observations in this study, it was seen that when the teacher was

just at the front of the class explaining the task to the students and not moving around to check if they were actually doing the task, the students were idling away their time as opposed to other classes where the teacher was walking around and giving feedback to students about their tasks. Many students claimed that they disengaged when the class was noisy, and the teacher was unable to control the class. They preferred their teachers to have the charisma to keep the class engaged as well as disciplined. All teachers who were interviewed believed that they were approachable and helpful, and concerned about their students' learning by providing relevant feedback. Very few recalled discussing careers or academics with students and connecting real-life situations to topics and/or activities in the curriculum.

The last research question considers students' and teachers' perspectives on improvements to be made by the schools in order to engage students in technology education classes.

4. To what extent should schools and teachers be working on challenges and developing strategies in order to promote and create engaging learning environments for technology education?

5.2.7 School Initiatives for High Student Engagement in Technology Education Lessons

As defined in the literature review, student engagement is a complex construct which involves students, teachers, the course, the school, its infrastructure and support (Kahu, 2013) and also it is a collaboration of work, time and resources by students and teachers, with the goal of enhancing teaching and learning experiences and outcomes (Trowler, 2010). Students and teachers had many suggestions for better student engagement in high school technology education classes in private schools in Abu Dhabi. From their perspectives, it can be noted that just as student engagement is multi-faceted, technology education also comes with specific

and varied aspects to consider that include the attitudes of digital natives, school curriculum and infrastructure.

Technology Education as a core subject

One of the foremost arguments against student engagement in technology education classes that kept coming to light with the students and teachers repeatedly was that the subject was not treated as a core subject. Based on the *Expectancy-Value Theory* that was referred to in the literature review, motivation is connected to the students' opinions of their own values and expectations in addition to those that matter to them (Martin et al, 2017). Students will not be engaged in a subject that is not perceived as valuable by themselves or others around them. Currently, students treat technology education lessons as relaxed sessions where they do not have to put much effort to learn or working. They view it as an easy subject that does not require any focus or practice for improvement. They are confident they will pass the subject and even score high marks, which will increase their overall term or year average. During observations in this study, it was noted that students were doing other tasks during technology education lessons, such as playing games, watching YouTube videos, studying for other lessons, etc. This confirmed what was reviewed in the literature that the lack of significance for technology education by schools, parents and even some teachers affected the subject and consequently, students and their engagement (Almekhlafi & Almeqdadi, 2010). Teachers insisted that schools, as well as the Ministry of Education, must classify technology education as a core subject, as we are living in the age of technology, which will instil in students and parents a sense of importance for it. To instil its importance, schools must conduct final exams for the subject, include it in the official weekly summative assessment calendar with strict assessments, and not allow for promotion to the next grade level without official make-up

exams in case of students failing the subject. Teachers in this study suggested that schools must constantly create awareness in students about the significance of technology in their future lives. Students mentioned that schools could give significance to the subject by conducting competitions in technology education topics within the school. Teachers added that funding for in-school technology exhibitions and also external competitions for students will instil confidence in them in their digital skills and also an understanding of the importance of technology education outside of their classrooms. It appears that, although in the United Arab Emirates, the Ministry of Education and ADEK give a lot of significance to technology education in school-level teaching and learning, by the time the effects of the significance trickle down to the classrooms in the private schools, it is reducing in magnitude as well as essence.

Standard technology education curriculum across the UAE

Another significant issue was the digital divide amongst the students in every grade level, leading to disengagement in technology education classes. Students suggested having different levels of technology education courses in each grade level to reduce the knowledge gaps in classes. Although this is a good suggestion, it involves logistical issues such as timetabling and the requirement for a greater number of technology education teachers. Usually, schools hire one or two teachers only over 3 grade levels. Another suggestion from the students was to offer the technology education subject as an elective subject for those who were interested and/or were talented in technology skills to choose, while others who were not interested could choose another subject in its place. Teachers also believed that offering technology education as an elective subject or having classes for different levels would affect student engagement positively. However, this would be a problem as many students would not opt for it, and this would leave a large number of students without basic coding or digital skills

that may be required from them in universities and future workplaces, irrespective of their career choices. Few teachers advocated for two courses that could be offered within the technology education realm, one offering computer fundamentals and the other offering advanced coding for those interested. This way, all students would acquire the digital skills they are interested in and be engaged in class as they would be willing to put in their effort towards their choice of subject. Students may choose not only based on their interest, but also for their careers or university requirements. However, it must be considered that some specific digital skills that are necessary for their future may still not be learnt. This issue of knowledge gaps may be resolved with consistency in the technology education curriculum from primary to high school, when there can be a progression in the skills learnt by the students based on their capacity, with extension as well as scaffolding ideas and techniques for high achievers and slow learners, respectively. As discussed in the literature review, computer science in the United States, was taught as a tool with no set curriculum (Ragoni, 2007 cited in Bell et al, 2010) and different states followed different standards and as the United Arab Emirates follows the American style of education, different schools follow different American state standards for technology education in high schools, causing great disparity when students move schools which is very common here. Schools and teachers must convene with the Ministry of Education and design a common curriculum for all schools that incorporates basic skills in addition to skills based on students' interests and university or career requirements. This will ensure *flow* for all the students as they progress through the school years, and also the confidence to learn and use new and advanced technologies in later years. It must be remembered that schools are preparing students to solve problems in the future that do not exist now, with technology that has not been invented yet (Savenko, 2011).

Professional development of technology education teachers

Regarding teachers, students demanded that they have better pedagogy skills in order to design suitable and relevant activities and to also control the class behaviour. Teachers also recognised that they must create interesting presentations and a variety of activities that appeal to different kinds of learners in the classes. While students and teachers conceded that the students immensely enjoyed game-like interactive activities, teachers commented that, due to time constraints, it was not possible to have these activities regularly. Furthermore, teachers acknowledged the need to use real-life scenarios in their activities, to be mindful of student interests and give students choices in activity topics to ensure student engagement. Students will be engaged when activities are relevant to their lives, appear beneficial to their communities and also when they are able to incorporate their own interests and aptitudes into them (Hoffman et al, 2019). In this study, the teachers surveyed and interviewed had experience ranging from 1 to 17 years. Teachers with less than 3 years of experience were unaware of the many pedagogy skills required to teach high school students. It was interesting to note that to create and maintain the reputation of being advanced and technology oriented, schools introduced new educational technologies every year with the hope of attracting new students and engaging existing students, however, they do not always provide the required pedagogy skills training to their teachers, only workshops for these new educational technologies the teachers were to teach and as these were only introductory workshops, teachers had to create whole term lesson plans and engaging activities for these technologies on their own. Teachers who taught the same grade levels in the school were encouraged to support each other and share materials, which emphasises the benefits of teacher communities in schools (Cooper et al., 2017); however, most teachers had to figure it out by themselves using only the internet as their resource. Schindler et al (2017) had pointed out rightly that

schools would not be able to keep pace with new technologies in the marketplace every year, which would result in ineffective curriculum implementation and reduced student engagement. As expected, teachers expressed that it was difficult to create plans and activities every term or year that may not be used or improvised upon in the following year, as new educational technologies would be introduced. In addition to a consistent curriculum, as mentioned earlier, teachers required the schools to provide relevant professional development regularly. They must be trained to teach technology to digital natives, to create differentiated activities and appropriate assessments. This was demonstrated in the Hoffman et al (2019) study, where teachers underwent professional training to learn strategies to teach students with different learning styles, including those having gaps in their knowledge and thereby, improved student engagement. These trainings included strategies to improve the physical learning environment to involve all learners, to incorporate different methods for activities and also to motivate students to persist in their learning in spite of failures or setbacks. The lack of training and adequate time for preparation for teachers is one of the major factors that affect student engagement in technology education classes (Almekhlafi & Almeqdadi, 2010). Qualified teachers who integrate technology education into other subjects, thereby enhancing students' conceptual understanding (de Vries, 2016) and who connect concepts and authentic activities to themselves and to their community (Hoffman et al, 2019) are valuable assets to the schools if also involved in curriculum design and implementation.

School support for technology education teachers

With respect to teacher personality, teachers recognised the significance of building relationships with students and believed that they were helpful and approachable to students. However, they claimed that with just two periods per week and many topics and concepts to teach in addition to managing classroom management issues, they were left with minimal time

to be motivating and supportive as they would like to be. Teachers need to be supported by the school administration to deal with challenging behaviours and to maintain discipline in classrooms. They suggested that class sizes be optimal for effective classroom management, as with too many students in a class, teachers are unable to check on individual progress and give effective feedback, especially when the school requires multiple assessments during the term. Teachers asked to be provided with technical assistance to deal with technical issues in the lab, as it is difficult for them to handle them during lessons with no expertise, causing frustration and disengagement for them and the students, respectively. It was observed in this study, in various lessons, technical issues such as slow internet, slow network connections to the smartboard, blurry or bright smartboards, software crashes with loss of student work and slow loading of software, causing frustration to the students and teachers alike. In their study, Almekhlafi & Almeqdadi (2010) mentioned the need for support and guidance for teachers in order to successfully engage students in technology education classes.

Effective technology education learning spaces

Regarding the school infrastructure, it is worth noting that the computer labs observed were not versatile enough to support group activities, which students and teachers alike reported as highly engaging methods. Teachers asked for upgraded hardware and software in networked labs, in addition to faster internet, monitoring software and a firewall to deal with online distractions and hacking. They also required purpose-built computer labs just like science labs with ideal seating arrangements, that allowed space for movement and group activities and plug points to charge student-owned devices that are in use post-COVID-19. Observations revealed that with lessons which were held in classrooms and students using their own devices, various issues such as some students not having their devices, forgetting login details or not having charged devices, all contributed majorly to the lack of engagement.

Technology education classes must be effective learning spaces, allowing for movement as well as conducting various types of activities, and that give students a sense of comfort and ownership of their learning environment.

5.3 Summary

Students recognise that their engagement is related to the effort put forth by themselves and also by their teachers, while teachers speak about only the effort and interest of the students when referring to student engagement. Students claim they engage mainly to get high marks and for their careers. Therefore, disengagement can be expected when students either have not made clear career choices at this age or have chosen careers which they believe are not related to technology. It concerns teachers that students are unaware of how learning about technology can affect their future in different ways, irrespective of the careers they choose. Students consider technology education as an easy subject to score marks, and their parents expect them to get high marks just as they did in lower grades, which eventually influences the school and the teachers to see it as the non-core subject it is and give easy assessments and undeserved bonus marks for the students to pass. Students enjoy hands-on interactive activities with their peers, but teachers argue that inconsistent school curricula and disorganised and outdated school infrastructures come in the way of conducting these kinds of activities regularly. As students have pointed out that the pedagogy skills and personalities of teachers play an important role in their engagement, teachers have requested timely professional development and technical and management support from the schools to meet these students' demands.

It becomes incumbent on the schools to consider the many factors responsible for student engagement in technology education. The results and discussion suggest that, for a start, they have to consider the significance of the subject, its curriculum, its infrastructure and

the teachers to improve the student engagement issues. Activities that are meaningful, interactive and challenging, that give students feelings of relevance, autonomy and choice, thereby fostering positive feelings towards the subject, are quite significant when it comes to engaging students in technology education. Empowering qualified teachers with timely and effective professional development and adequate support for technical assistance in the labs, as well as for classroom management, adds to the engagement of their students. It can be understood that creating an atmosphere in the school which gives significance to the subject and its learning with respect to teachers, curriculum, and environment contributes greatly to student engagement. The following chapter will conclude this study, elaborating more on the above points, stating its limitations, and suggesting recommendations for future research.

Chapter 6 - Conclusion

Overview

This study aimed to look at students' and teachers' perspectives with regard to high school students' engagement in technology education classes in private schools in Abu Dhabi. It has been assumed albeit with less evidence, that high school students are digital natives who have been engaging with technology during their developing years and are currently well-versed with its use outside schools, and therefore, will be engaged in learning technology in schools as they think and learn differently from their previous generations (Thompson, 2013). Teaching these students in high schools is a challenge, as they are digital immigrants, such as the researcher herself, and they need to engage these students with advanced educational technologies that cater to their interests as well as relevance.

This study used a qualitative-driven mixed methods approach, which was explanatory sequential in design. It was conducted in 5 private schools with a total of 516 student participants and 12 teacher participants. This study used teacher and student surveys, focus group student interviews, teacher interviews, observations, and document analysis to examine and explore the perspectives of students and teachers. Although there are many studies looking into student engagement in education (Kuh et al, 2007; Appleton et al, 2008; Skinner & Pitzer, 2012; Bond et al, 2020) and technology in education (Musawi, 2011; Castañeda & Selwyn, 2018; Wolf et al, 2020; Alaleeli & Alnajjar, 2020) separately, there is a dearth in studies exploring student engagement in technology education; very rare in schools and literally none in the Middle East. This is the first study that focuses on the students' and teachers' perspectives regarding student engagement in technology education classes in private high schools in Abu Dhabi. This study stemmed from the conundrum experienced by and subsequently the curiosity of the researcher, who is a technology education teacher teaching

high school students, when she noticed over many years that her students, who claim to be digital natives were not engaged in technology education classes despite all her efforts and that of her colleagues, who were facing the same dilemma. Therefore, it addresses a gap in research in the geographical area as well as in the field of technology education and student engagement in high schools.

This study aimed to look at the teachers' and students' experiences in schools and their attitudes towards the teaching and learning of technology, respectively. It also aimed to identify engaging topics and activities for the students, in addition to the issues faced by them that were specific to technology education. Furthermore, it intended to look at the teachers who teach technology education and the issues they faced when teaching the subject to digital natives. Lastly, this study wanted to explore the initiatives taken by schools and teachers to improve student engagement in technology education classes while looking for further areas for improvement based on students' and teachers' perspectives.

The surveys were distributed to high school students ranging from grades 9-11 in five private schools in Abu Dhabi. Grade 12 students were not considered as they were in their final year of schooling and were not available for surveys and/or interviews. The surveys collected quantitative data with respect to students' self-reported levels of engagement in technology education lessons. These were then compared with students' achievement in technology education lessons to identify a causal correlation. These surveys also collected qualitative data regarding students and teachers' understanding of the term student engagement as well as a range of factors that affected student engagement in technology education lessons such as topics and activities that were engaging and disengaging, teacher attributes such as their personalities and their pedagogy skills; any other issues unrelated to these that affected their engagement in these lessons and lastly, the initiatives students and

teachers would like schools to take to enhance student engagement. The surveys were strengthened with focus group interviews with students and one-to-one interviews with teachers, and further reinforced with observations of technology lessons in these schools. The theoretical underpinning of this research was mainly the sociological theory, in addition to many other theories, as student engagement is understood to be a complex construct. Selwyn (2012) explains using the social theory and the determinist perspectives that the technological education environment is a complicated social setting where students interact with their surroundings, the product as well as the process of learning, and this is related to their engagement in technology education lessons. The connectivism theory is also significant in this study with digital native students, as it is based on their seamless connections made with networks and their learning environments, as well as with unlimited access to information always (Sahin & Safieh, 2012).

In this chapter, the research questions will be considered again, and significant findings and conclusions will be summarised with respect to these research questions as well as the substantial literature reviewed. The implications of this research will also be stated, and then limitations of this research and lastly, recommendations for future research will be discussed.

6.1 Addressing the Research Questions

6.1.1 Students and Teachers' Understanding of the Term 'Student Engagement'

Both high school students and teachers understood the term 'student engagement' as the effort exerted by the students and the interest shown by them during the activities in technology education lessons. Students used words and phrases such as 'participate', 'interest', 'focus', 'passion', 'being active', 'interact' and 'asking questions' when asked about their engagement in these lessons. Interestingly, teachers focused mainly on the behavioural aspect of the student engagement construct and did not take any responsibility for the

engagement of students. They used terms for the students such as ‘responsibility’, ‘accountability’, ‘interest’, ‘asking and answering questions’, ‘participating’, ‘focus’, and ‘interacting’, all in relation to students. Students, on the other hand, while recognising their own responsibility, also attributed an obligation to their teachers regarding their engagement, as they mentioned their teachers’ attitudes and pedagogy skills in their interviews. This was already noted in international literature with teachers in tertiary institutions (Morgan et al, 2018b) and now in this study, it can be seen in high schools in the United Arab Emirates as well.

6.1.2 Students’ Perspectives of Their Engagement in Technology Education Classes

High school students mainly attributed their engagement in technology education to their interest in the subject, their career choices, getting higher grades in addition to topics and activities, their teachers and their interactions with their peers and environment. Although in the surveys, the students reported ‘interest’ as a main factor for engagement in technology education lessons, during their interviews, they elaborated that their interest was related to careers in technology, which resulted in increased engagement in these lessons, while those not interested in technology-related careers expressed their lack of interest in technology education. They claimed they did not understand the need to study coding and digital skills if they were not going to use them in their future. The implications here are that firstly, students are not aware of the usefulness of technology education irrespective of their career, but are only concerned with their daily lives in order to use and create with technology, to research and evaluate information and also to manage daily-use technologies such as smartphones and tablets. Also, students are unaware that being digitally savvy can launch them into lucrative pathways with respect to any career they choose. Lastly, they do not realise the hidden skills

they learn while learning to code and other technology skills, which include problem solving, critical thinking, cooperative and collaborative learning, etc.

With respect to getting high grades, students considered technology education as a fun and easy subject; a lesson where they can be at ease, requiring no extra effort to focus and still be able to score high marks to raise their overall average. From the findings, this was, surprisingly, the attitude of most of the students following the American curriculum with no external exams, as well as those following the IGCSE curriculum with external exams. The implications here are that students do not give importance to the subject as it is not considered a core subject, such as math or the sciences. Teachers reported that parents do not consider it a significant subject, as they complain during parent-teacher conferences when their children do not easily score high marks in high school, as they did in lower grade levels. Teachers, under pressure from the administration and management, claim that they cannot give adequate significance to the subject as they have to make sure all students pass the subject by giving easy assessments and awarding bonus marks to even the undeserving students to make the minimum grade to pass the tests.

Regarding the topics and activities, students made clear that they enjoy topics that are relevant to them in their current lives, which are contemporary and interesting. Collaborative activities where students can interact with peers were rated as highly engaging, and also activities that were autonomous, where students were able to choose according to their interests and which gave them a feeling of ownership, were mentioned as engaging by the students. Games such as *Kahoot*, *Quizziz* and *Blooket* were mentioned by the students in their surveys and interviews as their favourite interactive games in technology education lessons, while research and presentation to their peers were the collaborative activities mentioned in the findings. They also reported meaningful activities, that are hands-on and where they can

actually see the products as outcomes, were attractive, such as programming with Python, programming robots, creating 3D models and creating apps. On the other hand, theory topics, lectures, worksheets and videos were considered as disengaging as they did not involve active learning. The students described theory topics as being ‘abstract’, difficult to memorise and boring. Finally, in the findings, most students claimed that they were engaged only when it was easy and tended to disengage as concepts, topics, or activities got progressively difficult. The implications here include that students will engage in technology education lessons only if the topics and activities are related to their interests, their feelings of autonomy and their abilities.

With regard to teachers, students spoke mainly about their pedagogy skills and then their personalities. Students expected teachers to use different teaching strategies to reach all students with different learning styles, manage the classroom dynamics to ensure an effective learning environment and be supportive, encouraging, and approachable as a person. The implications here state that students will engage if the concepts and skills are communicated to them in different ways, ensuring their understanding. Students tend to engage when their teachers help and motivate them, and are always ready to answer their questions, explain difficult concepts multiple times and give meaningful and effective feedback so they feel safe to make mistakes and try multiple times to achieve.

Finally, with respect to their learning environment, students mentioned their frustrations related to their computer lab infrastructure. The findings related to this include weak internet, network connections and also the outdated hardware and software and in some cases, old furniture. Students also associated their engagement with that of their peers and mentioned that they enjoyed interacting with their peers as groups and in competitive game-like activities. The inferences to make here are that students claim to engage when their peers

are also engaged, and when they can interact with them to enhance engagement. Also, they required effective learning spaces where they are not frustrated with technology disruptions, resulting in classroom dynamics that are conducive to learning.

6.1.3 Teachers' Perspectives of Student Engagement in Technology Education Classes

High school teachers attributed student engagement to their career choices, their general attitude towards learning, topics and activities, school curriculum and infrastructure. With respect to student career choices, teachers mentioned that students were engaged in technology education lessons because they had already decided on careers involving technology based on their interest, which further explains their engagement in these lessons. Teachers believed that students were satisfied with their knowledge of using social media and watching videos. The implications here are that when students are not interested or do not believe that technology will serve them any purpose in their lives beyond careers that involve it, they will not put any effort into engaging in technology education lessons.

In the findings, teachers claimed that attitudes of students toward learning also influence their engagement in technology education lessons. If students are confident of their knowledge and skills, they will put in the required effort to understand new concepts and skills. This implies that students who have gaps in knowledge due to migration or lack of prerequisite knowledge from the previous years will find it difficult to learn new and complex concepts as well as skills. This, coupled with their feeling of a lack of significance for the subject, adds to their disengagement in these lessons.

Regarding topics and activities, teachers were of the opinion that students engaged best during game-like interactive activities or hands-on activities, which were related to their lives and also given choices of topics for these activities. However, the findings show that they were unable to conduct the activities on a regular basis due to time or space constraints. They

added that students were disengaged during theory lessons that involved abstract concepts and memorisation, but these topics needed to be taught for deeper understanding of technology and also for external or national exams. The implications here state that students engage in an interactive social environment, and when they are creating meaningful products that have community as well as personal value. Teachers stated that yearly changes in the subject curriculum made it difficult for them to create effective lesson plans and creative activities. The findings revealed that the school infrastructure with respect to the internet and network connections, in addition to class and classroom sizes, and also the support available to the teachers in terms of professional development, technical and class management, all played a huge role in student engagement in technology education lessons. This implies that in order for students to be engaged in lessons, teachers must be supported to create and sustain engaging learning environments.

6.1.4 School Initiatives for Enhanced Student Engagement in Technology Education Classes

From the above implications, it can be noted that much of the onus is on the schools to enhance high school students' engagement in technology education lessons. From the quantitative data results and discussion, although a clear causal correlation has not been established between achievement in technology education assessments and student engagement in technology education lessons as there may be other factors also playing a part in their achievement, it seems likely from the data that students that engage more in lessons are expected to perform better in assessments (Shernoff et al, 2019). From the perspective of the sociological theory, as mentioned before, the product or outcome of student learning, as well as the process of changes in students' perspectives related to their social interactions and their environment, are equally significant when considering student engagement (Selwyn,

2012). In this study, from the qualitative data results and discussion, it becomes evident that this is not a simple task and requires much consideration, commitment and action, as there are many factors to take into account in order to enhance student engagement in technology education lessons. Hence, it becomes imperative for the schools to act in full potential to ensure and enhance student engagement in these lessons.

First of all, the United Arab Emirates is constantly advancing in the field of technology as well as education and implementing new policies to encourage technology education in public as well as private schools, which are based on international standards (MOE, 2015). However, it must be remembered that when adopting curricula and standards from other countries, it cannot be expected to work well in a different country, as there will be differences in culture, experiences and technological advancement. These factors need to be considered before the implementation of these policies to ensure success. The necessary changes based on these factors must be made, and pilot programs must be conducted before the implementation. Moving on to the specific implications of this study, the first aspect to be considered is the significance of the subject. Schools must give technology education its due importance with respect to curriculum design, professional development, infrastructure and assessments in order to ensure student engagement in the lessons. Schools must create awareness regarding the use of technology while encouraging and emphasising the connections between technology and other subjects, and also regarding students' real lives beyond their classrooms with exhibitions, fairs and competitions, internal as well as external. Schools, with the help of qualified teachers, can help students develop skills such as problem-solving, critical thinking, and collaboration, which they can apply to other areas of their lives through technology education. Subsequently, students will also recognise its significance in their current and future lives and therefore, put effort into engaging during these lessons.

With respect to the curriculum design and implementation, if curriculum and standards are adopted from international countries, as mentioned before, they must be adapted to suit the students of the United Arab Emirates, their culture and environment. This will cultivate inclusivity and will capture and sustain students' interest and motivation. Curriculum must be consistent for all schools in the UAE from primary years to high school to guarantee gradual progression of concepts and skills with respect to difficulty and student development, and also to ensure there are no knowledge or skill gaps when students migrate from within the country, at the very least. Curriculum must include a balance of practical and theoretical concepts, including skills that cater to students' interests, as well as requirements for universities and careers. It must guide the creation of activities based on relevance for students, who are digital natives, their development, autonomy, and value, with respect to their community and self. Since teachers are directly involved with the students in their learning environment, they must be consulted by the Ministry of Education as well as the schools when creating the curriculum for the subject.

Professional development is also a very important factor contributing to student engagement in technology education lessons. Multiple, varied, and different difficulty level activities are required to engage students with different interests, skills and abilities. Teachers must be given pedagogical training and regular support to plan effective lessons and create such activities so as to engage all the differently skilled and interested students by supporting their autonomy and competency, by giving them a choice of topics and media which are relevant and which provide them chances for accomplishment (Shernoff et al, 2019). In addition to being supported, teachers must also be trained to manage classrooms and create effective learning environments.

This is further related to the school infrastructure, where schools are expected to provide adequate internet and network connections. In addition, schools must ensure safe learning spaces for the students with labs and classroom sizes that are spacious for movement and for executing different activities with class sizes that are optimal for effective management. Schools must also enforce consistent discipline with efficient supervisors to support teachers with classroom management.

Lastly, with regard to assessments, schools must give technology education its due significance by considering it as a core subject. Summative assessments must be official and announced accordingly in school assessment calendars. Assessment criteria must be clear to students, as students' awareness of how they will be assessed will enhance their engagement in the technology education classes (Brown & Brown, 2010). Assessments must be varied and challenging, catering to the different skills and abilities of the students.

6.2 Limitations of the Study

This study includes a few methodological limitations. With respect to surveys, it looks at self-reported data from the students regarding their engagement in technology education lessons, which can provide only an idea of their experiences in these lessons with limited nuance. In addition, self-reporting contributes to errors resulting from memory, mood, thoughtless completion, or even intentional fabrication. Regarding the causal correlation between students' self-reported levels of engagement and their achievement in technology education, as reflected in their final grade average, it is essential to consider that many other variables may also influence student achievement, which have not been examined in this study. Other methods used in this study, such as observations and interviews, may be affected by the *Hawthorne* effect, where students may behave differently as they are being observed or

given significance (Baxter & Babbie, 2003). Focus group interviews may highlight only the voices of the dominant speakers, while many may just echo the thoughts of the group.

Delimitations in this study include its scope, as only private schools in Abu Dhabi participated, and the experiences may vary in public schools in the UAE. Also, the participants from these schools were only from high school, following the school-based international American curriculum in grade 9, taking the IGCSE exams in grade 10, and those opting for programs including technology education in grade 11, also following the school-based international curriculum and their teachers. In addition, these participants were chosen based on convenient, purposive and comprehensive sampling selection, so the results may differ from the responses of those who did not participate. With respect to constraints in the methodology, it had been penned in the research proposal with the assumption that schools will run as normal as possible, however data collection was only possible during the academic year following the COVID pandemic, when schools were just starting to conduct face to face classes, but with great caution and many changes to the technology education course. All the five schools were having many of their technology education classes in regular classrooms, which were different from the usual computer lab setting that had personal computers for student use and vacant spaces (seen in only two schools from the five studied) to train for robotics and other innovative topics such as Python with MicroBits, Arduino, 3D printing etc. Students were using their own devices, and the curriculum was also modified to suit this kind of setting. The researcher had taught previously in the computer labs, but many observations for this study were conducted in regular classes, which may give different perspectives about the students' engagement. Six teachers out of twelve in all five schools were taking their students to the computer labs during this study. Some constraints must be considered when generalising these observations. Lastly, only twelve teachers participated in this study, as the

number of high school technology education teachers in schools is very small, so these are the perspectives of a very small group of teachers, which may be biased. All these factors are important when considering student engagement in technology education lessons.

6.3 Recommendations for Future Research

For future research, as this study was conducted only in private schools, it would be recommended to explore the perspectives of students and teachers in public schools in the UAE, which are directly under the supervision and guidance of the Ministry of Education, owing to the noteworthy distinctions between the two systems (Cooper et al, 2017). In addition, it would be recommended to study student engagement in primary and middle schools as a longitudinal study to explore how engagement changes over time and also with students' development and thereby, identify the gaps that may cause disengagement later in high schools. Another recommendation would be to include parents, Ministry of Education representatives, and school administration and management of private schools to gather their perspectives as well, with respect to student engagement in technology education lessons. There is special significance in involving parents currently, as they have experienced online learning with their children, and they may be able to offer a different insight into student engagement. Further research is also recommended for teachers to explore their confidence, qualifications, and varied professional experiences in teaching technology education in schools, especially now that artificial intelligence is entering the educational sphere. It is possible to gather more insight regarding student engagement from their firsthand experiences in the field.

6.4 Conclusions

A mixed method research design was used in this study to explore high school students' perspectives who are described as '*Digital Natives*' by Prensky (2001) and their

teachers' perspectives regarding student engagement in technology lessons in private schools in Abu Dhabi, United Arab Emirates and based on the findings, the researcher hoped to identify implications in other schools in the UAE and the Middle East. This study has only scratched the surface with respect to student engagement in technology education in schools but has fueled an awareness of the need to explore further to gain deeper insights from the data collected, which revealed the multiple factors involved in student engagement as well as the specific issues related to technology education in schools. As mentioned before, there are studies on student engagement and about technology education, but very rarely have they been explored together and very rarely in schools, and there are no studies about student engagement in technology education in schools in the Middle East. The limited international literature obtained for this study, was from first year university students and it showed that they were disengaged despite choosing careers in technology, so it becomes imperative to study student engagement in technology education lessons in order to identify the problems from the school level and develop solutions in schools itself, so students can make informed career choices based on their interests and skills. Exploring students' and teachers' perspectives from five private high schools that follow the American and the IGCSE curriculum, this study has contributed to filling a research gap that existed in this part of the world regarding student engagement and technology education in schools. In addition, this study was conducted just after the COVID-19 pandemic, thereby offering insights into the learning environments that came to exist when the schools were getting back to normal after going online for over a year.

Almost all high school students in the UAE, possess some type of digital devices, especially post COVID-19 pandemic and they also almost always have access to the internet, either at home or at school and even in public places such as malls, hospitals etc., thereby

allowing them to be connected with content and their communities at all times (Alaleeli & alnajjar, 2020). This awareness of student use of technology and the impact of their use can be used to create policies to reinforce their digital skills and also bring them together with their parents and the school community to positively engage them and influence their learning practices, online and offline, which will, in turn, eventually benefit the whole country. By exploring the students' and teachers' perspectives, who are the primary stakeholders in this study, it was able to delve into what actually goes on in classrooms, and with these perspectives, this study hopes to impact schools and policy makers to make research-informed decisions with regard to policies, curriculum design and implementation, and professional development of teachers. These decisions can support teachers to create effective learning environments and students to thrive and enjoy them during their time in schools. With research-based findings, there is hope for a comprehensive change, which is better than rushed solutions that cannot be sustained in the long run and also, changes that come with thorough understanding will reduce the digital divide that goes on unnoticed for years until the quality of our education systems becomes compromised (Martin, 2013).

For students to benefit from technology education in their current and future lives, they must be engaged in their learning; however, the data from this study has revealed that this is a challenging task that includes changes in school viewpoints, budgets, teacher training, infrastructure, student attitudes, student skills, teacher readiness and so on. This study does not claim to have all the answers to its research questions but hopes to start a conversation by exploring perspectives and ideas that will encourage more discussion. The inferences made in this study, however, can be compared with limited international literature and extended to schools in the other Emirates of the UAE and the Middle East, while adding current data to

world knowledge with respect to high school students' engagement in technology education lessons.

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Appendices

Appendix A

Technology Education Students' Perspectives and Experiences of Student Engagement

This survey of students aims to understand how you view student engagement in Technology Education (TE) classes. We are interested in understanding aspects of what types of activities lead to better student engagement and what types of activities lead to less engagement in your TE courses. This survey is being distributed to Technology Education (TE) students in different private schools in Abu Dhabi to understand and share common issues and best practice. The form should take approximately 25 minutes to complete depending on the extent of your written responses.

Statement on ethics approvals and consent:

You have been approached to participate in this survey because you currently study Technology Education (TE). Participation in the survey is entirely voluntary but by pressing the **Submit** button at the end of the survey you agree for your responses to be recorded and analysed. All the data will remain confidential to the researchers and no information that may identify individual participants will be published. Data collected for this research will not be used for any other purpose and any contact details provided will remain confidential.

Student Survey Questions (* Required)

1. Name:.....
2. What grade level are you studying? *
 - a. Grade 9 – International Curriculum
 - b. Grade 10 – IGCSE
 - c. Grade 11 - Any stream with ICT (Technology Education)
3. What is your gender? *

a) Female
b) Male
4. Are you studying in your own country? *

- a) Emirati b) International student – Country of origin:.....

5. Do you share your devices at home for studying with your family members?*

- a) Yes b) No

6. How would you rate your engagement with your current computing studies overall? *

Poor 1 2 3 4 5 6 7 Excellent

7. How would you describe your engagement with your current computing studies overall? *

.....

8. What does the term 'student engagement' mean to you? *

.....

.....

9. Can you explain the reasons for your rating of your engagement with your computing studies? *

.....

.....

10. Please describe any activities where you have experienced being highly engaged in your computing studies *

.....

.....

11. Please describe any activities where you have experienced being disengaged in your computing studies *

.....

.....

12. What do your teachers do that tends to encourage you to engage with your computing studies? *

.....

.....

13. What do your teachers do that tends to disengage you from your computing studies? *

.....

.....

14. Are there any initiatives, by your school or your teachers, that you would like to see that would improve your engagement with your computing studies? *

.....

.....

15. Are there any other issues you would like to raise regarding with how you engage with your computing studies?

.....

.....

16. If you are willing to be interviewed about your responses, please enter a contact email address along with your grade level to be in contact (note: you are under no obligation to do so).

.....

Appendix B

Technology Education Teachers' Perspectives and Experiences of Student Engagement

This survey of Technology Education (TE) Teachers aims to understand how you view student engagement and how you have engaged with your teaching in the past. We are interested in understanding aspects of what types of activities lead to better student engagement and what types of activities lead to less engagement with your TE courses. This survey is being distributed to Technology Education (TE) Teachers in different private schools in Abu Dhabi to understand and share common issues and best practice. The form should take approximately 25 minutes to complete depending on the extent of your written responses.

Statement on ethics approvals and consent:

You have been approached to participate in this survey because you currently teach Technology Education (TE). Participation in the survey is entirely voluntary but by pressing the **Submit** button at the end of the survey you agree for your responses to be recorded and analysed. All the data will remain confidential to the researchers and no information that may identify individual participants will be published. Data collected for this research will not be used for any other purpose and any contact details provided will remain confidential.

Teacher Survey Questions (*Required)

1. How many years have you been teaching? *

.....

2. What is your gender? *

a) Female

b) Male

3. What does the term 'student engagement' mean to you?' *

.....

-
4. How would you describe your TE student's engagement with the computing courses you teach? *
-
-

5. How would you rate the student engagement experience in the computing courses you teach? *

Poor 1 2 3 4 5 6 7 Excellent

6. Can you explain the reasons for your rating of your student's engagement with the computing courses you teach? *
-
-

7. Please describe any activities where you have experienced students being highly engaged with their computing studies? *
-
-

8. Please describe any activities where you have experienced students being disengaged in their computing studies? *
-
-

9. What do you do to encourage your students to engage with your computing courses?*
-
-

10. Are there any aspects of your courses that tend to disengage your computing students? *
-

.....

11. Are you aware of any initiatives in your department/faculty/school to promote student engagement? *

.....

.....

12. Do you believe computing students in general have any specific characteristics compared to other students? *

.....

.....

13. Do you believe there are any computing specific issues related to student engagement? *

.....

.....

14. Any other issues you would like to raise regarding with how your students engage with their computing studies?

.....

.....

15. If you are willing to be interviewed about your responses, please enter a contact email address to be in contact (note: you are under no obligation to do so).

Appendix C

Student Focus Group Interview Questions

1. What is your nationality?
2. How many years have you been studying technology?
3. What does 'student engagement' mean to you?
4. Please describe any activities where you have experienced being highly engaged in your computing studies.
5. Please describe any activities where you have experienced being highly disengaged in your computing studies.
6. Are you aware of any initiatives by your school/ TE teachers to promote student engagement?
7. Do you believe students opting for computing studies in general have any specific characteristics compared to other students?
8. Do you believe there are any computing studies specific issues related to student engagement?

Comment on any of the following aspects for the remainder of the questions:

- How relevant are these questions to your computing studies?
 - How much of this do you do in your computing studies?
9. During the current school year, in TE classes, about how often have you done the following?
 - Combined ideas from different subjects when completing assignments
 - Connected your learning to societal problems or issues
 - Included diverse perspectives (political, religious, racial/ethnic, gender, etc.) in course discussions or assignments
 - Examined the strengths and weaknesses of your own views on a topic or issue
 - Tried to better understand someone else's views by imagining how an issue looks from his or her perspective
 - Learned something that changed the way you understand an issue or concept.
 - Connected ideas from your courses to your prior experiences and knowledge
 10. During the current school year, about how often have you done the following?
 - Talked about career plans with the TE teacher
 - Discussed your academic performance with the TE teacher
 11. Have any of your TE projects included community-based learning (service-learning)?

12. How much has your experience in TE classes contributed to your knowledge, skills, and personal development in the following areas?

- Writing clearly and effectively
- Speaking clearly and effectively
- Thinking critically and analytically
- Analyzing numerical and statistical information
- Acquiring job/work-related knowledge and skills
- Working effectively with others
- Developing or clarifying a personal code of values and ethics
- Understanding people of other backgrounds (economic, racial/ethnic, political, religious, nationality, etc.)
- Solving complex real-world problems
- Being an informed and active citizen

13. In the current school year, to what extent has your TE teacher

- engaged you actively in learning?
- demonstrated concern for student learning?
- provided clear explanations on coursework and assessment?
- stimulated you intellectually?
- commented on your work in ways that help you learn?
- seemed helpful and approachable?
- set assessment tasks that challenge you to learn?

14. During the current school year, about how often have you done the following?

- Ask questions or contribute to course discussion in other ways
- Prepared two or more drafts of an assignment before turning it in
- Come to class without completing readings or assignments
- Worked with other students on TE projects or assignments
- Given a course presentation

15. During the current school year, how much has your course-work emphasized the following?

- Memorizing course material
- Applying facts, theories, or methods to practical problems or new situations
- Analyzing an idea, experience, or line of reasoning in depth by examining its parts
- Evaluating a point of view, decision, or information source
- Forming a new idea or understanding from various pieces of information

Appendix D

Teacher Interview Questions

General Questions:

1. What is your nationality?
2. What grade level do you teach?
3. How many years have you been teaching technology education?
4. What does 'student engagement' mean to you?
5. What have you done in your teaching practice to promote student engagement?
6. Have you participated any Student Experience/Engagement survey used in this country?
7. What activities have you observed in your lessons that maintain student engagement?
8. What activities in your lessons have caused students to disengage?
9. Do you believe students opting for computing studies in general have any specific characteristics compared to other students?
10. Do you believe there are any computing studies specific issues related to student engagement?

Comment on a series of questions (9 onwards) extracted from surveys of student experience (Appendix C).

- How would you interpret these question?
- How do you think CS students would interpret/answer these questions?
- How relevant are these questions to the CS domain?
- How much of this do you include in your own teaching? Provide an example if possible.
- Do you think that CS students do less of this than other students – and is that legitimate?
- Is this something CS faculty should be doing (or why not)?
- Can you suggest more relevant areas for CS to assess student engagement?
- Knowing that these questions are used to measure and report on the engagement of our students, would this prompt you to reconsider your teaching methods or content or context?

Instrument: Observation Guide/Protocol 1

Subject/ Topic: Grade: Length of Observation:.....No. of students:.....

Time :.....Date: Location: Teacher: Observer:.....

Role: Observer as Participant	
Physical Setting: (How are the students arranged? Is it group/pair work?)	
Activities: (Description of the general activity and what technology is to be used)	
Description of activities	Reflective notes
Beginning: How activity is introduced? How students respond?	Themes:
	Quotes:
	Personal:
Middle: Who is involved? What does teacher say? What do students respond? Variations in engagement:	Themes:
	Quotes:
	Personal:
Ending: How does the activity end? What is said to end? How do students react to the ending?	Themes:
	Quotes:
	Personal:
What does not happen?	
Technology challenges:	
Unplanned activities/distractions:	
Extra information: (repeated actions etc..)	

Instrument: Observation Guide/Protocol 2

Subject/ Topic: Grade: Length of Observation:.....No. of students:.....

Time :.....Date: Location: Teacher: Observer:.....

Role: Participant as Observer	
Physical Setting:(How are the students arranged? Is it group/pair work?)	
Activities:(Description of the general activity and what technology is to be used)	
Description of activities	Reflective notes
Beginning: What is the teacher saying? What are students asking? What are students saying about the technology used?	Themes:
	Quotes:
	Personal:
Middle: Are students doing the tasks? Do students ask for help from teacher? Do students ask for help from peers? Are students distracted? What are they doing? Are students frustrated? What are they saying?	Themes:
	Quotes:
	Personal:
Ending: What does teacher say? Do students end on time? What are they saying? Are students upset or happy to end the lesson? What are they saying? Do they care if they finished or no?	Themes:
	Quotes:
	Personal:
What does not happen?	
Technology challenges:	
Unplanned activities:	
Extra information:	

Appendix F-a

NSSE 2024 U.S. English Version

Available at (<https://nsse.indiana.edu/nsse/survey-instruments/us-english.html>)

Accessed on 31st March, 2024

1. During the current school year, about how often have you done the following?

Response options: Very often, Often, Sometimes, Never

- a. Asked questions or contributed to course discussions in other ways
- b. Asked another student to help you understand course material
- c. Explained course material to one or more students
- d. Prepared for exams by discussing or working through course material with other students
- e. Worked with other students on course projects or assignments
- f. Given a course presentation

2. During the current school year, about how often have you done the following?

Response options: Very often, Often, Sometimes, Never

- a. Combined ideas from different courses when completing assignments
- b. Connected your learning to societal problems or issues
- c. Included diverse perspectives (political, religious, racial/ethnic, gender, etc.) in course discussions or assignments
- d. Examined the strengths and weaknesses of your own views on a topic or issue
- e. Tried to better understand someone else's views by imagining how an issue looks from their perspective
- f. Learned something that changed the way you understand an issue or concept
- g. Connected ideas from your courses to your prior experiences and knowledge

3. During the current school year, about how often have you done the following?

Response options: Very often, Often, Sometimes, Never

- a. Talked about career plans with a faculty member
- b. Worked with a faculty member on activities other than coursework (committees, student groups, etc.)

- c. Discussed course topics, ideas, or concepts with a faculty member outside of class
- d. Discussed your academic performance with a faculty member

4. During the current school year, how much has your coursework emphasized the following?

Response options: Very much, Quite a bit, Some, Very little

- a. Memorizing course material
- b. Applying facts, theories, or methods to practical problems or new situations
- c. Analyzing an idea, experience, or line of reasoning in depth by examining its parts
- d. Evaluating a point of view, decision, or information source
- e. Forming a new idea or understanding from various pieces of information

5. During the current school year, to what extent have your instructors done the following?

Response options: Very much, Quite a bit, Some, Very little

- a. Clearly explained course goals and requirements
- b. Taught course sessions in an organized way
- c. Used examples or illustrations to explain difficult points
- d. Provided feedback on a draft or work in progress
- e. Provided prompt and detailed feedback on tests or completed assignments
- f. Explained in advance the criteria for successfully completing your assignments
- g. Reviewed and summarized key ideas or concepts
- h. Taught in a way that aligns with how you prefer to learn
- i. Enabled you to demonstrate your learning through quizzes, assignments, and other activities

6. During the current school year, about how often have you done the following?

Response options: Very often, Often, Sometimes, Never

- a. Reached conclusions based on your own analysis of numerical information (numbers, graphs, statistics, etc.)
- b. Used numerical information to examine a real-world problem or issue (unemployment, climate change, public health, etc.)

- c. Evaluated what others have concluded from numerical information

7. During the current school year, about how many papers, reports, or other writing tasks of the following lengths have you been assigned? (Include those not yet completed.)

Response options: None, 1-2, 3-5, 6-10, 11-15, 16-20, More than 20 papers

- a. Up to 5 pages
- b. Between 6 and 10 pages
- c. 11 pages or more

8. During the current school year, about how often have you had discussions with people from the following groups?

Response options: Very often, Often, Sometimes, Never

- a. People of races or ethnicities other than your own
- b. People from economic backgrounds other than your own
- c. People with religious beliefs other than your own
- d. People with political views other than your own
- e. People with sexual orientations other than your own
- f. People from countries other than your own

9. During the current school year, about how often have you done the following?

Response options: Very often, Often, Sometimes, Never

- a. Identified key information from reading assignments
- b. Reviewed your notes after class
- c. Summarized what you learned in class or from course materials

10. During the current school year, to what extent have your courses challenged you to do your best work?

Response options: 1=Not at all to 7=Very much

11. Which of the following have you done while in college or do you plan to do before you graduate?

Response options: Done or in progress, Plan to do, Do not plan to do, Have not decided

- a. Participate in an internship, co-op, field experience, student teaching, or clinical placement
- b. Hold a formal leadership role in a student organization or group
- c. Participate in a learning community or some other formal program where groups of students take two or more classes together
- d. Participate in a study abroad program
- e. Work with a faculty member on a research project
- f. Complete a culminating senior experience (capstone course, senior project or thesis, portfolio, recital, comprehensive exam, etc.)

12. About how many of your courses at this institution have included a community-based project (service-learning)?

Response options: All, Most, Some, None

13. Indicate the quality of your interactions with the following people at your institution.

Response options: 1=Poor to 7=Excellent, Not Applicable

- a. Students
- b. Academic advisors
- c. Faculty
- d. Student services staff (career services, student activities, housing, etc.)
- e. Other administrative staff and offices (registrar, financial aid, etc.)

14. How much does your institution emphasize the following?

Response options: Very much, Quite a bit, Some, Very little

- a. Spending significant amounts of time studying and on academic work
- b. Providing support to help students succeed academically
- c. Using learning support services (tutoring services, writing center, etc.)
- d. Encouraging contact among students from different backgrounds (social, racial/ethnic, religious, etc.)
- e. Providing opportunities to be involved socially
- f. Providing support for your overall well-being (recreation, health care, counseling, etc.)
- g. Helping you manage your non-academic responsibilities (work, family, etc.)
- h. Attending campus activities and events (performing arts, athletic events, etc.)

- i. Attending events that address important social, economic, or political issues

15. To what extent do you agree or disagree with the following statements?

Response options: Strongly agree, Agree, Disagree, Strongly Disagree

- a. I feel comfortable being myself at this institution.
- b. I feel valued by this institution.
- c. I feel like part of the community at this institution.

16. About how many hours do you spend in a typical 7-day week doing the following?

Response options: 0, 1-5, 6-10, 11-15, 16-20, 21-25, 26-30, More than 30 (Hours per week)

- a. Preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)
- b. Participating in co-curricular activities (organizations, campus publications, student government, fraternity or sorority, intercollegiate or intramural sports, etc.)
- c. Working for pay on campus
- d. Working for pay off campus
- e. Doing community service or volunteer work
- f. Relaxing and socializing (time with friends, video games, TV or videos, keeping up with friends online, etc.)
- g. Providing care for dependents (children, parents, etc.)
- h. Commuting to campus (driving, walking, etc.)

17. Of the time you spend preparing for class in a typical 7-day week, about how much is on *assigned reading*?

Response options: Very little, Some, About half, Most, Almost all

18. How much has your experience at this institution contributed to your knowledge, skills, and personal development in the following areas?

Response options: Very much, Quite a bit, Some, Very little

- a. Writing clearly and effectively
- b. Speaking clearly and effectively
- c. Thinking critically and analytically

- d. Analyzing numerical and statistical information
- e. Acquiring job- or work-related knowledge and skills
- f. Working effectively with others
- g. Developing or clarifying a personal code of values and ethics
- h. Understanding people of other backgrounds (economic, racial/ethnic, political, religious, nationality, etc.)
- i. Solving complex real-world problems
- j. Being an informed and active citizen

19. How would you evaluate your entire educational experience at this institution?

Response options: Excellent, Good, Fair, Poor

20. If you could start over again, would you go to the *same institution* you are now attending?

Response options: Definitely yes, Probably yes, Probably no, Definitely no

21. Do you intend to return to this institution next year? [Only non-seniors receive this question]

Response options: Yes, No, Not sure

22a. How many majors do you plan to complete? (Do not count minors.)

Response options: One, More than one

22b. [If answered "One"] Please enter your major or expected major: [Text box]

22c. [If answered "More than one"] Please enter up to two majors or expected majors (do not enter minors): [Text box]

23. What is your class level?

Response options: First-year, Sophomore, Junior, Senior, Unclassified

24. What types of courses have you taken at this institution this current school year?

Response options: Mostly in-person courses, Mostly remote courses (online, web-based, Zoom, etc.), Mostly hybrid or blended courses that combine in-person and remote instruction, A balanced mix of the above course types

25. What have most of your grades been up to now at this institution?

Response options: A, A-, B+, B, B-, C+, C, C- or lower

26. Did you begin college at this institution or elsewhere?

Response options: Started here, Started elsewhere

27. Since graduating from high school, which of the following types of schools have you attended *other than* the one you are now attending? (Select all that apply.)

Response options: Vocational or technical school, Community or junior college, 4-year college or university other than this one, None, Other

28. What is the highest level of education you ever expect to complete?

Response options: Some college but less than a bachelor's degree, Bachelor's degree (B.A., B.S., etc.), Master's degree (M.A., M.S., etc.), Doctoral or professional degree (Ph.D., J.D., M.D., etc.)

29. What is the highest level of education completed by your parent(s), guardian(s), or those who raised you?

Response options: Did not finish high school, High school diploma or G.E.D., Attended college but did not complete degree, Associate's degree (A.A., A.S., etc.), Bachelor's degree (B.A., B.S., etc.), Master's degree (M.A., M.S., etc.), Doctoral or professional degree (Ph.D., J.D., M.D., etc.), I prefer not to respond

30. How would you describe your gender identity? (Select all that apply.)

Response options: Woman; Man; Trans/Transgender; Agender or gender neutral; Demigender; Genderqueer, non-binary, gender non-conforming, or genderfluid; Two-spirit; Cis/Cisgender; Questioning or unsure; Another gender identity, please specify: ____; I prefer not to respond

31. How would you describe your sexual orientation? (Select all that apply.)

Response options: Straight or heterosexual; Bisexual; Lesbian; Gay; Queer; Pansexual or polysexual; Ace, gray, or asexual; Demisexual; Questioning or unsure; Another sexual orientation, please specify: ____; I prefer not to respond

32. How would you describe yourself? (Select all that apply.)

Response options: Asian; Black or African American; Hispanic, Latina/o, Latine, or Latinx; Indigenous, American Indian, Native American, or Alaska Native; Middle Eastern or North African; Native Hawaiian or Pacific Islander; White; Another race or ethnicity; I prefer not to respond

33a. Are you an international student?

Response options: Yes, No

33b. [If answered “yes”] What is your country of citizenship?

33c. [If answered “no”] What is the 5-digit ZIP code of your home address during your last year of high school?

34a. Do you have a disability or condition that impacts your learning, working, or living activities?

Response options: Yes, No, I prefer not to respond

34b. [If answered “yes”] Which of the following impacts your learning, working, or living activities? (Select all that apply.)

Response options: Sensory disability: Blind or low vision; Deaf or hard of hearing Physical disability: Mobility condition that affects walking; Mobility condition that does not affect walking; Speech or communication disorder; Traumatic or acquired brain injury (TBI); Mental health or developmental disability: Anxiety; Attention deficit or hyperactivity disorder (ADD or ADHD); Autism spectrum; Depression; Post-Traumatic Stress Disorder (PTSD); Another mental health or developmental disability (schizophrenia, eating disorder, etc.) Another disability or condition: Chronic medical condition (asthma, diabetes, Crohn’s disease, etc.); Learning disability; Intellectual disability; Disability or condition not listed

35. Of which of the following types of Greek letter social or service organizations are you a member? (Select all that apply.)

Response options: None, I am not a member of a Greek letter social or service organization; Independent Greek Council (IGC); Interfraternity Conference (IFC, NIC); National Panhellenic Council (NPC); National Pan-Hellenic Council (NPHC, The Divine 9); United Greek Council (UGC) or Multicultural Greek Councils (NMGC, NALFO, NAPA); Another Greek letter social or service organization, please specify:

36. Which of the following best describes where you are living while attending college?

Response options: Campus housing (other than a fraternity or sorority house), Fraternity or sorority house, House, apartment, or other residence within walking distance to campus, House, apartment, or other residence farther than walking distance to campus, Not applicable: No campus, entirely online program, etc., Not applicable: Homeless or in transition

37. Are you a student-athlete on a team sponsored by your institution's athletics department?

Response options: Yes, No

38. Are you a current or former member of the U.S. Armed Forces, Reserves, or National Guard?

Response options: Yes, No

39. Prompt for Open-Ended Comments (Institutions select one of four questions for the end of the NSSE questionnaire or writes their own question.)

- If you have any additional comments or feedback that you'd like to share on the quality of your educational experience, please enter them below.
- What has been most satisfying about your experience so far at this institution? What has been most disappointing?
- Please describe the most significant learning experience you have had so far at this institution.
- What one change would most improve the educational experience at this institution? What one thing should not be changed?

Appendix F-b

UK Engagement Survey - UKES 2017

Available at

(<https://www.cardiffmet.ac.uk/study/Documents/UKES%202017%20Questions.pdf>)

Accessed on 31st March, 2024

Welcome

This survey asks about your how you are engaging with your studies. Your responses will be combined with those of others to help inform your institution about the experiences of undergraduates, helping to improve future support. The results are also used nationally to help understand and improve students' engagement across the country.

Many thanks for your participation.

Data Protection

All data collected in this survey will be held securely. All participating institutions have agreed not to identify any individuals when reporting their results internally or externally, and to use their best efforts to ensure that no individuals can be identified by implication. The full UKES dataset will be available to the Higher Education Academy and selected third parties in order to conduct national level research and analysis.

Some information held by your institution, for example age, is attached to your response so that you do not have to provide it again. This data helps your institution and the sector better meet the needs of students like you.

1. Please confirm below that you have read the data protection statement and consent to the data being used in the way described (if you do not consent then please close this browser window to exit the survey).

Please select exactly 2 answer(s).

I have read and understand the data protection statement

I consent to my responses being used as described in the data protection statement

Notes for completion

The questionnaire should take **around ten minutes** to complete. When you arrive at the **final 'thank you' page**, you will know that your responses have been recorded on our database.

Where "course" is used in the questionnaire, this refers to your programme of study at your institution e.g. BA History, BSc Physics, etc.

After each section you will be asked for any further comments on the issues covered, to enable staff to gain a better understanding of what has gone well and what has worked less well. **Please do not directly identify yourself or other individuals (including staff) in your comments.**

If you have a complaint or need support with any of the issues raised within the survey, please contact haveyoursay@cardiffmet.ac.uk

Once you click 'Next' you will be directed to the first section of the survey.

Critical thinking

2. During the current academic year, how much has your course emphasised the following activities?

	Very much	Quite a bit	Some little	Very
Applying facts, theories or methods (for example to practical problems or new situations)				
Analysing ideas or theories in depth				
Evaluating or judging a point of view, decision or information source				
Forming a new understanding from various pieces of information				

3. If you have any further comments on these issues then please provide them here. Please be as specific as possible:

Learning with others

4. During the current academic year, about how often have you done each of the following?

	Very often Often Sometimes Never			
Worked with other students on course projects or assignments				
Explained course material to one or more students				
Asked another student to help you understand course material				
Prepared for exams or assessments by discussing or working through course material with other students				

5. If you have any further comments on these issues then please provide them here. Please be as specific as possible:

Interacting with staff

6. During the current academic year, about how often have you done each of the following?

	Very often Often Sometimes Never			
Asked questions in taught sessions or contributed to discussions about course material in other ways				
Discussed your academic performance and/or feedback with teaching staff				
Talked about your career plans with teaching staff or advisors				
Discussed ideas from your course with teaching staff outside taught sessions, including by email/online				

Worked with teaching staff on activities other than coursework				
Made significant changes to your work based on feedback				

7. If you have any further comments on these issues then please provide them here. Please be as specific as possible:

Reflecting and connecting

8. During the current academic year, about how often have you done each of the following?

	Very often Often Sometimes Never			
Combined ideas from different modules when completing assignments				
Connected your learning to real-world problems or issues				
Examined the strengths and weaknesses of your own views on a topic or issue				
Tried to better understand someone else's views by imagining how an issue looks from his or her perspective				
Changed the way you thought about a concept or issue as a result of what you learned				
Connected ideas from your course to your prior experience and knowledge				

9. If you have any further comments on these issues then please provide them here. Please be as specific as possible:

Course challenge

10. During the current academic year, how much has your course emphasised taking responsibility for your own learning?

Very much Quite a bit Some Very little

11. During the current academic year, how much has your course challenged you to do your best work?

Very much Quite a bit Some Very little

12. If you have any further comments on these issues then please provide them here. Please be as specific as possible:

Engagement with research and inquiry

13. During the current academic year, how much has your course emphasised the following activities?

	Very	Quite	Some	
	Very much	a bit	little	
Learning about the methods of research and analysis in your subject				
Learning about the outcomes of current research in your subject				
Formulating and exploring your own questions, problems or scenarios				
Doing research (such as working on your own research project, or working on a research project with staff)				

Staff-student partnerships

15. During the current academic year, how much have you been encouraged to do the following activities?

	Very much	Quite a bit	Some	Very little
Contributing to a joint community of staff and students				
Working with staff to make improvements to your course				
Working with staff to evaluate teaching and assessment practices				

Skills Development

17. How much has your overall student experience contributed to your knowledge, skills and personal development in the following areas?

	Very much	Quite a bit	Some	Very little
Writing clearly and effectively				
Speaking clearly and effectively				
Thinking critically and analytically				
Analysing numerical and statistical information				
Acquiring employability skills (e.g. skills to help you get a job such as CV writing or career planning)				
Becoming an independent learner				
Being innovative and creative				
Working effectively with others				
Developing or clarifying personal values or ethics				
Understanding people of other backgrounds (economic, racial/ethnic, political, religious, nationality, etc.)				
Exploring complex real-world problems				
Being an informed and active citizen				

How you spend your time

19. About how many hours do you spend in a typical 7-day week during term- time doing the following?

	0 hours	1-5 hours	6-10 hours	11- 15 hours	16- 20 hours	21- 25 hours	26- 30 hours	More than 30 hours
Time spent in taught sessions								
Time spent in independent study								
Participating in extra-curricular or co-curricular activities (societies, sports, etc. via the institution or the students' union)								
Working for pay								
Doing volunteer work								
Providing care for dependants (children, parents, etc.)								
Commuting to campus (driving, walking, etc.)								

20. If you have any further comments on these issues then please provide them here. Please be as specific as possible:

Institutional questions

Welsh Medium Support

21. I am satisfied with the opportunities given to study through the medium of Welsh

Definitely agree Mostly agree Neither agree nor disagree

Mostly disagree Definitely disagree Not applicable

22. As a Welsh speaking student, how do you rate your support from within your programme and from the University?

Year of study

23. What year of your course are you currently in?

Foundation year

First year

Second year

Third year

Fourth year

Fifth year

Sixth year or more

24. Are you in the final year of your course? *Required*

Yes, I am in my final year

No

Your Student Experience

The teaching on my course

25. Thinking of your current view of the course as a whole, to what extent do you agree or disagree that...

	Definitely agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Definitely disagree	Not applicable
a. Staff are good at explaining things						
b. Staff have made the subject interesting.						
c. The course is intellectually stimulating.						
d. My course has challenged me to achieve my best work						

Learning opportunities

26. Thinking of your current view of the course as a whole, to what extent do you agree or disagree that...

Definitely agree

Mostly agree

Neither agree nor disagree

Mostly disagree

Definitely disagree

Not applicable

a. My course has provided me with opportunities to explore ideas or concepts in depth

b. My course has provided me with opportunities to bring information and ideas together from different topics

c. My course has provided me with opportunities to apply what I have learnt

Assessment and feedback

27. Thinking of your current view of the course as a whole, to what extent do you agree or disagree that...

Definitely agree

Mostly agree

Neither agree nor disagree

Mostly disagree

Definitely disagree

Not applicable

a. The criteria used in marking have been clear in advance.

b. Marking and assessment has been fair.

c. Feedback on my work has been timely.

d. I have received helpful comments on my work.

Your Student Experience

Academic Support

28. Thinking of your current view of the course as a whole, to what extent do you agree or disagree that...

	Definitely agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Definitely disagree	Not applicable
a. I have been able to contact staff when I needed to.						
b. I have received sufficient advice						

and guidance in relation to my course.						
c. Good advice was available when I needed to make study choices on my course						

Organisation and management

29. Thinking of your current view of the course as a whole, to what extent do you agree or disagree that...

Definitely agree

Mostly agree

Neither agree nor disagree

Mostly disagree

Definitely disagree

Not applicable

a. The course is well organised and is running smoothly.

b. The timetable works efficiently for me.

c. Any changes in the course or teaching have been communicated effectively.

Your Student Experience

Learning resources

30. Thinking of your current view of the course as a whole, to what extent do you agree or disagree that...

	Definitely agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Definitely disagree	Not applicable
a. The IT resources and facilities provided have supported my learning well.						
b. The library resources (e.g. books, online services and learning spaces) have supported my learning well.						
c. I have been able to access course-specific resources (e.g. equipment, facilities, software, collections) when I needed to						

Learning community

31. Thinking of your current view of the course as a whole, to what extent do you agree or disagree that...

	Definitely agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Definitely disagree	Not applicable
a. I feel part of a community of staff and students.						
b. I have had the right opportunities to work with other students as part of my course.						

Student voice

32. Thinking of your current view of the course as a whole, to what extent do you agree or disagree that...

a. I have had the right opportunities to provide feedback on my course.

b. Staff value students' views and opinions about the course.

Definitely agree

Mostly agree

Neither agree nor disagree

Mostly disagree

Definitely disagree

Not applicable

c. It is clear how students' feedback on the course has been acted on.

d. The students' union (association or guild) effectively represents students' academic interests.

Your Student Experience

Overall satisfaction

33. Thinking of your current view of the course as a whole, to what extent do you agree or disagree that...

	Definitely agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Definitely disagree	Not applicable
Overall, I am satisfied with the quality of the course.						

34. Looking back on the experience, are there any positive aspects you would like to highlight?

35. Looking back on the experience, are there any negative aspects you would like to highlight?

To help us understand whether provision at this institution and across the sector is meeting the needs of all undergraduates, we would now like to ask some questions about you and your course. As with the rest of the survey, all reporting will be anonymous and your responses will be treated confidentially.

About yourself

36.

What is your age?

18 years old or under 19-21 years old 22-25 years old 26-30 years old 31-35 years old 36-40 years old 41-45 years old 46-50 years old 51-55 years old

56 years old or over Prefer not to say

37.

What is your gender?

Male
Female
Prefer not to say Other

37.a.

If you selected Other, please specify:

Appendix F-c

(Available at https://www.acer.org/files/AUSSE_2011_SEQ.pdf. Accessed on 31st March, 2024)

Student Engagement Questionnaire



Item stem	Response options
In your experience at your institution during the current academic year, about how often have you done each of the following? - Asked questions or contributed to discussions in class or online - Sought advice from academic staff - Made a class or online presentation - Worked hard to master difficult content - Prepared two or more drafts of an assignment before handing it in - Used library resources on campus or online - Worked on an essay or assignment that required integrating ideas or information from various sources - Used student learning support services - Blended academic learning with workplace experience - Included diverse perspectives (e.g. different races, religions, genders, political beliefs, etc.) in class discussions or written assignments - Came to class having completed readings or assignments - Kept up to date with your studies - Worked with other students on projects during class - Worked with other students outside class to prepare assignments - Put together ideas or concepts from different subjects when completing assignments or during class discussions - Tutored or taught other university students (paid or voluntary) - Participated in a community-based project (e.g. volunteering) as part of your study - Used an online learning system to discuss or complete an assignment - Used email or a forum to communicate with teaching staff - Discussed your grades or assignments with teaching staff - Talked about your career plans with teaching staff or advisors - Discussed ideas from your readings or classes with teaching staff outside class - Received prompt written or oral feedback from teachers/tutors on your academic performance	1 Never 2 Sometimes 3 Often 4 Very often

- Worked harder than you thought you could to meet a teacher's/tutor's standards or expectations - Worked with teaching staff on activities other than coursework (e.g. students, family members, co-workers, etc.) - Discussed ideas from your readings or classes with others outside class (e.g. students, family members, co-workers, etc.) - Had conversations with students of a different ethnic group than your own - Had conversations with students who are very different to you in terms of their religious beliefs, political opinions or personal values	
During the current academic year, how much has your coursework emphasised the following intellectual activities? - Memorising facts, ideas or methods from your subjects and readings - Analysing the basic elements of an idea, experience or theory, such as examining a particular case or situation in depth and considering its components - Synthesising and organising ideas, information or experiences into new, more complex interpretations and relationships - Making judgements about the value of information, arguments or methods, such as examining how other gather and interpret data and assessing the soundness of their conclusions - Applying theories or concepts to practical problems or in new situations	1 Very little 2 Some 3 Quite a bit 4 Very much
In a typical week, how many exercises, lab reports, problem sets and tutorial questions do you complete? - Number of pieces of work that take one hour or less to complete - Number of pieces of work that take more than one hour to complete	1 None 2 1 to 2 3 3 to 4 4 5 to 6 5 More than 6
During the current academic year, about how much reading and writing have you done? - Number of assigned textbooks, books or book-length packs of subject readings - Number of books read on your own (not assigned) for personal enjoyment or academic enrichment - Number of written assignments of fewer than 1,000 words - Number of written assignments of between 1,000 and 5,000 words	1 None 2 1 to 4 3 5 to 10 4 11 to 20 5 More than 20

• - Number of written assignments of more than 5,000 words	
--	--

Item stem	Response options
Which box best represents the extent to which your examinations during the current academic year have challenged you to do your best work?	1 Very little 22 33 44 55 66 7 Very much
During the current academic year, about how often have you done each of the following? • - Attended an art exhibition, play, dance, music, theatre or other performance • - Exercised or participated in physical fitness activities • - Examined the strengths and weaknesses of your own views on a topic or issue • - Improved knowledge and skills that will contribute to your employability • - Developed communication skills relevant to your discipline • - Explored how to apply your learning in the workplace • - Tried to better understand someone else's views by imagining how an issue looks from their perspective • - Learned something that changed the way you understand an issue or concept • - Spent time keeping your resume up-to-date • - Thought about how present yourself to potential employers • - Explored where to look for jobs relevant to your interests • - Used networking to source information on job opportunities • - Set career development goals and plans	1 Never 2 Sometimes 3 Often 4 Very often
Which of the following have you done or do you plan to do before you graduate from your institution? - Practicum, internship, fieldwork or clinical placement - Industry placement or work experience - Community service or volunteer work - Participate in a study group or learning community - Work on a research project with a staff member outside of coursework requirements - Study a foreign language - Study abroad or student exchange - Culminating final-year experience (e.g. honours thesis, capstone project, comprehensive exam, etc.) - Independent study or self-designed major - Consult a university careers service for advice - Hold a leadership position in a university group or the community	1 Do not know about 2 Have not decided 3 Do not plan to do 4 Plan to do 5 Done

Item stem	Response options
Which of these boxes best represent the quality of your relationships with people at your institution? - Relationships with other students	1 Unfriendly, unsupportive, sense of alienation 22 33 44 55 66 7 Friendly, supportive, sense of belonging
Which of these boxes best represent the quality of your relationships with people at your institution? - Relationships with teaching staff	1 Unavailable, unhelpful, unsympathetic 22 33 44 55 66 7 Available, helpful, sympathetic
Which of these boxes best represent the quality of your relationships with people at your institution? - Relationships with administrative personnel	1 Unhelpful, inconsiderate, rigid 22 33 44 55 66 7 Helpful, considerate, flexible
Which of these boxes best represent the quality of your relationships with people at your institution? - Relationships with student support services	1 Unfriendly, unavailable, unsympathetic 22 33 44 55 66 7 Friendly, available, sympathetic
About how many hours do you spend in a typical seven-day week doing each of the following? Leave blank if the item does not apply. • - Preparing for class (e.g. studying, reading, writing, doing homework or lab work, analysing data, rehearsing and other academic activities) • - Working for pay on campus • - Working for pay off campus • - Participating in extracurricular activities (e.g. organisations, campus publications, student associations, clubs and societies, sports, etc.) • - Relaxing and socialising (e.g. watching TV, partying, etc.) • - Providing care for dependents living with you (e.g. parents, children, spouse, etc.) • - Managing personal business (e.g. housework, shopping exercise, health needs, etc.) • - Travelling to campus (e.g. driving, walking etc.) • - Being on campus, including time spent in class • - Being on campus, excluding time spent in class	1 None 2 1 to 5 3 6 to 10 4 11 to 15 5 16 to 20 6 21 to 25 7 26 to 30 8 Over 30

If you are working for pay, how much is this work related to your field of study?	1 Not at all 2 Very little 3 Some 4 Quite a bit 5 Very much 6 Not in paid work
To what extent does your institution emphasise each of the following? - Spending significant amounts of time studying and on academic work - Providing the support you need to help you succeed academically - Encouraging contact among students from different economic, social and ethnic backgrounds - Helping you cope with your non-academic responsibilities (e.g. work, family, etc.) - Providing the support you need to socialise - Attending campus events and activities (e.g. special speakers, cultural performances, sporting events, etc.) - --Using computers in academic work	1 Very little 2 Some 3 Quite a bit 4 Very much
To what extent has your experience at this institution contributed to your knowledge, skills and personal development in the following areas? - Acquiring a broad general education - Acquiring job-related or work-related knowledge and skills - Writing clearly and effectively - Speaking clearly and effectively - Thinking critically and analytically - Analysing quantitative problems - Using computing and information technology - Working effectively with others - Voting informedly in local, state or national elections - Learning effectively on your own - Understanding yourself - Understanding people of other racial and ethnic backgrounds - Solving complex, real-world problems - Developing a personal code of values and ethics - Contributing to the welfare of your community - Securing relevant work after graduation	1 Very little 2 Some 3 Quite a bit 4 Very much
In this academic year have you seriously considered leaving your current institution? Mark all that apply. - No, I have not considered a change - Yes, please select reason - Academic exchange - Academic support - Administrative support - Boredom/lack of interest - Career prospects - Change of direction - Commuting difficulties - Difficulty paying fees	1 Selected 2 Not selected

- Difficulty with workload - Family responsibilities - Financial difficulties - Gap year/deferral - Government assistance - Graduating - Health or stress - Institution reputation - Moving residence - Need a break - Need to do paid work - Other opportunities - Paid work responsibilities - Personal reasons - Quality concerns - Received other offer - Social reasons - Standards too high - Study/life balance - Travel or tourism - Other: Please specify	
What are your plans for next year? Mark all that apply. - Continue with current study - Shift to another university - Move to vocational education and training - Leave before finishing qualification - Change to another qualification - Leave having completed qualification - Leave to do paid work - Leave to take time off	1 Selected 2 Not selected
Overall, how would you evaluate the quality of academic advice that you have received at your institution?	1 Poor 2 Fair 3 Good 4 Excellent
How would you evaluate your entire educational experience at this institution?	1 Poor 2 Fair 3 Good 4 Excellent
If you could start over again, would you go to the same institution you are now attending?	1 Definitely no 2 Probably no 3 Probably yes 4 Definitely yes
Are you male or female?	1 Male 2 Female
Where has your study been mainly based in the current academic year	1 On one or more campuses 2 Mix of external/distance and on- campus 3 External/distance

Item stem	Response options
In what year did you first start university?	0 Before 2007 1 2007 2 2008 3 2009 4 2010 5 2011
How many years of your qualification have you completed?	1 None, in first year 2 One year 3 Two years 4 Three years 5 More than three years
Since starting at university, have you been enrolled mainly part time or full time?	1 Part time 2 Full time
What is your major area of study (e.g. accounting, primary education; psychology, law)?	Open-ended
What is your student identification number? Please write in the following box. No individual is identified in any analyses or reports.	Open-ended
Do you have a government funded university place (e.g. HECS, CSP, NZ Student Loan Scheme)?	1 No 2 Yes
In the current academic year have you received any direct financial payments from the government?	1 No 2 Yes
In the current academic year, have you received any financial assistance from your university (e.g. scholarships, loans, stipends, etc.)?	1 No 2 Yes
Which category best represents your average overall grade so far?	1 No results 2 0 to 49 3 50 to 54 4 55 to 59 5 60 to 64 6 65 to 69 7 70 to 74 8 75 to 79 9 80 to 84 10 85 to 89 11 90 to 94 12 95 to 100
How much of your study do you do online?	1 None 2 About a quarter 3 About half 4 All or nearly all
What are the BEST ASPECTS of how your university engages students in Open-ended learning?	Open-ended

Appendix G

FSSE - Faculty Survey of Student Engagement

(Available at <https://scholarworks.iu.edu/iuwrrest/api/core/bitstreams/175aa978-8c95-4b2d-a3ce-2e159d7cf24c/content>) Accessed on 31st March, 2024

1. How important is it to you that undergraduates at your institution do the following before they graduate?

Response options: Very important, Important, Somewhat important, Not important

1. Participate in an internship, co-op, field experience, student teaching, or clinical placement
2. Hold a formal leadership role in a student organization or group
3. Participate in a learning community or some other formal program where groups of students take two or more classes together
4. Participate in a study abroad program
5. Work with a faculty member on a research project
6. Complete a culminating senior experience (capstone course, senior project or thesis, comprehensive exam, portfolio, etc.)
7. Participate in a community-based project (service- learning) as part of a course

2. How important is it to you that your institution increase its emphasis on each of the following?

Response options: Very important, Important, Somewhat important, Not important

1. Students spending significant amounts of time studying and on academic work
2. Providing support to help students succeed academically
3. Students using learning support services (tutoring services, writing center, etc.)
4. Encouraging contact among students from different backgrounds (social, racial/ethnic, religious, etc.)
5. Providing opportunities for students to be involved socially
6. Providing support for students' overall well-being (recreation, health care, counseling, etc.)
7. Helping students manage their non-academic responsibilities (work, family, etc.)
8. Students attending campus activities and events (performing arts, athletic events, etc.)
9. Students attending events that address important social, economic, or political issues

3. Indicate your perception of the quality of student interactions with the following people at your institution.

Response options: 1=Poor to 7=Excellent

1. Other students
2. Academic advisors
3. Faculty
4. Student services staff (career services, student activities, housing, etc.)
5. Other administrative staff and offices (registrar, financial aid, etc.)

4. In a typical 7-day week, about how many hours do you spend on each of the following?

Response options: 0, 1-4, 5-8, 9-12, 13-16, 17-20, 21-30, More than 30 hours

- a. Teaching activities (preparing, teaching class sessions, grading, meeting with students outside of class, etc.)
- b. Advising students
- c. Research, creative, or scholarly activities
- d. Service activities (committee work, administrative duties, etc.)

5. In a typical 7-day week, about how many hours do you spend on each of the following teaching-related activities?
Response options: 0, 1-4, 5-8, 9-12, 13-16, 17-20, More than 20 hours

- a. Preparing class sessions
- b. Teaching class sessions
- c. Grading assignments and exams
- d. Meeting with students outside of class
- e. Course administration (emailing students, maintaining course website, etc.)
- f. Working to improve your teaching (self-reflection, meeting with teaching consultants, attending teaching workshops, conducting research on your own courses, etc.)

6. In a typical 7-day week, do you participate in the following activities?
response options: Yes, No

- a. Working with undergraduates on research
- b. Supervising undergraduate internships or other field experiences

7. During the current school year, have you taught an undergraduate course?
Response options: Yes, No

If No, respondent skips to #11, and then to #31.

8. During the current school year, about how often have you done each of the following with the undergraduate students you teach or advise?
Response options: Very often, Often, Sometimes, Never

- a. Talked about their career plans
- b. Worked on activities other than coursework (committees, student groups, etc.)
- c. Discussed course topics, ideas, or concepts outside of class
- d. Discussed their academic performance

9. About how many of your undergraduate courses at this institution have included a community-based project (service-learning)?
Response options: All, Most, Some, None

10. In your undergraduate courses, to what extent do you do the following?
Response options: Very much, Quite a bit, Some, Very little

- 1. Clearly explain course goals and requirements
- 2. Teach course sessions in an organized way
- 3. Use examples or illustrations to explain difficult points
- 4. Use a variety of teaching techniques to accommodate diversity in student learning styles
- 5. Review and summarize material for students
- 6. Provide standards for satisfactory completion of assignments (rubrics, detailed outlines, etc.)
- 7. Provide feedback to students on drafts or works in progress
- 8. Provide prompt and detailed feedback on tests or completed assignments

11. What is the general academic discipline of your appointment?

[Write-in]

Please answer the following questions based on one particular undergraduate course section you are teaching or have taught during the current school year.

12a. Is your selected course section in the same academic discipline as your appointment?

Response options: Yes, No

12b. [If answered "No"] What is the general academic discipline of your selected course section?

[Write-in]

13. What is the class level of most students in your selected course section?

Response options: Lower division (mostly first-year students or sophomores); Upper division (mostly juniors or seniors); Other, please describe: _____

14. Estimate the total number of students in your selected course section.

Response options: 20 or fewer, 21-30, 31-40, 41-50, 51-100, More than 100

15. Does your selected course section fulfill a general education requirement on your campus?

Response options: Yes, No

16. In what format do you teach your selected course section?

Response options: Classroom instruction on-campus; Classroom instruction at an auxiliary location (satellite campus, rented facility, etc.); Distance education (online, live or pre-recorded video or audio, correspondence, etc.); Combination of classroom instruction and distance education

17. In an average 7-day week, about how many hours do you expect the typical student to spend preparing for your selected course section (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)?

Response options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, More than 10 hours

18. In an average 7-day week, about how many hours do you think the typical student actually spends preparing for your selected course section (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)?

Response options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, More than 10 hours

19a. In an average 7-day week of the time students spend preparing for your selected course section, about how many hours do you expect students to spend on assigned reading?

Response options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, More than 10 hours

19b. [If answered greater than 0] About how much of the assigned reading in your selected course section do you think the typical student completes?

Response options: All, Most, Some, None

20. In an average 7-day week, about how many hours do you think the typical student in your selected course section spends doing each of the following?

Response options: 0, 1-5, 6-10, 11-15, 16-20, 21-25, 26-30, More than 30 hours

- a. Preparing for class (studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities)
- b. Participating in co-curricular activities (organizations, campus publications, student government, fraternity or sorority, intercollegiate or intramural sports, etc.)
- c. Working for pay on campus
- d. Working for pay off campus
- e. Doing community service or volunteer work
- f. Relaxing and socializing (time with friends, video games, TV or videos, keeping up with friends online, etc.)
- g. Providing care for dependents (children, parents, etc.)

h. Commuting to campus (driving, walking, etc.)

21. In your selected course section, to what extent do you think the typical student does their best work?

Response options: Very much, Quite a bit, Some, Very little

22. In your selected course section, how important is it to you that the typical student do the following?

Response options: Very important, Important, Somewhat important, Not important

1. Ask questions or contribute to course discussions in other ways
2. Prepare two or more drafts of a paper or assignment before turning it in
3. Come to class having completed readings or assignments
4. Reach conclusions based on their own analysis of numerical information (numbers, graphs, statistics, etc.)
5. Use numerical information to examine a real-world problem or issue (unemployment, climate change, public health, etc.)
6. Evaluate what others have concluded from numerical information

23. In your selected course section, how important is it to you that the typical student do the following?

Response options: Very important, Important, Somewhat important, Not important

1. Combine ideas from different courses when completing assignments
2. Connect their learning to societal problems or issues
3. Include diverse perspectives (political, religious, racial/ethnic, gender, etc.) in course discussions or assignments
4. Examine the strengths and weaknesses of their own views on a topic or issue
5. Try to better understand someone else's views by imagining how an issue looks from their perspective
6. Learn something that changes the way they understand an issue or concept
7. Connect ideas from your course to their prior experiences and knowledge

24. In your selected course section, about what percent of class time is spent on the following?

Response options: 0%, 1-9%, 10-19%, 20-29%, 30-39%, 40-49%, 50-74%, 75% or more

1. Lecture
2. Discussion
3. Small-group activities
4. Student presentations or performances
5. Independent student work (writing, painting, designing, etc.)
6. Movies, videos, music, or other performances not involving or produced by students
7. Assessing student learning (tests, evaluations, surveys, polls, etc.)
8. Experiential activities (labs, field work, clinical or field placements, etc.)

25. In your selected course section, how much do you encourage students to do the following?

Response options: Very much, Quite a bit, Some, Very little

1. Ask other students for help understanding course material
2. Explain course material to other students
3. Prepare for exams by discussing or working through course material with other students
4. Work with other students on course projects or assignments
5. Identify key information from reading assignments
6. Review notes after class
7. Summarize what has been learned from class or from course materials

26. In your selected course section, how much opportunity do students have to engage in discussions with people from the following groups?

Response options: Very much, Quite a bit, Some, Very little

a. People of a race or ethnicity other than their own

- b. People from an economic background other than their own
- c. People with religious beliefs other than their own
- d. People with political views other than their own
- e. People with a sexual orientation other than their own

27. In your selected course section, how much does the coursework emphasize the following?

Response options: Very much, Quite a bit, Some, Very little

- a. Memorizing course material
- b. Applying facts, theories, or methods to practical problems or new situations
- c. Analyzing an idea, experience, or line of reasoning in depth by examining its parts
- d. Evaluating a point of view, decision, or information source
- e. Forming a new idea or understanding from various pieces of information

28a. Does your selected course section include assigned papers, reports, or other writing tasks?

Response options: Yes, No

[If answered "Yes"] About how many papers, reports, or other writing tasks of the following lengths do you assign?

Response options: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, More than 10 papers, etc.

- 28b. Up to 5 pages
- 28c. From 6 to 10 pages
- 28d. 11 pages or more

29. To what extent do you structure your selected course section so that students learn and develop in the following areas?

Response options: Very much, Quite a bit, Some, Very little

- 1. Writing clearly and effectively
- 2. Speaking clearly and effectively
- 3. Thinking critically and analytically
- 4. Analyzing numerical and statistical information
- 5. Acquiring job- or work-related knowledge and skills
- 6. Working effectively with others
- 7. Developing or clarifying a personal code of values and ethics
- 8. Understanding people of other backgrounds (economic, racial/ethnic, political, religious, nationality, etc.)
- 9. Solving complex real-world problems
- 10. Being an informed and active citizen

Appendix H

Teacher Engagement Report Form (TERF-N) (*Hart et al, 2011*)

The TERF-N is a 10-item, paper-and-pencil chart, where the teacher fills in 10 boxes, one for each item, per student. Each item is completed using a Likert- type scale of 1-5 (e.g., 1 = *strongly disagree*, 5 = *strongly agree*). The TERF-N requires approximately 45 minutes to complete for 30 students. The questionnaire items address aspects of affective, behavioral, and cognitive engagement.

ITEM & HYPOTHESIZED DOMAIN

AFFECTIVE

- Seems interested in school
- Gets along with peers
- Seems to care about grades

BEHAVIORAL

- Has good attendance
- Participates in class discussions/activities
- Is referred for out-of-class disciplinary procedures Is respectful to staff

COGNITIVE

- Persists on more challenging tasks
- Demonstrates appropriate effort for task
- Is self-motivated

Appendix I-a

(Available at <https://apps.sos.wv.gov/adlaw/csr/readfile.aspx?DocId=50990&Format=PDF>)

Accessed on 31st March, 2024

The **West Virginia Computer Science Standards** for grades 9-12 are designed to provide the opportunity to learn computer science that are necessary for students to prepare them for the workplace of the future and inspiring interest in careers that require computer science expertise.

Computer Science and Computational Thinking	
CS.9-12.1	Develop and apply criteria for evaluating a computer system for a given purpose.
CS.9-12.2	Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects.

Networks and Cyber Infrastructure	
CS.9-12.3	Analyze reliable and safe communication methods to transmit information among computing devices over the network.
CS.9-12.4	Analyze the utilization of computers and networks.

Data and Information	
CS.9-12.5	Store, transmit, and manipulate data electronically.
CS.9-12.6	Use tools to graphically represent the data and information.
CS.9-12.7	Create computational models for simulating real-world system.

Programming and Algorithms	
CS.9-12.8	Organize and create a modular program.
CS.9-12.9	Compare the effectiveness of the algorithms.
CS.9-12.10	Create computer program(s) to solve specific problems relevant to various real-world topics both independently and collaboratively.

Impacts of Computing	
CS.9-12.11	Explain the national and global economic impact of cybercrime.
CS.9-12.12	Analyze the negative and positive impact of new technology socially and globally.
CS.9-12.13	Test and refine computational artifacts to reduce bias and equity deficits.
CS.9-12.14	Use tools and methods for collaborating on a project to increase connectivity of people in different cultures and career fields.

Appendix I-b

Grades 9-12 Standards – West Virginia Standards for Technology Literacy

High school students perfect their understanding of the myriad ways technology is used to share information, communicate, collaborate and create. They use technology to solve higher-order real-world problems, apply it to complex tasks, develop their own technology and explore career options that are technology-based. Students explore the benefits and limitations of social media, discuss the ramifications of the improper use of technology and media, and grasp the importance of checking facts, distinguishing points of view, confirming the reliability of sources, and verifying information obtained via electronic and social media.

Empowered Learner	
T.9-12.1	Articulate personal learning goals, select, and manage appropriate technologies to achieve them, and reflect on their successes and areas of improvement in working toward their goals.
T.9-12.2	Develop online networks within school policy, and customize their learning environments in ways that support their learning.
T.9-12.3	Utilize a variety of technologies efficiently and transfer their knowledge and skills to learn how to use new technologies.
T.9-12.4	Select appropriate platforms and tools to create, share, and communicate their work effectively.
T.9-12.5	Explore real-world issues and problems and actively pursue an understanding of them and solutions for them
T.9-12.6	Locate and collect resources from a variety of sources and organize assets into collections for a wide range of projects and purposes.
T.9-12.7	Practice and demonstrate the ability to evaluate resources for accuracy, perspective, credibility, and relevance
T.9-12.8	Utilize research strategies effectively to locate appropriate digital resources across all content areas.

Digital Citizens	
T.9-12.9	Keep their personal data private and secure, including the awareness of terms such as encryption, HTTPS, passwords, cookies, and computer viruses; understand the limitations of data management and how data-collection technologies work.
T.9-12.10	Understand how to manage digital identities and reputations within school policy, including demonstrating an understanding of how digital actions are never fully erasable.
T.9-12.11	Demonstrate and advocate for positive, safe, legal, and ethical habits when using technology and when interacting with others online.
T.9-12.12	Demonstrate and advocate for an understanding of intellectual property with both print and digital media including copyright, permission and fair use by creating a variety of media products that include appropriate citation and attribution elements

Knowledge Constructor	
T.9-12.13	Publish, present, and defend content designed for specific audiences and select platforms that will effectively convey their ideas to those audiences.
T.9-12.14	Communicate complex ideas clearly using various digital tools to convey the concepts textually, visually, graphically, etc.
T.9-12.15	Create original works or responsibly repurpose other digital resources into new creative works.

Innovative Designer	
T.9-12.16	Engage in a design process and employ it to generate ideas, create innovative products or solve authentic problems.
T.9-12.17	Present ideas and information using appropriate tools that are appropriate for specific audiences.

Computational Thinker	
T.9-12.18	Find or organize relevant data and use technology to analyze and represent it in various ways to solve problems and make decisions.
T.9-12.19	Apply evaluation strategies when using electronic resources (such as publication/copyright date, fact vs. fiction, sources, credibility, ease of use).

Creative Communicator	
T.9-12.20	Actively seek performance feedback from people, including teachers, and from functionalities embedded in digital tools to improve their learning process, and select technology to demonstrate their learning in a variety of ways.
T.9-12.21	Use communication tools (such as email, discussion boards, online conferences, learning management systems, portfolios) to gather information, share ideas and respond to questions.

Global Collaborator	
T.9-12.22	Use collaborative technologies to connect with others, including peers, experts, and community members, to learn about issues and problems or to gain a broader perspective.
T.9-12.23	Use digital tools to interact with others to mutually develop a richer understanding of different perspectives and cultures.
T.9-12.24	Explore local and global issues and select collaborative technologies to use to work with others to investigate and develop solutions.

Appendix J

California State Standards (ICSM) Grades 9-12

(School Provided Curriculum – SAC2)

Progression of California K–12 Computer Science Standards				
California Department of Education (August 1, 2018)				
Concept + Subconcept	Grades 9–12 Core <i>By the end of Grade 12</i> ALL students will be able to...		Grades 9–12 Specialty <i>By the end of Grade 12</i> students will be able to...	
Computing Systems Devices	9-12.CS.1 Describe ways in which abstractions hide the underlying implementation details of computing systems to simplify user experiences. (P4.1)		9-12S.CS.1 Illustrate ways computing systems implement logic through hardware components. (P4.4, P7.2)	
	Digital Teens 4	Unit 5, task 5	Digital Teens 4	Unit 1, tasks:1,2,3
Computing Systems Hardware & Software	9-12.CS.2 Compare levels of abstraction and interactions between application software, system software, and hardware. (P4.1)		9-12S.CS.2 Categorize and describe the different functions of operating system software. (P7.2)	
	Digital Teens 1	Unit 1, tasks:1,2	Digital Teens 1	Unit 1, task 2
	Digital Teens 4	Unit 1, tasks:1,2,3	Digital Teens 4	Unit 1, task 3

Computing Systems Troubleshooting	9-12.CS.3 Develop guidelines that convey systematic troubleshooting strategies that others can use to identify and fix errors. <i>(P6.2)</i>		n/a	
	Digital Teens 1	Unit 3, task 5		
	Digital Teens 3	Unit 4, task 2,3		
	Digital Teens 4	Unit 1, task 2		
Network & The Internet Network Communication & Organization	9-12.NI.4 Describe issues that impact network functionality. <i>(P4.1)</i> 9-12.NI.5 Describe the design characteristics of the Internet. <i>(P7.2)</i>		9-12S.NI.3 Examine the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing. <i>(P4.4)</i> 9-12S.NI.4 Explain how the characteristics of the Internet influence the systems developed on it. <i>(P7.2)</i>	
	Digital Teens 2	Unit 4, task 1	Digital Teens 2	Unit 4, task 1
	Digital Teens 3	Unit4, task 1	Digital Teens 3	Unit 4, task 1
	Digital Teens 4	Unit 1, task 4	Digital Teens 4	Unit 1, task 4
Network & The Internet Cybersecurity	9-12.NI.6 Compare and contrast security measures to address various security threats. <i>(P7.2)</i> 9-12.NI.7 Compare and contrast cryptographic techniques to model the secure transmission of information. <i>(P3.3, P4.4)</i>		9-12S.NI.5 Develop solutions to security threats. <i>(P5.3)</i> 9-12S.NI.6 Analyze cryptographic techniques to model the secure transmission of information. <i>(P3.3, P4.2)</i>	

	Digital Teens 1	Unit 3, task 5	Digital Teens 1	Unit 3, task 5
	Digital Teens 3	Unit 4, tasks: 1,4	Digital Teens 4	Unit 1, tasks: 4
	Digital Teens 4	Unit 1, tasks: 4,5		
Data & Analysis Storage	9-12.DA.8 Translate between different representations of data abstractions of real-world phenomena, such as characters, numbers, and images. <i>(P4.1)</i> 9-12.DA.9 Describe tradeoffs associated with how data elements are organized and stored. <i>(P3.3)</i>		n/a	
	Digital Teens 2	Unit 3, task 2		
	Digital Teens 3	Unit 4, task 5		
	Digital Teens 4	Unit 1, task 1,4		
Data & Analysis Collection, Visualization, & Transformation	9-12.DA.10 Create data visualizations to help others better understand real-world phenomena. <i>(P5.2)</i>		9-12S.DA.7 Select and use data collection tools and techniques to generate data sets. <i>(P7.1)</i> 9-12S.DA.8 Use data analysis tools and techniques to identify patterns in data representing complex systems. <i>(P4.1, P7.1)</i>	

	Digital Teens 1	Unit 4	Digital Teens 1	Unit 4
	Digital Teens 2	Unit 5	Digital Teens 2	Unit 5
	Digital Teens 3	Unit 2, task 2	Digital Teens 3	Unit 2, task 2
Data & Analysis Inference & Models	9-12.DA.11 Refine computational models to better represent the relationships among different elements of data collected from a phenomenon or process. <i>(P4.4, P6.3)</i>		9-12S.DA.9 Evaluate the ability of models and simulations to test and support the refinement of hypotheses. <i>(P4.4)</i>	
	Digital Teens 1	Unit 4	Digital Teens 1	Unit 4
	Digital Teens 2	Unit 5	Digital Teens 2	Unit 5
Algorithms & Programming Algorithms	9-12.AP.12 Design algorithms to solve computational problems using a combination of original and existing algorithms. <i>(P4.2, P5.1)</i>		9-12S.AP.10 Describe how artificial intelligence drives many software and physical systems. <i>(P3.1, P7.2)</i> 9-12S.AP.11 Implement an algorithm that uses artificial intelligence to overcome a simple challenge. <i>(P3.1, P5.3)</i> 9-12S.AP.12 Implement searching and sorting algorithms to solve computational problems. <i>(P4.2, P5.2)</i> 9-12S.AP.13 Evaluate algorithms in terms of their efficiency. <i>(P3.3)</i>	
	Digital Teens 3	Unit 3, task 1	Digital Teens 3	Unit 3, task 1 Unit 5, task 3
Algorithms & Programming Variables	9-12.AP.13 Create more generalized computational solutions using collections instead of repeatedly using simple variables. <i>(P4.1)</i>		9-12S.AP.14 Compare and contrast fundamental data structures and their uses. <i>(P4.2)</i>	

	Digital Teens 3	Unit 3, tasks:2-5		
	Digital Teens 4	Unit 5, tasks:1-4		
Algorithms & Programming Control	9-12.AP.14 Justify the selection of specific control structures by identifying tradeoffs associated with implementation, readability, and performance. (P5.2) 9-12.AP.15 Iteratively design and develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions. (P5.1, P5.2, P5.3)		9-12S.AP.15 Demonstrate the flow of execution of a recursive algorithm. (P3.2, P7.2)	
	Digital Teens 3	Unit 3, tasks:3-5 Unit 5, task 4		
	Digital Teens 4	Unit 5, tasks:2-4		
Algorithms & Programming Modularity	9-12.AP.16 Decompose problems into smaller subproblems through systematic analysis, using constructs such as procedures, modules, and/or classes. (P3.2) 9-12.AP.17 Create computational artifacts using modular design. (P4.3, P5.2)		9-12S.AP.16 Analyze a large-scale computational problem and identify generalizable patterns or problem components that can be applied to a solution. (P3.2, P4.2) 9-12S.AP.17 Construct solutions to problems using student-created components, such as procedures, modules, and/or objects. (P4.3, P5.2) 9-12S.AP.18 Demonstrate code reuse by creating programming solutions using libraries and APIs. (P4.2, P5.3, P6.2)	
	Digital Teens 3	Unit 3, tasks: 4,5	Digital Teens 4	Unit 5, task 2,3,4
	Digital Teens 4	Unit 5, task 2		

	Digital Teens 5	Unit 3, task 3,4,5		
Algorithms & Programming Program Development	9-12.AP.18 Systematically design programs for broad audiences by incorporating feedback from users. (<i>P1.1, P5.1</i>) 9-12.AP.19 Explain the limitations of licenses that restrict use of computational artifacts when using resources such as libraries. (<i>P7.3</i>) 9-12.AP.20 Iteratively evaluate and refine a computational artifact to enhance its performance, reliability, usability, and accessibility. (<i>P6.3</i>) 9-12.AP.21 Design and develop computational artifacts working in team roles using collaborative tools. (<i>P2.4</i>) 9-12.AP.22 Document decisions made during the design process using text, graphics, presentations, and/or demonstrations in the development of complex programs. (<i>P7.2</i>)		9-12S.AP.18 Demonstrate code reuse by creating programming solutions using libraries and APIs 9-12S.AP.19 Plan and develop programs for broad audiences using a specific software life cycle process. (<i>P2.2, P2.3, P5.2</i>) 9-12S.AP.20 Develop programs for multiple computing platforms. (<i>P5.2</i>) 9-12S.AP.21 Identify and fix security issues that might compromise computer programs. (<i>P6.2</i>) 9-12S.AP.22 Develop and use a series of test cases to verify that a program performs according to its design specifications. (<i>P6.1</i>) 9-12S.AP.23 Modify an existing program to add additional functionality and discuss intended and unintended implications. (<i>P4.2, P5.3</i>) 9-12S.AP.24 Evaluate key qualities of a program through a process such as a code review. (<i>P6.3</i>) 9-12S.AP.25 Use version control systems, integrated development environments (IDEs), and collaborative tools and practices (e.g., code documentation) while developing software within a group. (<i>P2.4, P5.2</i>) 9-12S.AP.26 Compare multiple programming languages, and discuss how their features make them suitable for solving different types of problems. (<i>P7.2</i>)	
	Digital Teens 2	Unit 4, task 5	Digital Teens 5	Unit 5, task 2,5

	Digital Teens 3	Unit 3		
	Digital Teens 4	Unit 5, task 1- 5		
	Digital Teens 5	Unit 5		
Impacts of Computing Culture	9-12.IC.23 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. <i>(P1.2, P3.1)</i> 9-12.IC.24 Identify impacts of bias and equity deficit on design and implementation of computational artifacts and apply appropriate processes for evaluating issues of bias. <i>(P1.2)</i> 9-12.IC.25 Demonstrate ways a given algorithm applies to problems across disciplines. <i>(P3.1)</i> 9-12.IC.26 Study, discuss, and think critically about the potential impacts and implications of emerging technologies on larger social, economic, and political structures, with evidence from credible sources. <i>(P7.2)</i>		9-12S.IC.27 Evaluate computational artifacts with regard to improving their beneficial effects and reducing harmful effects on society. <i>(P1.2, P6.1)</i> 9-12S.IC.28 Evaluate how computational innovations that have revolutionized aspects of our culture might evolve. <i>(P7.2)</i> 9-12S.IC.29 Evaluate the impact of equity, access, and influence on the distribution of computing resources in a global society. <i>(P1.2)</i>	
	Digital Teens 4	Unit 1, task 5	Digital Teens 4	Unit 1, task 5
	Digital Teens 3	Unit 3, task 1		
Impacts of Computing Social Interactions	9-12.IC.27 Use collaboration tools and methods to increase connectivity with people of different cultures and careers. <i>(P2.4)</i>		n/a	

	Digital Teens 4	Unit 2, tasks:1-4		
Impacts of Computing Safety, Law, & Ethics	9-12.IC.28 Explain the beneficial and harmful effects that intellectual property laws can have on innovation. (P7.3) 9-12.IC.29 Explain the privacy concerns related to the collection and generation of data through automated processes. (P7.2) 9-12.IC.30 Evaluate the social and economic implications of privacy in the context of safety, law, or ethics. (P7.2)		9-12S.IC.30 Debate laws and regulations that impact the development and use of software. (P7.2)	
	Digital Teens 2	Unit 4, task 3,5		
Practices	<i>P6. Testing and Refining Computational Artifacts</i> <i>P7. Communicating About Computing</i>		[See K-12 CS Framework (k12cs.org) for subpractices.]	

Appendix K-a

Virginia State Standards - Grade 11 (PHP)

(School Provided Curriculum – SACI)

Standard	- Learning Outcomes	Resources
C/T 9-12.1	- Analyze and draw conclusions about a series of photos depicting device use. - Use online resources to track arguments for and against whether we are addicted to our devices. - Complete a short writing assignment analyzing one or more aspects related to the device addiction debate.	<i>Common Sense Education</i> Digital Citizenship: Can Media Be Addictive?
C/T 9-12.1	The students will be able to: ● define PHP ● describe the purpose of using PHP ● describe the term scripting ● describe a scripting language ● differentiate between scripting languages and programming languages	<i>Learn with Computers-PHP</i> , Chapter 1, "Getting started with PHP"
C/T 9-12.1	The students will be able to: ● describe what can be done using PHP ● identify & describe the types of web pages	<i>Learn with Computers-PHP</i> , Chapter 1, "Getting started with PHP"

	• describe the term cookies • identify advantages of using PHP • describe the WAMP server • identify the use of WAMP	
C/T 9-12.1	- describe the basic architecture of PHP web application and how the server handles the requests - differentiate between pure PHP & embedded PHP - define the term syntax - use the basic syntax of PHP - describe the PHP scripting syntax - describe the PHP tag	Learn with Computers-PHP, Chapter 2, "Basics of PHP" Extra exercises from: https://www.w3schools.com/php/php_examples.asp https://www.javatpoint.com/php-example https://www.tutorialspoint.com/php_programming_examples/
C/T 9-12.1	• describe the .PHP extension • describe the ways to display output in PHP • use the echo way to display output • use the print way to display output • describe the term localhost	<i>Learn with Computers-PHP, Chapter 2, "Basics of PHP"</i>

C/T 9-12.1	• Assignment operator • Introducing the conditional statements	<i>Learn with Computers-PHP, Chapter 2, "Basics of PHP"</i> Extra exercises from: https://www.w3schools.com/php/php_examples.asp https://www.javatpoint.com/php-example https://www.tutorialspoint.com/php_programming_examples/
C/T 9-12.12	• use the if statement • use the if-else statement • use the if-else-if statement • use the compact if statement	<i>Learn with Computers-PHP, Chapter 2, "Basics of PHP"</i> Extra exercises from: https://www.w3schools.com/php/php_examples.asp https://www.javatpoint.com/php-example https://www.tutorialspoint.com/php_programming_examples/
C/T 9-12.1	• use the Integer datatype • describe the rules for using Integers • use the float data type • use the var-dump function	Revision + Test Extra exercises from: https://www.w3schools.com/php/php_examples.asp https://www.javatpoint.com/php-example https://www.tutorialspoint.com/php_programming_examples/
C/T 9-12.12	Doing classwork to practice writing PHP code with arithmetic operators and conditional statements	<i>Learn with Computers-PHP, Chapter 2, "Basics of PHP"</i> Extra exercises from: https://www.w3schools.com/php/php_examples.asp https://www.javatpoint.com/php-example https://www.tutorialspoint.com/php_programming_examples/

C/T 9-12.12	• Declaring variables of different types • Performing some operations using the arithmetic operators • Using conditional statements	<i>Learn with Computers-PHP, Chapter 2, "Basics of PHP"</i>
C/T 9-12.1	- Analyze and draw conclusions about a series of photos depicting device use. - Use online resources to track arguments for and against whether we are addicted to our devices. - Complete a short writing assignment analyzing one or more aspects related to the device addiction debate.	<i>Common Sense Education Digital Citizenship: Can Media Be Addictive?</i>
C/T 9-12.1	The students will be able to: • define PHP • describe the purpose of using PHP • describe the term scripting • describe a scripting language • differentiate between scripting languages and programming languages	<i>Learn with Computers-PHP, Chapter 1, "Getting started with PHP"</i>
C/T 9-12.1	The students will be able to: • describe what can be done using PHP	<i>Learn with Computers-PHP, Chapter 1, "Getting started with PHP"</i>

	● identify & describe the types of web pages ● describe the term cookies ● identify advantages of using PHP ● describe the WAMP server ● identify the use of WAMP	
C/T 9-12.1	- describe the basic architecture of PHP web application and how the server handles the requests - differentiate between pure PHP & embedded PHP - define the term syntax - use the basic syntax of PHP - describe the PHP scripting syntax - describe the PHP tag	<i>Learn with Computers-PHP, Chapter 2, "Basics of PHP"</i> <i>Extra exercises from:</i> https://www.w3schools.com/php/php_examples.asp https://www.javatpoint.com/php-example https://www.tutorialspoint.com/php_programming_examples/
C/T 9-12.1	● describe the .PHP extension ● describe the ways to display output in PHP ● use the echo way to display output ● use the print way to display output ● describe the term localhost	<i>Learn with Computers-PHP, Chapter 2, "Basics of PHP"</i>
C/T 9-12.1	● Assignment operator ● Introducing the	<i>Learn with Computers-PHP, Chapter 2, "Basics of PHP"</i> <i>Extra exercises from:</i>

	conditional statements	https://www.w3schools.com/php/php_examples.asp https://www.javatpoint.com/php-example https://www.tutorialspoint.com/php_programming_examples/
C/T 9-12.12	● use the if statement ● use the if-else statement ● use the if-else-if statement ● use the compact if statement	<i>Learn with Computers-PHP, Chapter 2, "Basics of PHP"</i> <i>Extra exercises from:</i> https://www.w3schools.com/php/php_examples.asp https://www.javatpoint.com/php-example https://www.tutorialspoint.com/php_programming_examples/
C/T 9-12.1	● use the Integer datatype ● describe the rules for using Integers ● use the float data type ● use the var-dump function	<i>Revision + Test</i> <i>Extra exercises from:</i> https://www.w3schools.com/php/php_examples.asp https://www.javatpoint.com/php-example https://www.tutorialspoint.com/php_programming_examples/
C/T 9-12.12	Doing classwork to practice writing PHP code with arithmetic operators and conditional statements	<i>Learn with Computers-PHP, Chapter 2, "Basics of PHP"</i> <i>Extra exercises from:</i> https://www.w3schools.com/php/php_examples.asp https://www.javatpoint.com/php-example https://www.tutorialspoint.com/php_programming_examples/
C/T 9-12.12	● Declaring variables of different types ● Performing some	<i>Learn with Computers-PHP, Chapter 2, "Basics of PHP"</i>

	operations using the arithmetic operators • Using conditional statements	
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Appendix K-b

Virginia State Standards - Grade 11 (Java)

(School Provided Curriculum – SACI)

Standard	- Learning Outcomes	Resources
C/T 9-12.1 C/T 9-12.2	- Learn that they have a public presence online called a digital footprint. - Recognize that any information they post online can help or hurt their future opportunities (college admission, employment, etc.). - Create a vignette that shows how a positive digital footprint can help someone take advantage of an opportunity	<i>Common Sense Digital Citizenship</i> Digital Citizenship: Who's Looking at Your Digital Footprint?
C/T 9-12.1 C/T 9-12.2	● Give a brief history of computers. ● Describe how hardware and software make up computer architecture.	<i>Fundamentals of Java book, (Third edition),</i> Chapter 1, Lesson 1.1 “History of computers”, Lesson 1.2 “Computer Hardware & Software”
C/T 9-12.1 C/T 9-12.2	● Explain the Binary representation of data and programs in computers.	<i>Fundamentals of Java book, (Third edition),</i> Chapter 1, Lesson 1.3 “Binary representation of Information and computer memory”.
C/T 9-12.1 C/T 9-12.2	● Discuss the evolution of programming languages.	<i>Fundamentals of Java book, (Third edition),</i> Chapter 1: Lesson 1.4 “Programming languages
C/T 9-12.1	● Describe the software	<i>Fundamentals of Java book,</i>

C/T 9-12.2	development process.	(Third edition), Chapter 1: Lesson 1.5 “The software Development life cycle”.
C/T 9-12.1 C/T 9-12.2	Describe the basic OOP concepts.	Fundamentals of Java book, (Third edition), Chapter 1, Lesson 1.6 “Basic Concepts of OOP”
C/T 9-12.1 C/T 9-12.2 C/T 9-12.6	- Discuss why java is an important programming language. - Explain the java virtual machine and byte code.	Fundamentals of Java book, (Third edition), Chapter 2: Lessons: 2.1” Why Java?” Lesson 2.2 “The Java Virtual Machine and Byte Code”
C/T 9-12.1 C/T 9-12.2	- Choose a user interface. - Describe the structure of a simple java program. - Write a simple program - Edit, compile, and run a program using the java development environment.	Fundamentals of Java book, (Third edition), Chapter 2: Lesson 2.3 ” Choosing a User Interface Style” Lesson 2.4 “Hello World” Lesson 2.5 “Edit, Compile and Execute”.
C/T 9-12.1 C/T 9-12.2	- Format program to give a pleasing, consistent appearance. - Understand compile-time errors.	Fundamentals of Java book, (Third edition), Chapter 2: Lesson 2.6 “Temperature Conversion
C/T 9-12.6	Write a simple graphics program.	Fundamentals of Java book, (Third edition), Chapter 2: Lesson 2.7” Graphics and GUI”.

C/T 9-12.9	• The students will practice the learned concepts.	<i>Fundamentals of Java book, (Third edition), Chapter 2 Review Question</i>
`	• Construct and use numeric and string literals. • Name and use variables and constants.	<i>Fundamentals of Java book, (Third edition), Chapter 3:</i> <i>Lesson 3.1 "Language elements"</i> <i>Lesson 3.2 "Basic Java Syntax and Semantics"</i>
C/T 9-12.11	• Create arithmetic expressions. • Understand the precedence of different arithmetic operators.	<i>Fundamentals of Java book, (Third edition), Chapter 3, Lesson 3.2 "Basic Java Syntax and Semantics"</i>
C/T 9-12.11	• Concatenate two strings or a number and a string. • Use casting.	<i>Fundamentals of Java book, (Third edition), Chapter 3, Lesson 3.2 "Basic Java Syntax and Semantics"</i>
C/T 9-12.12	• Use the Scanner class to input data into a program.	<i>Fundamentals of Java book, (Third edition), Chapter 3, Lesson 3.3 "Terminal I/O for Different Data types"3, "Lists"</i>
C/T 9-12.12	• Know when and how to use comments in a program.	<i>Fundamentals of Java book, (Third edition), Chapter 3, Lesson 3.4 "Comments" + "Case Study 1: Income Tax Calculator "</i>
C/T 9-12.12	• Tell the difference between syntax errors, run-time errors, and logic errors.	<i>Fundamentals of Java book, (Third edition), Chapter 3, Lesson 3.5 "Programming Errors"</i>
C/T 9-12.9	• Insert output statements to debug	<i>Fundamentals of Java book,</i>

	a program.	<i>(Third edition),</i> Chapter 3, Lesson 3.6 “Debugging”.
C/T 9-12.14	• Work with colors and text properties.	<i>Fundamentals of Java book,</i> <i>(Third edition),</i> Chapter 3, Lesson 3.7 “Graphics and GUIs: Drawing Shapes and Text”
C/T 9-12.14	The Students will be able to: • Use the increment and decrement operators. • Use the Standard math methods	<i>Fundamentals of Java book,</i> <i>(Third edition),</i> Chapter 4 Lesson 4.1” Additional Operators” Lesson 4.2 “Standard Classes”
C/T 9-12.14	• Use if and if-else statements to make choices. • Use while loop to repeat a process.	<i>Fundamentals of Java book,</i> <i>(Third edition),</i> Chapter 4: Lesson 4.4 “The if and if-else statements” Lesson 4.5” The While statement””
C/T 9-12.9	• Use for loop to repeat a process. • Construct appropriate conditions for control statements using relational operators.	<i>Fundamentals of Java book,</i> <i>(Third edition),</i> Chapter 4: Lesson 4.6” The for Statement” Lesson 4.7 Nested Control Statements and the break Statement”
C/T 9-12.15	• Detects and corrects common errors involving loops.	<i>Fundamentals of Java book,</i> <i>(Third edition),</i> Chapter 4, Lesson 4.9” Errors in loops”

C/T 9-12.15	• Design and implement a simple class from user requirements • Organize a program in terms of a view class and a model class	<i>Fundamentals of Java book, (Third edition), Chapter 6, Lesson 6.1 "The internal Structure of classes and Objects"</i>
C/T 9-12.15	• Use visibility modifiers to make methods visible to clients and restrict access to data within a class	<i>Fundamentals of Java book, (Third edition), Chapter 6, Lesson 6.2 "A Student Class"</i>
C/T 9-12.15	• Write appropriate mutator methods, accessor methods, and constructors for a class	<i>Fundamentals of Java book, (Third edition), Chapter 6, Lesson 6.2 "A Student Class"</i>
C/T 9-12.14	• Understand how parameters transmit data to methods	<i>Fundamentals of Java book, (Third edition), Chapter 6, lesson 6.3 "Editing, Compiling, and Testing the Student Class".</i>
C/T 9-12.5	• Use instance variables, local variables, and parameters appropriately	<i>Fundamentals of Java book, (Third edition), Chapter 6, lesson 6.4 "The Structure and Behavior of methods"</i>
C/T 9-12.16	• Organize a complex task in terms of helper methods.	<i>Fundamentals of Java book, (Third edition), Chapter 6, , lesson 6.5 "Scope and Lifetime of Variables"</i>
C/T 9-12.16	• The students will practice the learned concepts.	<i>Barron's Chapter 1 Multiple choice Questions</i>

Appendix K-c

Virginia State Standards - Grade 10 (HTML)

(School Provided Curriculum – SACI)

Standard	Learning Outcomes	Resources
C/T 9-12.1	Digital Citizenship Reflect on how their social media use makes them feel and how it compares to other teenagers'. Describe how active and passive social media use can lead to positive and negative feelings.	Common Sense Education Grade 10: Social Media and How You Feel (Nearpod)
C/T 9-12.1	Introduction to HTML Starting with HTML	<i>Techno HTML 2, Session 1, Assignment 1: Starting with HTML Assignment 2: HTML Support (HTML Online - Notepad)</i>
C/T 9-12.2	Learn how to write basic tags in HTML	<i>Techno HTML 2, Session 2, Assignment 3: What is HTML File?</i>
C/T 9-12.3	Code your first website	<i>Techno HTML 2, Session 2, Project 1: "Father of the World Wide Web"</i>
C/T 9-12.3	Learn the color values and names in HTML	<i>Techno HTML 2, Session 2, Assignment 4: HTML Colors</i>
C/T 9-12.3	Learn how to add a background color and a background image to your website.	<i>Techno HTML 2, Session 3, Assignment 6: HTML Backgrounds</i>
C/T 9-12.3	Prepare a webpage about global warming.	<i>Techno HTML 2, Session 3, Project 2: Global Warming</i>
C/T 9-12.3	Learn about the different types of images and their extensions.	<i>Techno HTML 2, Session 3, Assignment 7: Background Image</i>

C/T 9-12.11	Prepare in order to link one webpage to another.	<i>Techno HTML 2, Session 4, Assignment 8: Project 3: Global Warming - Cause</i>
C/T 9-12.11	Prepare in order to link one webpage to another.	<i>Techno HTML 2, Session 4, Assignment 8: Project 3: Global Warming - Cause</i>
C/T 9-12.9	Learn how to create a link	<i>Techno HTML 2, Session 4, Assignment 9: Project 4: Effects of Global Warming</i>
C/T 9-12.2	Learn how to create a link on the same page.	<i>Techno HTML 2, Session 4, Assignment 9: Project 4: Effects of Global Warming</i>
C/T 9-12.2	Learn how to create a link on the same page.	<i>Techno HTML 2, Session 4, Assignment 9: Project 4: Effects of Global Warming</i> (continued)
C/T 9-12.2	Learn how to create 2 links	<i>Techno HTML 2, Session 4, Assignment 9: (Part 2)</i>
C/T 9-12.10	Learn to choose the right image format and resize and align it.	<i>Techno HTML 2, Session 5, Assignment 10: Working with Images</i>
C/T 9-12.10	Learn how to create an image map.	<i>Techno HTML 2, Session 5, Assignment 10: Working with Images (Continued)</i>
C/T 9-12.12	Create different types of lists: ordered and unordered lists.	<i>Techno HTML 2, Session 6, Assignment 11: Types of Listing</i>
C/T 9-12.12	Create nested lists (a list inside a list) Ordered inside ordered Unordered inside unordered	<i>Techno HTML 2, Session 6, Assignment 11: Types of Listing</i>
C/T 9-12.15	Create a table made of rows and columns.	<i>Techno HTML Session 7, Assignment : Tables</i>
C/T 9-12.15	Change the table's width and cell padding	<i>Techno HTML Session 7, Assignment : Tables</i>
C/T 9-12.16	Add borders to a table; merge cells in a row or a column.	<i>Techno HTML 2,</i>

		<i>Session 7, Assignment 13: Noframe Properties</i>
C/T 9-12.9	Create a table with pictures and merging and alignment.	<i>Techno HTML 2, Session 7, Project 7: Seven Wonders of the Ancient World.</i>
C/T 9-12.15	Learn about cell spacing, adding a background color or image to the table cell.	<i>Techno HTML 2, Session 7, Assignment 14: Cell Property</i> <i>Edulastic</i>
C/T 9-12.15	Learn to add different elements of forms such as text, checkbox, and radio buttons and submit buttons.	<i>Techno HTML 2, Session 9, Assignment 17: Form Elements</i>
C/T 9-12.9	Add a form in a table with all the different elements.	<i>Techno HTML 2,</i> <i>Session 9, Project 10: Opinion Forms: Form Elements (continued)</i>

Appendix K-d

Virginia State Standards - Grade 9 (Python)

(School Provided Curriculum – SACI)

Standard	Learning Outcomes	Resources
C/T 9-12.1 C/T 9-12.2	- Explain why websites that collect personal information have an age requirement of 13 in the United States. - Identify the risks of targeted advertising, especially when it is targeted to children. - Use the Take a Stand thinking routine to explore different perspectives about what age is best for starting to use social media.	<i>Common Sense Education</i> <i>Digital Citizenship</i> Lesson 1: How Young Is Too Young for Social Media?
C/T 9-12.1 C/T 9-12.2	The students will be able to: ● define Python ● identify pre-requests for python ● identify python programming language features	<i>Learn with Computers-Python,</i> Chapter 1, “An Introduction”
C/T 9-12.1 C/T 9-12.2	The students will be able to: ● describe where can python be used ● learn the basic syntax of python ● use variables	<i>Learn with Computers-Python,</i> Chapter 1, “An Introduction”

C/T 9-12.1 C/T 9-12.2	The Students will be able to: • learn about data types • use arithmetic operators • describe lists	<i>Learn with Computers-Python, Chapter 1, "An Introduction"</i>
C/T 9-12.1 C/T 9-12.2	The students will be able to: • describe a String • initialize Strings • store Strings in variables • find the length of a String • use the index() function	<i>Learn with Computers-Python, Chapter 2, "Strings"</i>
C/T 9-12.12	• slice Strings • reverse Strings	<i>Learn with Computers-Python, Revision for Chapter 1 + Chapter 2, "Strings"</i>
C/T 9-12.12	• convert cases • capitalize Strings	<i>Learn with Computers-Python, Chapter 2, "Strings"</i>
C/T 9-12.12	• concatenate 2 or more Strings • use repetition on a String	<i>Learn with Computers-Python, Chapter 2, "Strings"</i>
C/T 9-12.12 C/T 9-12.6	• describe a list • identify different types of lists	<i>Learn with Computers-Python, Chapter 3, "Lists"</i>
C/T 9-12.12 C/T 9-12.6	• define a list • create a list	<i>Learn with Computers-Python, Chapter 3, "Lists"</i>
C/T 9-12.12 C/T 9-12.6	• describe a nested list • access elements of a list	<i>Learn with Computers-Python, Chapter 3, "Lists"</i>
C/T 9-12.12 C/T 9-12.6	• describe the term negative indexing • slice lists	<i>Learn with Computers-Python, Chapter 3, "Lists"</i>
C/T 9-12.12	• find the length of a list	<i>Learn with Computers-Python,</i>

C/T 9-12.6	• change or add elements to a list • add items using append	<i>Chapter 3, "Lists"</i>
C/T 9-12.12 C/T 9-12.6	• add items using extend • insert item into the list	<i>Learn with Computers-Python, Chapter 3, "Lists"</i>
C/T 9-12.12 C/T 9-12.6	• add items using squeezing • Concatenate two / more lists • Repeat a list	<i>Learn with Computers-Python, Chapter 3, "Lists"</i>
C/T 9-12.12 C/T 9-12.6	• Delete one item • Delete multiple items • Delete entire list • Delete using remove method	<i>Learn with Computers-Python, Chapter 3, "Lists"</i>
C/T 9-12.12 C/T 9-12.6	• Delete using remove method • Delete using pop method	<i>Learn with Computers-Python, Chapter 3, "Lists"</i>
C/T 9-12.12 C/T 9-12.6	• Empty a list using the clear method • Using additional python list methods: index, sort, count	<i>Learn with Computers-Python, Chapter 3, "Lists"</i>
C/T 9-12.12 C/T 9-12.6	• Using additional python list methods: reverse, copy • Checking item membership	<i>Learn with Computers-Python, Chapter 3, "Lists"</i>
C/T 9-12.12 C/T 9-12.6	• Introduction to flowchart • describe the purpose of decision statements • learn the python if-statement syntax	<i>Learn with Computers-Python, Chapter 4, "Flow Controls"</i>
C/T 9-12.12 C/T 9-12.6	• describe the if-statement using a flowchart • learn the syntax of if-else	

Appendix L

POLICY ON TECHNOLOGY USE & ONLINE SAFETY - *School SAC3*

PURPOSE

This policy is for the purpose of safeguarding students when using the Internet and electronic communications by educating students about potential risks and their sensible and safe usage. The policy includes guidelines for staff, students, and parents for ensuring that the quality of online activities that students engage in are safe. The policy is consistent with the school's Discipline Code and Behavioral Policy, Child Protection Policy, Anti-Bullying Policy, and Student Health & Wellbeing Policy.

INTRODUCTION

There is a significant increase in the amount of time students spend on digital media and technology, whether for leisure or learning; it is crucial that we ensure their safety and keep them out of harm's way when connected to the digital landscape. The school plays an important role in raising awareness, and in safeguarding students from online threats, including cyberbullying, which is a violation of a student's right to be safe and secure, and is not tolerated by the school.

DEFINITIONS

Technology refers to the suite of digital technologies, both existing and emerging, and includes laptops, desktop computers, mobile digital devices (iPads, tablets), internet based services such as social networking tools and websites that incorporate wikis, blogs, virtual worlds (i.e., Google Apps, Moodle), microblogs (i.e., Twitter, Facebook), social networks, and media sharing.

Digital Citizenship is the responsible, positive and ethical use of technology when creating and consuming digital content, communicating with others and participating in society. As digital citizens, students must be aware of the dangers of cyberspace, be informed on how to safeguard and protect themselves from cyber perpetrators, and always ensure that they positively and constructively engage in the digital communities.

SCOPE

This policy applies to all members of our school community, including staff, students, and parents. As members of the AIS community we have a responsibility to support and promote this document for the benefit of all.

AIMS

1. To ensure that students, parents and staff understand the risks of technology usage and the steps to be taken to promote its safe use.
2. To ensure that students, parents and staff are aware of cyberbullying and the distressing effects it could have on its victims.
3. To ensure that students, parents and staff are fully aware of the referral procedures for reporting cyberbullying incidents and the strategies adopted for supporting those involved in these incidents

GUIDING PRINCIPLES & PROCEDURES

School Responsibilities:

- The school will provide access to this and all other pertinent policies to all members of the school community via the school website.
- The school will create a positive culture around media and technology and will incorporate digital citizenship education as part of the curriculum to raise student awareness and promote positive and safe approaches to internet usage.
- The school will ensure that students are given clear guidance on the use of technology safely and positively both in school and beyond including how to manage their personal data and how to report abuse and bullying online.
- The school will provide a workshop to parents on online safety and their roles and responsibilities in safeguarding their children online.
- The school will ensure that staff are aware of their role in implementing cyberbullying prevention and response strategies, and are confident in identifying and referring students at risk.
- The school will ensure that all incidents of cyber-bullying both inside and outside school are dealt with immediately and are managed according to the procedures set out in the school's Anti-bullying Policy, Behavior Policy and Child Protection Policy.
- Staff members who suspect or are told about a cyberbullying incident related to any of their students must immediately respond by asking the student to show the evidence and to save evidence, including textual and audiovisual materials, and informing the Department Head or Head of Grade immediately.
- The IT Support will ensure adequate safeguards are in place to filter and monitor inappropriate content on campus.
- Student misuse of technology or social media will be subject to disciplinary consequences.

Student Responsibilities:

- Students will be held responsible for the proper usage of technology. They are expected to use it for learning purposes only when on school campus and must refrain from gaming.
- Students should not be taking pictures or videos of classmates and teachers. The school administration has the right to inspect, review or retain electronic communication created, sent, displayed, received or stored on devices that are on the school premises.
- Students are expected to respect other users through good network etiquette. They are expected to communicate with others in a proper and respectful manner. Communication that is considered offensive or inappropriate is considered a serious offense.
- Students must be careful who they allow to become a friend online and what information they share with them.
- Students must not share personal information, including login credentials, passwords, phone numbers and addresses without the permission of a parent/guardian.
- Students must refrain from visiting unauthorized websites.
- Students must not reply to someone they do not know or to abusive emails.
- Students must immediately tell an adult if they feel unsafe or worried online.
- Students must refrain in engaging in any form of cyberbullying. Cyberbullying is a serious offense and results in serious consequences.
- Students who believe they are victims of cyberbullying should refrain from responding to the bully, must save the abusive messages, and must immediately inform an adult (parent/guardian or member of staff). Students must not delete any evidence of bullying (even if it is upsetting) until it has been reported and shared as evidence with their parents or the school.

- Students must follow all other online safety rules and tips shared by their teachers.
- Students are responsible for their personal laptops/tablets:
- Students must store their laptops in protective cases to avoid any damage.
- Students must label their laptops with their name and grade to avoid loss or confusion.
- Students are expected to charge their laptops before coming to school. Classrooms will not be equipped to charge laptops.
- Students must use laptops only during instructional time for learning purposes. Students are not allowed to play games on their laptops at any time when on school campus.
- Students are advised to set their laptops to be passcode protected to refrain others from accessing their machines.
- The school will not be held responsible for the loss or mishandling of student devices.
- Any misuse of laptops will result in the confiscation of the device, and the device will be returned directly to the parents after parents sign an undertaking. Consequences will apply according to the Student Code of Conduct.

Parent Responsibilities:

- Parents must ensure that their children learn how to take responsibility of their own devices.
- Parents must attend information sessions offered by the school on online safety.
- Parents must make sure their children understand the school's policy regarding cyberbullying and the legal issues related to cyberbullying.
- Parents must ensure their children are aware of the dangers of digital technology and that they build healthy habits and practices when using such technology.
- Parents must play their role and take responsibility for monitoring their children's online activity.
- Parents must discuss with their children network etiquette and establish clarity on what online activities are permissible and what is unacceptable, as well as the importance in using the time they spend online responsibly and safely.
- Parents are strongly recommended to install parental control software on their children's devices to allow them to monitor their online activity, control the time spent online, and block content that is not appropriate.
- Parents must ensure that their children do not divulge any information about themselves or other persons through any form of online communication.
- Through monitoring and regular discussions with their children, parents must ensure that their children have not experienced any form of cyberbullying or have been exposed to inappropriate content.
- Parents must immediately inform the Department Head or Head of Grade if their child reports any inappropriate communication or any form of cyberbullying that has taken place on the online platforms the school is using or with any AIS student. Parents should save the offending material and make sure they have all relevant information before deleting anything.

Appendix M – IGCSE Curricula

The IGCSE ICT curriculum from Cambridge.

<https://www.cambridgeinternational.org/Images/466435-2020-2022-syllabus.pdf>

The IGCSE curriculum from Edexcel Pearson (ICT)

<https://qualifications.pearson.com/content/dam/pdf/International%20GCSE/Information%20and%20Communication%20Technology/2017/Specification%20and%20sample%20assessments/international-gcse-in-ict-spec.pdf>

The IGCSE curriculum from Oxford AQA (Computer Science)

<https://www.oxfordaqa.com/qualifications/international-gcse-computer-science/>

Appendix N – Pearson's Correlation Coefficient Calculations

x = self-reported student engagement level

y = student end of term technology education marks

GRADE 10								
	Students	X	Y	X-X'	Y-Y'	(X-X')(Y-Y')	(X-X')^2	(Y-Y')^2
SIG2	S1	7	70	-0.06	-1.11	0.06	0.00	1.23
	S2	10	90	2.94	18.89	55.62	8.67	356.79
	S3	7	70	-0.06	-1.11	0.06	0.00	1.23
	S4	8	80	0.94	8.89	8.40	0.89	79.01
	S5	4	90	-3.06	18.89	-57.72	9.34	356.79
	S6	9	80	1.94	8.89	17.28	3.78	79.01
	S7	6	70	-1.06	-1.11	1.17	1.11	1.23
	S8	9	90	1.94	18.89	36.73	3.78	356.79
	S9	9	70	1.94	-1.11	-2.16	3.78	1.23
	S10	7	50	-0.06	-21.11	1.17	0.00	445.68
	S11	4	50	-3.06	-21.11	64.51	9.34	445.68
	S12	4	60	-3.06	-11.11	33.95	9.34	123.46
	S13	7	60	-0.06	-11.11	0.62	0.00	123.46
	S14	7	70	-0.06	-1.11	0.06	0.00	1.23
	S15	5	60	-2.06	-11.11	22.84	4.23	123.46
	S16	10	90	2.94	18.89	55.62	8.67	356.79
	S17	9	90	1.94	18.89	36.73	3.78	356.79
	S18	5	40	-2.06	-31.11	63.95	4.23	967.90
n=	18	7.06	71.11			338.89	70.94	4177.78

num	33.89	
denom	54.44	2963.87
r =	0.623	

Grade 10								
Students	X	Y	X-X'	Y-Y'	(X-X')(Y-Y')	(X-X')^2	(Y-Y')^2	
SAC2	S19	9	95	2.32	7.73	17.91	5.38	59.68
	S20	8	97	1.32	9.73	12.82	1.74	94.58
	S21	5	94	-1.68	6.73	-11.31	2.83	45.23
	S22	8	86	1.32	-1.27	-1.68	1.74	1.62
	S23	5	88	-1.68	0.73	-1.22	2.83	0.53
	S24	7	97	0.32	9.73	3.10	0.10	94.58
	S25	10	86	3.32	-1.27	-4.23	11.01	1.62
	S26	5	83	-1.68	-4.27	7.19	2.83	18.27
	S27	9	90	2.32	2.73	6.32	5.38	7.43
	S28	3	93	-3.68	5.73	-21.08	13.55	32.78
	S29	9	95	2.32	7.73	17.91	5.38	59.68
	S30	10	83	3.32	-4.27	-14.19	11.01	18.27
	S31	3	88	-3.68	0.73	-2.67	13.55	0.53
	S32	5	90	-1.68	2.73	-4.58	2.83	7.43
	S33	6	85	-0.68	-2.27	1.55	0.46	5.17
	S34	5	89	-1.68	1.73	-2.90	2.83	2.98
	S35	10	90	3.32	2.73	9.04	11.01	7.43
	S36	5	84	-1.68	-3.27	5.51	2.83	10.72
	S37	8	69	1.32	-18.27	-24.10	1.74	333.97
	S38	6	76	-0.68	-11.27	7.68	0.46	127.12
	S39	5	67	-1.68	-20.27	34.09	2.83	411.06
	S40	3	75	-3.68	-12.27	45.19	13.55	150.67
	S41	1	78	-5.68	-9.27	52.69	32.28	86.02
	S42	6	92	-0.68	4.73	-3.22	0.46	22.33
	S43	9	68	2.32	-19.27	-44.69	5.38	371.52
	S44	8	88	1.32	0.73	0.96	1.74	0.53
	S45	8	86	1.32	-1.27	-1.68	1.74	1.62
	S46	6	93	-0.68	5.73	-3.90	0.46	32.78
	S47	10	98	3.32	10.73	35.59	11.01	115.03
	S48	5	80	-1.68	-7.27	12.23	2.83	52.92
	S49	7	93	0.32	5.73	1.82	0.10	32.78
	S50	6	85	-0.68	-2.27	1.55	0.46	5.17
	S51	7	85	0.32	-2.27	-0.72	0.10	5.17
	S52	8	88	1.32	0.73	0.96	1.74	0.53
	S53	6	89	-0.68	1.73	-1.18	0.46	2.98

SAC3	S54	7	66	0.32	-21.27	-6.78	0.10	452.61
	S55	5	87	-1.68	-0.27	0.46	2.83	0.08
	S56	8	73	1.32	-14.27	-18.82	1.74	203.77
	S57	8	77	1.32	-10.27	-13.55	1.74	105.57
	S58	8	81	1.32	-6.27	-8.27	1.74	39.37
	S59	4	74	-2.68	-13.27	35.59	7.19	176.22
	S60	8	60	1.32	-27.27	-35.97	1.74	743.91
	S61	2	77	-4.68	-10.27	48.10	21.91	105.57
	S62	5	61	-1.68	-26.27	44.18	2.83	690.36
	S63	7	76	0.32	-11.27	-3.59	0.10	127.12
	S64	10	87	3.32	-0.27	-0.91	11.01	0.08
	S65	3	73	-3.68	-14.27	52.55	13.55	203.77
	S66	5	84	-1.68	-3.27	5.51	2.83	10.72
	S67	5	81	-1.68	-6.27	10.55	2.83	39.37
	S68	8	92	1.32	4.73	6.23	1.74	22.33
	S69	8	88	1.32	0.73	0.96	1.74	0.53
	S70	2	98	-4.68	10.73	-50.21	21.91	115.03
	S71	2	93	-4.68	5.73	-26.80	21.91	32.78
	S72	4	93	-2.68	5.73	-15.35	7.19	32.78
	S73	5	90	-1.68	2.73	-4.58	2.83	7.43
	S74	6	89	-0.68	1.73	-1.18	0.46	2.98
	S75	3	92	-3.68	4.73	-17.40	13.55	22.33
	S76	8	97	1.32	9.73	12.82	1.74	94.58
	S77	4	97	-2.68	9.73	-26.08	7.19	94.58
	S78	4	99	-2.68	11.73	-31.44	7.19	137.48
	S79	5	93	-1.68	5.73	-9.63	2.83	32.78
	S80	6	89	-0.68	1.73	-1.18	0.46	2.98
	S81	5	97	-1.68	9.73	-16.35	2.83	94.58
	S82	9	100	2.32	12.73	29.51	5.38	161.93
	S83	7	85	0.32	-2.27	-0.72	0.10	5.17
	S84	8	88	1.32	0.73	0.96	1.74	0.53
	S85	9	99	2.32	11.73	27.19	5.38	137.48
	S86	7	89	0.32	1.73	0.55	0.10	2.98
SAC1	S87	10	93	3.32	5.73	19.00	11.01	32.78
	S88	10	89	3.32	1.73	5.73	11.01	2.98
	S89	8	94	1.32	6.73	8.87	1.74	45.23
	S90	10	96	3.32	8.73	28.96	11.01	76.13
	S91	10	82	3.32	-5.27	-17.51	11.01	27.82

S92	8	95	1.32	7.73	10.19	1.74	59.68	
S93	8	90	1.32	2.73	3.59	1.74	7.43	
S94	8	90	1.32	2.73	3.59	1.74	7.43	
S95	8	95	1.32	7.73	10.19	1.74	59.68	
S96	9	86	2.32	-1.27	-2.96	5.38	1.62	
S97	7	82	0.32	-5.27	-1.68	0.10	27.82	
S98	8	97	1.32	9.73	12.82	1.74	94.58	
S99	5	95	-1.68	7.73	-12.99	2.83	59.68	
S100	10	86	3.32	-1.27	-4.23	11.01	1.62	
S101	8	98	1.32	10.73	14.14	1.74	115.03	
S102	10	90	3.32	2.73	9.04	11.01	7.43	
S103	10	96	3.32	8.73	28.96	11.01	76.13	
S104	4	84	-2.68	-3.27	8.78	7.19	10.72	
S105	5	88	-1.68	0.73	-1.22	2.83	0.53	
S106	8	98	1.32	10.73	14.14	1.74	115.03	
S107	3	88	-3.68	0.73	-2.67	13.55	0.53	
S108	7	94	0.32	6.73	2.14	0.10	45.23	
S109	8	88	1.32	0.73	0.96	1.74	0.53	
n=	91	6.68	87.27			254.97	477.76	6996.13

NUM	254.97	
DENOM	1828.24	0
r =	0.14	

Grade 10

From the schools following the international American curriculum, 91 grade 10 students survey results rendered the Pearson's correlation coefficient with the following calculation:

The mean of the student engagement rating out of 10 for these students represented by $\bar{x}$: 6.68

The mean of their term averages (out of 100) represented by $\bar{y}$: 87.27

If x is each student's engagement rating, then $\sum (x - \bar{x})^2 = 477.76$

If y is each student's term average, then $\sum (y - \bar{y})^2 = 6996.13$

And $\sum((x - \bar{x})(y - \bar{y})) = 254.97$

Substituting these values in the Pearson's Correlation Coefficient formula,

$$r = \frac{\sum((x - \bar{x})(y - \bar{y}))}{\sqrt{\sum(x - \bar{x})^2 \sum(y - \bar{y})^2}}$$

$$= \frac{254.97}{\sqrt{477.76 * 6996.13}} = 0.14$$

From the schools following the IGCSE curriculum, 18 grade 10 students survey results rendered the Pearson's correlation coefficient with the following calculation:

The mean of the student engagement rating out of 10 for these students represented by $\bar{x}$: 7.06

The mean of their term averages (out of 10) represented by $\bar{y}$: 7.11

If x is each student's engagement rating, then $\sum(x - \bar{x})^2 = 70.94$

If y is each student's term average, then $\sum(y - \bar{y})^2 = 41.78$

And $\sum((x - \bar{x})(y - \bar{y})) = 33.89$

Substituting these values in the Pearson's Correlation Coefficient formula,

$$r = \frac{\sum((x - \bar{x})(y - \bar{y}))}{\sqrt{\sum(x - \bar{x})^2 \sum(y - \bar{y})^2}}$$

$$= \frac{33.89}{\sqrt{70.94 * 41.78}} = 0.62$$

Grade 9								
		x	y	$x-x'$	$y-y'$	$(x-x')(y-y')$	$(x-x')^2$	$(y-y')^2$
SAC3	S1	6	94	-0.45	4.42	-1.99	0.20	19.57
	S2	4	96	-2.45	6.42	-15.73	6.00	41.27
	S3	9	97	2.55	7.42	18.94	6.51	55.12
	S4	9	94	2.55	4.42	11.28	6.51	19.57
	S5	9	97	2.55	7.42	18.94	6.51	55.12
	S6	9	85	2.55	-4.58	-11.67	6.51	20.94
	S7	4	90	-2.45	0.42	-1.04	6.00	0.18
	S8	5	93	-1.45	3.42	-4.96	2.10	11.72
	S9	1	82	-5.45	-7.58	41.28	29.70	57.40
	S10	9	97	2.55	7.42	18.94	6.51	55.12
	S11	8	86	1.55	-3.58	-5.54	2.40	12.79
	S12	10	89	3.55	-0.58	-2.04	12.61	0.33
	S13	7	83	0.55	-6.58	-3.62	0.30	43.24
	S14	9	80	2.55	-9.58	-24.42	6.51	91.70
	S15	8	88	1.55	-1.58	-2.44	2.40	2.48
	S16	8	98	1.55	8.42	13.06	2.40	70.96
	S17	7	86	0.55	-3.58	-1.97	0.30	12.79
	S18	8	70	1.55	-19.58	-30.36	2.40	383.22
	S19	10	82	3.55	-7.58	-26.90	12.61	57.40
	S20	8	81	1.55	-8.58	-13.30	2.40	73.55
	S21	6	88	-0.45	-1.58	0.71	0.20	2.48
	S22	7	76	0.55	-13.58	-7.48	0.30	184.31
	S23	7	75	0.55	-14.58	-8.03	0.30	212.46
	S24	8	81	1.55	-8.58	-13.30	2.40	73.55
	S25	10	80	3.55	-9.58	-34.00	12.61	91.70
	S26	6	76	-0.45	-13.58	6.10	0.20	184.31
	S27	10	90	3.55	0.42	1.51	12.61	0.18
	S28	10	89	3.55	-0.58	-2.04	12.61	0.33
	S29	8	76	1.55	-13.58	-21.05	2.40	184.31
	S30	9	82	2.55	-7.58	-19.32	6.51	57.40
	S31	7	78	0.55	-11.58	-6.37	0.30	134.00
	S32	9	92	2.55	2.42	6.18	6.51	5.88
	S33	9	92	2.55	2.42	6.18	6.51	5.88
	S34	6	88	-0.45	-1.58	0.71	0.20	2.48
	S35	7	65	0.55	-24.58	-13.53	0.30	603.98
	S36	3	97	-3.45	7.42	-25.61	11.90	55.12
	S37	1	83	-5.45	-6.58	35.83	29.70	43.24

	S38	8	89	1.55	-0.58	-0.89	2.40	0.33
	S39	8	80	1.55	-9.58	-14.85	2.40	91.70
	S40	6	65	-0.45	-24.58	11.04	0.20	603.98
	S41	3	71	-3.45	-18.58	64.08	11.90	345.07
	S42	9	98	2.55	8.42	21.49	6.51	70.96
	S43	10	86	3.55	-3.58	-12.70	12.61	12.79
	S44	10	98	3.55	8.42	29.91	12.61	70.96
	S45	6	80	-0.45	-9.58	4.30	0.20	91.70
	S46	9	91	2.55	1.42	3.63	6.51	2.03
	S47	8	98	1.55	8.42	13.06	2.40	70.96
	S48	10	98	3.55	8.42	29.91	12.61	70.96
	S49	5	89	-1.45	-0.58	0.83	2.10	0.33
	S50	8	90	1.55	0.42	0.66	2.40	0.18
	S51	6	92	-0.45	2.42	-1.09	0.20	5.88
	S52	7	71	0.55	-18.58	-10.23	0.30	345.07
	S53	8	92	1.55	2.42	3.76	2.40	5.88
	S54	5	96	-1.45	6.42	-9.31	2.10	41.27
	S55	9	87	2.55	-2.58	-6.57	6.51	6.64
SAC1	S56	2	94	-4.45	4.42	-19.68	19.80	19.57
	S57	9	91	2.55	1.42	3.63	6.51	2.03
	S58	5	78	-1.45	-11.58	16.78	2.10	134.00
	S59	2	94	-4.45	4.42	-19.68	19.80	19.57
	S60	5	99	-1.45	9.42	-13.66	2.10	88.81
	S61	5	95	-1.45	5.42	-7.86	2.10	29.42
	S62	7	90	0.55	0.42	0.23	0.30	0.18
	S63	6	96	-0.45	6.42	-2.89	0.20	41.27
	S64	7	100	0.55	10.42	5.74	0.30	108.66
	S65	6	99	-0.45	9.42	-4.23	0.20	88.81
	S66	3	99	-3.45	9.42	-32.51	11.90	88.81
	S67	6	99	-0.45	9.42	-4.23	0.20	88.81
	S68	2	87	-4.45	-2.58	11.46	19.80	6.64
	S69	6	91	-0.45	1.42	-0.64	0.20	2.03
	S70	4	100	-2.45	10.42	-25.53	6.00	108.66
	S71	10	78	3.55	-11.58	-41.10	12.61	134.00
	S72	5	98	-1.45	8.42	-12.21	2.10	70.96
	S73	2	93	-4.45	3.42	-15.23	19.80	11.72
	S74	3	70	-3.45	-19.58	67.52	11.90	383.22
	S75	7	97	0.55	7.42	4.09	0.30	55.12
	S76	7	83	0.55	-6.58	-3.62	0.30	43.24

S77	3	87	-3.45	-2.58	8.89	11.90	6.64
S78	2	98	-4.45	8.42	-37.48	19.80	70.96
S79	3	98	-3.45	8.42	-29.06	11.90	70.96
S80	8	100	1.55	10.42	16.16	2.40	108.66
S81	4	100	-2.45	10.42	-25.53	6.00	108.66
S82	8	95	1.55	5.42	8.41	2.40	29.42
S83	4	70	-2.45	-19.58	47.95	6.00	383.22
S84	3	95	-3.45	5.42	-18.71	11.90	29.42
S85	5	87	-1.45	-2.58	3.73	2.10	6.64
S86	7	77	0.55	-12.58	-6.92	0.30	158.15
S87	4	96	-2.45	6.42	-15.73	6.00	41.27
S88	9	100	2.55	10.42	26.59	6.51	108.66
S89	5	93	-1.45	3.42	-4.96	2.10	11.72
S90	7	84	0.55	-5.58	-3.07	0.30	31.09
S91	3	96	-3.45	6.42	-22.16	11.90	41.27
S92	7	93	0.55	3.42	1.89	0.30	11.72
S93	7	97	0.55	7.42	4.09	0.30	55.12
S94	4	87	-2.45	-2.58	6.31	6.00	6.64
S95	8	90	1.55	0.42	0.66	2.40	0.18
S96	9	81	2.55	-8.58	-21.87	6.51	73.55
S97	9	93	2.55	3.42	8.73	6.51	11.72
S98	8	66	1.55	-23.58	-36.56	2.40	555.83
S99	6	100	-0.45	10.42	-4.68	0.20	108.66
S100	7	99	0.55	9.42	5.19	0.30	88.81
S101	6	88	-0.45	-1.58	0.71	0.20	2.48
S102	3	62	-3.45	-27.58	95.12	11.90	760.43
S103	3	87	-3.45	-2.58	8.89	11.90	6.64
S104	3	85	-3.45	-4.58	15.78	11.90	20.94
S105	4	100	-2.45	10.42	-25.53	6.00	108.66
S106	8	100	1.55	10.42	16.16	2.40	108.66
S107	10	96	3.55	6.42	22.81	12.61	41.27
S108	8	99	1.55	9.42	14.61	2.40	88.81
S109	6	95	-0.45	5.42	-2.44	0.20	29.42
S110	10	100	3.55	10.42	37.01	12.61	108.66
S111	4	96	-2.45	6.42	-15.73	6.00	41.27
S112	10	100	3.55	10.42	37.01	12.61	108.66
S113	10	100	3.55	10.42	37.01	12.61	108.66
S114	10	90	3.55	0.42	1.51	12.61	0.18

	S115	5	97	-1.45	7.42	-10.76	2.10	55.12
	S116	7	88	0.55	-1.58	-0.87	0.30	2.48
	S117	3	76	-3.45	-13.58	46.83	11.90	184.31
	S118	9	97	2.55	7.42	18.94	6.51	55.12
	S119	7	91	0.55	1.42	0.78	0.30	2.03
	S120	7	100	0.55	10.42	5.74	0.30	108.66
	S121	7	100	0.55	10.42	5.74	0.30	108.66
	S122	9	100	2.55	10.42	26.59	6.51	108.66
	S123	5	100	-1.45	10.42	-15.11	2.10	108.66
	S124	7	84	0.55	-5.58	-3.07	0.30	31.09
	S125	3	100	-3.45	10.42	-35.96	11.90	108.66
SAC2	S126	7	92	0.55	2.42	1.33	0.30	5.88
	S127	5	89	-1.45	-0.58	0.83	2.10	0.33
	S128	7	93	0.55	3.42	1.89	0.30	11.72
	S129	5	88	-1.45	-1.58	2.28	2.10	2.48
	S130	1	80	-5.45	-9.58	52.18	29.70	91.70
	S131	7	95	0.55	5.42	2.99	0.30	29.42
	S132	10	88	3.55	-1.58	-5.60	12.61	2.48
	S133	6	92	-0.45	2.42	-1.09	0.20	5.88
	S134	10	78	3.55	-11.58	-41.10	12.61	134.00
	S135	10	96	3.55	6.42	22.81	12.61	41.27
	S136	10	98	3.55	8.42	29.91	12.61	70.96
	S137	6	92	-0.45	2.42	-1.09	0.20	5.88
	S138	5	90	-1.45	0.42	-0.61	2.10	0.18
	S139	7	85	0.55	-4.58	-2.52	0.30	20.94
	S140	5	86	-1.45	-3.58	5.18	2.10	12.79
	S141	6	90	-0.45	0.42	-0.19	0.20	0.18
	S142	5	88	-1.45	-1.58	2.28	2.10	2.48
	S143	3	87	-3.45	-2.58	8.89	11.90	6.64
	S144	10	97	3.55	7.42	26.36	12.61	55.12
	S145	4	86	-2.45	-3.58	8.76	6.00	12.79
	S146	7	96	0.55	6.42	3.54	0.30	41.27
	S147	6	95	-0.45	5.42	-2.44	0.20	29.42
	S148	8	91	1.55	1.42	2.21	2.40	2.03
	S149	5	85	-1.45	-4.58	6.63	2.10	20.94
	S150	1	87	-5.45	-2.58	14.04	29.70	6.64
	S151	6	89	-0.45	-0.58	0.26	0.20	0.33
	S152	4	86	-2.45	-3.58	8.76	6.00	12.79

S153	5	87	-1.45	-2.58	3.73	2.10	6.64
S154	3	90	-3.45	0.42	-1.46	11.90	0.18
S155	6	90	-0.45	0.42	-0.19	0.20	0.18
S156	6	90	-0.45	0.42	-0.19	0.20	0.18
S157	10	97	3.55	7.42	26.36	12.61	55.12
S158	4	89	-2.45	-0.58	1.41	6.00	0.33
n=	158	6.45	89.58		286.11	933.09	11504.59

numerator	286.11
denominator	3276.4
r=	0.08732

Grade 9								
	x	y	x-x'	y-y'	(x-x')(y-y')	(x-x')^2	(y-y')^2	
SIG1	S159	4	74	-1.96	-6.00	11.74	3.83	36
	S160	7	87	1.04	7.00	7.30	1.09	49
	S161	8	86	2.04	6.00	12.26	4.17	36
	S162	7	82	1.04	2.00	2.09	1.09	4
	S163	6	82	0.04	2.00	0.09	0.00	4
	S164	5	72	-0.96	-8.00	7.66	0.92	64
	S165	6	91	0.04	11.00	0.47	0.00	121
	S166	5	68	-0.96	-12.00	11.49	0.92	144
	S167	7	88	1.04	8.00	8.34	1.09	64
	S168	5	68	-0.96	-12.00	11.49	0.92	144
	S169	5	86	-0.96	6.00	-5.74	0.92	36
	S170	8	68	2.04	-12.00	-24.51	4.17	144
	S171	5	75	-0.96	-5.00	4.79	0.92	25
	S172	8	88	2.04	8.00	16.34	4.17	64
	S173	10	87	4.04	7.00	28.30	16.34	49
	S174	2	49	-3.96	-31.00	122.67	15.66	961
	S175	6	76	0.04	-4.00	-0.17	0.00	16
	S176	6	85	0.04	5.00	0.21	0.00	25
	S177	4	83	-1.96	3.00	-5.87	3.83	9
	S178	4	84	-1.96	4.00	-7.83	3.83	16
	S179	2	75	-3.96	-5.00	19.79	15.66	25
	S180	4	71	-1.96	-9.00	17.61	3.83	81
	S181	6	64	0.04	-16.00	-0.69	0.00	256
	S182	6	81	0.04	1.00	0.04	0.00	1
	S183	7	57	1.04	-23.00	-23.99	1.09	529

S184	9	92	3.04	12.00	36.51	9.26	144
S185	9	95	3.04	15.00	45.64	9.26	225
S186	6	80	0.04	0.00	0.00	0.00	0
S187	3	61	-2.96	-19.00	56.19	8.74	361
S188	4	83	-1.96	3.00	-5.87	3.83	9
S189	5	92	-0.96	12.00	-11.49	0.92	144
S190	10	95	4.04	15.00	60.64	16.34	225
S191	7	70	1.04	-10.00	-10.43	1.09	100
S192	2	88	-3.96	8.00	-31.66	15.66	64
S193	2	79	-3.96	-1.00	3.96	15.66	1
S194	6	91	0.04	11.00	0.47	0.00	121
S195	6	79	0.04	-1.00	-0.04	0.00	1
S196	7	82	1.04	2.00	2.09	1.09	4
S197	6	85	0.04	5.00	0.21	0.00	25
S198	5	85	-0.96	5.00	-4.79	0.92	25
S199	5	75	-0.96	-5.00	4.79	0.92	25
S200	6	90	0.04	10.00	0.43	0.00	100
S201	7	93	1.04	13.00	13.56	1.09	169
S202	6	97	0.04	17.00	0.73	0.00	289
S203	1	72	-4.96	-8.00	39.66	24.57	64
S204	8	96	2.04	16.00	32.69	4.17	256
S205	6	80	0.04	0.00	0.00	0.00	0
S206	4	84	-1.96	4.00	-7.83	3.83	16
S207	7	76	1.04	-4.00	-4.17	1.09	16
S208	4	73	-1.96	-7.00	13.70	3.83	49
S209	3	87	-2.96	7.00	-20.70	8.74	49
S210	4	61	-1.96	-19.00	37.19	3.83	361
S211	7	92	1.04	12.00	12.51	1.09	144
S212	8	69	2.04	-11.00	-22.47	4.17	121
S213	7	87	1.04	7.00	7.30	1.09	49
S214	7	90	1.04	10.00	10.43	1.09	100
S215	6	86	0.04	6.00	0.26	0.00	36
S216	6	83	0.04	3.00	0.13	0.00	9
S217	7	63	1.04	-17.00	-17.73	1.09	289
S218	8	84	2.04	4.00	8.17	4.17	16
S219	9	73	3.04	-7.00	-21.30	9.26	49
S220	8	72	2.04	-8.00	-16.34	4.17	64

S221	8	84	2.04	4.00	8.17	4.17	16
S222	8	88	2.04	8.00	16.34	4.17	64
S223	5	71	-0.96	-9.00	8.61	0.92	81
S224	7	79	1.04	-1.00	-1.04	1.09	1
S225	6	76	0.04	-4.00	-0.17	0.00	16
S226	5	85	-0.96	5.00	-4.79	0.92	25
S227	8	86	2.04	6.00	12.26	4.17	36
S228	6	64	0.04	-16.00	-0.69	0.00	256
n=	70	5.96	80.00		465	260.87	7118

numerator	465
denominator	1362.67
r=	0.34

Grade 9

From the schools following the international American curriculum, 158 grade 9 students survey results rendered the Pearson's correlation coefficient with the following calculation:

The mean of the student engagement rating out of 10 for these students represented by $\bar{x}$: 6.45

The mean of their term averages (out of 100) represented by $\bar{y}$: 89.58

If x is each student's engagement rating, then $\sum (x - \bar{x})^2 = 933.09$

If y is each student's term average, then $\sum (y - \bar{y})^2 = 11504.59$

And $\sum ((x - \bar{x}) (y - \bar{y})) = 286.11$

Substituting these values in the Pearson's Correlation Coefficient formula,

$$r = \frac{\sum ((x - \bar{x}) (y - \bar{y}))}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

$$= \frac{286.11}{\sqrt{933.09 * 11504.59}} = 0.09$$

From the schools following the IGCSE curriculum, 70 grade 9 students survey

results rendered the Pearson's correlation coefficient with the following calculation:

The mean of the student engagement rating out of 10 for these students represented by $\bar{x}$: 5.96

The mean of their term averages (out of 100) represented by $\bar{y}$: 80

If x is each student's engagement rating, then $\sum (x - \bar{x})^2 = 260.87$

If y is each student's term average, then $\sum (y - \bar{y})^2 = 7118$

And $\sum ((x - \bar{x})(y - \bar{y})) = 465$

Substituting these values in the Pearson's Correlation Coefficient formula,

$$r = \frac{\sum ((x - \bar{x})(y - \bar{y}))}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

$$= \frac{465}{\sqrt{260.87 * 7118}} = 0.34$$

GRADE 11								
	Students	x	y	x-x'	y-y'	(x-x')(y-y')	x-x') ²	y-y') ²
SAC3	S1	7	81	-0.26	-6.79	1.77	0.07	46.12
	S2	6	77	-1.26	-10.79	13.61	1.59	116.45
	S3	5	72	-2.26	-15.79	35.70	5.11	249.37
	S4	6	85	-1.26	-2.79	3.52	1.59	7.79
	S5	4	83	-3.26	-4.79	15.62	10.63	22.96
	S6	5	83	-2.26	-4.79	10.83	5.11	22.96
	S7	7	71	-0.26	-16.79	4.38	0.07	281.95
	S8	5	88	-2.26	0.21	-0.47	5.11	0.04
	S9	3	86	-4.26	-1.79	7.63	18.16	3.21
	S10	5	83	-2.26	-4.79	10.83	5.11	22.96
	S11	4	83	-3.26	-4.79	15.62	10.63	22.96
	S12	7	81	-0.26	-6.79	1.77	0.07	46.12
	S13	5	81	-2.26	-6.79	15.35	5.11	46.12
	S14	7	91	-0.26	3.21	-0.84	0.07	10.30
	S15	7	83	-0.26	-4.79	1.25	0.07	22.96

S16	7	98	-0.26	10.21	-2.66	0.07	104.22
S17	8	79	0.74	-8.79	-6.50	0.55	77.29
S18	7	99	-0.26	11.21	-2.92	0.07	125.63
S19	5	94	-2.26	6.21	-14.04	5.11	38.55
S20	8	99	0.74	11.21	8.28	0.55	125.63
S21	8	100	0.74	12.21	9.02	0.55	149.05

S22	10	83	2.74	-4.79	-13.12	7.50	22.96
S23	8	82	0.74	-5.79	-4.28	0.55	33.54
S24	7	90	-0.26	2.21	-0.58	0.07	4.88
S25	9	91	1.74	3.21	5.58	3.02	10.30
S26	8	82	0.74	-5.79	-4.28	0.55	33.54
S27	2	84	-5.26	-3.79	19.95	27.68	14.37
S28	9	89	1.74	1.21	2.10	3.02	1.46
S29	10	96	2.74	8.21	22.48	7.50	67.38
S30	8	90	0.74	2.21	1.63	0.55	4.88
S31	6	84	-1.26	-3.79	4.78	1.59	14.37
S32	5	90	-2.26	2.21	-4.99	5.11	4.88
S33	7	88	-0.26	0.21	-0.05	0.07	0.04
S34	6	87	-1.26	-0.79	1.00	1.59	0.63
S35	8	83	0.74	-4.79	-3.54	0.55	22.96
S36	6	95	-1.26	7.21	-9.09	1.59	51.97
S37	8	77	0.74	-10.79	-7.98	0.55	116.45
S38	6	74	-1.26	-13.79	17.39	1.59	190.20
S39	9	94	1.74	6.21	10.80	3.02	38.55
S40	5	93	-2.26	5.21	-11.78	5.11	27.13
S41	8	71	0.74	-16.79	-12.41	0.55	281.95
S42	5	96	-2.26	8.21	-18.56	5.11	67.38
S43	7	80	-0.26	-7.79	2.03	0.07	60.70
S44	7	83	-0.26	-4.79	1.25	0.07	22.96
S45	5	76	-2.26	-11.79	26.66	5.11	139.03
S46	3	82	-4.26	-5.79	24.68	18.16	33.54
S47	7	79	-0.26	-8.79	2.29	0.07	77.29
S48	6	87	-1.26	-0.79	1.00	1.59	0.63
S49	7	86	-0.26	-1.79	0.47	0.07	3.21
S50	6	83	-1.26	-4.79	6.04	1.59	22.96
S51	8	94	0.74	6.21	4.59	0.55	38.55
S52	9	91	1.74	3.21	5.58	3.02	10.30
S53	8	79	0.74	-8.79	-6.50	0.55	77.29

S54	7	91	-0.26	3.21	-0.84	0.07	10.30
S55	9	99	1.74	11.21	19.49	3.02	125.63
S56	8	83	0.74	-4.79	-3.54	0.55	22.96
S57	8	95	0.74	7.21	5.33	0.55	51.97
S58	9	93	1.74	5.21	9.06	3.02	27.13
S59	10	97	2.74	9.21	25.22	7.50	84.80

SAC2	S60	8	97	0.74	9.21	6.81	0.55	84.80
	S61	7	98	-0.26	10.21	-2.66	0.07	104.22
	S62	8	96	0.74	8.21	6.07	0.55	67.38
	S63	9	96	1.74	8.21	14.28	3.02	67.38
	S64	5	85	-2.26	-2.79	6.31	5.11	7.79
	S65	6	96	-1.26	8.21	-10.35	1.59	67.38
	S66	7	86	-0.26	-1.79	0.47	0.07	3.21
	S67	10	76	2.74	-11.79	-32.30	7.50	139.03
	S68	9	86	1.74	-1.79	-3.12	3.02	3.21
	S69	9	91	1.74	3.21	5.58	3.02	10.30
	S70	4	83	-3.26	-4.79	15.62	10.63	22.96
	S71	9	65	1.74	-22.79	-39.64	3.02	519.44
	S72	9	72	1.74	-15.79	-27.46	3.02	249.37
	S73	8	82	0.74	-5.79	-4.28	0.55	33.54
	S74	8	70	0.74	-17.79	-13.15	0.55	316.53
	S75	7	85	-0.26	-2.79	0.73	0.07	7.79
	S76	8	85	0.74	-2.79	-2.06	0.55	7.79
	S77	8	87	0.74	-0.79	-0.58	0.55	0.63
	S78	9	88	1.74	0.21	0.36	3.02	0.04
	S79	8	98	0.74	10.21	7.55	0.55	104.22
	S80	8	92	0.74	4.21	3.11	0.55	17.71
	S81	7	83	-0.26	-4.79	1.25	0.07	22.96
	S82	9	83	1.74	-4.79	-8.33	3.02	22.96
	S83	10	95	2.74	7.21	19.75	7.50	51.97
	S84	10	83	2.74	-4.79	-13.12	7.50	22.96
	S85	7	75	-0.26	-12.79	3.34	0.07	163.62
SAC1	S86	8	52	0.74	-35.79	-26.45	0.55	1281.02
	S87	10	98	2.74	10.21	27.96	7.50	104.22
	S88	8	92	0.74	4.21	3.11	0.55	17.71
	S89	7	57	-0.26	-30.79	8.03	0.07	948.10
	S90	8	86	0.74	-1.79	-1.32	0.55	3.21
	S91	6	98	-1.26	10.21	-12.87	1.59	104.22

S92	8	100	0.74	12.21	9.02	0.55	149.05
S93	10	96	2.74	8.21	22.48	7.50	67.38
S94	10	100	2.74	12.21	33.44	7.50	149.05
S95	7	99	-0.26	11.21	-2.92	0.07	125.63
S96	8	90	0.74	2.21	1.63	0.55	4.88
S97	6	87	-1.26	-0.79	1.00	1.59	0.63

S98	7	68	-0.26	-19.79	5.16	0.07	391.70
S99	5	98	-2.26	10.21	-23.08	5.11	104.22
S100	7	100	-0.26	12.21	-3.18	0.07	149.05
S101	9	100	1.74	12.21	21.23	3.02	149.05
S102	8	94	0.74	6.21	4.59	0.55	38.55
S103	9	96	1.74	8.21	14.28	3.02	67.38
S104	9	93	1.74	5.21	9.06	3.02	27.13
S105	4	96	-3.26	8.21	-26.77	10.63	67.38
S106	5	92	-2.26	4.21	-9.52	5.11	17.71
S107	8	100	0.74	12.21	9.02	0.55	149.05
S108	8	100	0.74	12.21	9.02	0.55	149.05
S109	8	100	0.74	12.21	9.02	0.55	149.05
S110	7	100	-0.26	12.21	-3.18	0.07	149.05
S111	7	100	-0.26	12.21	-3.18	0.07	149.05
S112	5	92	-2.26	4.21	-9.52	5.11	17.71
S113	10	98	2.74	10.21	27.96	7.50	104.22
S114	8	92	0.74	4.21	3.11	0.55	17.71
S115	8	95	0.74	7.21	5.33	0.55	51.97

n=	115	7.26	87.79			282.26	338.17	10384.99
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numerator	513.44
denominator	1874.01
r=	0.27

Grade 11

From the schools following the international American curriculum, 115 grade 11 students survey results rendered the Pearson's correlation coefficient with the following calculation:

The mean of the student engagement rating out of 10 for these students represented by $\bar{x}$: 7.26

The mean of their term averages (out of 100) represented by $\bar{y}$: 87.79

If x is each student's engagement rating, then $\sum (x - \bar{x})^2 = 338.17$

If y is each student's term average, then $\sum (y - \bar{y})^2 = 10384.99$

And $\sum ((x - \bar{x}) (y - \bar{y})) = 282.26$

Substituting these values in the Pearson's Correlation Coefficient formula,

$$r = \frac{\sum ((x - \bar{x}) (y - \bar{y}))}{\sqrt{\sum (x - \bar{x})^2 \sum (y - \bar{y})^2}}$$

$$= \frac{282.26}{\sqrt{338.17 * 10384.99}} = 0.27$$