The Management of Digital Technology towards Equipping Students with 21st Century Skills: Its Implementation in Lower Primary Pedagogy

إدارة التكنولوجيا الرقمية من أجل تزويد الطلاب بمهارات القرن الحادي والعشرين: تنفيذها في التربية الابتدائية الدنيا

by

HIBA ABU ZAHRA

Dissertation submitted in fulfilment

of the requirements for the degree of

MASTER OF EDUCATION

at

The British University in Dubai

May 2020

DECLARATION

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that the content of this research is the direct result of my own work and that any use made in it of published or unpublished copyright material falls within the limits permitted by international copyright conventions.

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

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

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

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

_____*Hiba Abu Zahra*_____
Signature of the student

COPYRIGHT AND INFORMATION TO USERS

ABSTRACT

The UAE is working towards fostering the educational attainment and skills that will prepare all students to graduate with the necessary 21st century skills, that the workforce requires, and that will enable the students to be successful in their life. Several educational frameworks have attempted to define what constitutes the 21st century skills. Mutually, the 21st century skills are made up of the 6 Cs; critical thinking, collaboration, communication, creativity, character education and citizenship. However, the measurable benefits are only the first 4 Cs, and this paper attempts to explore how ICT tools used in the classroom foster these four skills in young learners. The research looks into the implementation of ICT in the lower primary cycle in an American curriculum school in Dubai. The research recognized the personal views of the teachers on how accessible and feasible ICT implementation is in their classrooms. The research, further, found teachers to value and implement digital tools to foster the skills of critical thinking, communication, collaboration and creativity in the classrooms as they delivered their lessons.

ملخص البحث

تعمل دولة الإمارات العربية المتحدة على تعزيز التحصيل العلمي والمهارات التي ستعد جميع الطلاب للتخرج بمهارات القرن الحادي والعشرين اللازمة، والتي تتطلبتها القوى العاملة، والتي ستمكن الطلاب من النجاح في حياتهم. حاولت العديد من الأطر التعليمية تحديد ما يشكل مهارات القرن الحادي والعشرين. بشكل متبادل، تتكون مهارات القرن الحادي والعشرين من ستة مهارات (6 C's)؛ التفكير النقدي والتعاون والتواصل والإبداع وتعليم الشخصية والمواطنة. ومع ذلك، فإن الفوائد القابلة للقياس هي فقط أول أربعة مهارات، وتحاول هذه الورقة استكشاف كيف تعزز أدوات تكنولوجيا المعلومات والاتصالات المستخدمة في الفصل الدراسي هذه المهارات الأربع لدى المتعلمين الصغار. يبحث البحث في تطبيق تكنولوجيا المعلومات والاتصالات في المرحلة الابتدائية الدنيا في مدرسة تطبق المنهاج الأمريكي في دبي.

أقر البحث بالأراء الشخصية للمعلمين حول مدى سهولة الوصول إلى تطبيق تكنولوجيا المعلومات والاتصلات خلال التدريس وإمكانية تنفيذها في الفصول الدراسية. علاوة على ذلك، وجد البحث أن المعلمين يقدرون ويطبقون الأدوات الرقمية لتعزيز مهارات التفكير النقدي والتواصل والتعاون والإبداع في الفصول الدراسية أثناء عملية التدريس.

DEDICATION

This dissertation is dedicated to my beloved parents, who have been my source of support and encouragement throughout this incredible journey. I dedicate it, also, to my loving husband, who believed in me and motivated me in the most challenging days. And, finally, to my daughters who stood by me, I thank you for your patience and being there for me every time I needed you.

You are all my source of inspiration. Thank you. This experience would not have been possible without the support provided by all of you.

ACKNOWLEDGMENTS

I would like to express my gratitude to my advisor Dr. Christopher Hill, who supported me and guided me throughout my research, and during my M.Ed. studies. His guidance was pivotal in helping me navigate my path when writing this study, especially in these difficult times where resources are scarce. Thank you.

Also, I thank the British University in Dubai for extending a learning environment that I could learn from and offer in my own classes. Through the innovative learning opportunities that I engaged in along the way, I have learned to challenge myself, both, in the workplace and personally.

I thank my colleagues at work for supporting me and standing by me when I needed their help to go on with this study, during this difficult time.

I would, also, like to thank my husband for encouraging and motivating me throughout this journey. You stood by my side every time I needed you, and offered me the emotional support I could not go on without. Thank you.

Table of Contents

List of Figures

Chapter 1: Introduction

1.1. Research Background

The United Arab Emirates (UAE) School Inspection Framework works towards setting a framework where high educational standards are adopted nationwide (UAE Government 2015). Its vision for 2021 is to foster educational attainment and create "a knowledge-based economy driven by innovation, research, science and technology" (UAE Government 2015, p.7). As such, a paradigm shift is taking place in the country with the integration of technology in schools' educational systems. A report released in 2019 by Khaleej Times gives an extensive list of technological advancement in schools (Nasir 2019). Nasir (2019) lists various smart technologies including Virtual Reality experiences and creative touch boards, among a few. He states that their use has an impact on the students' engagement levels. However, harnessing such digital technology to optimize instruction and student learning should be at the core of the learning and instructional design process.

In 2016, the Minister of Education, Hussain Ebrahim Al Hammadi, stated that the vision of the UAE is to offer students a 21st century education, that provides them with the set of skills that the workforce needs to turn the country into a globalized, knowledge economy (*Advertiser* 2016). In a research paper, the authors revealed that employers prefer "soft" skills as an essential quality that they look for, where students are capable to perform and adapt to unpredictable models of economic development (British Council 2014).

However, the understanding of what constitutes a 21st century skill set is evolving and dynamic (OPS 2016). Traditionally, success of an individual was indicated solely by his/her level of cognitive and problem-solving capabilities. However, as a result of the introduction of new

technology, and the changing social and economic settings in the current era, acquiring more

competencies such as intrapersonal and interpersonal skills are key indicators of success. The

new set of 21st century skills are a result of the learners' novel expectancy to learn information

relevant to them, and to which they can implement in real life situations (OPS 2016). In addition,

the globalized knowledge economy that has emerged in the past decade has integrated

technology into the education system in a method that transforms and deepens the concepts

learnt (ibid).

Figure 1: 21st Century Skills
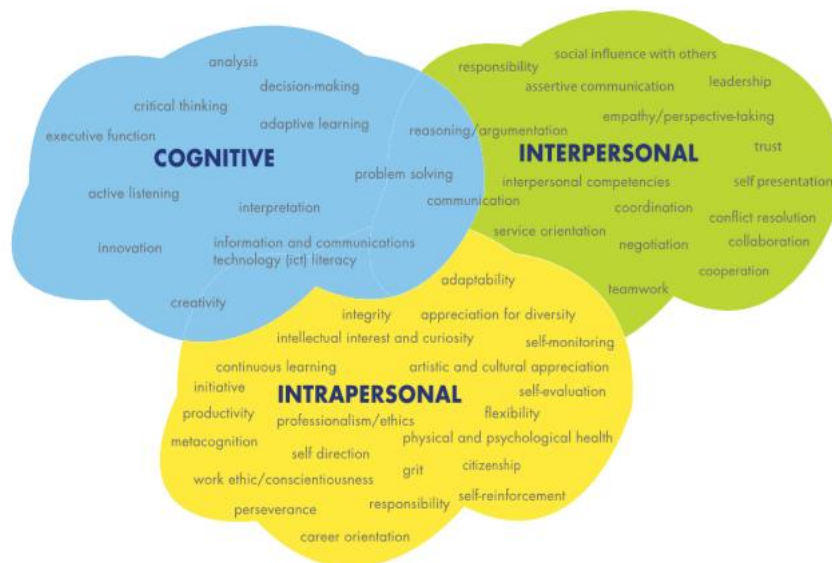
Source: National Research Council 2012

Figure 1 illustrates the three main domains that reflect the 21st century skills. The National

Research Council defines the cognitive domain as the reasoning and problem-solving attribute in

learners. The interpersonal attribute reflects the learners' ability to work and communicate with

others, while the intrapersonal attribute indicates "self-management, including the ability to

regulate one's behavior and emotions to reach goals" (National Research Council 2012, p.2). The

workforce highlights the importance of acquiring intrapersonal skills such as perseverance, grit and a growth mindset as important competencies to overcome challenges and achieve success (British Council 2014).

The three domains of 21st century skills – the cognitive, interpersonal and intrapersonal competencies – form the base of entrepreneurial activity. This activity is the overarching aim of education as it is the contributing factor of economic flourish in communities and industries (OPS 2016). In essence, this entrepreneurial drive is characterized by risk-taking, innovation, creativity, problem solving capacities and commitment (Toronto: Ontario MOE 2013). The United Arab Emirates Vision 2021 aims to align its educational strategy with the international standards, and clearly states that it aspires "for citizenship, a spirit of entrepreneurship, enhanced educational attainment, and a knowledge-based economy driven by innovation, research, science and technology" (UAE Government 2015).

Of the three domains that entail the 21st century skills, OPS (2016) name four measurable benefits as most prominent; critical thinking, communication, collaboration, creativity and innovation (OPS 2016). AES (2020) clarifies these concepts as applied in education. Critical thinking involves the learners being problem solvers, trying to find answers for themselves in school, and later in the workplace. The second element, collaboration, is "the practice of working together to achieve a common goal" (AES 2020, p.6). It is a crucial skill where the learners practice compromise, negotiation and leadership early on in school, to prepare them for collaborative practices in the workplace. The communication skill, on the other hand, is about explaining and conveying thoughts accurately. The fourth element, creativity, is a way of thinking of a problem from multiple perspectives and expressing creativity in a healthy and productive manner. In essence, creativity allows students to think in an unconventional manner

to issues and come up with creative solutions, or paths, to an objective. Kivunja (2015) explicates on the interrelatedness of the four elements. Together, mastery of the four C's empowers students to be successful in their careers, college, and life outside schools (Kivunja 2015).

Fullan further names character education and citizenship as two further measurable qualities that encompass 21st century qualities (Toronto: Ontario MOE 2013). Interestingly, OPS (2016) names the same qualities as fundamental competencies, further in its research paper. Fullan defines character education competencies as incorporating self-regulation, empathy and honesty; characteristics reflected in the intrapersonal domain of the 21st century skills model. Furthermore, he describes citizenship as a reflection of a student's respect for different cultures, as well as knowledge of the global issues. Shelly, Gunter and Gunter (2010) further elaborate on digital citizenship, as an embrace of the set of ethics that students practice when using technology. Figure 2 demonstrates the key elements that reflect digital citizenship in a student's behavior towards digital artifacts and use.

Figure 2: Digital Citizenship

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:
a. advocate and practice safe, legal, and responsible use of information and technology.
b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.
c. demonstrate personal responsibility for lifelong learning.
d. exhibit leadership for digital citizenship.

Source: Shelly, Gunter and Gunter 2010

Together, all these qualities encompass what Fullan refers to as the six Cs, which he continues to assert as qualities that employers look for, and the public and parents pursue. However, Fullan

stipulates that high results of implementing the six Cs are arrived at once pedagogy is the force driving technology in the educational system (Toronto: Ontario MOE 2013).

Figure 3 clarifies the elements of student learning, as the six Cs accompanied with technology, to

Figure 3: Alberta's Framework for Student Learning
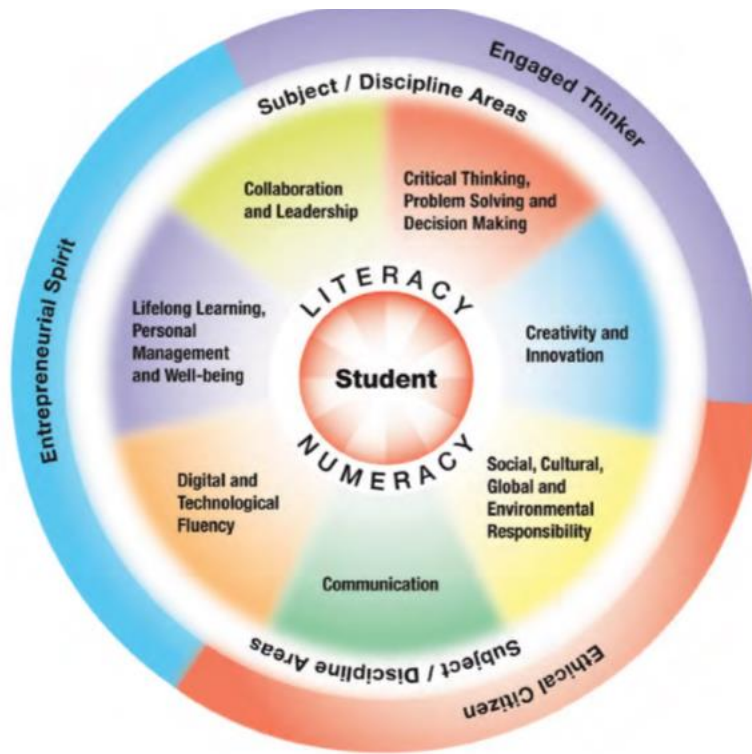
Source: Alberta Education 2011

bring about a wholesome education for the students. A student's learning will give rise to an Ethical Citizen, with Entrepreneurial Spirit who is an Engaged, rather than passive, Thinker (Alberta Education 2011).

The UAE's Ministry of Education is aware of the importance of transforming education to "build a knowledgeable and globally competitive society" (UAE Government 2019, p.1). In 2017, it launched a five-year strategic plan, termed the Education 2020 strategy, to improve the educational system extensively. The plan included fostering citizenship, innovation and

technology, to name a few, with the aim of fostering 21st century skills and employment for all students (UAE Government 2019).

The UAE School Inspection Framework (UAE Government 2015) further promotes innovation, as it recognizes it to be key for nationwide economic growth and advancement. Based on curiosity in essence, innovation is about testing assumptions and challenging the long-established concepts. Including innovation as an educational pillar promotes student capacity to take risks in order to achieve their objectives.

1.2. Problem Statement

Although the 21st century skills incorporate what Fullan refers to as the six Cs (Toronto: Ontario MOE 2013), there are only four measurable qualities, what OPS (2016) refers to as the four Cs, namely; critical thinking, communication, collaboration, creativity. Therefore, this paper will look at these four qualities and their integration in the classrooms.

Wide research has investigated the impact of technology in different classrooms cycles, throughout kindergarten to high school (Murphy 2016; Amante 2007). Engagement levels of students were researched, and across all cycles, students have shown higher engagement levels and motivation when using technology in school (Kintu, Zhu & Kagambe 2017; Sivakumaran et al. 2012; Szparagowski 2014). However, most teachers have been observed as using technology to complement their teaching practices, rather than changing it to accommodate higher-thinking skills (Smeets 2017). This study, therefore, is looking to explore the use of ICT tools in lower primary classrooms in a Dubai-based, American curriculum school. The study will note the extent to which these tools work towards preparing students with the 21st century skills they need (Pennington 2017), in alignment with the UAE Vision 2021. The rationale of this study is

brought about by the relative novelty of integrating technology in classrooms in UAE in general, and Dubai in particular.

1.3. Research Question

The study is seeking to provide answers to the following questions:

1- How do teachers see integrating technology as an essential tool to enhance the 21st century skills?

2- How is technology used in lower primary classrooms to equip students with 21st century skills?

(i)   How is ICT used in classrooms to promote critical thinking?

(ii)   How is ICT used in classrooms to promote collaboration?

(iii)   How is ICT used in classrooms to promote communication?

(iv)   How is ICT used in classrooms to promote creativity?

This study aims to evaluate how teachers do, or do not, embed ICT in their classrooms to promote the 21st century skills of the students in their class.

1.4. Objective of the Study

This study seeks to explore:

1. How teachers evaluate the importance of embedding ICT in their classroom instruction.

2. How teachers evaluate the feasibility of embedding ICT in their classrooms.

3. How ICT is used in classrooms to promote critical thinking.

4. How ICT is used in classrooms to promote collaboration.

5. How ICT is used in classrooms to promote communication.

6. How ICT is used in classrooms to promote creativity.

Chapter 2: Literature Review

2.1.   Introduction

This section begins by looking at the theoretical framework upon which this study is founded. Then, to understand the role of technology in classrooms, it is critical to be familiar with the factors that establish such a classroom. Therefore, the next section begins by reviewing pedagogical theories. Next, an overview of the research discussing the integration of technology in classrooms is presented. The four skills that are integral to 21st century competence – critical thinking, communication, collaboration and creativity – are discussed with relation to the impact technology has on fostering these skills for students. Finally, the correlation between the four C's and the desired student-centered outcomes in education is presented.

2.2.   Theoretical Framework

This study is informed by Davis's (1989) Technology Acceptance Model (TAM). According to this model, the "use and acceptance of … technology by individual users" can be projected through the ease of use (EOU), and usefulness, of the digital medium (Surendran 2012, p.175). Davis (1989) defines the usefulness factor as the conviction that using a specific technology increases job efficiency and effectiveness. EOU, furthermore, indicates that users choose technology that requires less effort to use when fulfilling a task. To this end, this model provides an appropriate framework to this study. Teachers choose to adopt, and make available to students, digital mediums and tools that facilitate and support their pedagogy and achieving their learning objectives, while promoting the 21st century skills students need to be equipped with.

2.3. The Theories Behind Pedagogy

In the 1970s, Richard Mayer and Gagne both contented that learning takes place when a change in social, emotional and academic behavior is observed (Cizek 1997); which signifies behaviorism. In the late 1970s, however, the notion of learning focused more on cognitive change rather than change in behavior. In fact, in 1977, Wittrock (cited in Phye 1997) defined learning as a permanent change in ability, knowledge and skill through experience. This model of learning has its roots in Piaget's constructivist theory that emerged in the first half of the twentieth century. His Theory of Cognitive Learning identified learning as a reorganization of mental processes that takes place as students assimilate new knowledge into existing ones (Westwood 2016). According to Piaget, however, assimilation of new knowledge requires an active learner because problem-solving skills are discovered (Ewing, Foster & Whittington 2011). In 1984, Glaser further stated that individual differences in learners must be accounted for and reflected in the different instructional designs delivered in the classroom (Goldman & Pellegrino 2012). Glaser further supported designing assessments to be aligned with instruction for "effective and individualized learning" (Goldman & Pellegrino 2012, p.484).

In his work, Piaget highlighted the importance of mathematical reasoning and logic in the constructive mental processes that learners undergo (Mayer 2008). He proposed a developmental analysis of the younger learners, expounding on the mental models, or schema, that learners restructure to create new knowledge. In contrast, Vygotsky "developed a sociocultural approach to cognitive development" (McLeod 2018, p.1), and believed that social interaction preceded development. Vygotsky highlighted the importance of language as an important component to influencing thoughts. He, further, encouraged the importance of establishing opportunities for children to learn from their more knowledgeable peers, and the teacher (McLeod 2018), placing

an emphasis on the importance of culture and a learner's environment in constructing learning (Mayer 2008).

Like Piaget, Dewey portrayed children as active and motivated learners who learn through interaction with the environment around them (Seltzer 2012). Dewey, however, believed that students are at the heart of the learning process, and should be engaged in experiential learning. To Dewey, hands-on learning is taken to the next level, as students reflect on their learning, based on real-life, practical experiences; making a connection between the real world and the classroom activities (Jackson 1998). Dewey maintains that the teacher should direct learning towards the natural instincts that drive the student's learning. He proposes four main tendencies as central to a child's learning; "the social instinct… the constructive impulse… the instinct of investigation…[and] the expressive impulse" (Jackson 1998, p. 420). Dewey further encouraged teachers to utilize knowledge of these tendencies to guide learners toward greater knowledge and understanding. As such, Dewey's Theory of Inquiry works towards a framework that involves the learners engaged in activities that respond to their individual interest, and work towards the holistic education of the learner. Like Vygotsky, Dewey supported the Social Learning Theory, which emphasizes the role of the environment, culture and the learners' inclination to communicate in enabling the learners to attain higher cognitive forms (Mayer 2008). This places Dewey as a pragmatist who advocated practical, real-life applications to foster learning, and learning through experience (Pavlis & Gkiosos 2017).

2.4.   ICT in Education

In his paper, Tardif (2005) explores the introduction of ICT into classrooms and their effect on the long-established brick-and-mortar traditional schooling systems. He argues that the new

digital tools are introduced to a classroom that has, already, set its pedagogical guidelines and techniques. Technology, he contends, simplifies and fosters learning. Technology-Enhanced Learning (TEL) is an interdisciplinary approach that integrates both technology and education (Laurillard 2007). Laurillard argues that, though technology has different features to offer, it is essential to look at what is called for by pedagogy.

In his research paper, Amante (2007) states that technology should be integrated in learning when three important factors are established. First, technology should actively construct knowledge by presenting new experiences so that the learners can reconstruct their prior schemas. This aligns with Dewey's and Piaget's constructivist theory. Also, learning through technology should be relevant so that the new experiences are aligned with student interests and, thus, prior knowledge. When students are engaged in activities that correspond to their interests, individual engagement is promoted and engagement in the learning process is enhanced, which mirrors Dewey's Theory of Inquiry. According to Jesson et al. (2018), the digital environment allows for engagement, or affective learning, in student learning as reflected in their enthusiasm and motivation to learning, participation in activities, and on-task behavior in the classroom. Finally, Amante (2007) contends that learning is not isolated, and the social factor must be integrated in the technology used; this is aligned with Dewey's Social Learning Theory.

In his research paper, Murphy (2016) studies the effect of technology on student engagement and student learning attainment in math lessons. Murphy observes increased engagement in the classroom and a 75% decrease in errors when students used tablets. Likewise, Sanders (2006) contends that increased engagement levels is found among students who use technology consistently when embedded in the curriculum. However, Jesson et al. (2018) affirms that using digital technology in classrooms, though increases engagement, does not enhance learning and

does not reflect positively on student achievement. He concludes his paper maintaining that technology needs to be aligned with the educational goals to realize effects on student achievement. Mativo, Womble & Jones (2013) propose implementing a curriculum that integrates technology in all grade levels, giving consistency of the learning experience of students as they use technology in all subjects. Furthermore, Murphy (2016) declares the importance of integrating technology at an early age in classrooms, allowing students to be familiar with the devices and confident in the use of technology. Teachers who ensure their pedagogy includes technology, at a regular basis, prepare students for life-long success beyond their school setting.

Smeets (2017) observes in his paper that teachers tend to use technology for drill practice, simulations for understanding, as well as for productivity and problem-solving. However, as teachers are pressured to reach their annual instructional target, they overlook the innovative features that can be taken advantage of with technology. ICT tools provide the opportunity for students to access resources and view simulations to enable learning and understanding (ibid). To contribute to an effective learning environment, computers should be placed in the classroom to foster student understanding and promote higher order thinking. "Open ended constructive software" help learners engage in higher order mental processes as they explore and find answers to their questions, rather than engage in "skill-based transmission software" where they drill practice their knowledge (Smeets 2017, p.345). A research paper written by Amante (2007) indicated that verbal communication and collaboration, two important 21st century competencies, was enhanced with kindergarten and elementary learners when interacting with the computer. This age group demonstrated enhanced language development as they read electronic story

books, used the word processor to display written language, and used the audio feature in computers to foster their phonological awareness.

A learning environment that incorporates technology into the classroom activities must be watchful of using technology solely for reiterating facts and basic concepts. Though this low-level task for learning is necessary at times, activities should be designed to broaden the students' skills and challenge their cognition with digital tools (Jesson et al. 2018). In their research paper, Bebell and Kay (2010) conducted a three-year research where triangulation of evidence from surveys, document analysis and classroom observations was conducted to look into outcomes achieved through use of digital tools in classrooms. A particular outcome of interest in this paper is how technology "enhanced capabilities among students to conduct independent research, and collaborate with peers" (Bebell & Kay 2010, p. 9). The result revealed the emergence of three student skills of a higher level when working in a digitally enabled environment. The first is critical literacy, where critical thinking was fostered. The second is the skill of independent learning, where students were able to organize their learning habits and study organization to achieve their maximum potential. Finally, the use of technology fostered the students' informational skills, where students were able to filter large amounts of information they found digitally, from multiple sources, to compose a single digital artifact with a single objective. These findings reveal the significance of integrating technology in classrooms, as they foster the 21st century intrapersonal competencies.

2.5. The Four Cs and Technology

In his paper, Kivunja (2015) contends that the four C's work hand-in-hand with technology skills to create an effective framework of 21st century skills, and, therefore, recognizes the importance

of integration of ICT in the learning process (Garba, Byabazaire & Busthami 2015). A learning

technology integrates people, procedures, devices and ideas to provide tools to enhance the

learning process (Kumar & Daniel 2016), and is referred to as EdTech (Stosic 2015). The

sections that follow further explain what the 4Cs are, and how technology is incorporated to

maximize their potential in pedagogical instruction.

2.5.1. Critical Thinking

Figure 4: Core Critical Thinking Skills

Source: Facione 2011

Research has presented many definitions of critical thinking over the years. Norris (1985)

described critical thinking as a learners' choice of choosing what is true or not. Elder and Paul

(1994) find critical thinking a thinker's adeptness to be in control and regulate their own

thinking. Duron, Limbach & Waugh (2006) define critical thinking as "the ability to examine

information by posing crucial questions, analyzing and evaluating relevant information,

implementing theoretic notions, and effectively communicating with others" (cited in Giraldo-

García, Roy & Alotebi 2015, p.1). Facione (2011, p.5) presents the process of critical thinking as

an array of six cognitive competencies; "interpretation, analysis, evaluation, inference,

explanation, and self-regulation," as presented in Figure 4.

Facione (2011) describes interpretation as the cognitive process of understanding and clarifying the meaning of concepts, and procedures without bias. It can include paraphrasing an idea presented in a reading, representing data in a graph, or simply categorizing and identifying main ideas. Analysis, which represents a higher cognitive level, is identifying the relationship presented in ideas and expressing one's own beliefs, experiences and concepts. For example, inferring the main idea, or conjectures that are unspecified, by looking into the arguments presented in text, or drawing a graphic organizer to express the relationship between ideas, are examples of analysis. Next is evaluation, defined as judging the credibility of a source by looking at the relationships presented in ideas, and the rational strength of the argument. This includes judging the "strength of arguments based on hypothetical conclusions" (Facione 2011, p.6). These three levels of cognitive domains are the higher three levels in Bloom's Taxonomy, which signify the ability to think critically (Duron, Limbach & Waugh 2006).

Facione (2011) continues to describe the next three cognitive domains of critical thinking; explanation, inference and self-regulation. Explanation entails the ability to present the logic and interpretation on of one's argument in a consistent manner. For example, presenting an argument and justifying the reasoning behind choosing this argument, is an example of explanation. Inference refers to the ability to link information from many sources to form a single deduction. Finally, self-regulation refers to one's awareness of the cognitive process of thinking. Self-examination and self-correction are two sub-skills of this domain, and reflect one's ability to keep track of the learning, and be mindful of mistakes that need to be corrected or misjudgments when assessing findings. Figure 5 presents the six cognitive domains of critical thinking, with the subskills that are incorporated in each.

These critical thinking skills are paramount in providing students with the 21st century skills that they need. It allows students to better understand the information they are presented with, use abstract ideas, while raising important questions about ideas (Duron, Limbach & Waugh 2006). Adams et al. (2012) contend that critical thinking gives the learners an advantage in judging

Figure 5: Skills and Subskills of Core Critical Thinking

Core Critical Thinking Skills		
SKILL	**Experts' Consensus Description**	**Subskill**
Interpretation	"To comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria"	Categorize Decode significance Clarify meaning
Analysis	"To identify the intended and actual inferential relationships among statements, questions, concepts, descriptions, or other forms of representation intended to express belief, judgment, experiences, reasons, information, or opinions"	Examine ideas Identify arguments Identify reasons and claims
Inference	"To identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to reduce the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation"	Query evidence Conjecture alternatives Draw logically valid or justified conclusions
Evaluation	"To assess the credibility of statements or other representations that are accounts or descriptions of a person's perception, experience, situation, judgment, belief, or opinion; and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions, or other forms of representation"	Assess credibility of claims Assess quality of arguments that were made using inductive or deductive reasoning
Explanation	"To state and to justify that reasoning in terms of the evidential, conceptual, methodological, criteriological, and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments"	State results Justify procedures Present arguments
Self-Regulation	"Self-consciously to monitor one's cognitive activities, the elements used in those activities, and the results educed, particularly by applying skills in analysis, and evaluation to one's own inferential judgments with a view toward questioning, confirming, validating, or correcting either one's reasoning or one's results"	Self-monitor Self-correct

Source: Facione 2011

critically, while fostering their leadership capabilities. However, there has been no consensus in literature on the best practice to equip the students with the critical thinking skills they need. Gelder (2001, cited in Giraldo-García, Roy & Alotebi 2015) proposes direct and indirect approaches to teaching critical thinking. The indirect

approach proposes students gaining understanding of critical thinking skills and approaches implicitly as they study different courses over the school years, while the direct approach suggests teaching critical thinking skills through several instructor-led approaches, such as questioning techniques and objective verbs (ibid; Duron, Limbach & Waugh 2006; van Gelder 2001). Van Gelder (2001) describes both techniques as ineffective, and proposes the use of technology as a solution.

Critical thinking can be effectively fostered in digitally-enabled classrooms where the digital tools represent and analyze the large amounts of information and data to create the relevant learning experiences that a student requires (Toronto: Ontario MOE 2013). In his research paper, van Gelder (2001), states that using technology further assists learners in developing their critical thinking capabilities.

Shelly, Gunter and Gunter (2010) argue that students must be encouraged to be active learners, seeking authentic experiences, and encourage data literacy among the students. Data literacy is defined as the ability to "view, manipulate, analyze, and interpret data" (Shelly, Gunter and Gunter 2010, p.21). As students learn to find the information that is relevant to them, they are encouraged to find solutions to problems as they critically analyze the facts and create arguments. Using digital tools, teachers are responsible to prepare the learning environment to offer the students the opportunity to find solutions to complex problems through, for example, visualizing data in various graph formats.

Huang, Hung and Cheng (2012) state "that technology facilitated in-class communication and thus enabled students to develop arguments supported by evidence, explain opinions by making thinking processes 'visible', and eventually foster enhanced critical thinking skills".

2.5.2. Communication

The Oxford Learner's Dictionary defines 'communication' as "the activity or process of expressing ideas and feelings or of giving people information." It involves oral and written modes of interaction with others to relate ideas and convey information (OPS 2016). Group members communicate ideas with each other, though not only verbally. Emotions and intentions are revealed through a person's posture and gesture (Jacques & Salmon 2007). It is only effective when there is "a predisposition to observe, listen, …read and watch and try to understand… this implies a degree of trust and openness between participants" (Jacques & Salmon 2007, p. 68).

Tardif (2005) sees pedagogy and schooling as a social and communication exercise, which has expanded in its interactions beyond the brick-and-mortar physical space, to encompass all aspects in society. The practices that are socially acceptable are exercised by families, in-service trainings and other societal applications. Teaching, he continues, is an "interactive job" (Tardif 2005, p.5) where the teacher communicates with a group of students to transform their thoughts in order to reach the teaching aim. Communication is, however, two-way, where students and teachers both interact and initiate communication with each other, and where students, Tardif explains, also communicate with each other. This resonates with Vygotsky's social constructivist theory, who believed that thoughts are strongly affected by language (McLeod 2018).

The introduction of ICT into the classroom reflected in the new mode of interaction that transformed, as a result, in the classroom. The use of ICT resulted in a new paradigm shift in the interaction that happens, as it shifted from in-class to outside-its-boundaries (Tardif 2005). Since school pedagogy is a practice with communication at its heart, ICT should, consequently, be integrated as a tool for communicational practices.

As technology advances, so do the tools that are accessible for students to communicate with. Cell phones, emails, networking websites, wikis, blogs, tweets and persuasive essays are several modes of communication that result from increased Internet connectivity, and apply different forms of rhetoric (OPS 2016). However, it is essential to be able to master creating all the different forms of rhetoric, as well as practice good listening skills (ibid). Effective communication using digital tools is a principal skill that allows learners to interact with others on a global scale, enhancing their interactivity and communicative skills.

2.5.3. Collaboration

In the workforce, employers seek skills such as authentic interaction and collaboration for international projects (Bikowski 2014). Jacques and Salmon (2007) argue that a group is a collection of people who join to learn from each other, and interact with each other as they are, at times, interdependent. This skill reflects Vygotsky's social constructivist theory, where individuals learn from each other.

Teams, on the other hand, are a group of individuals who work towards a common aim, sharing and learning from each other in the process (Jacques and Salmon 2007). These teams form collaborations (Moseley 2019). To work in teams, students must learn how to learn from others, and contribute to others (Toronto: Ontario MOE 2013). The team members co-construct new meaning together by communicating effectively with one another.

The act of learning together and collaborating in learning and finishing a task has several life-long advantages. Jacques and Salmon (2007) categorize them into intellectual aims, such as finding and encountering new points of view; emotional aims, enhancing a student's feeling of

being appreciated and heard within a group; and social aims, as the student feels a member of a larger unit.

In classrooms, team-based learning (TBL) is one way to foster student communication, critical thinking, collaboration and fundamental subject knowledge competencies (Michaelsen, Knight and Fink 2004). In their paper, Michaelsen and Sweet (2008, p.7) argue that TBL lessons give greater focus on "conceptual and procedural knowledge" as the lesson's instructional strategy emphasizes teamwork and problem-solving skills, as both a medium and an end (Jacques & Salmon 2007). Classrooms that adopt this approach devote the majority of the time in class to group collaborative work. As students learn from each other, the teams are ultimately self-directed as they are free from dependency on instructors, and are open to listen to other ideas and approaches to thinking. This is deeply rooted in Vygotsky's belief in the importance of interacting socially in a learning environment, as the more knowledgeable peers and teachers add great wealth of knowledge to an individual (McLeod 2018).

When collaborating digitally, a specific set of skills emerge, whether the participants are remotely situated or in sharing the physical space (OPS 2016). Jacques and Salmon (2007) present three important aspects to communicating effectively with group members. The first is sharing empathy and mutual trust with the other members. It demands that the individuals be open to themselves and the people around them. This reflects closely on the interpersonal domain of 21st century skills. The second aspect for effective communication and collaboration is giving and receiving constructive feedback. This will allow for any misinterpretations in meaning to be fixed when working remotely, and further clarification when delivering ideas even when sharing the physical space. The third and final aspect proposed is being part of meta-

communication. Giving and receiving feedback with the end goal of collaborating more effectively in the future is essential for successful collaboration.

Integrating technology encourages collaboration as the different digital tools, such as wikis, blogs, shared drives, and emails, are utilized. However, in a group with a boundaryless nature, where group members may meet at any place or time, Jacques and Salmon (2007) offer four alternatives for collaboration. The first is being engaged with group members in the same place at the same time. This allows for members to build a sense of identity as they engage with the different members in the group. The second alternative is using technology to work in the same place at the same time. Digital video-conferencing brings together the different members as they collaborate and work to achieve the same end goal. The third option is working in different places at the same time. Here, the mediating technology is used to bring the different members together so that they feel connected as they hear and see each other. The last option is the different place at different time strategy, which reflects the asynchronous environment in communicating with the group members. Using this method, the participants in different locations can connect and offer "contributions …[that] appear as a continuous stream" (Jacques and Salmon 2007, p.14).

2.5.4. Creativity and Innovation

Creative pedagogy emphasizes that effective learning is an outcome of creativity. Creative teaching and teaching for creativity are two elements of creative pedagogy (Selkrig & Keamy 2017). Jeffrey and Craft (2010) explore the difference between creative teaching and teaching for creativity in their paper. They define creative teaching as creatively exercising certain teaching approaches in order to achieve their educational goals. In their paper, they describe a primary

21

school that adopts this technique through incorporating a "dynamic, appreciative, captivating and caring ethos" (Jeffrey & Craft 2010, p. 79). The learners are observed to be constantly energetic, happy and learning. This was arrived at, they argue, because of the authenticity of the activities presented to the learners. At its core, it presented its younger learners with hands-on activities. The learner-centered approach to learning resonates with Dewey's pragmatic theory of learning, where students are constructing their own knowledge and problem-solving through hands-on experiences. Research has shown that inquiry-based instruction benefits students in the classroom as they learn content, have higher levels of engagement, and enhance their noncognitive skills (Keiler 2018).

This creative teaching reflects learner-centered classrooms, where emphasis is on students being active participants, and not recipients of knowledge from the teacher. The individualized instruction delivered in the classroom corresponds with the humanistic educational philosophy, which values the learner as a whole and treats all learners with dignity and respect (Nuckles 2000). Vygotsky contented that educators act as mediators, making an effort to improve interaction between the students as they cooperate and learn together, and working towards scaffolding learning of individual students (Amante 2007).

The primary school presented in Jeffrey's and Craft's paper (2010) argue that creative teaching is arrived at by the teachers as they creatively adapted the learning to their individual needs. The role of teachers in this approach to learning is to facilitate the learning process, as they recognize the differences in learners in various domains; intellectually, emotionally, developmentally and academically (ibid). Nuckles (2000) contends that an effective teacher would foster a learner-centered classroom through the management of several elements. Individual learner needs are an important aspect to attend to when catering instruction for the different students. Similarly,

taking into account the different student preferences and their various learning styles is an important component to successful teaching. Understanding how to cater to different physical differences, and the preferences for learning environments, is as important for effective student-centered teaching. As teachers plan for effective instruction, they design the activities according to student interests, emphasizing project and group learning (Williams 2017).

Teaching for creativity, on the other hand, emphasizes guiding the students on creatively exploring further dimensions to ideas and concepts, so as to "[pursue] … new ideas, concepts, or products" that offer a solution to problem (OPS 2016). Creative learners initiate learning, are imaginative and can produce new ideas, or determine if a particular setting can adopt the new ideas. Innovation, furthermore, is founded in creativity, as students are encouraged to put their creative ideas into action. Therefore, innovators are risk takers who are skilled at adapting to changes and new situations (Alberta Education 2011). Fullan describes innovation as "leadership for action" (Toronto: Ontario MOE 2013, p.9).

The generation of students who are users of digital devices are growing up in an environment that is constantly changing with the changing settings and technologies (Shelly, Gunter & Gunter 2010). Therefore, the students should be equipped with the tools they need to become producers. Their creative minds are fostered in the classroom environment as they produce authentic work individually and in groups (ibid).

In order to motivate students, digital tools are put into use in the classroom to allow learners to reflect on and present their learning and understanding. This reflection of knowledge can demonstrate their higher-order skills, promoting their creativity and innovation (Shelly, Gunter

and Gunter 2010). In 2012, PISA results found a high correlation between creativity, problem solving capabilities and the high academic scores that were achieved (OECD 2014).

2.6.   21st Century Learner-Centered Outcomes

An instructional design, focusing on learner-centered outcomes, will tailor the content delivered in class to ensure that the outcomes measured prepare the learner for the 21st century skills (Esdal 2018). When students take active part in the learning process, outcomes consistent with the 21st century skills are demonstrated.

Student-centered outcomes span four domains; the content, cognitive, social-emotional and navigational domains. Content competency is essential, as the foundational knowledge of subjects is the basis for higher order cognition (Esdal 2018). This is related to cognitive competency, which allows the learners to be able to access higher order skills to solve problems, create plans and analyze material. In this domain, critical thinking and creativity are harnessed. Esdal (2018) contends that it is essential to create learning experiences that develop the content and cognitive competencies to achieve a successful student-centered learning experience.

Collaboration and communication are developed in the third domain; the social-emotional competency which entails understanding the relationship of one's self and with others (ibid). Self-efficacy, collaboration, social awareness and maintaining a positive, growth mindset, are some of the skills that are mastered in this domain. These skills, furthermore, are developed through learning experiences and are associated with success in college, career and life. The fourth and final domain is navigational competency, which focuses on the skills a student needs once they graduate from school, such as opportunity seeking skills, social capital skills and

practical life skills. The four competency domains are the outcomes teachers need to design instructions to achieve, when preparing instructional design in the classroom.

2.7. Conclusion

This section has looked at the theories that support integrating ICT tools in education in order to promote the 21st century skills that students need. The theories that underly the pedagogy as implemented in the classrooms, and the integration and use of ICT in education were discussed. Theories and research studies that inform on the enhanced engagement levels in classrooms through using technology, and the importance of using this same technology to enhance critical literacy skills were detailed. Furthermore, a thorough description of each of the four C's - critical thinking, communication, collaboration and creativity – and how each skill is affected and incorporated in technology was discussed. Finally, a synopsis of how the learner-centered outcomes found in literature are a reflection of the four C's was presented.

Chapter 3: Methodology

3.1.   Introduction

In the previous sections, research on how 21st century skills, together with digital tools, promote a student's life-long learning was established. The research questions presented at the beginning of this paper aim to explore how successful the integration of digital tools is in the curriculum, and its success in promoting the four 21st century skills; critical thinking, communication, collaboration, and creativity. This methodology section will describe the qualitative approaches chosen to answer these research questions. First, the setting of this research will be described. Second, the population sample is presented. Then, the data collection methods are illustrated with the reasons behind choosing these methods. Further, the validity and reliability of the methods are discussed. Finally, the ethical considerations undertaken in this research are described.

3.2.   Research Setting

This research will take place in grade 1 and grade 2 of a Dubai-based, American curriculum school. This school has a student population of over 1280 students, of which the Emiratis make up approximately 75% of them. The Head of KG, Head of Lower Primary and the Head of Upper Primary report to the Head of Elementary, who is a member of the Senior Management Team (SLT).

This study focuses on the Lower Primary Cycle, grades 1 and 2. The cycle is comprised of ten classrooms, five for each grade level. One homeroom teacher and assistant are responsible for the twenty-five students in each class. However, teachers for the Arabic Language, Islamic Studies, Social Studies, Music, and Art sessions share the teaching role in these classes. Since

the homeroom teachers are responsible for the planning, designing and delivery of the core subjects of English, Math and Science, and for maintaining an ongoing communication channel between the classroom and the parents, the empirical evidence was collected solely from the homeroom teachers.

Seeing as the integration of ICT tools in pedagogy is a primary focus in this research, it is essential to discuss the ICT tools available to the students and teachers. The primary school library is responsible for the maintenance and upkeep of twenty laptops, shared between the ten classes. Teachers in grades 1 and 2 who wish to use the laptops in the classroom are responsible for picking up the laptops, and returning them to the library when they are done. Each classroom contains a projector and a desktop for the teacher's use.

3.3.   Research Population and Sample

According to Mackey and Gass (2005), the reliability of the research relies on the sample population chosen for the research. Non probability sampling took place, as this technique is implemented specifically in qualitative research (Taherdoost 2016). In purposive sampling, certain cases are chosen for the research, depending on the particular need (Cohen, Manion & Morrison 2018). For this research, the complete collection sampling was adopted, where the ten teachers of grades 1 and 2 were deliberately chosen to provide their input on the planning and the intention of use of specific ICT tools (ibid). All ten teachers completed the online survey, while the input of nine was available for the questionnaires. In addition, the Head of the teachers was also interviewed to provide feedback on the guidance and extent of support she provides the teachers with. This purposive sampling technique will promote in-depth understanding of the study (Gentles et al. 2015).

3.4. Data Collection Methods

The philosophy behind this research is the interpretive paradigm (Cohen, Manion & Morrison 2018). This view accentuates how people differ from each other, with a "concern for the individual… to understand the subjective world of human experience" (Cohen, Manion & Morrison 2018, p.19). This design is qualitative in nature and aims to understand the phenomenon as understood by individual participants or a group of participants, reflecting Piaget's constructivism and Vygotsky's social constructivism, respectively (ibid).

According to Kawulich (2005), qualitative methods may include interviews, observations and document analysis. For this research, the descriptive research approach, was employed, as this approach informs on the "characteristics of the …phenomenon that is being studied" (Bhat 2020, p.1). It is concerned more on what has happened rather than on the reason it has (Nassaji 2015), which responds to the research questions sought. Bhat (2020) describes four main features of descriptive research. The first is that the nature and patterns of the studied demography can be informed by accumulating quantitative data. This is essential in finding the general characteristics and patterns across the ten classrooms influencing the teachers and guiding their practice. The second feature of the descriptive research is that no variables are controlled, as an observational tool will not allow the researcher to misinterpret or manipulate material. This is essential in any paper, in order to find authentic data to inform the research. The third characteristic of descriptive research is that it allows for different units from the same group to be studied (Bhat 2020). This is of primary importance to this study, as the research questions aim to find a pattern across different classrooms, in two different grade levels, to find the common belief and practice, if they do exist. The fourth and final feature of descriptive research is that it

is can create grounds for further research to explore the questions further, or to replicate in a different setting.

Ideally, qualitative observations would be conducted, to allow the researcher to note the natural and unchanged environment; by observing the interaction and communication of the students and the teacher, noting any nonverbal feelings (Kawulich 2005). However, this study has been conducted during the worldwide pandemic of Covid-19 coronavirus. As such, distance learning was employed across UAE educational institutions starting March 22 (Shaaban 2020). The public's movement was inadmissible, except in the case of acquiring a permit (Bernarrd 2020). As a result of these unusual constraints, conducting observations was unfeasible.

Consequently, the data collection method chosen was the survey research. According to Ary et al. (2010), a survey research gathers information through the implementation of surveys and questionnaires. Bhat (2020) claims that a survey that conveys sound quality data must employ both closed-ended questions and open-ended questions. Therefore, this research paper conducts two surveys, putting into practice both kind of questions.

Ary et al. (2010) argue that open-ended questions are difficult to analyze, though easier to create. Some of the answers might be ambiguous, and the answers may differ in length, depending on the attitudes and knowledge on the side of the respondents. To answer the open-ended question survey (Appendix A), the teachers had a choice of filling up the surveys in writing on their own, or video-conferencing with the researching on Zoom software. In the case of the latter, semi-structured interviews were deployed where the interview questions were open-ended to an extent that allowed the researcher to clarify any details (Cohen, Manion & Morrison 2018). Mackey and Gass (2005) state that participants should have a choice of orally answering the questionnaire.

Furthermore, Ary et al. (2010) contend that close-ended questions are more difficult to construct, though easier to analyze. These types of questions are easier to answer and classify in a table, presenting clear patterns. For this research, the close-ended question online surveys were sent to the teachers to fill in at their own time, and the results were automatically emailed to the researcher (Appendix B). Leading questions were avoided in both types of surveys (University of Leeds 2001).

3.4.1. Interviews

Ary et al. (2010) define interviews as the form of questioning that is conducted face-to-face between the interviewer and the respondent. The interviewer directs the question and notes the responses given from each participant. One of the most important elements of this approach is the ability to redirect the questions if the interviewer finds gaps in the answers, or needs further data to complement his/her research. Ary et al. (2010) describe this approach as having a high response rate, as the personal contact motivates the respondents to take part in the interview. Two disadvantages of this approach are the interviewer's bias, and the presentation of socially acceptable responses (Ary et al. 2010; Cohen, Manion & Morrison 2018). Respondents may feel pressured into answering questions to show their practice in the socially acceptable forms of behavior, or as a reaction to what they believe an interviewer believes in.

The teachers were presented with the open-ended questions and given the choice to answer the questions in an interview, using the Zoom software. Four teachers of the ten were interviewed, and responses were recorded after they granted their consent. Since the teachers were presented with the questions in advance, they had the opportunity to reflect and share lengthy answers. When the researcher did not understand an idea, it was easy to reword ideas for further

clarification, and further seek elaborations on responses. This reflects the semi-structured interview approach, where the researcher asks pre-set questions, but may add to them when needed (Ary et al. 2010).

3.4.2. Self-Administered Questionnaires

A data collection method that is used to answer the research questions in this paper are self-administered questionnaires. In the questionnaire, the researcher gives out a set of questions to the participants, who record their answers individually to the questions and return their responses to the researcher (Ary et al. 2010). Advantages of this approach is that the researcher is available to assist the respondents in clarifying questions. In addition, Mackey and Gass (2005) contend that questionnaires allow the interviewer to find longitudinal patterns.

A main disadvantage of this data collection method is that generalizability is at stake when the number of participants is low. Since the sample size in this research paper is a total of only ten teachers, generalization of the results is a concern (Ary et al. 2010).

Questionnaires are a popular method for respondents to convey their attitudes towards activities in the classroom and learning (Mackey & Gass 2005). To this end, the questionnaire shared with the teachers consisted of six open-ended questions, emailed to the ten teachers to answer at their own time (Appendix A). The format of the questions followed Ary et al.'s (2005) guide to formulating good questions. Questions were phrased so that answers from teachers were unbiased; formulated questions to avoid misleading to a desired answer; took into account teachers' time and kept the questionnaire brief; grouped and numbered questions so as to make sense and lead to easy flow of responses; and avoided questions that may embarrass or cause teachers' suspicion (Appendix A).

3.4.3. Internet Surveys

A popular data collection method is the use of internet surveys, where the questions are chosen by the researcher and the respondents answer the survey online (Ary et al. 2010). The main disadvantage of applying this method is the inaccessibility to technology.

The survey shared with teachers looked into their understanding of what the four 21st century skills are; namely, critical thinking, communication, collaboration and creativity. To allow for closed-ended questions, the teachers chose the statements that reflected the skill, to the best of their knowledge. The remainder of the survey consisted of their reflection on the skills they believed were fostered in the three core subjects that they taught, English, Math and Science. They, also, imparted their belief in the role of ICT in enhancing the 21st century skills in the three subjects.

To keep all these variables unambiguous to teachers, short and direct questions were formulated, where teachers had to answer only single response questions, Yes/No (University of Leeds 2001). The survey design and question sequence followed Burgess's guidelines; headings were clear and uncluttered; the layout was neat; and there was consistency in the question types and flow (University of Leeds 2001) (Appendix B).

3.5. Reliability and Validity

The consistency and trustworthiness of data and the participants is defined as their reliability; the main characteristic being "precision and accuracy" (Cohen, Manion & Morrison 2018, p.268). Lincoln and Guba (1985; cited in Cohen, Manion & Morrison 2018) prefer referring to reliability in qualitative research as the very terms of *consistency*, and *credibility*. This refers to the extent of precision in describing the setting and participants involved.

Validity, on the other hand, is a cornerstone in research, to ensure that "a particular instrument in fact measures what it intends" (Cohen, Manion & Morrison 2018, p.245). While validity applies to the methods chosen for the research and the design executed, validity ensures that the results reflect the observed incidents (Henrichsen et al. 1997). In qualitative research, validity is influenced by confirmability, dependability, transferability and credibility (Ary et al. 2010). According to Ary et al. (2010), confirmability refers to the unbiased nature and neutrality of the research while dependability describes the regularity and steadiness of the findings. In qualitative research, transferability refers to how the findings can be transferred and used in other contexts, and credibility refers to the truthfulness and candor reflected.

Figure 6: The Four Types of Validity of Research Design

Internal validity: The validity of the inferences about whether the effect of variable A (the treatment) on variable B (the outcome) reflects a causal relationship

Statistical conclusion validity: The validity of the inferences about the covariation between treatment and outcome

Construct validity: The validity of the inferences about psychological constructs involved in the subjects, settings, treatments, and observations used in the experiment

External validity: The validity of the inference about whether the cause–effect relationship holds up with other subjects, settings, and measurements

Source: Shadish 2001

Figure 6 describes the four kinds of validity suggested by Shadish (2001). According to Henrichsen et al. (1997), internal validity refers to the failings and weaknesses in the design of the research itself or in the data collection method chosen. External validity, however, refers to the degree the research findings can be generalized to include a larger population. When a research is not externally valid, findings in the research cannot be applied or replicated to different contexts and groups.

3.5.1. Validity in Interviews, Online Surveys and Questionnaires

In interviews, validity is attained by unbiased questions or interpretations of answers; this is referred to as face validity (Cohen, Manion & Morrison 2018). Mackey and Gass (2005) explain face validity as the participant's belief in the importance and genuinity of the research questions and the interviewer. The attitudes of the interviewer, the respondent and the nature of the questions, can all be, or lead to, prejudiced conclusions.

To apply internal validity to the data collected in interviews, the credibility and confirmability of the data was checked by the teachers, to ensure that the information represented in the study was understood and conveyed as they had disclosed during the interview. Saturation of the results demonstrated the extent of validity. In addition, internal validity is achieved in the surveys and questionnaires when the questions measure and answer the intended objectives (Mackey & Gass 2005). Jain, Dubey and Jain (2016) affirm that a questionnaire is valid when participants provide relevant responses because the questions are short and clear, and they understand the question.

External validity was addressed when transferability was presented, by generalizing the findings of the study. However, Lincoln and Guba argued in 1985 (cited in Cohen, Manion & Morrison 2018) that generalization is not the main aim of interpretivist studies, and researchers should focus on presenting a rich revelation of the data gathered. Construct validity, ensuring the research is "meaningful to participants" and relevant, was achieved as the researcher learned and gathered data about the implementation of the ICT tools in the classrooms where they were used with students, across multiple subjects, to ensure dependability and authenticity of the data (Cohen, Manion & Morrison 2018, p.257).

3.5.2. Reliability in Interviews, Online Surveys and Questionnaires

Mackey and Gass (2005) contend that using close-ended questions yields a greater degree of reliability because of the consistency of measurement employed. The analysis of results is, further, easier to compute and evaluate, which leads to a high reliability level. This approach was put into practice through the use of online surveys.

Mackey and Gass (2005) further contend that the responses in open-ended questionnaires are more difficult to analyze and quantify, as the respondents convey their own ideas and may cause unpredicted data. The interviews that took place and the self-administered questionnaires used the open-ended question approach. Although less reliable, it was important to allow the teachers to express their thoughts and add to the value of the research, by offering concepts and ideas that are invaluable to the researcher.

3.6. Ethical Considerations

The qualitative nature of the study took into account to inflict no harm on the participants (BERA 2011). According to Mackey and Gass (2005), all parties taking part in the study should extend their consent in participating in the research. Informed consent should be sought from participants, and the purpose of the study and confidentiality it entails was shared with them (Appendix D). They were, also, informed that their names and the name of the institution was not used throughout the study (BERA 2011).

According to BERA (2011), the school management should be made aware of the study, and consent should be given before the study begins. The Head of Section was sent an official email, with details of the nature of the study, assured confidentiality and required approval (Appendix C). Ary et al. (2010) state that using a cover letter to inform the participants of the study is

beneficial in getting the participants motivated to take part in the study. A cover letter was shared

with the teachers, with the purpose of the study and confidentiality it entails (Appendix D). They

were informed, also, that names of data sources and institutions will not be used throughout the

study. To this end, the teacher names have been replaced with the pseudonyms T1 through T10,

to ensure their anonymity. For the purpose of classification and clear representation of data in

this research, T1, T2, T3, T4 and T5 represent first-grade teachers. Participants were informed of

their voluntary choice to participate. As such, T10 has chosen to leave the questionnaire. At the

end of the study, the researcher published and shared the findings with the school administration

and teachers; the involved parties in this study (BERA 2011).

Chapter 4: Findings

4.1. Introduction

The interviews, open-ended questionnaires and surveys gave a descriptive and detailed description that reflected the different experiences of teachers. In addition, the online surveys that were shared included close-ended questions that evaluated the teachers' understanding of the four 21st century skills. Thomas (2010) argues that the aim of a qualitative study is to use direct interpretation of what is related and experienced to generate meanings. Furthermore, Dudovskiy (2019) states that inductive analysis results from detailed accounts of observations and reports, and developing generalizations and relationships as patterns emerge. Therefore, an inductive analysis approach and a qualitative description was found to be the most appropriate approach to interpret and present findings in this study.

4.2. Results and Data Analysis

4.2.1. Experience of Teachers

Figure 7: Years of Experience

How many years of teaching experience do you have?

10 Responses

Data	Response	%
Over 10 years of experience	4	40%
5-10 years	3	30%
2-5 years	3	30%
0-2 years	0	0%
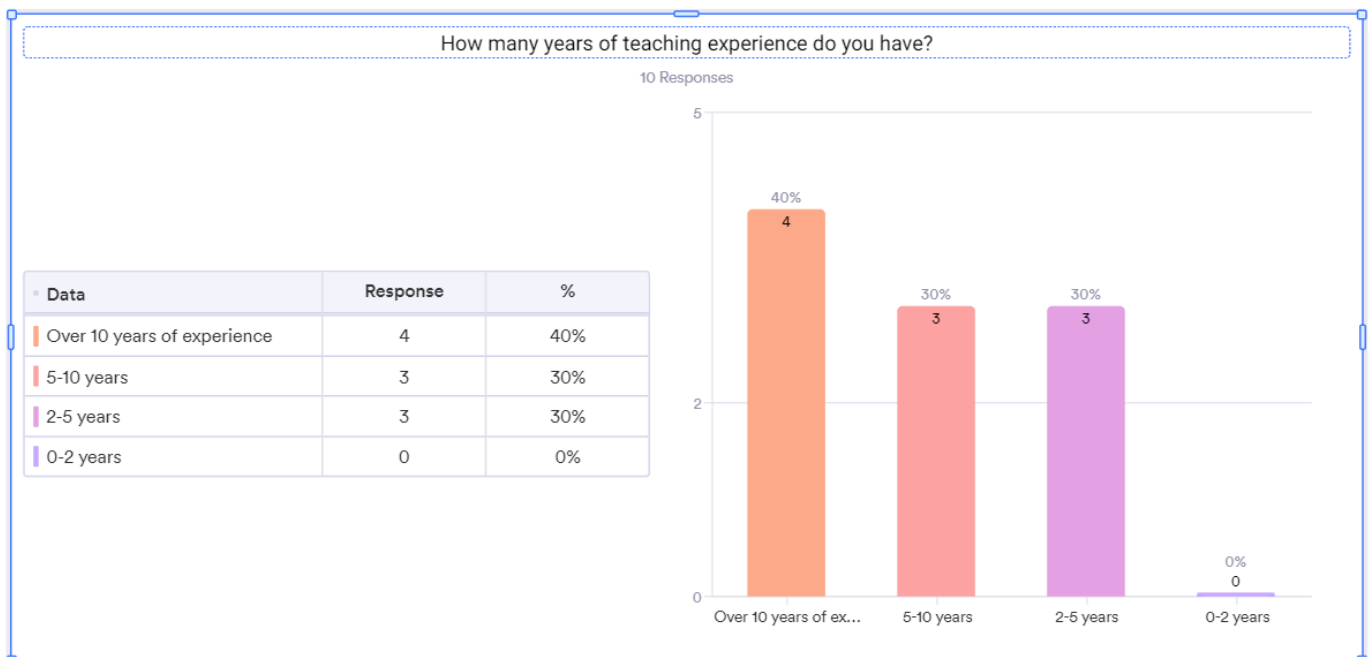
The online survey shared with the teachers looked into the teaching experience each participant

has. Figure 7 shows that there is an equal distribution of the years of experience teachers have

between them. While a slight majority have over ten years of experience, the rest have an equal

experience between them. There are no fresh graduates, as all teachers have over two years of

teaching experience.

4.2.2.   Digital Tools in the Classroom

In the questionnaire, teacher views on the importance of incorporating digital tools was

evaluated. T6 and T9 believe that this era of technology demands the integration of technology

and digital tools during lesson delivery. T7, likewise, believes it is key to incorporate for today's

generation, since they are all adapted and well-educated in using digital tools. She clarifies that

we, the adults, may be confused or lost when it comes to technology. Children, however, get the

technology at a faster pace, move faster, and play games that are faster. With today's fast-

growing pace of technology, she believes that it is of utmost importance to incorporate digital

tools in schools. Digital media, she continues, brings motion and real time 3D digital effects

which allows students to understand and the subject content and learn more effectively. To a

certain extent, the lesson delivery can be carried out with using media. However, the learning

that happens when digital media is incorporated is unquestionable and tangible. Smeets (2017)

supports this as he affirms that ICT tools provides students with the opportunity to access

resources and view simulations, which enables their learning and understanding.

 T1 believes that using and preparing digital tools is an important element in the classroom, as it

enhances interactivity and student engagement in the classroom. She shares that this is true

through gamification elements, such as Kahoot!. Similarly, T4 shares this outlook and further

believes that incorporating digital tools helps maintain and control the classroom environment. She explains that this happens because students become deeply engaged with the different technologies, which stimulate movement, creativity and innovation that stimulates their minds. This corresponds with Jesson et al.'s report of digital environments allowing for engagement, as they are motivated to learn and display on-task behavior in the classroom (2018).

Likewise, T5, T8 and T2 find that the inclusion of digital tools plays an essential role in the success of their lessons. T2 explains that using those digital tools motivate her students to explore and learn beyond the content they find in books, as they have easy access to any information they may look for. This is supported by Bebell and Kay (2010, p. 9) who contend that technology promotes the students' ability to "conduct independent research." However, T2 believes books should never be completely replaced by digital tools and should be used moderately as a supplement, since iPads and laptops can have a negative impact on children, especially at their young age.

While T3 acknowledges the importance of incorporating digital tools, she clarifies that using the tools requires less workload on her as a teacher, if the digital mediums are to be duly prepared for the students' use. She, further, explains that in some lessons and concepts, the students grasp the learning objective quickly and there is enough time within the lesson to incorporate technology. In other instances, the concept is difficult and there is hardly time to add the element of technology to the lesson. She concludes that though it is difficult to bring in the digital tools daily to the lesson, it is still doable from time to time. However, Murphy (2016) contends that teachers who ensure their pedagogy includes technology, at a regular basis, prepare students for life-long success beyond their school setting.

4.2.2.1. Laptop Accessibility

According to teachers, the two main digital tools made available to the teachers are the projectors in the classes, and the laptops. The twenty laptops are placed in the library for overnight charge, and teachers are responsible for taking and returning the laptops, as needed. Some teachers arrange picking up laptops at the beginning of the day, or delegate this responsibility to their teaching assistants. T4, however, employs a different approach to laptop accessibility:

On most days, I do find time. I tend to plan ahead to what I want to use and the things I want to view to the kids. Other crowded, busy days it may be harder to attend to going by myself and getting the laptops and getting them to class. On those busy days, I ask a responsible student whom I trust to help me with this task or my assistant. YouTube videos give students access to a wide range of information about the topics and allow the students to look at the same topic from different perspectives. This enhances their critical thinking skills.

The teachers, however, expressed their need of having laptops in their classes, to save the time and ensure the availability of the laptops whenever they need them. T2, further, adds that students would be familiar with the laptops and this will boost the efficiency when using them during class. T7 expresses the importance of having a well-equipped classroom to incorporate digital tools more effectively, enhancing and maximizing the learning platform for students. This is supported by Murphy (2016) who affirms the importance of integrating technology at an early age in the classrooms, allowing the students to be familiar and confident in the use of technology.

On the other hand, T3 expressed that the first-grade students in her class are too young to have laptops for educational purposes every day, and having laptops occasionally available did not bother her. T8, also, finds that the use of a projector in the classroom makes up for the inaccessibility of laptops, as issues of log-ins and internet connections take up substantial learning time in the classroom. She favors an all-digital classroom session dedicated to the use of

laptops, where all the technical issues would be solved and the laptops ready for an effective use of class time.

4.2.2.2. Projectors and Laptops

T8 describes this time as the era of technology, and watching different materials through the use of technology widens students' horizons and adds to their skills, beyond just passively listening to instructions from the teacher. While both projectors and laptops are important, T1 explains, the students get very excited when she projects videos for whole-class instruction. Lesson content is, also, projected so that lesson time is not wasted on writing content on the whiteboard by hand. Furthermore, in an interactive game, such as Kahoot!, the question is projected on the screen, while they are using the laptops to record the answers. As a result, she finds both tools to be equally important.

T4 finds that the projector enhances skills such as creativity and imagination, as children watch and discuss what they observe as a group. However, she finds that using the laptop is more beneficial to developing skills, as it teaches the students to think outside the box, especially when they run into an obstacle they are not familiar with. Then, they will have to spend time thinking about how to fix the issue they are going through. Laptops, also, help the students become more independent. It is up to them to find a topic of interest and work on it. Smeets (2017) supports this as he contends that laptops should be placed to classrooms to contribute to an effective learning environment, fostering student understanding and promoting higher order thinking.

T2 describes the use of projectors in the classroom to be very effective as it improves teaching and learning and provides opportunity for students to interact and communicate during the lesson. Likewise, T3 and T5 find projectors to work towards all-class instruction which enhances

communication and interaction between students, and coveys a sense of belonging to a larger group. T2 and T3 finds that laptops are excellent tools for individual learning, but hinder communication skills.

4.2.3. Critical Thinking

4.2.3.1. Understanding Critical Thinking

Figure 8: Teachers' Understanding of Critical Thinking

Check the box if you believe that the statement is true. You can choose more than one.

10 Responses

- Critical thinking involves a student's ability to analyze information. 9 43%
- Critical thinking involves a student's ability to explain the lesson. 5 24%
- Critical thinking involves a student's knowledge of the lesson's content. 3 14%
- Critical thinking involves a student's ability to remember the information he learnt. 4 19%

Legend:
● Critical thinking involves a student's ability to analyze information. ● Critical thinking involves a student's ability to explain the lesson.
● Critical thinking involves a student's ability to remember the information he learnt. ● Critical thinking involves a student's knowledge of the lesson's content.
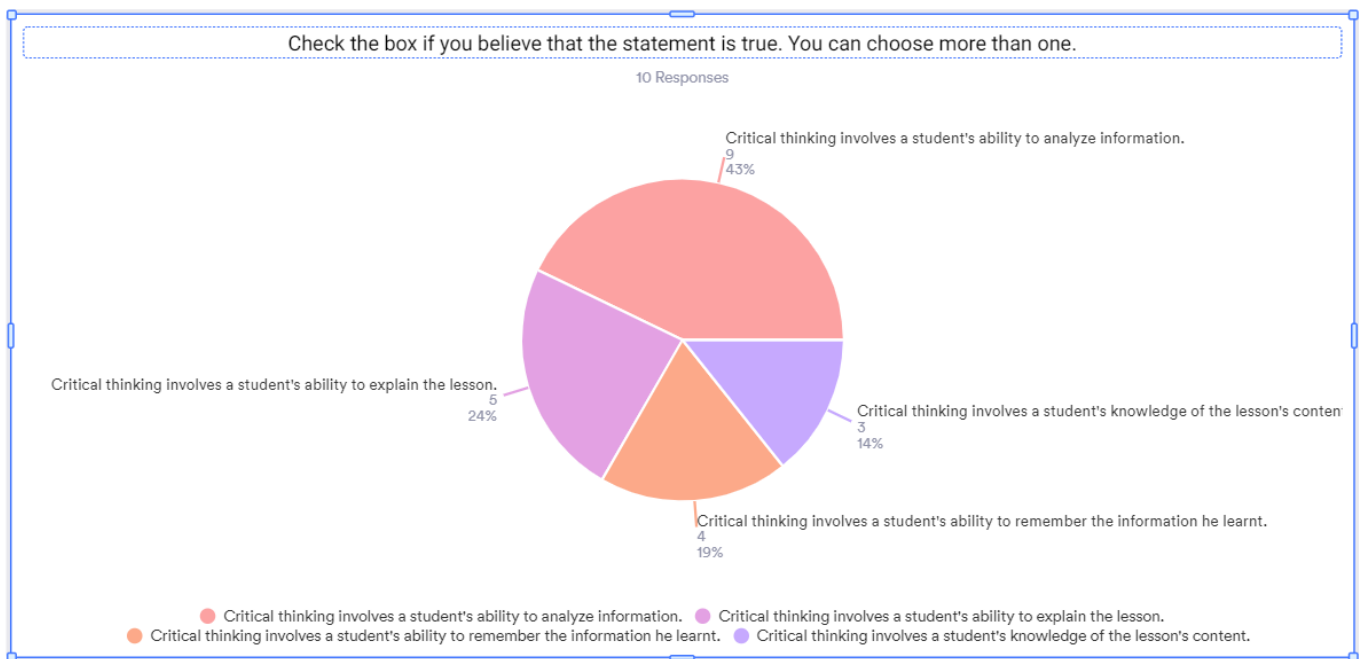
Figure 8 summarizes the ten teachers' understanding of what critical thinking entails. Nine of the ten teachers accurately understand critical thinking to mean analyzing information. However, only half of the teachers include the understanding of this concept to further include being able to explain the lesson. Elder and Paul (1994) find critical thinking to be the learners' ability to regulate their thinking. According to Facione (2011), this includes explanation of concepts, interpretation of data presented and analysis of the information. It is the structured process of

using and further enhancing the knowledge gained. As such, the chart in Figure 8 shows that four teachers misunderstand critical thinking to be remembering the information, and three to knowing it.

4.2.3.2. Critical Thinking and Technology

While there are misconceptions on the understanding of critical thinking, most teachers believe that integrating digital tools into the instructional design enhances the learners' critical thinking skills. One teacher, T1, expressed this skill to be more accessible to students who are above their grade level cognitively. As she presents a research task, the teacher notices those students analyzing and explaining what they have seen to the teacher. Also, those same students pose critical thinking questions that allow the teacher to detect their ability to work on a more complex task. Posing critical questions is one characteristic of enhancing critical thinking skills, according to Duron, Limbach & Waugh (2006). The students who are on-level, on the other hand, recap information they see through videos, emphasizing their content knowledge. One teacher stated, "When I ask them to research animals, for example, they watch [the video] and talk about what they watched. Mostly, Science topics can enhance critical thinking, though there is always integration of two or more subjects, like Math and Science." Although the online survey revealed that all teachers believed critical thinking is fostered in the three core subjects, T3, T5, T7 and T9 all expressed in the questionnaires that critical thinking is mostly promoted during the science sessions.

Another teacher, T2, stated that limiting a students' knowledge to books is not enough and may be outdated. The students can learn the content in the book, but extend their learning by researching and studying the topic in depth. T4 and T5, also, believed that students can learn

within a broader environment when digital tools are incorporated. T4 stated that students "are not just talking and writing about what they are learning, they are also learning to search, think and analyze on their own." This is a reflection of Facione's (2011) array of cognitive competencies that demonstrate critical thinking as process of interpretation, analysis, evaluation, inference, explanation and self-regulation. This, also, resonates with Dewey's Theory of Inquiry, where he maintained that children have a "instinct on investigation," where they have a natural proclivity to learn more about different things (Jackson 1998, p.420).

T2, further, emphasized the importance of using the internet, where students can research any topic. She believed that as students collect and learn more information, their curiosity sparks and motivates them to learn even more. This approach to learning will allow students to look at the same topic from even more perspectives, which will promote their critical thinking skills (Shelly, Gunter and Gunter 2010). This concept is reinforced by T3, who expressed her strong belief in the importance of laptops and projectors as digital tools for enhancing critical thinking for students. She stated that as students watch videos, they learn more information, and correlate the different concepts and notice patterns and relations in what they have learnt. She gave an example of students relating a concept they learned in science during their English lesson, where students who watched videos about tigers identified them as mammals. As students organize information, relating ideas to each other, the students are employing their critical thinking skill of analysis (Facione 2011).

In his research paper, van Gelder (2001) states that using technology further assists learners in developing their critical thinking capabilities. However, T5, a first-grade teacher, expressed that she finds the use of technology solely by students to be overwhelming to them. She proposes letting the students explore to get the point of view of a critical thinker, but making sure it is a

44

step-by-step process to ensure that students do not get confused. A second-grade teacher, T6, also, stated that when digital tools are used as a supplement to the teacher's explanation, they are a powerful tool. By themselves, they cannot be a sole drive for critical thinking for the students. The teacher's explanation and enhancement of what the video is referring to is important, especially for students who need further support in understanding the content. T7 expressed the importance of teacher input, where she stated that after the students watch a YouTube video, she re-represents the information to simplify the concept. Then, she asks the students to respond and reflect on what they learned. This drives the students to analyze the information, interpret it and explain it; all of which are critical thinking elements (Facione 2011; Shelly, Gunter & Gunter 2010). T7 stated that, using the same digital tools, "every student expresses their critical thinking with different approaches and strategies."

Additionally, T7 shared her experience of preparing the learning environment to include an online game as a task for students to practice their new math concept. She explains that the game presented the students with a more difficult task each time the student solved a question, enhancing their skills, and allowing them to deduce and learn how to solve a more difficult question by problem solving and analysis of what they have already learnt. This self-regulation of thinking is an important element defining critical thinking (Facione 2011).

In conclusion, all of the teachers believed that the use of digital tools widens the horizons of students, and found gamification to be a powerful element in encouraging the students to think critically, as they organized their mathematical thinking, for example, or enhanced their deduction abilities. Students correlated concepts and identified patterns as they analyzed and questioned. However, an emphasis was placed on teacher's input to guide the student thinking
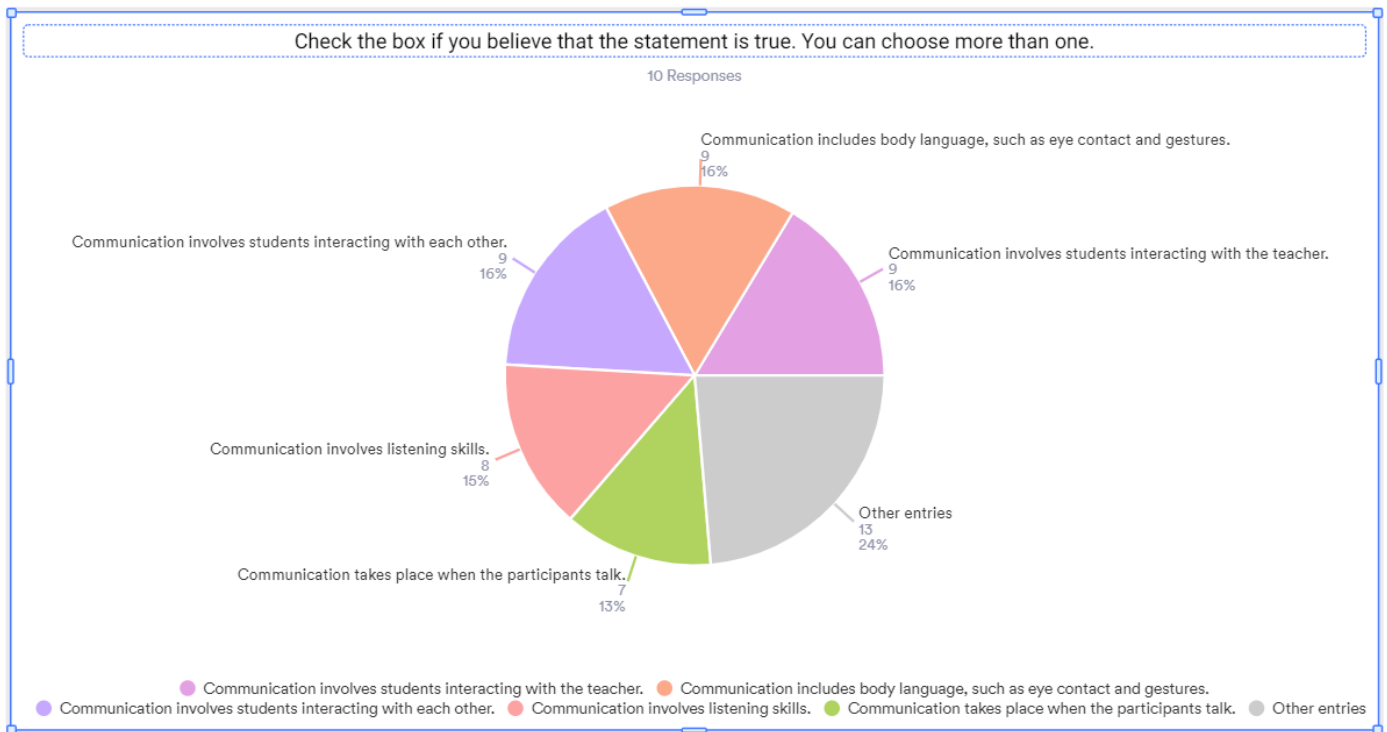
and analysis in a critical approach. This correlates with Vygotsky's Theory of Social Learning, where students learn by interacting with the teacher and more knowledgeable peers.

4.2.4. Communication

4.2.4.1. Understanding Communication

*Figure 9: Teachers' Understanding of Communication*

The chart in Figure 9 shows the understanding of teachers on the communication skill. Nine of the ten teachers accurately understood communication to be the multi-faceted concept of learners interacting with each other and with the teacher, including the use of body language and eye contact. Only seven found communication happening when the participants talk to each other, and a majority of eight believe communication include listening skills. To find out what the 'Other entries' category included, the researcher looked back at the statements that were included

in the survey. Two statements were found; Communication needs 2 or more people; When you

communicate you must be in the same physical space. All ten teachers rightfully believed the

first statement to be true. The second statement was found by three teachers to be a reflection of

communication. However, it is worthwhile to note that the introduction of ICT into the

classroom transformed communication and shifted it from its in-class boundaries to the world

beyond the classroom (Tardif 2005).

4.2.5. Collaboration

4.2.5.1. Understanding Collaboration

Figure 10: Teachers' Understanding of Collaboration
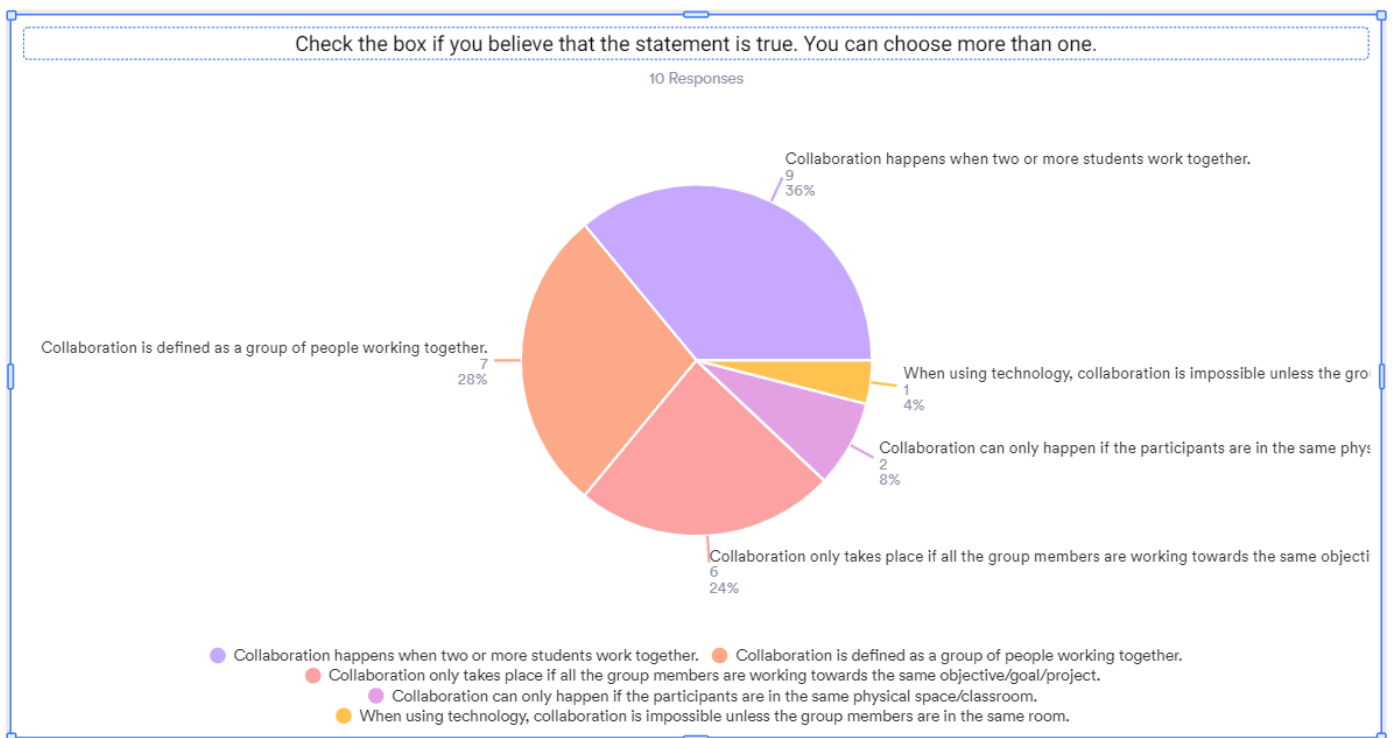
According to Moseley (2019), collaboration takes place when a group of people work together

towards a common goal, forming a team. The majority of teachers believe collaboration is

defined and happens when a group of people work together. Almost half of them, six, accurately believe that collaboration takes place when the members are working towards the same objective.

4.2.5.2. Collaboration, Communication and Technology

Most teachers correctly understand what communication is, as working together with others towards a common objective. However, for this to happen successfully, excellent speaking and listening communication skills are important. T1 finds that communication and collaboration go hand-in-hand, as students work together on simple tasks such as playing Kahoot! in teams. They discuss with each other the name of the team, which will require good interaction skills as they take into account their friends' input. The students arrange their seating, decide together on who will click the chosen answer, and communicate on taking turns. This is supported by Bebell and Kay's (2010) three-year research where they stated that technology promoted peer collaboration.

Likewise, T2 gives another example of technology enhancing collaboration in her classroom. She gives an example when her class was learning about planets, and the students shared laptops to collect, compare and analyze information from the internet to answer questions she had projected on her screen. T4 and T5 also, believed that digital tools can help with collaboration. T5 gave an example of giving the students a research question to find more about a season, animal or plant. The students talked to each other, and used the laptop to collaborate and produce a drawing that reflected their understanding of the topic. Amante's research paper (2007) indicated that verbal communication and collaboration, two important 21st century competencies, were enhanced when elementary learners interacted with laptops.

On the other hand, T6 finds that collaboration is very difficult to achieve when laptops are involved, as the student with the strongest personality takes over the laptop. Likewise, T3 finds that first graders are very shy, and the children with stronger and more assertive personalities tend to keep the laptops to themselves. She explains that, like other groupwork forms, one person may take over more workload than others. Therefore, she finds that first graders need to work on their collaborative skills before introducing laptops, too. Jacques and Salmon (2007) contend that collaborative work enhances emotional skills as students feels appreciated, and social skills when students feel part of a larger group.

T7 believes in the same concept of supporting the students when presenting digital content. She recounts the time she was introducing landforms and gave examples of mountains, plateaus and plains, with descriptions and pictures. The objective of the lesson was to have students create a model featuring several platforms. T7 showed the students a video of what the project looks like, and paused intermittently to explain the various materials used in the video. She, also, discussed how to rebuild and recreate the project using the materials they had in school such as clay, papers, and straws. This is supported by Tardif (2005), who argues that teaching requires that a teacher transforms thoughts and ideas, communicating with students, to reach the teaching aim. The teacher explains that as the students talked to each other on how to create mountains, they used different materials, while the videos helped them think of different ways to create the project. "Different people bring in different ideas, because it opens up horizons and can turn around the direction of the project," T7 explains. She asserts Problem Based Learning (PBL) in Science is a practical way to allow students to collaborate while using digital tools at such a young age. Many students began building the mountain and asked for brown playdough, T7

clarifies. When they started talking to each other, different students started building other landforms to create a unified structure within the allotted time frame of the science session.

T8 complements this argument by clarifying that a teacher's verbal explanation of a project is insufficient if there is no visual aid, such as a video, to further elaborate and display the idea. Instead of showing the students, hands on, a model of what is expected, a video can clearly demonstrate the idea. She gives an example when the students in her class were asked to build a bridge that could withstand weight. Displaying a video explaining the concept really enhanced their understanding and gave them a clear path to follow, as they learned about different bridge models, materials that can be used and bridge structures. After that, she explains, they had to talk to each other, listen to each other's ideas and perspectives, in order to build a proper bridge. The groups that had individuals working by themselves, without communicating with each other, had the weakest structure. A child's tendency to communicate and talk to others resonates with Dewey's Theory of Inquiry, which states that children have a "social instinct" (Jackson 1998, p.420).

T9, also, believes that using digital mediums such as a laptop motivates students to work on a project towards a common objective. However, T9 shares an example in her Science class, where students were given a laptop, in teams, and asked to present one difference and one similarity between plains and hills after an allotted thirty minutes. The class was divided into six teams, with groups of three to four students in each team. The different outputs, T9 explains, was surprising. While some teams came back with one or more areas of similarities and differences, some teams had nothing to share with the others. "These teams were not working together, and the boy with the laptop kept it to himself, while the others passively watched." The

communication, she clarifies, was lacking, and having a laptop seemed to widen the gap between the team members.

Therefore, teachers strongly found gamification to bring the students together to collaborate, as they aimed to answer questions correctly in order to win. In order to collaborate, the first-grade teachers clarified that the students had been shown and trained on how to communicate with their friends, listening to them, and taking turns. This allowed the students to work successfully on a project when they reached second grade. The biggest issue in collaboration at this young age, with or without technology, seems to be a result of their lack of practice on how to behave constructively in a group, as they are not ready, yet, to be participants of an effective collaboration. Teachers, again, expressed the importance of supporting the students throughout their collaboration on a project to further guide them on what is needed and how to move forward, especially when students interpret material from digital mediums to reach a learning objective together. Again, Vygotsky's Theory of Social Learning is evident as students communicated with each other, and their teacher, and worked together towards a common goal.

4.2.6. Creativity

4.2.6.1. Understanding Creativity

Figure 11: Teachers' Understanding of Creativity
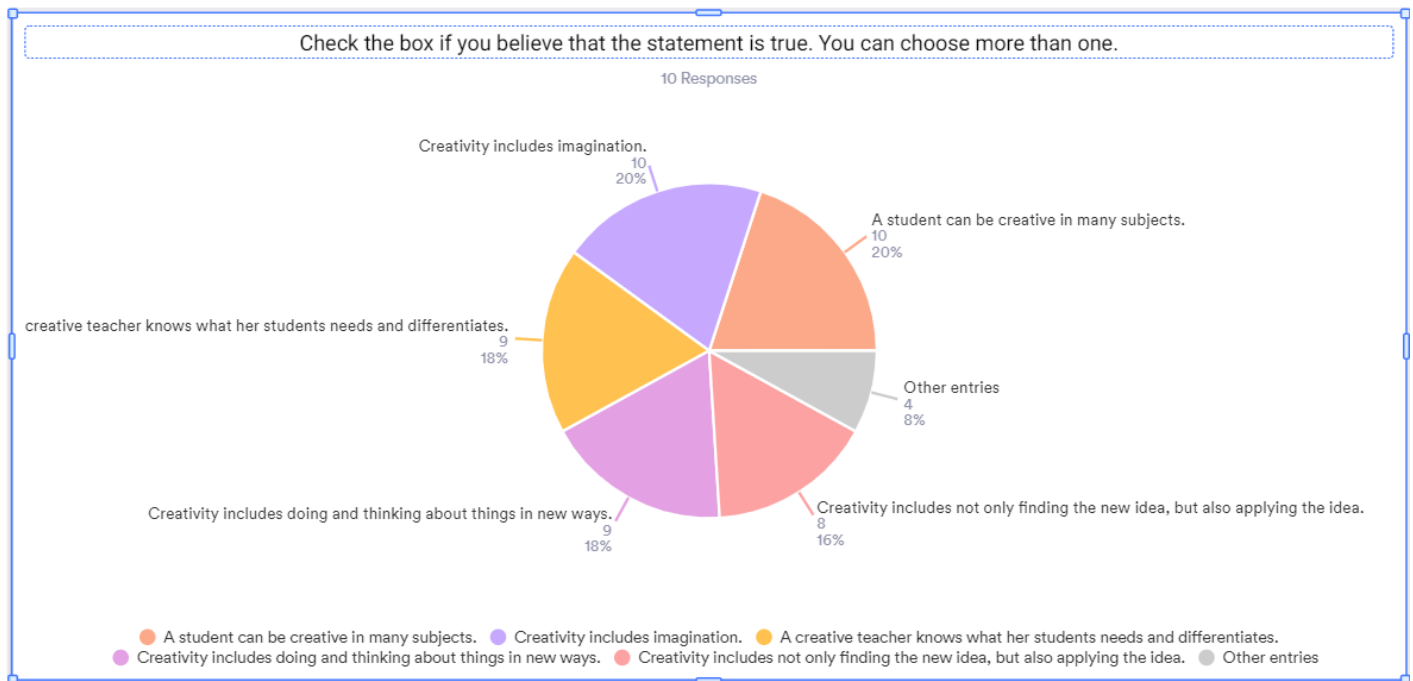
In the lower primary cycle, all teachers found creativity to, correctly, include imagination, which can be applied to many subjects. Most of the teachers also believed imagination to include out-of-the box solutions, and found teachers' creativity applicable in the classroom by catering to individual student needs. However, eight of the teachers found creativity to incorporate the implementation of the idea, which is innovation rather than creativity.

4.2.6.2. Creativity and Technology

While there is a uniform agreement on what creativity means and entails, there was a gap of how to implement digital mediums to drive this creativity. T1 saw laptops as a tool for research to

expand on ideas, and finding songs. She believes they cannot come up with creative material on their own using the laptops in their young age. However, Shelly, Gunter and Gunter (2010) argue that as students are equipped with digital tools that expose them to new mediums and ideas, creative learning is initiated and new ideas are fostered.

T2 finds that constantly exposing the students to digital tools will enhance their creativity as they interact, communicate and engage in challenging activities and explore more ideas by watching the huge content available online. This allows them, she believes, to come up with out-of-the-box solutions. T4 also expressed that when students learn new ways of representing their ideas, they start using those ways to get their thoughts across. ICT encourages them to explore the digital mediums and what they can accomplish using them. T6 adds to this idea by clarifying that students will create videos and express themselves with the videos as they come up with new innovations. These digital tools promote student creativity, as they, also, learn from their friends how to apply different ideas in different contexts.

Shelly, Gunter and Gunter (2010) contend that when the students use the digital tools present in the classroom to reflect their understanding, it promotes their creativity and higher-order thinking skills. T3 believes that this is true specifically in math, as it is more systematic. She explains that the laptop allows a student who is cognitively able to move on to the next level in a particular concept to move on and come up with new solutions to problems as s/he is guided by the digital tools. T5 shares an example when the students were creating cards for Mother's Day. "I had given them laptops, and each group created their own design. Then, I could see the next level of work, because they could see the idea on the laptop and they added on to that." Likewise, T8 finds that the internet widens the horizons of students as they watch and see ideas beyond the teacher's explanation or point of view. The students are bound to discover ideas and

notice solutions and small details that their teacher may miss, because they are looking for a different point of view; they are reflective inquirers, who use the digital mediums to know and reach further heights in their learning journey. T9, similarly, shares an example of her students learning about fresh and salt water and returning to school with a PowerPoint presentation. She explains that they used the skills they learned in their ICT class to create a presentation about coral reefs and rainforest animals, among other topics. The creativity and reflection on their learning inspired their classmates to do the same, and share with their classmates at every opportunity. Alberta Education (2011) states that innovation is founded in creativity, as students are encouraged to put their creative ideas into action.

In conclusion, students demonstrate their creativity when coming up with out-of-the-box, atypical solutions. Student horizons were extended when watching videos and being introduced to new ideas through digital mediums. Students, also, revealed their creativity when creating artforms that extended the ideas presented in digital tools. Students in second grade further used the digital tools to create presentations and reflect on their learning. The teachers shared that once a student shared a presentation, it motivated the students in the class to do the same. This, again, reflects Vygotsky's Theory of Social Learning, as students give each other ideas when interacting in class. Dewey's Theory of Inquiry is, again, evident as students demonstrated their "expressive impulse" as they had a natural instinct to create (Jackson 1998, p. 420).

Chapter 5: Summary, Conclusions and Recommendations

5.1.   Summary

This dissertation has looked into the integration of ICT tools for the purpose of promoting 21st century skills in students, in a lower primary cycle. The UAE's Vision 2021 aims at promoting the attainment of students and preparing them for the knowledgeable society it aims to build (UAE Government 2015; UAE Government 2019). Research has found that most teachers integrate technology into their classroom for the purpose of drill-practice, rather than fostering the higher order thinking skills it has the potential to foster (Smeets 2017). Therefore, this study looked at the perceptions of teachers on how they saw the importance of incorporating technology in the classrooms, and how they used this same technology to promote the four C's.

This study employed an interpretive qualitative approach to gathering perspective and information on how digital tools were employed in the classrooms. The setting is Dubai-based American-curriculum school. This study focused on the Lower Primary Cycle; the first and second grade classes, which make up a total of ten classes, taught by homeroom teachers. Non probability, complete collection sampling was chosen to include all the perspectives and inputs of the teachers.

A descriptive research approach was employed in this study to narrate and inform on the collected perceptions (Bhat 2020). Bhat (2020) maintains that descriptive research allows the researcher to find and report on patterns found in the demography. Descriptive research allows the researcher to look into different angles and deliver authentic findings as no variables are controlled. Further, descriptive research is grounds for further research on the topic, by replicating or extending the research questions in another context.

Ideally, a descriptive research would include observation as a primary data collection tool. It allows the researcher to note the natural and unchanged environment; by observing the interaction and communication of the students and the teacher, noting any nonverbal feelings (Kawulich 2005). However, this research was conducted during the worldwide pandemic of the Covid-19 coronavirus. Distance learning and nationwide lockdown prevented the researcher from using observation.

Instead, the survey research approach was chosen. Online surveys, questionnaires and interviews were implemented for this research study. Bhat (2020) states that a survey that includes close-ended and open-ended questions reveal sound quality data. Therefore, both question types were used for this study. The online survey questions included, mostly, close-ended questions. The entire sample of ten teachers responded to this survey. Questionnaires, on the other hand, included open-ended questions. While some teachers answered the questions in writing, other teachers preferred to answer the questions in an interview form by video-conferencing via the Zoom application. By implementing an interview, the questionnaire developed into a semi-structured interview that allowed the researcher to clarify details (Cohen, Manion & Morrison 2018). Nine of the ten teachers responded to the questionnaire, and to ensure anonymity, pseudonyms were imparted, where the five first grade teachers were named T1 through T5. T6 through T9 referred to the second-grade teachers.

To ensure internal validity, all interviews were transcribed and emailed for the teachers to add to, modify and verify as their responses. Mackey and Gass (2005) believe that although face validity refers to the genuine nature of the research questions and the interviewer's attitude, these can, nevertheless, lead to prejudiced conclusions on the part of the researcher. These were kept to a

minimal as the researcher iterated facts and examples, rather than feelings and emotional reactions (Holton, Strandbu & Eriksen 2013).

5.2.   Key Findings

Teachers found the digital tools to be an important element in the classrooms, as they believed that the new generation needed to be literate and well-educated in the digital tools of their time. Some of the teachers believed that adding digital tools to the classroom should not be the main emphasis when delivering instruction, as the students were too young, and needed to work on skills such as communication and collaboration, before adding the element of a digital medium. The teachers, also, found that the digital tools widened horizons and added valuable material to classes through their interactive element.

Although teachers unanimously agreed on the importance of integrating technology in classrooms, they were divided on the feasibility of utilizing this technology. In the classrooms, the projector and the laptops are the two digital mediums that are utilized. While accessibility and preparation of the projector were found to be effortless for all teachers, laptops were more difficult to acquire. Time, log-in and internet connection constraints complicated the process of attaining the laptops. Furthermore, a majority of teachers believe that the provision of laptops in the classroom is essential for familiarizing students to the use of technology, which, eventually, will support their creative endeavors. The use of a projector was found to promote classroom management, spark interaction between students, and enhance engagement.

In his paper, Kivunja (2015) contends that technology works hand-in-hand with the four C's to create an effective framework of 21st century skills. The teachers were inquired on their understanding of the four C's, and on their endeavors to incorporate technology to promote those

skills. Bebell and Kay (2010) revealed the emergence of a critical literacy skill when students worked in a digitally enabled environment. Although there were misconceptions of what critical thinking entails among the teachers, most of them accurately maintained that critical thinking included the ability to analyze, categorize and break down a concept into subparts. All of the teachers believed that the use of digital tools widens the horizons of students, especially as they watched videos, given their young age. Also, they found gamification to be a powerful element in encouraging the students to think critically, as they organized their mathematical thinking, for example, or enhanced their deduction abilities. The teachers distinguished this through questions students asked. As those students questioned and analyzed, they correlated concepts and identified patterns. Dewey's Theory of Inquiry is evident as students have an investigative instinct (Jackson 1998). In addition, teachers emphasized that the teacher's input is an important tool to guide the students towards thinking and analyzing the different concepts in a critical approach. This correlates with Vygotsky's Theory of Social Learning, where students learn by interacting with the teacher and more knowledgeable peers.

Likewise, the teachers strongly found gamification an element that brought the students together to collaborate, as they aimed to answer questions accurately. In order to collaborate, teachers guided the students on the skills they need to work in a group in a constructive method to achieve their goal. Again, teachers voiced the importance of supporting the students and guiding them in order to use the digital medium to achieve a learning objective. Vygotsky's Theory of Social Learning is manifested when students communicate and interact with each other, and their teacher, as they collaborate and work together towards a common objective. This is, also, evident in Dewey's Theory of Inquiry, where he proposes that children have a natural impulse to communicate with others (Jackson 1998).

The fourth C, creativity, involves using imagination and inventiveness. While many students show their creative side in their drawings, creativity can also mean coming up with out-of-the-box solutions. Teachers found that using the digital tools and watching videos allowed students to think in contexts outside their books and suggest new solutions to problems. In addition, students were creative in their artistic endeavors and added to their productions when using digital tools. Students produced presentations and shared their productions with their classmates, who, in turn, learned and created their own presentations. This, again, reflects Vygotsky's Theory of Social Learning, where student interaction is motivation for student learning and production. It, also, reflects Dewey's Theory of Inquiry, where students demonstrated their "expressive impulse" (Jackson 1998, p. 420).

5.3.   Implications and Recommendations

On the whole, this research has contributed to understanding how one of the many schools in Dubai is implementing the use of technology in the lower primary cycle, with the goal of promoting the 21st century skills of the students. While the skills of critical thinking, communication, collaboration and creativity have been pedagogically tackled and cultivated in students, adding digital mediums to, further, enhance these skills in line with the UAE vision is a novel ground to explore. The results have revealed challenges encountered and good practices that work towards the promotion of these skills. In addition, teachers imparted that implementing digital tools in the lower cycle was a successful medium, in congruence with prior research that has proven positive impact of digital tools on learning (Jesson et al. 2018; Amante 2007; Smeets 2017).

The study recommends the use of digital mediums in the lower primary cycle. Guiding the students on applying the 21st century skills while using these mediums is an important element to incorporate in pedagogy. Furthermore, gamification was found to be a tool that facilitated the attainment of the four C's, as it motivated the students in class. Students learn, produce and create as a result of the creative pedagogy implemented, and through digital mediums can widen their horizons and develop their imaginative competence.

5.4.   Limitations and Scope for Further Research

Nevertheless, further research will verify the findings, and shed more light on the successful practices and challenges when integrating technology into the curriculum design to enhance the essential skills of the students. In light of the limitation imposed by the current pandemic, incorporating observation to gather and triangulate data is an essential tool to use when replicating this study. A qualitative assessment that incorporates the observational tool will further note the successful practices of teachers and the difference in achieving the learning objective with and without implementing digital tools. Also, feedback from students as well as observing student interaction in class gives insight and valuable input to the constructive and useful practices when implementing digital mediums with the objective of promoting the four C's.

In addition, a limitation inherent to this research is the lack of the digital tools and laptops in the classroom setting. This poses a limitation to observing how influential a laptop, iPad or digital medium can be, if accessible to students, and how it can be integrated into classroom instruction to support the 21st century skills a student should be equipped with. A study that embraces a

setting with a more digitally enabled environment will yield different, and very valuable, outcomes.

This research, also, observed the practices and use of digital mediums in the lower primary cycle. Increasing the age level and looking at the integration of technology to support the higher primary cycle will allow educators to understand the shortcomings that teachers in the earlier years need to address and reinforce. It, also, will cast light at a pattern of challenges, good practices and weaknesses common to educators. This will impart the evidences and materials that the teachers need to effectively integrate through the technology they share to equip students with the 21st century skills they need, in line with the UAE's Vision 2021 (UAE Government 2015).

References

Adams, B. L., Cain, H. R., Giraud, V., & Stedman, N. L. (2012). Leadership, motivation, and teamwork behaviors of principal investigator's in interdisciplinary teams: A synthesis of research. *Journal of Leadership Education*, vol. 11 (2), pp. 176 – 191.

Advertiser. (2016). Ministry of education announces new curriculum. 6 October, p. 1. [Accessed 9 April 2020]. Available at: https://gulfnews.com/uae/education/ministry-of-education-announces-new-curriculum-1.1908029.

Alberta Education. (2011). *Framework for student learning: Competencies for engaged thinkers and ethical citizens with an entrepreneurial spirit* [online]. [Accessed 10 April 2020]. Available at: https://open.alberta.ca/dataset/4c47d713-d1fc-4c94-bc97-08998d93d3ad/resource/58e18175-5681-4543-b617-c8efe5b7b0e9/download/5365951-2011-framework-student-learning.pdf.

Amante, L. (2007). The ICT at elementary school and kindergarten. Reasons and factors for their integration. *Educational Sciences Journal*, vol. 3, pp. 49 – 62.

Applied Educational Systems (AES). (2020). *What are the 4 C's of 21st century skills?* [online]. [Accssed 16 March 2020]. Available at: https://www.aeseducation.com/career-readiness/what-are-the-4-cs-of-21st-century-skills.

Ary, D., Jacobs, L.C., Sorensen, C. & Razavieh, A. (2010). *Introduction to research in education*. 8th edn. Australia:Wadsworth CENGAGE Learning.

Barrouillet, P. (2015). Theories of cognitive development: from Piaget to today. *Developmental Review* [online]. Vol. 38 (1). [Accessed 14 March 2020]. Available at: https://www.deepdyve.com/lp/elsevier/theories-of-cognitive-development-from-piaget-to-today-Owz1y7WRxU.

Bebell, D., & Kay, R. E. (2010). One to one computing: a summary of the quantitative results from the Berkshire wireless learning initiative. *Journal of Technology, Learning and Assessment*, vol. 9 (2), pp. 4 – 59.

Bernarrd, J. (2020). Combatting covid-19: Dubai move permit needed even for pedestrians, cyclists. *Khaleej Times* [online] 7 April. [Accessed 17 April 2020]. Available at: https://www.khaleejtimes.com/coronavirus-pandemic/combating-covid-19-dubai-move-permit-needed-even-for-pedestrians-cyclists-.

Bhat, A. (2020). *Descriptive Research: Definition, Characteristics, Methods, Examples and Advantages* [online]. [Accessed 17 April 2020]. Available at: https://www.questionpro.com/blog/descriptive-research/.

Bikowski, D. (2014). The Pedagogy of Collaboration: teaching effectively with an evolving technology landscape. 4th *International Teacher Educator Conference* [online]. British Council. [Accessed 11 April 2020]. Available at: https://www.researchgate.net/publication/274252669_The_Pedagogy_of_Collaboration_teaching_effectively_within_an_evolving_technology_landscape.

British Council. (2014). *TNE graduate employability study: an analysis of graduate employment trends in Malaysia (a research study in three phases) phase I employability of graduates in Malaysia* [online]. [Accessed 9 April 2020]. Available at: https://www.britishcouncil.org/education/ihe/knowledge-centre/developing-talent-employability/analysis-graduate-employment-trends-malaysia.

British Educational Research Association (BERA). (2011). *Ethical guidelines for educational research 2011 – a summary* [online]. [Accessed 18 March 2020]. Available at: http://www.wickfordtsa.co.uk/rnd/BERA_Ethical_Guidelines_2011_-_A_Summary_WTSA_May_2018.pdf.

Cizek, G.J. (1997). 'Learning, achievement, and assessment: constructs at a crossroads', in G.D. Phye (ed). *Handbook of classroom assessment: learning, achievement, and adjustment.* London:Academic Press, pp. 2-29.

Cohen, L., Manion, L. & Morrison, K. (2018). *Research methods in education*. London:Routledge.

Dudovskiy, J. (2019). *Inductive Approach (Inductive Reasoning)* [online]. [Accessed 27 April 2020] Available at: https://research-methodology.net/research-methodology/research-approach/inductive-approach-2/.

Duron, R., Limbach, B., & Waugh, W. (2006). Critical thinking framework for any discipline. *International Journal of Teaching and Learning in Higher Education*, vol. 17 (2), pp. 160 – 166.

Elder, L., & Paul, R. (1994). Critical thinking: why we must transform our teaching. *Journal of Developmental Education*, vol. 18 (1), pp. 34 – 35.

Esdal, L. (2018). *Defining and Measuring Student-Centered Outcomes* [online]. [Accessed 16 March 2020] Available at: https://www.educationevolving.org/content/defining-and-measuring-student-centered-outcomes.

Ewing, J.C., Foster, D.D. & Whittington, M.S. (2011). Explaining student cognition during class sessions in the context Piaget's Theory of Cognitive Development. *NACTA Journal*, vol. 1, pp. 68 -75.

Facione, P. (2011). Critical thinking: what it is and why it counts. *Insight Assessment*, vol. 2007 (1), pp. 1 – 23.

Garba, S.A., Byabazaire, Y. & Busthami, A.H. (2015). Toward the use of 21st century teaching-learning approaches: the trend of development in Malaysian schools within the context of Asia Pacific. *International Journal of Engineering and Technology*, vol. 10 (4), pp. 72 – 79.

Gentles, S.J., Charles, C., Ploeg, J. & McKibbon, K.A. (2015). Sampling in qualitative research: insights from an overview of the methods literature. *The Qualitative Report*, vol. 20 (11), pp. 1772 – 1789.

Giraldo-García, R., Roy, M. & Alotebi, H. (2015). The interplay of technology and critical thinking skills in the 21st century blended classroom. *International Journal of Advanced Research in Education Technology*, vol. 2 (3), pp. 32 – 35.

Goldman, S.R. & Pellegrino, J.W. (2012). Now who will ask "what did you discover today"? a tribute to Robert Glaser. *Journal of the Learning Sciences*, vol. 21 (3), pp. 483 – 485.

Henrichsen, L., Smith, M.T. & Baker, D.S. (1997). *Taming the Research Beast: Research Methods in TESL and Language Acquisition* [online]. [Accessed 18 April 2020] Available at: https://linguistics.byu.edu/faculty/henrichsenl/ResearchMethods/.

Holton, A., Strandbu, A. & Eriksen, S.H. (2013). When emotions count in construction of interview data. *Nordic Social Work Research*, vol. 4 (2), pp. 99 – 112.

Huang, K.H., Hung, K. & Cheng, C. (2012). Enhancing interactivity in geography class: fostering critical thinking skills through technology. *Problems of Education in the 21st century*, vol. 50, pp. 32 – 45.

Irby, B.J., Brown, G., Lara-Alecio, R. & Jackson, S. (2013). *The handbook of educational theories*. North Carolina:Information Age Publishing, Inc.

Jackson, P.W. (1998). John Dewey's school and society revisited. *The Elementary School Journal,* vol. 98 (5), pp. 415 – 426.

Jacques, D. & Salmon, G. (2007). Learning in groups: a handbook for face-to-face and online environments. 4th edn. London:Routledge.

Jain, S., Dubey, S. & Jain, S. (2016). Designing and validation of questionnaire. *International Dental & Medical Journal of Advanced Research*, vol. 2, pp. 1 – 3.

Jesson, R., McNaughton, S., Wilson, A., Zhu, T. & Cockle, V. (2018). Improving achievement using digital pedagogy: impact of a research practice partnership in New Zealand. *Journal of Research on Technology in Education*, vol. 50 (3), pp. 183 – 199.

Kawulich, B.B. (2005). Participant observation as a data collection method. *Forum: Qualitative Social Research* [online]. Vol. 6 (2). [Accessed 19 February 2020]. Available at: http://www.qualitative-research.net/index.php/fqs/article/view/466/996.

Keiler, L.S. (2018). Teachers' roles and identities in student-centered classrooms. *International Journal of STEM Education* [online]. Vol. 5 (34). [Accessed 14 March 2020]. Available at: https://stemeducationjournal.springeropen.com/articles/10.1186/s40594-018-0131-6.

Kinvunja, C. (2015). Exploring the pedagogical meaning and implications of the 4Cs "super skills" for the 21st century through Bruner's 5E lenses of knowledge construction to improve pedagogies of the new learning paradigm. *Creative Education*, vol. 6 (2), pp. 224 – 239.

Kumar, S. & Daniel, B.K. (2016). Integration of learning technologies into teaching within Fijan polytechnic institutions. *International Journal of Educational Technology in Higher Education* [online]. Vol. 13 (36). [Accessed 16 March 2020]. Available at: https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-016-0036-8.

Laurillard, D. (2007). Technology, pedagogy and education: concluding comments. *Teaching and Learning Research Programme*, vol. 16 (3), pp. 357 – 360.

Mackey, A. & Gass, S.M. (2005). *Second language research: methodology and design*. London:Lawrence Erlbaum Associates, Publishers.

Mayer, S.J. (2008). Dewey's dynamic integration of Vygotsky and Piaget. *Education and Culture*, vol. 24 (2), pp. 6 – 24.

Michaelsen, L.K., Knight, A.B. & Fink, L.D. (2004). *Team-based learning: a transformative use of small groups in college teaching*. London: Praeger.

Michaelsen, L.K & Sweet, M. (2008). The essential elements of team-based learning. *New Directions for Teaching and Learning*, vol. 116, pp. 7 – 27.

Mativo, J.M., Womble, M.N. & Jones, K.H. (2013). Engineering and technology students' perceptions of courses. *International Journal of Technology and Design Education*, vol. 23, pp. 103 – 115.

Moseley, C. (2019). *7 reasons why collaboration is important*. [blog entry] [Accessed 11 April 2020]. Available at: https://blog.jostle.me/blog/why-collaboration-is-important.

McLeod, S.A. (2018). *Lev Vygotsky* [online]. [Accessed 9 March 2020] Available at: https://www.simplypsychology.org/vygotsky.html.

Miranda, G.L. (2007). The limits and possibilities of ICT in education. *Educational Sciences Journal*, vol. 3, pp. 39 – 48.

Murphy, D. (2016). A literature review: the effect of implementing technology in a high school mathematics classroom. *International Journal of Research in Education and Science*, vol. 2 (2), pp. 295 – 299.

Nassaji, H. (2015). Qualitative and descriptive research: data type versus data anaylysis. *Language Teaching Research*, vol. 19 (2), pp. 129 – 132.

Nasir, S. (2019). Expect more high-tech tools in UAE schools from this year on. *Khaleej Times* [online]. 13 January.

National Research Council. (2012). *Education for life and work: developing transferable knowledge and skills in the 21st century* [online]. [Accessed 10 April 2020]. Available at: http:// sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/ dbasse_070895.pdf.

Norris, Stephen P. (1985). Synthesis of research on critical thinking. *Educational Leadership*, vol. 42 (8), pp. 40 – 45.

Nuckles, C.R. (2000). Student-centered teaching: making it work. *Adult Learning*, vol. 11 (4), pp. 5 – 6.

Ontario Public Service (OPS). (2016). *21st century competencies: foundation document for discussion: phase 1 towards defining 21st century competencies for Ontario* [online]. [Accessed 10 April 2020]. Available at: http://www.edugains.ca/resources21CL/About21stCentury/21CL_21stCenturyCompetencies.pdf.

Orangization for Economic Co-operation and Development (OECD). (2014). *PISA 2012 results: creative problem solving: students' skills in tackling real-life problems* [online]. [Accessed 13 April 2020]. Available at: https://www.oecd-ilibrary.org/education/pisa-2012-results-skills-for-life-volume-v_9789264208070-en.

Oxford Learner's Dictionary [online]. (2020). [Accessed 11 April 2020]. Available at: https://www.oxfordlearnersdictionaries.com/definition/american_english/communication.

Pavlis, D. & Gkiosos, J. (2017). John Dewey, from philosophy of pragmatism to progressive education. *Journal of Arts and Humanities*, vol. 6 (9), pp. 23 – 30.

Pennington, R. (2017). Dubai schools to focus on 21st century skills. *NUAE* [ONLINE]. 21 July.

Phye, G.D. (1997). *Handbook of classroom assessment: learning, achievement, and adjustment*. London:Academic Press.

Sanders, R. (2006). The "imponderable" bloom: reconsidering the role of technology in education. *Innovate: Journal of Online Education* [online]. Vol 2 (6). [Accessed 10 April 2020]. Available at: https://nsuworks.nova.edu/cgi/viewcontent.cgi?article=1125&context=innovate.

Selkrig, M. & Keamy, R.K. (2017). Creative pedagogy: a case for teachers' creative learning being at the centre. *Teaching Education*, vol. 28 (3), pp. 317 – 332.

Shaaban, A. (2020). Coronavirus in UAE: distance learning to continue until end of academic year. *Khaleej Times* [online] 30 March. [Accessed 17 April 2020]. Available at: https://www.khaleejtimes.com/coronavirus-outbreak/coronavirus-in-uae-distance-learning-to-continue-until-end-of-academic-year.

Shadish, W.R., Cook, T.D. & Campbell, D.T. (2001). *Experimental and quasi-experimental designs for generalized casual inference*. 2nd edn. Boston:Cengage.

Shelly, G.B., Gunter, G.A. & Gunter, R.E. (2010). *Integrating technology and digital media in the classroom.* 6th edn. Boston:Course Technology Cengage Learning.

Sivakumaran, T., Garcia, K., Jones, Q., Choi, J. & Dawson, M. (2012). Student perceptions of multimedia technology integrated in classroom learning. *International Journal of Humanities and Social Science*, vol. 2 (11), pp. 67 – 70.

Smeets, E. (2005). Does ICT contribute to powerful learning environments in primary education? *Computers & Education*, vol. 44, pp. 343 – 355.

Stosic, L. (2015). The importance of educational technology in teaching. *International Journal of Cognitive Research in Science, Engineering and Education*, vol. 3 (1), pp. 111 – 114.

Surendran, P. (2012). Technology acceptance model: a survey of literature. *International Journal of Business and Social Research*, vol. 2 (4), pp. 175 – 178.

Szparagowski, R. (2014). *The effectiveness of the flipped classroom* [online]. [Accessed 9 April 2020]. Available at:
https://scholarworks.bgsu.edu/cgi/viewcontent.cgi?article=1118&context=honorsprojects.

Tardif, M. (2005). Communication technology and pedagogical power [online]. *Research* Gate. [Accessed 11 April 2020]. Available at:
https://www.researchgate.net/publication/266371989_Communication_Technology_and_Pedagogical_Power.

Thomas, P.Y. (2010). *Towards developing a web-based blended learning environment at the University of Botswana* [online]. Ph.D. Thesis. University of South Africa. [Accessed 27 April 2020]. Available at: http://uir.unisa.ac.za/handle/10500/4245.

Toronto: Ontario Ministry of Education (Ontario MOE). (2013). *Great to excellent: launching the next stage of Ontario's education agenda* [online]. [Accessed 10 April 2020]. Available at:
http://michaelfullan.ca/wp-content/uploads/2016/06/13599974110.pdf.

United Arab Emirates (UAE) Government (2015). *United Arab Emirates school inspection framework* [online]. [Accssed 16 March 2020]. Available at:
https://www.khda.gov.ae/Areas/Administration/Content/FileUploads/Publication/Documents/English/2015-52-24-08-34-KHDA_INSPECTION_FRAMEWORK_EN.pdf.

United Arab Emirates (UAE) Government (2019). *Quality Education* [online]. [Accessed 10 April 2020]. Available at: https://u.ae/en/about-the-uae/leaving-no-one-behind/4qualityeducation.

University of Leeds. (2001). *A general introduction to the design of questionnaires for survey research* [online]. [Accessed 17 April 2020]. Available at: https://nats-www.informatik.uni-hamburg.de/pub/User/InterculturalCommunication/top2.pdf .

Van Gelder, T. (2001). *How to Improve Critical Thinking Using Educational Technology* [online]. [Accessed 11 April 2020]. Available at:
https://www.ascilite.org/conferences/melbourne01/pdf/papers/vangeldert.pdf.

Williams, M.K. (2017). John Dewey in the 21st century. *Journal of Inquiry & Action in Education*, vol. 9 (1), pp. 91 – 102.

Westwood, P. (2016). *Teaching and learning difficulties: a cross-curricular approach*. 2nd edn. Australia:ACER Press.

Appendix A

Teacher Questionnaire

Dear Supportive Team,

Your opinion not only matters, but is the most meaningful input I can possibly hope for. The school name and your names are completely anonymous. This is a study to look for possible and practical solutions to problems that teachers face every day, as teachers are overwhelmed worldwide and no school system is ideal.

1. In the classroom, some teaching time is spent on classroom management, and some time to get books and materials ready. How do you find the use and preparation of digital tools an important element that the lesson absolutely cannot do without? Is it really essential to spend time on using them?

2. Do you consider the whiteboard/projector a digital tool in your classroom that enhances the students' skills? How do you think using laptops is different?

3. Of course, getting the laptops and digital media ready should be done ahead of time. Do you find time during the school day to ensure your digital media is ready?

4. YouTube videos give students access to a wide range of information about the topics, and allow the students to look at the same topic from different perspectives. This enhances their critical thinking skills.

   Do you usually find that incorporating digital tools in the lessons fosters students' critical thinking? If yes, how do they express their critical thinking?

5. Collaboration happens when all group members work towards the same objective/project. For this to happen, excellent communication (speaking and listening) skills are important. Can digital tools help in communication and/or collaboration? Can you share an example?

6. Creativity involves using imagination and inventiveness. While many students show their creative side in their drawings, creativity can also mean coming up with out-of-the-box solutions.
In your teaching practice, do you find that ICT helps promote student creativity in any of its forms?

Appendix B

Teacher Survey

Please take a moment to fill out this survey

Which grade level do you teach? *

[_____]

1 OR 2

Other

Not a teacher

How many years of teaching experience do you have? *

0-2 years

2-5 years

5-10 years

Over 10 years of experience

Schools are working towards equipping students with the 21st-century skills they need to become life-long learners. ICT tools are used to this end.

The 21-century skills include the 4 Cs:

critical thinking,

communication,

collaboration, and

creativity

Critical Thinking

Check the box if you believe that the statement is true. You can choose more than one. *

Critical thinking involves a student's knowledge of the lesson's content.

Critical thinking involves a student's ability to explain the lesson.

Critical thinking involves a student's ability to analyze information.

Critical thinking involves a student's ability to remember the information he learnt.

1

In the classroom, do students apply critical thinking skills:

In English: *
 Yes
 No

In Math: *
 Yes
 No

In Science:
 Yes
 No

Think about the classroom. Do digital tools (YouTube videos/ online games/ laptops/ and others) promote student's critical thinking skills:

In English: *
 Yes
 No

In Math: *
 Yes
 No

In Science: *
 Yes
 No

Communication

2

Check the box if you believe that the statement is true. You can choose more than one. *

    Communication involves students interacting with each other.

    Communication involves students interacting with the teacher.

    Communication involves listening skills.

    Communication includes body language, such as eye contact and gestures.

    Communication happens in writing.

    Communication takes place when the participants talk.

    Communication needs 2 or more people.

    When you communicate you must be in the same physical space.

In the classroom, do students apply communication skills:

In English: *

    Yes

    No

In Math: *

    Yes

    No

In Science: *

    Yes

    No

Think about the classroom. Do digital tools (youTube videos/ online games/ laptops/ and others) promote students' communication skills:

In English: *

    Yes

    No

3

In Math: *

    Yes

    No

In Science: *

    Yes

    No

Collaboration

Check the box if you believe that the statement is true. You can choose more than one.

    Collaboration happens when two or more students work together.

    Collaboration can only happen if the participants are in the same physical space/classroom.

    Collaboration only takes place if all the group members are working towards the same objective/goal/project.

    Collaboration is defined as a group of people working together.

    When using technology, collaboration is impossible unless the group members are in the same room.

In the classroom, do students apply collaboration skills:

In English: *

    Yes

    No

In Math: *

    Yes

    No

In Science: *

    Yes

    No

Think about the classroom. Do digital tools (youTube videos/ online

4

games/ laptops/ and others) promote students' collaboration skills:

In English: *
  Yes
  No

In Math: *
  Yes
  No

In Science: *
  Yes
  No

Creativity and Innovation

Check the box if you believe that the statement is true. You can choose more than one. *
  Creativity includes imagination.
  Creativity includes doing and thinking about things in new ways.
  Creativity includes not only finding the new idea, but also applying the idea.
  A student can be creative in many subjects.
  A creative teacher knows what her students needs and differentiates.
  You are either born creative or you are not.
  Creativity is the same as innovation.

In the classroom, can students be creative and apply creativity:

In English: *
  Yes
  No

In Math: *

Yes

No

In Science: *

Yes

No

Think about the classroom. Do digital tools (youTube videos/ online games/ laptops/ and others) promote students' creative skills:

In English *

Yes

No

In Math: *

Yes

No

In Science: *

Yes

No

As a homeroom teacher who is trying to reach the learning objective every day:

How do you feel about digital tools promoting skills while you are trying to achieve the learning objective? Useful? Depends on the subject?

Submit

Appendix C

Informed Agreement Email

Dear (x),

As you know I am wrapping up my Master's Degree in Education with the focus of Management, Leadership, and Policy at The British University in Dubai. This term I am working on my dissertation. My research topic is The Management of Technology towards Equipping Students with 21st Century Skills: Its Implementation in Lower Primary Pedagogy.

I am looking at how ICT tools are used in grades 1 and 2 to prepare students for 21st-century skills. These are 6 skills, but I will be examining only the 4 that have been proven measurable in research: critical thinking, communication, collaboration, and creativity/innovation.
Through a survey and a questionnaire, I aim at exploring how teachers use ICT to equip the students with these skills, their understanding of what these skills are, and their personal view of how these skills can really be fostered in students with the current learning objectives.

I aim at achieving all this, and I cannot be successful without your support and guidance. I do hope you will give me the approval to pursue this research question in our school. Needless to say, the school's name, teachers' names and any identification are going to be completely anonymous. Any teacher who does not wish to be involved is free to not participate in the study, though my success is unachievable without my team's support. If the school requests it, I will gladly share my results with you.

An official letter from the university is attached herewith. I hope you will grant me your approval.

Stay safe!
Kind regards,

Appendix D

Cover Letter for Teachers

Dear team,

A year ago, I started my journey in the Master's degree path by myself. However, now that it is coming to an end, my success cannot be arrived at without your support.

The current, uncertain times that we are at have made my dissertation composition even more difficult. I cannot conduct observations or sit and have a chat with you. The only solution is your contribution to the survey and short questionnaire that I have created.

I am trying to answer the question: how are ICT tools (online games, videos, laptops) equipping students with the 21st century skills they need. My aim here is not to judge, as all names are anonymous. I need honest data to create a successful essay.

The survey is T/F. The questionnaire I will send to you. You can choose to answer it in writing, make a phone call and just orally tell me what the answers are, or we can conduct a zoom meeting. I apologize for I am the one person who knows how much work we have. But I really cannot move forward without your support.

I thank you in advance for the time you are giving me, and apologize for the inconvenience. Stay home team, and stay safe!

Appendix E

Letter of Consent

www.buid.ac.ae

April 16, 2020

This is to certify that **Mrs. Hiba Abu Zahra** with student ID number **20189621** is a registered part-time student on the **Master of Education in Management Leadership and Policy** programme at **The British University in Dubai** since **April 2019.**

Mrs. Abu Zahra has successfully completed her taught modules and is currently working on her dissertation titled **"The Management of ICT in Lower Primary Pedagogy".**

She needs your support in conducting surveys and distributing questionnaires to complete her research.

This letter is issued on student`s request.

Yours sincerely,

Amer Alaya
Head of Student Administration