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DIGITAL TRANSFORMATION IN SECONDARY EDUCATION: A CASE STUDY OF ICT USAGE IN GEORGETOWN GUYANA

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ABSTRACT

The importance of educational technology and its use are becoming a standard in the conventional classroom, and the rapid pace of technological change in education itself has made it difficult for instructors to keep up with ICT integration in teaching. This study focuses on digital transformation in education and key ICT patterns as well as synchronization between ICT and instruction for academic improvement. Digital transformation trends in education have been used as a conceptual framework to determine whether the use of ICT tools and/or resources has, through an exploratory case study, transformed secondary education in Georgetown Guyana. This research also focused on teachers' awareness of the usefulness and use of ICT tools, as well as other factors such as the ability to use ICT tools, the purpose of use, and so on. By using an online survey and interviews, participants generated data primarily aimed at gathering teachers' views and opinions on their experiences of teaching using ICT. The findings revealed that secondary education in Georgetown is on the path to digital transformation due in part to the strong drive of the government to integrate ICT into the national education system, and the use of ICT tools and teaching resources by secondary teachers.

1. INTRODUCTION

This research investigates whether secondary education in Georgetown Guyana has been digitally transformed through the use of ICT tools and/or resources, and the chapter covers background information on the topic, the problem statement, goals and research questions that guided the researcher, the study overview and the study's significance and scope.

1.1. Background Information

Over the past few years, the term 'digital metamorphosis' has been synonymous with the adoption of new technologies and new innovations (Haq 2006; Keary, 2019). Digital transformation or 'advanced change' in this context refers to advances in digital technology applications, more so 'computerized innovation applications' and their integration into all social spheres. It moves from physical to advanced or from physical to digital. (What is Digital Transformation … 2019)

The most straightforward definition of digital transformation, in a way, refers to the change within an institution related to the use of advanced innovation (i.e., digital technology application). The shift in this new reality stems from changing tasks that rely on development and innovation, rather than simply improving conventional strategies. (Ismail, 2017) These digital technologies essentially enable institutions to reinvent themselves by shifting their focus to discover and exploit new valuable resources (The Digital Culture Journey … 2017).

Furthermore, digital transformation programs promote the ongoing acceleration of transformation through improved working methodologies, which in turn offers significant benefits to all users (Kennah 2016; Learning in the digital age … 2019; Smits 2013). In the context of digital education, however, putting students first is a top priority. And as such, both educational authorities and institutions need to reinvent themselves by shifting their focus to digital innovation, as it is unfathomable to try and imagine what the digital world will offer students in the next decade given the profound impact that technological improvements are now making in the classroom. (*Ibid.*) This implies that apart from having the necessary framework, application development, new

communication models, etc. (which is paramount in the digital world), governments and educational authorities need to implement and maintain an effective cost-benefit analysis structure to be well positioned to shape the future of learning. This is essential if the student is to be first in this new digital landscape, ensuring that the benefits of digital innovation in education are freely and readily available and easily accessible to all. (*Ibid.*)

The process of digital transformation can be considered as 'technology' (although inherently 'digital') that provides resources to solve traditional problems, based on the above premise and for this study's purpose. Therefore, the 'digital' resources allow teachers to solve traditional issues. These 'digital solutions' are preferred over time over traditional ones, leading to a 'digital transformation.'

Moreover, complex educational challenges in today's digital world require' smart solutions,' and on that note 'digital transformation' becomes a 'need' requiring 'simplicity, efficiency, and sustainability' (Digital Transformation … 2019; Geoffrey 2016; Kinaanath 2013). Moreover, in an era of technological revolutions encompassing digital transformation "characterized by the connection between physical and digital systems, from complex analysis through big data, the use of smart and Internet-based machines," the role of ICTs is a strategic function within institutions (Digital Transformation & Iot … 2019; Haq 2006; Smits 2013). So much so that many educational institutions in today's society use digital infrastructures, more so information communication and technology (ICT) tools (such as computers, laptops, desktops, data projectors, software programs, printers, scanners, etc.) (What is ICT Tools … 2019) to complete a digital transformation with "tangible, offline, real-world success" resulting in both efficiency and effectiveness.

It is also inevitably apparent that ICT learning and best practices provide additional benefits to institutions to facilitate their transformation and transition into the new digital era (Geoffrey 2016, Kareji 2016; Kennah 2016; Smits 2013; The Digital Culture Journey … 2017).

1.2. Statement of the problem

Regarding digital education, putting students first is a top priority, and ICT tools and resources allow educational institutions to harness and use technology to complement and enhance the process of teaching and learning. However, despite the enormous emphasis placed on the

integration of technology in the classroom, government funding and the donation of ICT hardware to schools, Guyana's Ministry of Education still faces the challenge of how the learning process for students can be transformed; as one of its main objectives is to equip high school graduates with the ICT skills needed for the workplace. If this issue is not addressed, there would be little interest in the Ministry of Education's focus on integrating technology into the classroom, so any improvement in teaching and learning would be slow. As such, the specific impacts of the accessibility, availability, and usability of ICT tools (Geoffrey, 2016) and resources for secondary teachers are an inherent concern that warrants further research.

1.3. Aim of the Study

The purpose of this research is to determine whether the usage of ICT tools and/or resources has digitally transformed secondary education in Georgetown Guyana, by using an exploratory case study to make relevant recommendations.

1.4. Research Questions

The research questions mentioned below will be used to discuss this study:

1. How relevant are ICT tools in the process of teaching and learning?
2. Why are ICT tools used by teachers and students?
3. How did the use of ICTs digitally transform secondary education in Georgetown Guyana?

1.5. Overview of the Study

In an educational context, this introductory section provides a foundation for digital transformation. The digital scene is generally painted, illuminating the development of ICT's role in instruction. The purpose behind setting out on this investigation is arranged around the research issue, motivation, questions, overview, significance, and scope. (Yancy, 2013)

Chapter 2 reviews the theoretical framework for this study. Since this is an exploratory study, the literature surveyed includes digital transformation trends in education, ways to bring digital transformation to education, and ways in which ICTs help education (*Ibid.*).

Chapter 3 provides details of the methodology used, ranging from the selected conceptual framework justification by the researcher, research approach, and research design. Reliability and validity issues are also discussed. (Yancy, 2013)

Chapters 4 and 5 discuss the background of the case and the key findings related to the research questions respectively. Chapter 6 addresses the research questions by mapping them out and placing them among the literature being scanned. Chapter 7 examines the implications of findings for policymakers, school administrators, teachers and future directions of research. (*Ibid.*)

1.6. Significance of the Study

This case study is expected to be important for Guyanese policymakers and school administrators, primarily because it will support policymakers at the Ministry of Education and teachers in promoting ICT use in schools, as well as an opportunity to break down educators' and policymakers' views on technology integration in the classroom. Furthermore, school administrators and policymakers will be encouraged to generate better ideas to encourage the implementation of ICT in the teaching and learning process and to select reasonable techniques to screen changes in the educational system identified with the use of ICT tools and resources (Geoffrey, 2016).

1.7. Scope

The investigation was conducted during March and April 2019 to determine whether the use of ICT tools and resources had digitally transformed secondary education in Georgetown Guyana. A specific focus was on the various types of ICT tools used by educators and students, and more on how ICT devices are used along with the purpose of their use.

1.8. Chapter Summary

The chapter gave an introduction to the study. It covered areas such as the background of the study and the problem statement, the purpose of the study, the research questions, an overview of the

study's organization, as well as the study's significance and scope. The following chapter focuses on the theoretical framework of the study.

2. THEORETICAL FRAMEWORK

This section is based on building the subject setting, identifying the research gaps, increasing applied and methodological bits of knowledge on the focus point to investigate the research issue and providing a system to connect the discoveries with the meager existing knowledge base on digital transformation in education (Yancy, 2013).

2.1. Digital Transformation Trends in Education

Theoretically, digital transformation trends are a game-changer in education, and today, state-funded schools or those in the public education system are often not the earliest adopters of new technology. As such, compared to other sectors, digital transformation trends in education tend to move a little slower. (Almadhour 2010; Burns 2018; Newman 2018; Yancy 2013) Moreover, most educational processes (for all intents and purposes) have remained unchanged for quite some time not so long ago and perhaps until recently (Burns 2018; Yancy 2018). On the other hand, it is fortunate that there is an advanced shift (or digital transformation) to drive highly skilled and successful customized, digital learning strategies (Almadhour 2010; Lopez 2018; Yancy 2013).

Moreover, since technology is prevalent in many facets of learning: from the physical format of classrooms (with PCs and smart boards) to the arrangement of exercises and the evaluation of results (e.g. automated grading and engagement tracking) (O'Neill, 2018), the impact of a modernized school can be transformative for learning outcomes in keeping students actively engaged as it is a huge challenge (Geoffrey 2016; Kinaanath 2013; Laronde 2010; Lopez 2018; Yancy 2013). The digital revolution did not overlook education, and finally more educational institutions (such as schools and universities) started radical change (Ilomäki 2008; Smits 2013). That said, and with all things considered, it is highly likely that the education sector will experience a complete digital metamorphosis over the next decade. (Almadhour 2010; Burns 2018)

In the subsequent paragraphs, some of the most crucial and promising trends in digital transformation will be discussed that will have an immense impact on education (Burns 2018; Lopez 2018; Newman 2018; O'Neill 2018).

1. *Augmented and Virtual Reality* — are examples of game-changing technologies whose suggestions are hard to anticipate, and potential applications in the education sector are monstrous. Some examples include allowing students to select their learning environment, providing direct experiences of something that cannot be cultivated in a different way (such as visiting ancient cities) (Rubenstein, 2018), and empowering students to cooperate with educators and their peers through virtual reality (Burns 2018; Newman 2018). Moreover, although the overall use of these advances is not yet fully understood, it is evident that both increased and virtual realities can potentially build intelligence, immersion, coordinated effort, and attention (Burns, 2018).

2. *Personalized Learning* — the last few decades have seen a steady move towards progressively customized or personalized learning. As instruction innovation improves, more approaches are being discovered by educators to open their students to individualized learning. (Akir 2006; Rubenstein 2018; Tochukwu 2015) Digital transformation patterns of blended and adaptive learning are two ways to adjust or customize educational experience (Burns 2018; Lopez 2018; Newman 2018; O'Neill 2018).

a. *Blended Learning* — Educators are always keen to relate the value of learning student ownership, and blended learning customizes exercises that allow students to focus on discovery and make their own inferences (Kolbakova, 2014). The idea is to integrate innovation with up-to-date and personal interactions and collaborations (such as a mobile learning platform or other online environments). (Burns 2018; Kinaanath 2013; Lopez 2018; O'Neill 2018; Saqib Khan et al. 2015; Tochukwu 2015)

b. *Adaptive Learning* — provides students with more opportunities to plan their own educational paths. Adaptive learning innovation generally breaks down a student's input and quickly changes the student's learning materials and assessments. Adaptive learning tools can also improve classroom dexterity and enhance student accomplishment. (Lopez 2018; Newman 2018)

3. *Student-Led Learning* — In the wake of explaining it to others, most people expand their understanding of a topic and will remember making presentations during their childhood. The mind is effectively and significantly focused or 'engaged' in teaching, and even though teachers have long used student-led learning in their classrooms, twenty-first-century instruction has brought student-led learning into a whole new dimension with remote frameworks, wireless presentation systems, and mirroring devices. (Akir 2006; Alharbi 2014; Almadhour 2010; Al Mofarreh 2016, Kinaanath 2013; Laronde 2010; Lopez 2018; Smits 2013; Yancy 2013)

4. *IoT (Internet of Things)* — Many schools are planning to be furnished with smart classrooms as they grasp digital transformation (Burns 2018; O'Neill 2018). Smart Classrooms are upgraded classrooms that foster opportunities for teaching and learning by incorporating technology and specialized software that tracks student performance through related IoT (Internet of Things) technologies (Burns 2018; Newman 2018; O'Neill 2018). It is also expected that the IoT (Internet of Things) will have a profound impact on school activities in the future (Newman 2018; O'Neill 2018). In addition to the IoT (Internet of Things) technology that clearly supports learning, schools are also consolidating air conditioning and lighting systems as well as frameworks for waste management to improve productivity (O'Neill, 2018).

5. *Artificial Intelligence (AI)* — can support individualized education learning by understanding the needs of each student to ensure they are equipped with the materials they need to succeed (Newman 2018; O'Neill 2018). This can be conceived by mentoring enabled by artificial intelligence, artificial intelligence that delivers immediate feedback, prompt output, and more (Burns 2018; O'Neill 2018). Additionally, Artificial Intelligence can be used to speed up review techniques and grading procedures that give educators a greater opportunity to focus on the needs of their students when used in this way (Burns 2018; Newman 2018; O'Neill 2018).

6. To evaluate and enhance courses and educational modules or potentially educational programs, schools use — *Big Data* (Newman 2018; O'Neill 2018). While customized learning is about individual students' needs, Big Data can encourage teachers to improve their classes gradually (Lopez 2018; Newman 2018; O'Neill 2018; Smits 2013). As student engagement and achievement data are collected through IoT (Internet of Things) devices and Artificial Intelligence interfaces, this data can then be broken down to understand patterns indicating where students are most actively engaged or areas where improvements can be made (*Ibid.*).

7. *Gamification* — For quite some time, many educators seemed to have felt that learning and playing were completely unrelated (Burns, 2018). However, games can address issues that educators have faced for ages, and they are constantly searching for motivating and engaging games to implement in their classrooms (Lopez, 2018; Tochukwu 2015). This is because games provide a brief analysis of exercises as opposed to memorizing sections or equations and allow students to learn by doing (Burns, 2018). In addition, educators can actively engage students while reinforcing low-level and high-level concepts by using this trend of digital transformation in the classroom (Lopez 2018; Yancy 2013). Gamification encourages students to use their understanding (for all purposes) and to solve real-life problems (Burns 2018; Kennah 2016; Lopez 2018; Tochukwu 2015). Even better, it greatly increases motivation and commitment despite coordinated effort or collaborative teamwork (*Ibid.*).

8. *One-to-One Ratio Classrooms* — A critical trend in digital transformation is the ascension of one personal computer (PC) for each student, more so one-to-one ratio classrooms. This is because it gives teachers the flexibility to improve primary subjects to customize exercises even more with intuitive online substance. (Lopez, 2018; Saqib Khan et al. 2015; Tochukwu 2015) Furthermore, initiatives such as the 'One Laptop Per Child' program have been effective and are further encouraged by government funding and donations from around the world.

Furthermore, schools pool their resources into remote and classroom orchestration systems such as Screenbeam's Classroom Commander to use computers and enable teachers to maximize student engagement and retention in many ways (*Ibid.*). Another example is the Windows Ink support, which allows educators to clarify remarks on a student device directly from the classroom display. Additionally, educators can see all student screens and dynamic applications, launch websites and apps across student devices, and even clear screens on a lone device or the entire classroom if necessary. (*Ibid.*)

9. *Cloud-based technology* — provides access to content, resources, and tools for students and educators from anywhere. All things considered, as this is a fundamental necessity of a school's digital transformation effort, there should no longer be a loss of records, lack of resources or lack of access. (*Ibid.*)

10. *Security* — A state-of-the-art firewall, verified system access and endpoint protection must be included as schools plan their security infrastructure (Newman 2018; O'Neill 2018). Next-

Generation Firewalls (NGFW) provide schools with the strong edge they need to enable digital transformation, and as cybercriminals dispatch propelled attacks on software and equipment that interface with the framework, Next-Generation Firewalls can monitor this traffic using current hazard insights to enable valid traffic while simultaneously terminating suspicious activity (O'Neill, 2018).

For schools, secure network access arrangements are essential as they provide protection against digital hazards from internal user devices and IoT items (Newman, 2018). In addition, endpoint protection is urgently needed when securing digital transformation and the IoT devices involved with it. What this means is that, with the growth of smart classrooms, more endpoints are interfaced with educational networks (from smartphones, tablets to remote printers and lighting frameworks) and these endpoints are inputs into the systems. Hence, strong endpoint security that provides end-to-end visibility of threats and automated protection against malware and other exploits is necessary. (O'Neill, 2018)

To sum up, as schools strive to gain a competitive edge in their educational programs and combine innovations such as Big Data, IoT (Internet of Things) and Artificial Intelligence, digital defenses become a necessity to support their efforts to transform digitally (Kinaanath, 2013).

2.1.1. The Need for Digital Transformation in Education

Digitization has brought enormous benefits to education, specifically increased convenience, less reliance on geographical area, increased accessibility of data, instant correspondence, and faster processing, and this applies to all types of training (from schools, tertiary institutions, training centers, and even in-house worker training courses) (Almadhour 2010; Al Mofarreh 2016; Ilomäki 2008; Kennah 2016; Kinaanath 2013; Tochukwu 2015; Why Digital Transformation … 2018; Yancy 2013).

Digitization involves three key stages: digital skills, digital use, and digital transformation. The primary stage or digital skill refers to the time frame in which users build their skills and digital tools confidently, and these digital tools are likely to be educational platforms such as learning management systems (LMS) and learning content management systems (LCMS) in an educational context (*Ibid.*).

The second stage called' digital use' is where all users know and have reasonable confidence in these digital tools, and it is at this stage that digital education solutions become an integral and normal part of the workplace. Digital transformation is the third phase of' real digitization,' and this is when users start testing and improving the digital tools they have at their disposal. Thus, by using these new technologies to enrich the environment, advancement prompts innovative ways (*Ibid.*).

Advanced instructional change is a need of the 21st century. From tutoring to higher education, innovation influences every dimension of the learning framework. The way learning is adjusted and consumed today is changed by rapidly advancing technology. (Akir 2006; Almadhour 2010; Al Mofarreh 2016; Geoffrey 2016; Haq 2006; Ilomäki 2008; Lopez, 2018) Expanding digitalization paves the way for new communication tools to enable faster sharing of knowledge in schools and universities. Essentially, in education and skill development, it redefines learning models. (Almadhour 2010; Al Mofarreh 2016, Ilomäki 2008; Jain 2018; Smits 2013; Yancy 2013)

One of the important explanations for incorporating digital technologies in instruction is the improvement of more personalized content with greater access to aptitude advancement courses (Akir 2006; Burns 2018; Jain 2018; Lopez 2018; Newman 2018; Yancy 2013). The need is to distinguish the significant use of digital technologies to improve the overall learning of students and to integrate the smart use of digital technologies to enhance the experience of teaching and learning (Akir 2006; Burns 2018; Ilomäki 2008; Kareji 2016; Lopez 2018; O'Neill 2018). New developments such as cloud computing, Massive Open Online Courses, smart boards, and so on already have a major impact on the teaching-learning process (Jain 2018; Lopez 2018; Saqib Khan et al. 2015; Tochukwu 2015).

In addition, the educational curriculum is always an advancing territory, dependent on current and future patterns of digital transformation and strategies of instruction and learning, where experiments and advances are particularly essential (Akir 2006; Geoffrey 2016; Ilomäki 2008; Jain 2018; Yancy 2013). While education systems are driven by consistent technological progress, innovative virtual learning models have been launched by some universities and educational technology firms through free online courses and certification programs (Burns 2018; Jain 2018). Furthermore, as the widespread use of digital innovation changes the needs of current students, they are always looking for open doors to learn beyond the usual classroom-based methodology (Almadhour 2010; Jain 2018; Lopez 2018).

In order to combat the situation, educational institutions must create alternative teaching models (Burns 2018; Jain 2018). Digital transformation in education can improve learning by creating a blended learning experience that consolidates customary classroom-based techniques with current technology (Burns 2018; Kinaanath 2013; Lopez 2018; O'Neill 2018; Saqib Khan et al. 2015; Yancy 2013). Blended learning programs that incorporate face-to-face teaching backed up by educational platforms can be great ways for teachers to ensure that their students get the best parts of both options (Burns 2018; Jain 2018; Kinaanath 2013; Lopez 2018; O'Neill 2018; Saqib Khan et al. 2015; Yancy 2013).

These digital education solutions can also be very advantageous for a wide range of students, including those attending classroom-based courses that are more conventional (Ilomäki 2008; Lopez 2018; Newman 2018; Yancy 2013). It can provide teachers with the opportunity to improve education models to better connect with students (Almadhour 2010; Ilomäki, 2008). However, most students are associated with a virtual world that uses the web and smartphones to assimilate heaps of online substance, so that educational institutions have to choose the option to adapt as technology has given students from different backgrounds a level playing field. (Jain 2018; Kinaanath 2013)

In this regard, the eLearning business has developed extremely rapidly over the past decade, rapidly prompting new digital education solutions, including educational platforms such as learning management systems (LMS) and learning content management systems (LCMS) (Saqib Khan et al. 2015; Tochukwu 2015; Why Digital Transformation … 2018).

The management of education itself is another favorable advantage of digital education transformation. Digital interventions can make it even more effective for educational institutions to manage relationships with students, parents, alumni, teachers and other partners. By digitizing academic support services, it can also manage and monitor systems and processes even more successfully. Therefore, these organizations will streamline administrative activities along these lines. (Al Mofarreh 2016: Ilomäki 2008; Jain 2018; Kareji 2016; Kinaanath 2013; Smits 2013; Yancy 2013)

To put it plainly, digital transformation is critical because teachers are facilitated with digital tools to find better solutions that offer more value to their students (e.g. finding new and engaging ways

to connect digitally, investigating uses for a virtual classroom, or experimenting with different forms of blended learning). While teachers are approaching this phase of the process, creative experimentation with educational platforms can be an incredible method of improving the learning experience, and the higher the learning quality, the more likely it is to engage students. (*Ibid.*)

On that note, the adoption of new educational technologies will also allow teachers to make dramatic improvements both in the academic delivery and evaluation process for students. Apart from providing students with a better learning experience, and it can also enhance work prospects. This, in turn, helps to improve student performance, decrease dropout rates, and increase enrollment. In a nutshell, technological interventions can add significant value to current pedagogical practices at this point. (*Ibid.*)

2.1.2. The Impact of Digital Transformation on the Future of Education

Every day, both school administrators and teachers struggle to properly consolidate technological advances within their institutions and classrooms. Obsolete frameworks and network infrastructures block modernization and digital transformation capabilities to enhance school security, cooperation and efficiency dimensions. (Kinaanath 2013, Laronde 2010; Tursi 2018; Yancy 2013) Again, the main objective is to attract an 'online' generation of learners. This new generation is never surprised by the latest technological developments and, as a result, educators have to adapt to the advanced change by setting up new techniques and tools to fulfill and amaze them; moreover, making a wow impact along these lines since the acquisition of information has never been as conceivable as it is today with the web. (Kolbakova 2014; The impact of digital transfromation … 2018; Tochukwu 2015)

In addition, digital transformation in schools is not just about progress or innovation, it is more about culture (Al Mofarreh 2016; Kinaanath 2013; Laronde 2010). Educators and students can enhance their skills with a shared goal by digitizing the learning experience: to make the educational process even more captivating and effective. (5 ways Digital Transformation … 2017; Kennah 2016; Yancy 2013) Innovative concepts and products are also designed to improve the learning and absorption of information. Whether it is equipment, software or interface, educators need to redesign their classrooms, such as upgrading a homeroom that encourages coordinated effort, collaboration, exchange of ideas, self-sufficient work, and access to customized courses. (Kinaanath 2013, Rubenstein 2018; Yancy 2013) These tools are used to gradually advance creativity, and there is no doubt that with all the innovative progress and digital transformation,

both education and training will evolve (Al Mofarreh 2016; Kolbakova 2014; The impact of digital transfromation … 2018; Tochukwu 2015; Yancy, 2013).

All things considered, educators have an inalienable need to adapt learning with technological advances to the present world by opening up training to more individuals, offering more content gradually and making it more and more available anywhere. This, in turn, would provide students with a similar balance on better learning conditions promoting creativity and innovation. (*Ibid.*) This should provide students with an opportunity to meet, communicate, use whiteboards, share resources on any gadget— all through classrooms— to improve student learning and working together (Al Mofarreh 2016; Kolbakova 2014; Tursi 2018; Yancy 2013).

Some ways in which digital transformation affects classrooms are as follows:

1. *Strengthening digital equity* — Advanced educational value means that all students have easier and more affordable access to learning resources because they can literally use any device such as a smartphone, tablet or PC to access a wide range of information from anywhere, regardless of their finances. This is because digital content is more affordable and it can be easily shared by educators and students. In addition, schools can provide easy access to learning resources through free and open content and tools that allow learners to pursue their education simultaneously while fulfilling their work or family responsibilities. (Al Mofarreh 2016; 5 ways Digital Transformation … 2017; Tochukwu 2015).

2. *Personalized Experience* — Promoting digital transformation in educational institutions means allowing students to take advantage of customization, and building huge information-based educational programs to shape their future. Currently, unique projects can suggest which courses students should consider based on their recent completion of courses, scores and aptitude. (*Ibid.*) These frameworks use enormous information to prescribe courses for students based on their interests, further prompting them on the likelihood of good results being achieved (Rubenstein, 2018). Personalized learning makes the education of each student more profitable, i.e. it quickly analyzes the more immediate needs of the student and accelerates progress (5 ways Digital Transformation … 2017; Rubenstein 2018; Yancy 2013).

3. *Global Audience* — Educational platforms such as learning management systems (LMS) and learning content management systems (LCMS) really break the topographical and social

boundaries, enabling educators to bring information to the entire global crowd, possibly beyond the classroom. Through such a vast number of different perspectives, learners and individuals from around the world can visit and add to exercises, making similar worldwide discussions, resulting in an enhanced educational experience. (5 ways Digital Transformation … 2017) Asynchronous classrooms, for example, allow students to attend classes at any point, giving graduate students the opportunity to obtain cutting-edge data for research projects, whereas undergraduates can benefit from the 'adaptability' while engaging in interdisciplinary activities (5 ways Digital Transformation … 2017; Kinaanath 2013; Rubenstein 2018).

4. *Modular Application Approach* — Digital transformation in education's most prominent and positive effect is the likelihood that schools will produce learning modules faster. This is because teachers can set up their courses and projects using the best content that different teachers have recently created, not just from their schools, but from different institutions as well. That's why teachers can tackle the battle to create a variety of powerful learning materials to meet a variety of different skills, levels of difficulty, etc. (5 ways Digital Transformation … 2017; Yancy 2013) In addition, thanks to ICT tools, teachers can quantify how best students learn and change the learning modules accordingly (5 ways Digital Transformation … 2017; Jatileni, Jatileni 2018; Rubenstein 2018; Tochukwu 2015; Yancy 2013).

5. *Exceptional teachers* — Teacher training is critical to achieving digital transformation in schools. This is because it needs trained teachers who feel enabled and need to use ICT tools in the most productive way. Educators can register with online expert learning networks to inquire and provide tips for other educators, stay connected and accelerate the shared goal of creating an evolved high-quality education standard. (5 ways Digital Transformation … 2017; Al Mofarreh 2016; Haq 2006; Jatileni, Jatileni 2018)

The end result is the days when students used to sit down and adapt to lectures in the classroom are long gone. Student-oriented and engaging education is needed today, and educators are rolling out unusual improvements to their approach to teaching with technology at the forefront. Digital transformation, in essence, definitely affects learning by opening up an unlimited universe of potential results and coordinated effort.

2.2. How to Bring Digital Transformation to Education

As the education sector advances, digital transformation becomes an essential survival method, and this new digital world expects teachers to adapt and embrace digital technologies, approaches, and attitudes (Kareji 2016; O'Brien, 2019). In addition, opportunities to increase efficiency, joint effort and reduce operating costs and errors are undiscovered in educational tasks (Deshpande 2018; Kareji 2016; Smits 2013).

Unfortunately, however, most institutions still do not appear to be able to change the administrative procedures at the core of their activities, as most of these daily undertakings still use paper or email-based procedures that provide zero adaptability and waste of time. Current digital tools and technologies, such as low-code visual platforms, can help schools automate internal procedures effectively, streamline routine exercises, and upgrade correspondence between students, educators, and guardians, which can have a major impact by allowing educators to focus on students rather than administrative tasks. (*Ibid.*)

2.2.1. Digital transformation in education challenges

Some obstacles to achieving digital transformation in education are as follows:

1. *Hesitation to adjust* — Overall, people will be acclimated to accomplishing things with a specific goal in mind and will hesitate to leave their usual familiarity. They are afraid of disappointment when there is a need to embrace new technology or innovation and hesitate to adopt new skills or procedures. To overcome this, the absolute first step is to ensure that these people clearly understand the benefits of such changes. (Al Mofarreh 2016; Deshpande 2018; Kinaanath 2013; O'Brien 2019; Tochukwu 2015; Yancy 2013)

2. *Second-rate learning or skills* — The center of progress is skills, and as the biggest digital transformation test, lack of resources or expertise has developed. This is why educational institutions must gradually chase rare talent from user experience to cloud security in different areas. (*Ibid.*)

3. *Information storehouses* — Information in educational institutions is siloed like most institutions, and inquiries about accuracy and reliability are an integral factor. Issues such as which information was used to execute new procedures for what is to come, or which data set is often

asked to settle on an effective business choice. As such, timely and accurate information is required to make informed decisions. (*Ibid.*)

4. *Lack of direction or technique* — This is the most important test to make a technique into a solid plan of action. Ideally, where to start is the key factor for progress, and it is necessary to distinguish between a business process that is not very straightforward or one that is too mind-boggling and has a reasonable volume, and to ensure that it is understood that both time and effort are needed to change it carefully. (*Ibid.*)

5. *System-based compatibility* — Often existing frameworks are vital for institutional processes. However, current applications for online business do not guarantee compatibility with them. And that's where educational institutions hit a barricade, forcing them to spend more on a custom infrastructure or an overhaul mix. (*Ibid.*)

2.2.2. Digital transformation in education: Solutions

Step by step instructions to saddle digital transformation in education are as follows:

Building a system and skills training — Throughout schools, paper-based procedures are omnipresent and educational institutions use a huge amount of paper in different offices. Going paperless therefore has critical benefits and is a simple first step in creating amazing new digital solutions. (Deshpande, 2018) Furthermore, being able to thrive and succeed expertly is the essential goal for educational institutions as they teach and upgrade educators. Within this methodology, educational institutions are most likely to carry out a learning program that will allow educators in schools to develop their skills, thus becoming a digital transformation catalyst. In addition, upgrading departmental resources, helping educators build confidence in learning while cultivating departmental pioneers will help drive schools as best they can. (Al Mofarreh 2016; Kinaanath 2013; O'Brien 2019; Yancy 2013)

Coordinate and influence digital data and experiment with rising innovations — Cloud technology is a key machine gear in the digital transformation wheel and provides a framework within educational institutions for it. This is because cloud-based processes are critical to enabling portability, speed, and capability gaps, and cloud vendors now have significant experience and interest in delivering reliable, adaptable, and secure solutions. In addition, cloud technology needs

to be embraced on the off chance that an educational institution seeks agility, efficiency, flexibility, and cost optimization. (Deshpande 2018; Tochukwu 2015)

In order to gain the greatest incentive from the huge strands and information storehouses gathered in the education sector, it is essential to be able to consistently incorporate and use information sources-understanding where all knowledge comes from and how it can benefit educational institutions. As such, the xAPI and IMS Caliper standards were implemented to ensure that all information is handled in a standardized format to ensure consistent streaming and understanding of the enormous amount of information available to student educational institutions. (Haq 2006; O'Brien 2019)

In addition, numerous data platforms have embraced these standards and are creating educational technology devices that fold knowledge across these bits of knowledge— helping educational institutions fragment information and understanding existing student practices to enhance educational programs, procedures and provide a more prominent dimension of personalization (*Ibid.*).

Automation — Because of the speed with which innovation affects organizations, it is clear that in the coming years' educational establishments will be deserted if they fail to grasp digital transformation. Soaring costs, particularly unreasonably expensive educational costs, and compulsory spending plans place extraordinary weight in putting resources into operational activities to compete in a digitally transformed setting on current educational systems. Automating the work process, cloud and maximum digitization with minimal infrastructure must, therefore, be a focus. (Al Mofarreh 2016; Deshpande 2018; Kinaanath 2013; O'Brien 2019; Yancy 2013)

Grasp the intensity of portable — We live in a time when a smartphone can be used to request taxis and book holidays. This is because, given that portability leads to more changes than web upheaval, many digital natives consider it the 'decision platform' to grasp the mobile smartphone intensity. (Deshpande 2018; Kolbakova 2014) Moreover, portability is a requirement for the information age, and if students are unable to access the data or materials they need in an adaptable, portable format, there will be limited opportunities to value them. Portable learning is an incredibly powerful value delivery approach and should not be limited to learning material. (Kinaanath 2013; Kolbakova 2014; O'Brien 2019) This means students have grown up with their smartphones and

in the not - so-distant future it would be better to prioritize mobility for educational institutions (Deshpande 2018; Kolbakova 2014).

Basically, despite how dedicated the school is, without any forethought, no digital transformation takes place. Apart from helping educators move further into digital transformation (without focusing too much on their current organization), and helping to streamline IT managers' processes, overseeing administrations can also help to link different frameworks together and' fill in the holes' as educational institutions update their current framework even after revisions. (Deshpande 2018; O'Brien 2019; Yancy 2013)

Working with a system specialist, IT pioneers can implement a state-of-the-art system and IT framework suitable for handling all parts of the transformation of digital education. School districts can use private virtual and physical Ethernet networks to ensure that organized execution and accessibility for basic applications do not pose any problems in all school areas. They can also get all or part of their most basic network as a managed service, including network supervision and security, WiFi, and business continuity plans, etc. (*Ibid.*)

In short, the second period of digital transformation builds the accomplishment schools enjoyed their first period of digital transformation through new technologies aimed at expanding and enhancing the educational experience, and because society is always driven by technology, schools should work with a technology-oriented mindset to better position students today and in the future for progress (*Ibid.*).

2.3. How does ICT help education?

ICT is an educational method for assisting, upgrading and improving data delivery. ICT is taking on a vital job in the education sector these days, particularly during the time spent allowing technology to be used in educational exercises. The education sector may also be the best sector for predicting and dispensing ICT's negative impact. (Bakare 2014; Bose 2017; Laronde 2010; Yancy, 2013)

The basic motivation behind the ICT implementation strategy in education is to provide ICT coordination prospects and patterns in general educational exercises (Kaka 2008; Laronde 2010;

Yancy 2013). By enhancing student motivation and responsibility, securing basic skills and enhancing teacher training, ICTs can upgrade teaching (Bakare 2014; Noor-Ul-Amin 2013; Yancy 2013). In addition, ICTs are transformative tools and can raise the movement to a student-focused environment when used properly (Al Mofarreh 2016; Bakare 2014; Thijs *et al.* 2001; Tochukwu 2015; Yancy 2013).

Overall research has shown that ICT can foster better learning for students and better strategies for teaching. ICTs are now being used in education to help students adapt even more appropriately by providing educators with access to a wide range of new educational methodologies. These innovations are also used to enhance the productivity of managerial tasks for educators. (Al Mofarreh 2016; Bakare 2014; Flecknoe 2002; Laronde 2010; Yancy 2013) In short, ICT provides a variety of outstanding learning materials with self-managed learning and access. It also enhances learning through a mix of sound, video, images, content and movement, and through interaction and coordinated effort upgrades learning. ICT has changed the lives of both students and teachers in many ways, and while ICT presence has begun, the ideal effect is sadly lacking despite the fact that ICT education plays a key role in today's society. (Al Mofarreh 2016; Bakare 2014; Desai 2010; Kinaanath 2013; Laronde 2010; Yancy 2013)

2.3.1. Why is ICT necessary in teaching and learning?

It is critical to use ICT in teaching and learning because it provides opportunities for teachers and students to work, store, control and recover data, foster dynamic learning and self-responsibility with respect to distance learning, motivate teachers and students, and so on (Ali *et al.* 2013; Bakare 2014; Kinaanath 2013; Laronde 2010). ICT is usually used independently of the subject as a vehicle for teaching and learning. It is in itself a teaching and learning tool, more so the medium through which teachers can educate and students can learn, and it assumes a critical job in student assessment. (Al Mofarreh 2016; Bakare 2014; Bhattacharjee, Deb 2016; Laronde 2010) Information and Communication Technology (ICT) is imperative as it empowers students to search and sort out what they have found for the data they need. In essence, students gradually become responsible for their own learning as they progress through the education system. (Jeffels 2019; Laronde 2010)

Technology needs to improve the learning process and enhance student evaluations. In other words, it must encourage and enhance singular learning (i.e. students should use technology to learn with limited support from educators). (Laronde 2010; Ramey 2013) Moreover, to improve

teaching and learning, PCs can be used in a variety of ways, namely: individual students, teacher meetings, and discussion. ICT can also develop student thinking in a variety of ways, including reasoning, understanding, and creativity. (Bakare 2014; Briggs 2015; Kennah 2016; Laronde 2010)

Technologies can be used to enable students to express themselves in writing. In addition, students may use a variety of tools requiring different forms of expression, such as databases, tablets and expert systems (*Ibid.*). What's more, PCs enable students to conduct research and further communicate with different educational providers. This helps students to better understand concepts by experiencing distinctive types of teaching. They can also help teachers mentor their students, and the teachers can also use the PCs to communicate with their students. (Bakare 2014; Kwesi 2015; Laronde 2010)

Adding technology to the classroom much means more than showing basic PC capabilities and software applications (Seymour, 2016), and according to the United States Department of Education, "[Technology has the ability to change teaching by introducing a new model of connected teaching, connecting teachers with their students and knowledgeable content, resources and systems to enable them to improve their own teaching and tailor-made learning]" (Leslie, 2017). Technology can improve connections between teachers and students; and as teachers incorporate technology into their subject areas, they develop their roles into advisors, experts, and mentors. Technology, in essence, helps gradually make teaching and learning meaningful and fun. (Al Mofarreh 2016; Bakare 2014; Laronde 2010; Wantulok, 2015)

On the other hand, while technology aids student progress, improving teaching and learning can be a 'constraint multiplier' for teachers. However, students can visit websites, online training exercises, etc. to get more help apart from teachers, who are the main source of knowledge in a classroom. (Al Mofarreh 2016; Bakare 2014; Laronde 2010; Whiteside, 2011) In particular, students can use learning management systems (LMS) to access online resources in order to obtain assistance on demand beyond their teacher's physical reach. It can also be said that technology can expand education when used in this way. (Al Mofarreh 2016; Khan T.A., 2019; Laronde 2010)

Integrating technology in teaching and learning can help break the boundaries for people with disabilities and facilitate their access to more advanced educational programs for custom curricula such as those for special educational programs. Furthermore, specific software and equipment are

designed to empower students with special needs to obtain modern and up-to-date education, together with the information needed for their online courses. (Dikusar 2018; Kolbakova 2014; Laronde 2010; Smits 2013)

Assistive Technology helps academically successful students with learning disabilities, and these students may limit their weaknesses due to their learning disability. Additionally, speech-to-text software facilitates learning for students with disabilities who are struggling to regularly communicate their words on paper. (Kolbakova 2014; Lynch 2018; Smits 2013) Moreover, special needs programs help autistic students use technology to enhance learning, and teachers can bring about academic change and address major issues affecting students with special educational needs by incorporating technology into education (Kolbakova 2014; Smits 2013; Waddell 2015).

In short, ICT takes on a remarkable job for students to achieve better understanding, learning, and education, while teachers are trying to keep up-to-date and improve their teaching skills (Bakare 2014; Laronde 2010; Watson 2017). In essence, learning with ICTS tends to support students on learning-related issues as they inquire, process and store data. Moreover, students will generally develop basic ICT skills with such assistance. What's more, technology generally helps students, and in classrooms mobile devices along with their supported apps will help prepare students for their future professions whenever they are used effectively. Finally, integrating technology into the classroom is an effective way to connect with students of all learning styles. (Alharbi 2014; Bakare 2014; Kolbakova 2014; Laronde 2010; Mareco 2017)

2.3.2. What is the significance of ICT tools?

ICTs represent data and communication innovations and are characterized as a variety of technological tools and resources for communicating, producing, dispersing, storing and monitoring data. ICTS can also enhance the nature of life as it can very well be used as a learning and education media, in science, and so on. It facilitates wider learning and can help access and acquire data. (Al Mofarreh 2016; Bakare 2014; Haq 2006; Importance of Information … 2016; Jatileni, Jatileni 2018; Laronde 2010; Tochukwu 2015)

Then again, educational technology is one of the fastest growing fields of today, referring to the use of current computerized gadgets, software, web resources, and PCs to improve the teaching and learning process (educational technologies). Moreover, according to the IGI Global technology-based learning lexicon, it is characterized as "coordinating instructional technology

into schools' learning environment." More along these lines, it refers to educational settings that apply trend-setting innovations, such as PCs and web during the teaching and learning process. (Akir 2006; Al Mofarreh 2016; Bakare 2014; Haq 2006; Kennah 2016; Laronde 2010)

What's more, in view of the use of information and communication technologies, the teaching work of educational technology is of incredible importance today as never before. Using various applications for distance education, the Internet, educators, and students themselves, they see the upside of educational technology. (Al Mofarreh 2016; Bakare 2014; Haq 2006; Kinaanath 2013; Laronde 2010; Stosic, 2015)

As indicated by TechTerms, ICT refers to advances that provide data access through media communications. Like IT, however, it focuses primarily on communication advances that include the Internet, PDA, and other media such as PCs, smartphones, cell phone towers, video conferencing, software, television, radio, etc. (Bakare, 2014). Then again, Riley (2019) argues that "ICT is concerned with the capacity, recovery, control, transmission or receipt of advanced information," and ICT devices cover any item that is stored, retrieved, controlled, transmitted or received electronically in a digital structure (including PCs, digital TVs, email, etc.) (Kareji, 2016).

ICT, i.e. IT and communication, is the fundamental task that communication systems perform (Bakare, 2014). ICT has a significant learning job because of its ability to change and its ability to build relationships among students (Al Mofarreh 2016; Bakare 2014; Laronde 2010; Shahmir *et al.* 2011). Students also use their ICT skills to build their language and relational skills, as the objective of ICT tools is to provide the skills they need to use technology to become independent learners. Considering all things, ICT adopts a functioning and reasonable style of teaching. With regard to the importance of information and communication technology in schools, the web has become an essential part of every individual's life, and through the implementation of ICT strategies, schools are gaining positive results for their most evident stakeholders–their students. (Al Mofarreh 2016; Bakare 2014; Haq 2006; Importance of Information … 2016; Jatileni, Jatileni 2018; Kennah 2016; Laronde 2010; Tochukwu 2015)

In addition, schools use a variety of ICT tools to transmit, create, distribute, store, and monitor data. In some unique circumstances, ICT has also proven to be essential to the teaching and learning process through methodologies such as replacing blackboards with smartboards–using smartphones or various gadgets to learn during classroom time; and the 'flipped classroom' model

where students view lectures at home and participate in interactive activities during classroom time. (Alharbi 2014; Al Mofarreh 2016; Haq 2006; Information and communication … 2018; Laronde 2010)

A vital impact on the use of ICT in subjects and classes is also the number and scope of ICT resources available to educators (Al Mofarreh 2016; Cox *et al.* 2003; Kennah 2016; Laronde 2010). In addition, the viable combination of ICT in schools and classrooms may change teaching methodologies and involve students. Moreover, educators must be able to effectively mesh technology into learning, and should urge their students to use ICT to create art and take care of their own experience-based issues; because to attract young students to the subject, this is particularly necessary. (Alharbi 2014; Al Mofarreh 2016; Jatileni, Jatileni 2018; Laronde 2010; Morrish, 2016)

For example, while students need to use technology— PCs and the Internet to finish schoolwork, projects, and conduct research, technology itself speeds up student learning as it creates an increasingly interactive and stimulating learning environment. To put it bluntly, there are many positive benefits to the use of ICT tools in the teaching and learning process, and since ICTs has gained considerable attention as a critical research area, its nature has profoundly transformed education in recent decades. (Advantages of Using ICT … 2014; Alharbi 2014; Al Mofarreh 2016; Bakare 2014; Haq 2006; Jatileni, Jatileni 2018; Laronde 2010; Tochukwu 2015)

2.4. Chapter Summary

Theoretically, trends in digital transformation are a game-changer in education (Tochukwu, 2015), and today, state-funded schools or those in the public education system are often not new technology's earliest adopters. As such, digital transformation trends in education tend to move a little slower compared to other sectors, and as schools strive to gain a competitive edge in their educational programs and combine innovations like Big Data, IoT (Internet of Things) and Artificial Intelligence, digital defenses become a necessity to support their digital transformation efforts. (Burns 2018; Kinaanath 2013; Laronde 2010; Newman 2018; Tochukwu 2015)

On another note, sigitization has brought tremendous benefits to education, specifically increased convenience, less reliance on geographic area, increased data accessibility, instant correspondence,

and faster processing, and this applies to all types of training (from schools, tertiary institutions, training centers, and even in-house worker training courses) (Al Mofarreh 2016; Laronde 2010; Why Digital Transformation … 2018).

To put it plainly, digital transformation is critical because teachers are facilitated with digital tools to find better solutions that give their students more value (e.g. finding new and engaging ways to connect digitally, investigating uses for a virtual classroom, or experimenting with various forms of mixed learning). While teachers are approaching this phase of the process, creative experimentation with educational platforms can be an incredible method of enhancing learning experience, and the higher the quality of learning, the more likely it is to involve students. (Al Mofarreh 2016; Jain 2018; Laronde 2010)

In this regard, the adoption of new educational technologies will also enable teachers to make dramatic improvements for students in both the academic delivery and evaluation process. Besides providing a better learning experience for students, it can also improve job prospects. In turn, this helps improve student performance, lower dropout rates, and increase enrollment. (*Ibid.*)

On the other hand, in their institutions and classrooms, both school administrators and teachers struggle every day to properly consolidate technological advances. Out of date structures and system frameworks block modernization and digital transformation capabilities to upgrade school security and effectiveness measures. (Tursi, 2018) All things considered, educators have an inalienable need to adapt learning to the present world with technological advances by opening up training to more people, gradually offering more content and making it more and more available anywhere. This, in turn, would provide a similar balance to students on better learning conditions that foster creativity and innovation. (Laronde 2010; The impact of digital transfromation … 2018) This should provide an opportunity for students to meet, communicate, use whiteboards, share resources on any gadget— all through classrooms— to enhance student learning and working together (Haq 2006; Laronde 2010; Tursi 2018).

In addition, as the education sector advances in digital transformation, this new digital world expects teachers to adapt and embrace digital technologies, approaches, and attitudes (Al Mofarreh 2016; Laronde 2010; O'Brien, 2019). In addition, opportunities to increase efficiency, joint effort and reduce operating costs and errors are not discovered in educational tasks (Al Mofarreh 2016; Deshpande, 2018; Kinaanath 2013; Laronde 2010). Unfortunately, however, most institutions still

do not appear to be able to change the administrative procedures at the core of their activities, as most of these daily undertakings still use paper or email-based procedures that provide zero. Current digital tools and technologies, such as low-code visual platforms, can help schools effectively automate internal procedures, streamline routine exercises, and upgrade correspondence among students, educators, and guardians, which can have a significant impact by allowing educators to focus on students rather than administrative tasks. (*Ibid.*)

However, overall research has shown that ICT can foster better student learning and better teaching strategies. In education, ICTs are now being used to help students adapt even more appropriately by providing access to a wide range of new educational methodologies for educators. These innovations are also used to improve the productivity of educators ' managerial tasks. (Al Mofarreh 2016; Flecknoe 2002; Laronde 2010; Yancy 2013) In short, ICT provides self-managed learning and access to a variety of outstanding learning materials. It also enhances learning by mixing sound, video, images, content and movement, as well as learning upgrades through interaction and coordinated effort. In many ways, ICT has changed the lives of both students and teachers, and while ICT presence has begun, the ideal effect is unfortunately lacking despite the fact that ICT education plays a key role in today's society. (Al Mofarreh 2016; Desai 2010; Haq 2006; Kareji, 2016; Kinaanath 2013; Laronde 2010; Yancy 2013).

This chapter outlined the setting of the subject and identified the gaps in the research, while the following chapter presents the study methodology (Yancy, 2013).

3. METHODOLOGY

This section focuses on the methodologies to be used in conducting the investigation, and will clarify the configuration of the research, sample data, context analysis, and procedures for data collection.

3.1. Research Method

A case is a social unit with deviant behavior and can be a social unit issue, procedure or examination. This social unit can be an individual, family, foundation or society. (Kothari, 2004) Therefore, a case study investigation is a concentrated examination of the unit being considered and is widely used in many areas, such as education, economics, political theory, etc. Its goal is to get a full and detailed account of either a social phenomenon or a social unit event. In case studies, information can be collected from different sources using any qualitative methods of collecting data, such as interviews, observations, archives, etc. The case study technique is an in-depth collection of data that is either descriptive, exploratory or explanatory. (*Ibid.*)

3.1.1. Definitions of Case Study Methods

Numerous researchers have used a myriad of definitions for the term 'case study.' A case study, to tell the truth, is a comprehensive investigation of a social unit; be it an individual, an individual gathering, a foundation, a community or a family. (Young, 2011) It could also be a way of investigating and examining the life of a social unit (Freeman, 1953). Moreover, a case study is subject to observation and provides a clear understanding of the life registry (Cooley, 1928).

It can also be described as a technique for explicitly looking in detail at a given circumstance (Bogardus, 1933), and to wrap things up, it can very well be portrayed as a research strategy involving an empirical investigation of a particular contemporary phenomenon within its real-life context using numerous sources of evidence (Robson, 1993). A basic investigation of the above definitions also reveals that the case study technique involves a minute and detailed study

(intensively and comprehensively) of a social unit circumstance in order to understand the individual and shrouded dimensions of life.

This research is basically an exploratory case study investigation and since there is almost no clarification for the topic under consideration, exploratory research is extremely helpful (Creswell, Poth 2017). Furthermore, case studies are an examination of a specific phenomenon in its setting when there is clearly no obvious barrier between the phenomenon and the test (Yin, 2003). In any case, description or survey research is strongly linked to awareness, hypotheses, practices and techniques (Gay *et al.* 2012), and the accumulation of different ways of handling data prompts authentic data (Glesne, 2011). And last but not least, it is undoubtedly a type of subjective examination involving careful and thorough observation of cases.

3.1.2. Characteristics of a Case Study

In addition to the settings in which they occurred, the data collected in an expressive report are portrayals of psychological procedures and occasions. The fundamental emphasis is reliably on structuring verbal descriptions of behavioral behavior or experience, but gathering quantitative information is conceivable once in a while. (Kothari, 2004) The case study technique is therefore more a subjective strategy than a quantitative technique, as elevated amounts of detail are given, and the unit's standard of conduct is legitimately examined in which attempts are made to know the common interrelationship of the causal components (*Ibid.*).

On the other hand, a narrowly focused investigation usually provides a comprehensive and complete portrayal of all the features of a social unit, regardless of whether it is an individual or a social gathering (*Ibid.*). The technique of case study regularly focuses on a limited part of an individual or event that connects objective and abstract information, as the two types of information are considered substantial for data analysis. It also allows the case study technique to gain a top-to-bottom understanding of an individual's behavior and experience due to its process-oriented nature, and after some time the researcher will likely investigate and portray the idea of the procedures. (*Ibid.*)

3.1.3. Advantages of Case Study

The case study strategy encourages serious examination of a social unit and a thorough investigation that repudiates established theory. As it were, this strategy gathers in-depth and

comprehensive data, which encourages new research. It is suitable for collecting data on sensitive areas of a social phenomenon and gathers insights on the various propensities and characteristics of the unit under scrutiny. (Kothari, 2004) The researcher can understand the social difference in different characteristics of a social unit all the more likely, and as a result of its emphasis on authentic examination, the investigation can be a method of understanding the past of a social unit. The researcher may also use a few types of data collection techniques, such as interviews, surveys, documents, etc. Moreover, the information gained through the case study method is valuable in the definition of theories, including further research surveys. (*Ibid.*)

Basically, case study analysis allows the researcher to make speculation using the information gathered, thus enhancing his/her experience and ability to examine the substance of the information. And finally, this method is equally valuable for managerial purposes, especially research (*Ibid.*).

3.1.4. Disadvantages of Case Study

Instead of quantitative, this strategy is fundamentally subjective, so a subjectivity issue may emerge as there are chances of data inaccuracy as a uniform and standardized recording case history framework has not been developed (*Ibid.*). Information gathered from case study investigations is normally based on different speculations, and drawing speculations depending on a few cases can sometimes be impractical. Sampling is not possible in a case study as this strategy can only be used in a limited unit. The data gathered from the case study investigation is exceptional as each respondent provides their own perspectives, the researcher's predisposition may twist the nature of the analysis of the case study. (*Ibid.*) In addition, this technique is equally tedious and expensive and in large and complex societies cannot be used adequately, and replication is impractical in this way (*Ibid.*).

To put it plainly, the case study technique retains both the comprehensive and substantial attributes of real-life opportunities such as individual life cycles, behaviors, and so on. A case study is essentially a research method used to investigate an individual, a group of individuals, or a particular phenomenon. It is used mostly by social science researchers who use different methodologies of research and techniques of data collection such as interview, questionnaire, etc. (*Ibid.*)

3.2. Participants

A research group is any group of individuals who share at least one or more common qualities of importance to the researcher (Best, Kahn 1993). The target group is also known as the research group that the researcher may want to generalize (Gay *et al.* 2012), (Tochukwu, 2015) and the target population for this case study is secondary educators attached to state-subsidized or government-funded schools in Georgetown Guyana.

3.2.1. Interview Participants

Purposive testing is a technique used by scientists to accurately depict populations, and a sample of convenience is a group of relevant individuals available for study (Wallen, Fraenkel 2001). The current sample was both a convenience selection in the teachers willing to be interviewed, but also intended to provide answers to survey inquiries to validate the survey gaps. Former colleagues of the researcher who were and still are secondary educators attached to state-funded or government-subsidized schools in Georgetown Guyana were invited via social media to volunteer for an interview. Unfortunately, the willingness to be interviewed was confirmed by only three (3) teachers (two males and one female).

3.2.2. Survey Participants

Again, purposeful and convenience sampling was used, as the researcher used social media to actively solicit secondary educators attached to state-funded or government-subsidized schools in Georgetown Guyana to participate in the anonymous online survey. The researcher was also supported by Mr. Olato Sam, her former lecturer and the former Chief Education Officer of Guyana who actively solicited participants on behalf of the researcher. This strategy resulted in the attempt and completion of the survey by seven (7) participants.

3.3. Data Collection Tools and Techniques

This case study uses quantitative and qualitative (i.e. subjective) measures, namely interviews and an online survey. By combining quantitative and subjective methodologies, research questions are better understood than either approach alone. (Plano Clark, Creswell 2007). The subjective data collected in the interviews investigated the main stage phenomenon, in particular the procedures for ICT integration in teaching, thus affecting the quantitative survey tool improvement. In

addition, an exploratory design is useful if a researcher does not require an instrument to be structured and tested, (*Ibid.*) and to gain a thorough understanding of their goals and interests and how they integrated technology into their practice, the interviews and surveys were aimed at participants.

3.3.1. Interviews

Case study interviews are generally conducted to obtain richer responses from interviewers who are free to offer their bits of knowledge (Yin, 2003), as well as attempts to demonstrate collaborative achievements according to (Miller, Glassner 2004; Silverman, 2006). Moreover, the procedure between the interviewer and the interviewee, despite its qualities, is important as long as it is affirmed that the beginning of the dialog is understood and that it can be cleverly used to assume generalizations (Holstein, Gubrium 2008). (Yancy, 2013) Therefore, using interviews to achieve a deep mutual understanding is strongly justified. Semi-structured interviews were intended to analyze data thoroughly (i.e. through confirmation and clarification) in the present investigation. (*Ibid.*) Interviewees were approached to present and discuss their ICT integration level, including some of the technology integration triumphs and challenges. The interviews investigated how participants engaged in ICT advancement, how their students successfully adapted (for example, the technological skills and strategies gained through the use of ICT devices in exercises), and how participants saw the benefits of ICT integration in their schools' way of life and culture (Al Mofarreh, 2016). The interview questions and the responses of the interviewees can be found in Appendix 1.

3.3.2. Survey

It is extremely important to fine-tune a survey to a study's major research questions (Cohen *et al.* 2005), and as such the survey instrument used in this study is an incredibly concise modification of the original version of the SoGoSurvey's online survey entitled 'Instructional Technology Needs Assessment' (Technology Needs … 2019) in conjunction with a questionnaire from Kareji (2016) study. This was done to make it increasingly applicable to investigate different aspects of secondary teachers ' use of technology in Georgetown Guyana.

The survey instrument was tested with 7 respondents during the information accumulation process and the online survey completion time was 4 minutes. Every potential respondent was sent an invitation with an embedded link to the survey via social media, which meant that the survey could

be answered and completed on any web-related gadget or PC. The https:/www.surveymonkey.com site was used to collect, review and perform simple statistical data analyses; with a consent form on the first page of the survey and implied consent by continuing the survey (see Appendix 2).

The online survey asked respondents to include statistical data, for example, gender, age, qualifications, and years of experience. Using a five-point Likert scale, they distinguished their ability with different ICT skills, how they incorporated ICT into their teaching and their belief in the integration of technology into their current classes. The various ICT tools/resources used by students at their schools and ICT technologies used to display student learning were also included in the questions. Appendix 2 contains the online survey questions and the consent form.

3.3.3. Internal Legitimacy/Validation of interview and online survey as data collection tools

Legitimacy refers to the property, criticality and usefulness of the particular assumptions based on the information gathered, and the survey presents four major risks to inward legitimacy, namely mortality, area, instrumentation and decline (Wallen, Fraenkel 2001). As regards mortality, the survey was propelled by the end of March 2019 with respondents either resigning or moving and not responding to the survey. The survey area was either on any web connection at school or at home, and it was not a concern because of the internet-based tool. Although the tool may be debased if the respondents are hurried, in this situation it may take some time to complete the survey. Furthermore, due to the unchanged instrument and scoring methodology, there was little concern about the decline of the tool in the course of information accumulation.

Steps have been taken to control internal legitimacy as quantitative questions are both close-ended and compulsory. This meant that all the information collected was used and the results were not influenced by partially completed surveys. In addition, the interviews included sufficient subjective information from open-ended inquiries, and time-related concerns were addressed through interviews with in-service educators rather than school administrators, thus limiting the risk to internal legitimacy. Recurring inquiries also resulted in interviews from each of the three interviewees with comparative responses. (Yancy, 2013)

The interviews were completed, to begin with, and comparable inquiries were followed up in the online survey that supported a portion of the information collected in the interviews. The information gathered on the integration of ICT helped validate both the results of the interview and the online survey. The online survey was anonymous and participants in the interview were

selected to represent age, gender, service length, and the level they are teaching to acquire an objective cross-section of the target population. The interviews were transcribed and transcriptions were received by the participants, to which no concerns were raised (Yancy, 2013).

3.4. Limitations

Any aspect that impedes a study and its findings is a limitation and this research has several limitations, namely sample size, sample profile, data collection process, time, timing of the study and literature access, all of which are explained in detail below:

1. There are many limitations in the current study starting with Access to Literature. As there is a shortage of accurate and up-to-date information on Guyana's history and education system, the researcher did not have access to a wider range of literature for the theoretical background. This was also combined with the lack of previous research on the topic, as very little research can be found on the digital transformation of educational systems.

2. The current study's main limitations were time constraints. This study's research findings were limited by the research duration, which was relatively short. This was because the research proposal was approved on February 22, 2019, and the deadline for submitting Master's thesis to the supervisor of the researcher was April 29, 2019, which gave the researcher a mere 9 weeks to conduct and complete this exploratory case study.

3. One of the limitations of this study was related to the ‘Study Timing’ as data was collected over a period that was not exactly suitable for respondents. This is because most data were obtained between March 22, 2019, and April 19, 2019, and the timing was inappropriate due to the 2018/2019 Academic Year's School Holidays in Guyana. The school year is divided into three terms, and between April 15-26, 2019, Term 2 Holidays took place.

This meant that the respondents were busy grading exams and preparing the report cards before the start of the holidays for all students in each class they taught. This is because report cards are usually issued before the holidays for Term 2. In addition, respondents who taught senior high school students (i.e. those in grades 10 and 11) would also have been responsible for submitting student coursework to the Ministry of Education for the Caribbean Secondary Education

Certificate (CSEC) exams in May. What's more, the annual deadline for coursework submission to the Ministry of Education is usually between the end of March and mid-April.

4. This study was further limited by the inherent limitations of the instruments (i.e. an online questionnaire created with SurveyMonkey). This is because the free Basic plan of SurveyMonkey allows customers to create and send surveys with a maximum of 10 questions and only provides up to 100 responses for each survey.

5. The most obvious restriction in this case study was a small sample, which prevented a clear generalized explanation. This is because the number of participants was too small to even consider adequately addressing the research questions or maybe summarizing past the context of the study. With a larger sample, differences were more than likely to have arisen. In any case, the small sample did not hinder the investigation noteworthiness or significance.

In addition,' the nature of the sample' makes it difficult to summarize the results for Guyana as a whole. This is on the grounds that the education system is partitioned into 11 regions, 10 of which identify with the administrative and geographic locales of the country, while Georgetown, the capital, is treated as a different district of education.

6. Finally, the predisposition of the researcher may distort the nature of the case study analysis. Refer to the background of the researcher for further clarification in Appendix 3.

3.5. Chapter Summary

This chapter outlined the implications of the research selection methodology. It was suggested that the case study analysis allows the researcher to use the information gathered to make speculation, thereby enhancing her experience and ability to examine the information's substance. To put it plainly, the case study technique retains both the comprehensive and substantial attributes of real-life opportunities such as individual life cycles, behaviors, and so on (Kothari, 2004). A case study is essentially a research method used to investigate an individual, a group of individuals, or a particular phenomenon in this context of this research (*Ibid.*). Data collection techniques such as semi-structured interviews and an online survey were used to triangulate data (Yancy 2013). Using the SurveyMonkey ® analytics tool and categorical aggregation or direct interpretation, the data

were then analyzed. Attempts have been made throughout the process of the study to comply with ethical guidelines. The chapter ends with the study's limitations narrative, and the next chapter will focus on the background of the case.

4. THE CASE DESCRIPTION

This chapter highlights the background of the case, a brief history of Guyana's education system, and examples of Guyana's Digital Turn in Education strategies.

4.1. Case Background - The Cooperative Republic of Guyana

The nation or what is referred to as the Cooperative Republic of Guyana, simply known as 'Guyana,' contains the enormous shield landmass north of the Amazon River and east of the Orinoco River known as 'Land of many waters' (Bissessar, 2017). It is an extremely small country nestled on the northern coast of South America between Venezuela and Suriname and just north of Brazil (Wilson, 2016).

European encounters in 1498 upset the lives of the indigenous peoples of Guyana, the Amerindians, as it was the Dutch who established the first colony in Guyana and contacted the indigenous peoples. The Dutch administration introduced sugar plantations and African slaves to Guyana. (*Ibid.*) Before 1787, the nation consisted of three Dutch provinces: Essequibo, Demerara, and Berbice. The Dutch colonizers presented the first draft constitution in 1787, which later became the reason for the province's constitutional changes in 1789. The provinces of Demerara and Essequibo were reintegrated authoritatively under the leadership of a representative with central command at Stabroek in Demerara. A key policy council was to be set up and private planters were allowed to select delegates to the council. (Bissessar, 2017)

Guyana has changed colonial administration between the Netherlands, France, and Britain a few times (Wilson, 2016). Historical records, however, indicate that after' a frequent change of hands,' the provinces were restored to the Netherlands with the Treaty of Amiens in 1802. However, by 1803, when war broke out among the various colonial powers, the British claimed the provinces for the third time. (Bissessar, 2017) In 1814, areas not controlled by the British were formally surrendered to Britain and in 1831 they were incorporated into a single colony called' British

Guiana' (Wilson, 2016). This constitutional change introduced another stage in the legislative issues of Guyana in 1831, along with the abolition of slavery in 1834 (Bissessar, 2017).

To compensate for the labor shortages resulting from the 1834 slave liberation, indentured servants were brought from Portugal, China, and especially India (Wilson, 2016); and in May 1838 the first group of indentured servants arrived in Guyana. This plan was temporarily halted from July 1839 to 1845, after which it continued uninterrupted until 1917, when the indentured system was abolished by the Indian government. (Bissessar, 2017) Moreover, the introduction of indentured servants diversified the population, resulting in five basic ethnic groups — Amerindians, Europeans (counting Portuguese), Africans, Indians, and Chinese (Wilson, 2016).

In 1966, Guyana obtained its freedom from Britain after some exceptionally intense disputes between the two predominant ethnic groups— the descendants of enslaved African and indentured Indian servants. After four years, in 1970, Her Majesty Elizabeth II, Queen of the United Kingdom was replaced as the Head of State by a Ceremonial President elected for a fixed term. Guyana was then declared a republic and renamed 'The Cooperative Republic of Guyana.' This renaming sought to mirror the socialist inclination of Guyana's politics. (*Ibid.*) "[It is said that the domestic policies of this new government depended to some extent on gerrymandering, control of the electoral process, and politicization of the civil service. In any case, apart from claims and inconsistency charges, nationalization was one of the government's approaches.]" (Bissessar 2017, 61)

For instance, the government took over one of the largest bauxite companies, the Reynolds Bauxite Company, in 1973. Shortly afterward, the new administration shifted its focus to the sugar industry and the government had nationalized Booker McConnell Company, a huge sugar company, by 1976. In addition, the government controlled over 80 percent of the Guyanese economy by the late 1970s, and apart from the nationalization of large foreign firms by the mid-1980s, the new administration also took control of most retail and distribution systems. Essentially, it was a virtual acquisition of everything from exports, imports, financial institutions and currency exchange regulations of the nation. (Bissessar, 2017)

In 1980, the government created a new constitution that made the president an executive president (Wilson, 2016). The economy of Guyana fell dramatically during the 1980s, and unfavorable world prices were only part of the problem. There have been two fundamental challenges: the lack of local managers fit to run the vast horticultural and mining ventures, and the lack of investment in

those areas as government assets have been severely depleted. The decrease in productivity was also a major issue and only aggravated the situation by responding to the economic downturn by the government. The fall in export earnings resulted in a shortage of foreign exchange. (Bissessar, 2017)

The goverment managed all exchanges requiring foreign trade and seriously confined imports. As such, these checks resulted in both deficiencies and shortages (*Ibid.*). Fundamentally, the tight government controls empowered the establishment of a colossal parallel market where dealers received illegal imports and currency traders evaded foreign exchange controls. Although numerous Guyanese in the parallel economy started to work and trade, many others left the nation. “[An estimated 72,000 Guyanese emigrated between 1976 and 1981, about one-tenth of the population,]” many of whom were trained and skilled professionals. Additionally, "[the unfriendly political introduction of the administration had likewise invalidated the probability of assistance from the US.]" (*Ibid.,* 63)

The situation at long last achieved a critical stage in the late 1980s because of Guyana's unsustainable debt obligation, and as income from export revenues declined, the government began borrowing funds from abroad to support the purchase of fundamental imports. “[Moreover, the external debt had risen to 1.7 billion dollars by 1988 (about six times Guyana's official GDP), and since the government piped cash into consumption instead of profitable ventures, Guyana's economy has not developed from debt. Rather the administration turned out to be progressively unequipped for satisfying its obligation commitments, achieving an astounding US$ 1 billion in 1988.]" (*Ibid.*) Indeed, even in the midst of Guyana's stagnant economic atmosphere, which lasted well over two decades (1961–1988), it was remarkable that no revolts or uprisings occurred in Guyanese society during that period (Bissessar, 2017).

Moreover, “[the government embarked on an austerity and recovery program supported by the IMF rather than risk curtailment of all foreign credit, and the Economic Reform Program (ERP) introduced in 1988 resulted in a reversal of the approaches that overwhelmed Guyana's economy for two decades]” (*Ibid.,* 63). “[Between 1985–1990, the government established fundamental electoral reform processes and incorporated the foundation of a free election commission with power across all parts of the electoral process. In any case, these changes were moderate, and some changes were not submitted until the government entered into a 'Standby Arrangement' with the International Monetary Fund.]” (*Ibid.,* 66)

“[One of the most important presentations was the passage of the 1990 Elections Laws Amendment Act. This revision gave the Elections Commission some level of command on issues related to decisions on the election workforce and the organization of national elections. While the change indicated that the Elections Commission was able to ‘regulate and direct’ the Election Commissioner's duties, one challenge remained unclear as to the employees ' day-to-day activities, including their appointment.]” (*Ibid.*) “[The Carter Electoral Observer Team influenced some of the extra electoral reform measures adopted on December 29, 1990, and included among these measures: the Election Law (Amendment) (No. 2) Act 1990 and the People's Representation Act 1990. In addition, in order to allow sufficient time for the registration process, Parliament passed a constitutional amendment prolonging the life of Parliament that the government passed the date of its booked disintegration (2 February 1991, but not to exceed 30 September 1991).]” (*Ibid.*)

Guyana's political and economic circumstances in 1992 were grim (Wilson, 2016), and the above revisions could be said to be responsible for the dramatic change in the General Elections of 1992 (Bissessar, 2017). It was obvious, however, that the intrigue appealed from the newly inaugurated president and former leader of the opposition. His name was Dr. Cheddi Jagan, and when he took office on October 9, 1992, he did not focus on his ideological position in grasping communism, “[but instead called on the people to rebuild Guyana and have a unified front.]” (*Ibid.,* 67) “[He was a strong supporter of foreign investment to help build the Guyanese economy and called for support from international donors, saying his administration sees the private sector as the main segment of economic growth, while the public sector will serve a steady and empowering economy regardless of its size and commitment to development and advancement]” (Wilson 2016, 86).

Dr. Jagan made an admirable attempt to assure the international community that the political belief system of his administration did not struggle with the neoliberal economic agenda (Wilson, 2016), and unfortunately he died in office in March 1997. Shortly after his passing, the then Prime Minister, Mr. Samuel Hinds, succeeded Dr. Jagan as president until December 1997, when he was replaced by Dr. Jagan's American widow, Mrs. Janet Jagan after the December 1997 general election (Bissessar, 2017). “[Guyana is generally based on the race for political power between the African Party, the National People's Congress (PNC) and the East Indian Party, the People's Progressive Party (PPP). The system of casting a relative ballot portrayal supported the group that obtained the most votes, and it wasn’t surprising that the People's Progressive Party consecutively won the 1992, 1997, 2001, 2006 and 2011 electoral races. However, as Table 4.4 illustrates the

number of smaller political parties, with the possibility of a 'coalition' of political alliances, had begun to try different things.]" (*Ibid.,* 67)

Year	Parties	Votes	Percentage	Seats
1992	People's Progressive Party	162,058	53.15%	28
	People's National Congress	128,286	42.31%	23
	The United Force	3,183	1.05%	1
	Working People's Alliance	6,86	2.01%	1
1997	People's Progressive Party/Civic	220,667	55.23%	29
	People's National Congress/Reform	161,901	40.52%	22
	Alliance For Guyana	4,983	1.25%	1
	The United Force	5,937	1.49%	1
2001	People's Progressive Party/Civic	210,013	52.96%	34
	People's National Congress/Reform	165,866	41.8%	27
	Guyana Action Party/ Working People's Alliance	9,451	2.38%	2
	Rise Organized And Rebuild	3,695	0.93%	1
	The United Force	2,904	0.73%	1
2006	People's Progressive Party/Civic	182,156	54.33%	36
	People's National Congress/Reform	114,283	34.09%	22
	Alliance For Change	27,397	8.17%	5
	Guyana Action Party/ Rise Organized And Rebuild	4,588	1.37%	1
	The United Force	2,915	0.87%	1
2011	People's Progressive Party	166,340	48.60%	32
	A Partnership For National Unity	139,678	40.81%	26
2015	APNU – Alliance For Change	207,201	50.30%	33
	People's Progressive Party	202,694	49.20%	32

Figure 1. Election results in Guyana from 1992 to 2015
Source: (Bissessar 2017, 68)

"[The task for these smaller political parties (such as Rise, Organize and Rebuild (ROAR), The United Force (TUF), etc.) was that they did not understand that alliances were supposed to have an establishment or stage in which to dispatch their ideas. However, in 2011, the National Unity Partnership (a coalition of the National People's Congress (PNC), the Guyana Action Party (GAP) and the Working People's Alliance (WPA)) selected Mr. David A. Granger, a former commander of the Guyana Defense Force (GDF), and a government alliance took shape. The result in 2015 was a victory for the APNU–Alliance for Change Union of the National Assembly, which won 33 of the 65 seats.]" (*Ibid.*, 67-68)

It was, however, a 'one' seat triumph for His Excellency Brigadier David Arthur Granger, the Cooperative Republic of Guyana's official leader and executive president. However, "[this limited

control is not out of the ordinary, a proportion of Guyana's instability continues to hinder its advancement.]" (*Ibid.,* 68) Moreover, the political framework that the colonial government has left behind does not fit well with Guyana, 'considering the cultural makeup of the nation.' Nevertheless, irrespective of ethnic backgrounds, both young and old alike are troubled with government and public safety issues in Guyana, so mass migration is likely to continue along with crime and violence. (Wilson, 2016)

In a nutshell, in Guyana, "[due to competition over scarce resources, ethnopolitics prevails at the mass level, which is considerably scarcer in a resource-deficient environment such as Guyana. In any case, ethnopolitics prevail in the face of indiscipline and doubt and the co-optation of the ethnic weaknesses of the electorate.]" (*Ibid.,* 97) One might even allude to the fact that 'no vision or authority exists', since there isn't much evidence to conclude that any of the major political parties have done much to pacify the apprehensions of the other ethnic group and this inherently fosters ethnic strife during electoral races (*Ibid.*).

4.2. Guyana's Education System

Religious associations ran government-funded schools that began to emerge in the mid-1800s under the leadership of the London Missionary Society's elementary schools. In 1876, primary education became compulsory for all ages 6 to 14. However, lectures and textbooks were prepared and mainly focused on the history and writing of the United Kingdom. In fact, all exams were held in the UK and specialized instruction was not accessible as trades were learned from apprenticeships exclusively. Moreover, before the University of Guyana was established in 1963, those who wanted advanced education had to attend institutions abroad. (Guyana … 2019)

However, Guyana's education system experienced real change in 1961, when the administration took over the schools and created the Ministry of Education. After obtaining its freedom in 1966, the nation acquired an established educational framework, but its educational curriculum and objectives were designed in accordance with the British system. The government then made adjustments to align schools with the nation's political objectives, ethnic mix, and financial needs. (Wilson, 2016) Private education was nullified in 1976 and from nursery to university education became free. What this meant was that anyone could go to school, irrespective of their financial situation. Moreover, Guyana's new constitution in 1980 gave citizens the privilege of continuous

training and education. This meant that academic, scholastic, specialized (technical) and vocational high schools could be chosen by those attending high school. The government also established commercial schools offering training in engineering and construction work. (Guyana … 2019)

Though Guyana's literacy rate transcended 95 percent with the new adjustments, school conditions were far from perfect. Schools were overcrowded during the 1970s and educators who opposed the government's efforts to ensure that "all educators taught loyalty to the administration and its socialist ideals" were terminated. (Bissessar, 2017; Wilson, 2016) As a result, truancy and illiteracy greatly increased. This coupled with the reduction in educators led to weakened school conditions and low scores on Caribbean-wide examinations. (Guyana … 2019)

Guyana's financial problems in the 1980s, coupled with the government's promise to support free public education, led to school underfunding and a decline in quality education. As such school infrastructure was neglected, educational materials were rare or non-existent, and teaching equipment deteriorated. Educators' pay rates were poor, and as supply budgets fell, so did the number of trained educators, as many sought positions abroad and migrated overseas to escape political abuse and occupation uncertainty. (*Ibid*.) In 1989, however, the government presented an Economic Recovery Program (ERP), leaving a state-controlled, socialist economy to a free-market system (Wilson, 2016). Furthermore, improvement in education was one of the administration's top priorities by 1999 and increased compensation for educators. Moreover, new schools were built and this, in essence, reflected a rise in the nation's struggling educational system. (Guyana … 2019)

Today, the government mainly provides education through the Ministry of Education in Guyana. The government is responsible for determining school curricula, allocating funding to schools, setting school standards and policies, and the Ministry of Education and other related government agencies are responsible for implementing them. In addition, Guyana's government allocates a substantial portion of the country's GDP to education, making the nation one of the top education spenders in the Commonwealth Caribbean. (The Education System … 2019)

4.2.1. Structure of the Education System

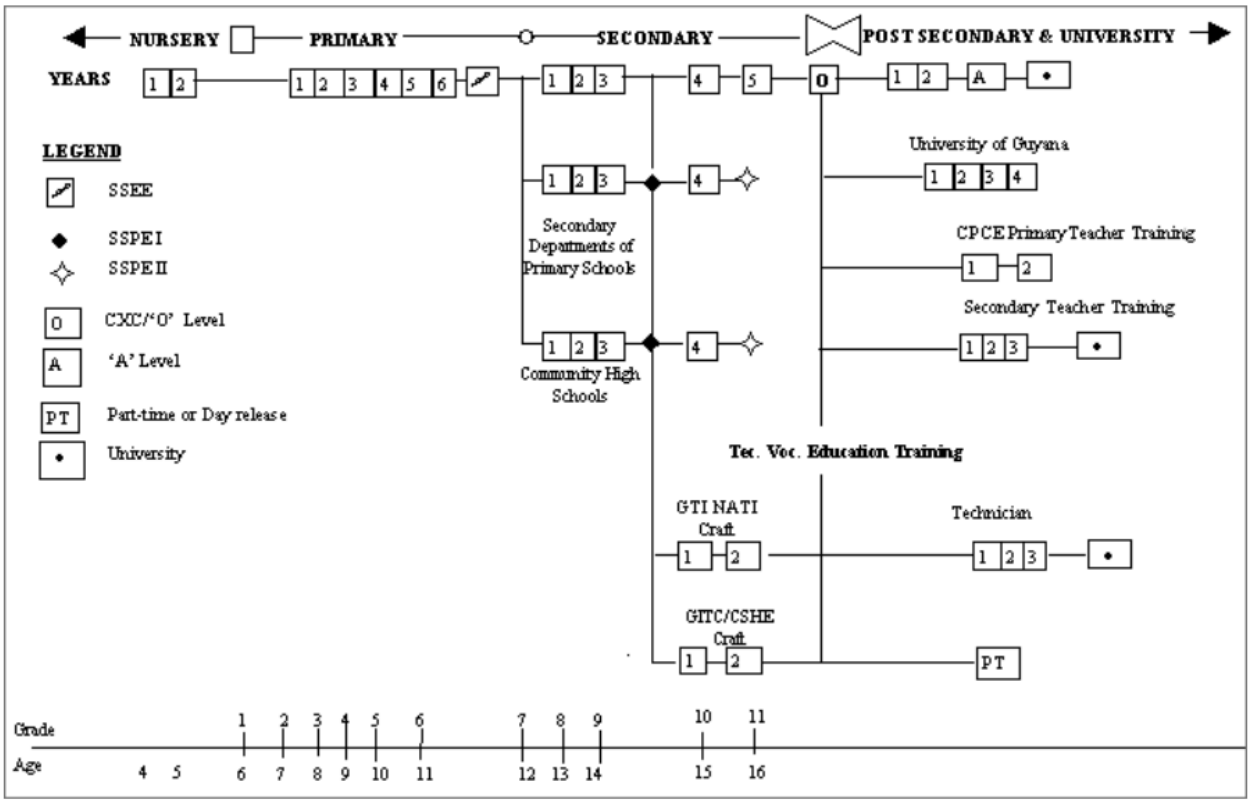

Figure 2. Guyana: structure of the education system

Source: (Guyana; World Data on Education … 2011, 8)

Education in Guyana is compulsory from 5 years of age and 9 months to 16 years of age. There are six years of primary education and five years of secondary education, and afterwards students have the option of attending university and/or pursuing postgraduate studies. The school year also begins in September and ends in July. (Education in Guyana … 2019)

4.2.2. Organization of the Education System

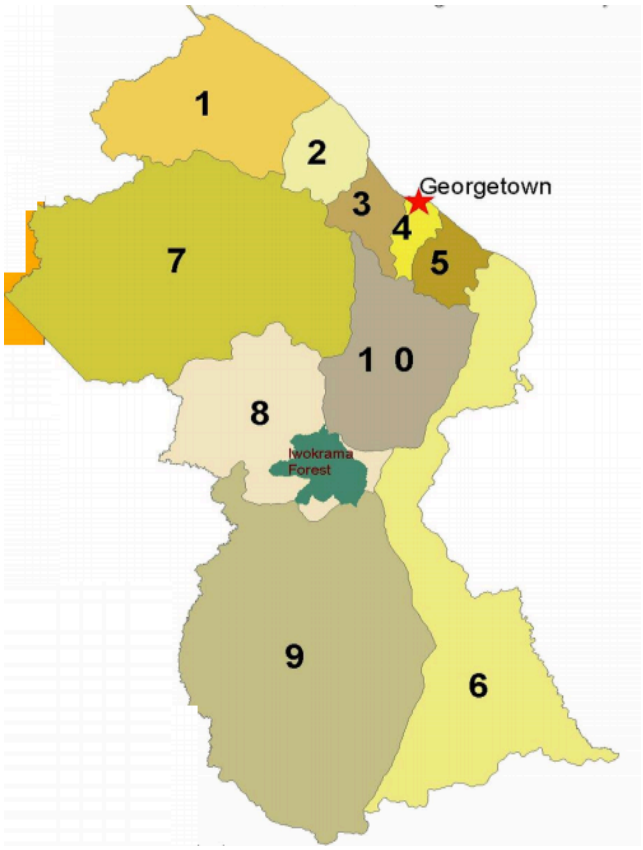

Figure 3. Education districts by number
Source: (Universal Secondary Education … 2008, 3)

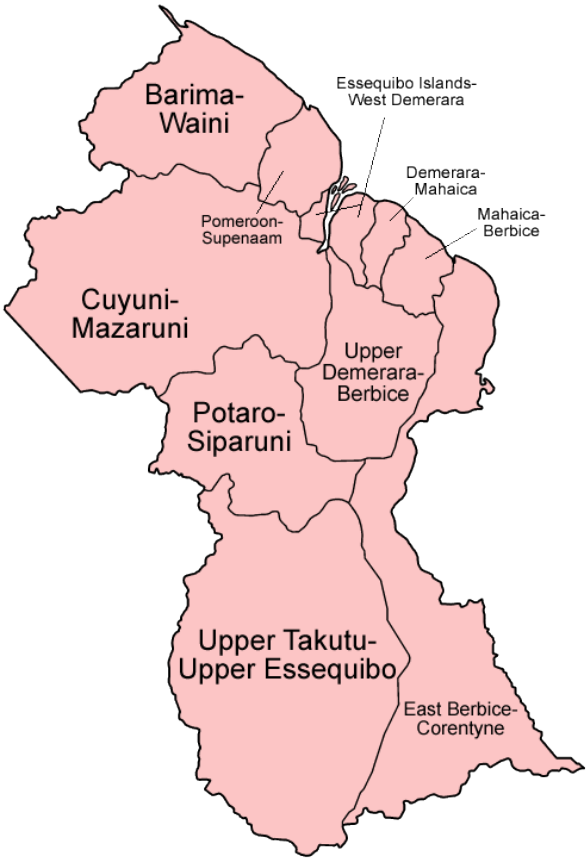

Figure 4. Education districts by name
Source: (Regions of Guyana, 2019)

In addition to Georgetown, the capital, which is administered separately, Guyana is divided into ten geographical and administrative regions (and districts of education). "[At the local or regional level, the responsibility for education lies with the Regional Democratic Council (RDC) and their respective chairpersons, who oversees the Regional Education Officers (REDOs) and educators. These local officers are under the political supervision of the Minister of Regional Development who controls the spending limit, support, and development through his/her Permanent Secretary and Secretariat. The Ministry of Education (MOE) remains in charge of by and large education strategies and co-ordinates, screens and assesses the delivery of instructive services within the education districts.]" (Guyana; World Data on Education … 2011)

4.3. Examples of Guyana's strategies for Digital Turn in Education

Guyana's 2014-2018 Education Sector Plan (ESP) outlines two needs: expanding learning outcomes across all educational dimensions and subgroups; and decreasing contrasting learning outcomes among subgroups, particularly among coastal and hinterland students; and a major concern for science and technology, skills and numeracy (Education in Guyana … 2019). As such, a few examples of government strategies for a digital turn in education are discussed below:

1. In October 2016 at the Cyril Potter College of Education (CPCE) (a.k.a.'The Teacher's Training College') in Georgetown, the government of Guyana (in a joint effort with the Ministries of Public Telecommunications and Education) and supported by the People's Republic of China (which provided approximately 30,000 computers for the One Laptop Per Family Project in 2014), launched the 'One Laptop per Teacher ' initiative. This initiative aimed to support educators with the ultimate goal of improving the delivery of education and irrespective of their use (either for record keeping, lesson planning, research or as a learning asset in the classroom) these laptops would greatly improve the delivery and receipt of education. (One Laptop per Teacher … 2016)

2. Public Telecommunications Minister Catherine Hughes attended the launch and reported that more than 100 educational institutions and organizations were connected to the fiber optic network of the government in September 2016 (*Ibid.*). At the 2017 Guyana Business Summit, the Guyanese Minister of Public Telecommunications indicated in her address to the Private Sector Commission that, apart from networking and Internet access, the government provided educational institutions in September 2016 with other capacity-building initiatives such as the distribution of laptops to almost every Guyanese teacher (Human capital development … 2017).

What's more, one of the interventions undertaken by the current administration to bridge the gaps in quality and educational opportunities between the capital, provincial and hinterland regions (i.e. between Georgetown and the 10 educational districts shown in Figure 3) was the establishment of a national e-library (*Ibid.*). This would give Guyanese students the same access to web-based learning materials irrespective of where they are located. This meant that students at the St. Ignatius High School in Lethem's hinterland (region 9 in Figure 3) could continuously interface with a Biology class at the Bishops High School in Georgetown (see Figure 3). (*Ibid.*)

3. In November 2017, the Ministry of Education at the National Center for Education and Resource Development (NCERD) propelled the first smart classroom in Guyana with the point of continuously using innovative technology to associate schools and classrooms across Guyana. The room is equipped with a Promethean touchscreen board, 30 tablet charging stations, smartphones and PCs, and student-friendly ergonomic furniture. (Education Ministry launches $6M 'Smart' classroom … 2017) In fact, in the state-funded education system, students and instructors from eight of the 10 administrative regions are able to use different reading materials. Similarly, the Smart classroom is intended to overcome barriers to bridging the gap between coastal and hinterland schools and rural communities. (The Smart Classroom … 2017)

4. Ten months later, in September 2018, the Ministry of Education promoted its first Smart Classroom in Region One (see Figure 3) due to the lack of educators repressing local capacity to deal legitimately with the number of young people passing through the state-funded education system. Again, the new smart classroom formed part of the plans of the Ministry of Education to reduce the imbalance and discrepancy between the nature of instruction on the coast and in the hinterland. In addition, Region One expects to commit more assets to modernize the delivery of scholastic substance to students in Barima-Waini (see Figure 4). (Education Ministry launches first Smart Classroom … 2018)

5. Two months later, in November 2018, the government's spending limit for smart classrooms and more ICT centers was set at $4B of the full spending plan for the ICT sector in 2019, covering various activities such as making smart classrooms and increasing security in Georgetown's education district by introducing CCTV cameras at key points (Khan A., 2019). In addition, it was reported that the Minister of Finance planned to accelerate the ICT sector's transformation with the development of the national broadband infrastructure in 2019 (Gov't budgets for 'smart' classrooms … 2018).

6. Subsequently, the Minister of Public Telecommunications, Ms. Catherine Hughes, reiterated in her January 2019 speech that one of the Ministry's primary objectives was to educate and prepare Guyanese citizens for the use of ICT. In addition, based on an in-depth investigation of two prominent undertakings (e.g. Guyanese Girls Code and Regional Code Camps) in 2018, it was found that both initiatives had gained a strong foothold. (Khan A., 2019)

7. In addition, Region 9 received its first smart classroom in the hinterland of Guyana in February 2019 (see Figure 3). This meant that students attending schools in the Upper Takutu Upper Essequibo region (see Figure 4) are the fortunate beneficiaries of a smart classroom that is centrally located at the Lethem Learning Resource Center and is expected to benefit a vast number of students in the Region. Together with the Regional Democratic Council (RDC) of the Ministry of Education in Region 9, the brainchild behind this unique venture is the National Center for Education and Resource Development (NCERD). The project was sanctioned by Education Minister Dr. Nicolette Henry in accordance with the Ministry's goal of 'providing enhanced learning opportunities for all' and all districts of education (see Figure 3) are expected to have smart classrooms before the end of the year. (Isaacs, 2019)

8. Moreover, since February, the performance improvements of Region 9's students have been noted in the Smart Classroom, and the Ministry of Education reported that the students of the Region would benefit greatly from educational reforms on the grounds that the Smart Classroom and the performance improvements of the students have now made the 1976 educational modules obsolete. In short, changing the 1976 module variant will enable students to become productive citizens and all the more likely achieve their maximum potential. On that note, in combination with new educational reforms, smart classrooms similar to the one recently commissioned in Region 9 will encourage students to work progressively, which in turn means that students in Region 9 will have the same opportunities as those in the capital and elsewhere in coastal education districts (see Figure 3). (Two new schools, smart classrooms commissioned … 2019)

Case in point, the above indicates that Guyana has gained critical ground in recent times in improving overall access to education by increasing the number of trained educators, providing more access to ICT resources, especially PCs, and revising physical facilities. Despite this progress, however, Guyana's education system continues to recover from long stretches of underinvestment and numerous challenges, including early childhood education services, quality teaching, and reliable data access. (Education in Guyana … 2019) Essentially following the government's mandate to create a Digital Turn in Education, integrating ICT into the teaching process as well as improving ICT tools such as' hardware' will in the long run create environments that foster both technology utilization and ICT investment (Information and Communication Technology … 2019; Tochukwu 2015).

4.4. Chapter Summary

This chapter described the background of the case (i.e., The Cooperative Republic of Guyana's detailed history), a rather minute description of the education system, and examples of the country's Digital Turn in Education strategies. The next chapter will examine the quantitative and qualitative data of the study.

5. DATA ANALYSIS

5.1. Introduction

Data analysis in a subjective report basically includes incorporating the investigator's data from various sources into a reasonable portrayal of what he or she has observed or generally found (Wallen, Fraenkel 2001). It is critical to consider techniques just as timing and weighting to choose how subjective and quantitative information is blended (Plano Clark, Creswell 2007). The interviews were transcribed into Microsoft Word documents and the interview data initially condensed and arranged within the structure of the research questions. Subjective information from the open-ended interview questions has also been arranged as a feature of research questions.

Quantitative survey data was analyzed using the SurveyMonkey ® analytics tool that provides descriptive statistical analysis. These include frequency analysis, mean, standard deviation, and a detailed analysis of each question. While selecting a configuration of a blended strategy, weighting must be considered by organizing the subjective or quantitative information collected in response to research questions, and although the underlying expectation was to give equivalent weighting to the quantitative and subjective information collected, the subjective information was of greater importance as it gave a more extravagant portrayal through the interview process. (*Ibid.*)

In addition, the findings discussed in this part of the study are comparable to the Mafang'ha (2016) research on teacher experience in using ICT to facilitate teaching in secondary schools in the Ilala district of Tanzania, as well as the Kareji (2016) research on ICT integration in high school English teaching in the Kisumu County sub-county of Nyakach, Kenya. The results in Mafang'ha (2016) were partially used as a guide to analyze quantitative data from the online survey and are discussed as follows:

5.1.1. General details of the respondents

This section presents information about the gender and age of respondents, their highest level of education, and the length of their teaching experience. The respondents were asked to indicate their gender, (Kareji 2016; Mafang'ha 2016) and it should be noted that 100% of the respondents are female.

Table 1. Overview of the respondents

Gender	Frequency	Percentage
Female	7	100.00%
Male	0	0.00%
Total	7	100.00%

Source: (Field Data, 2019), author's calculations

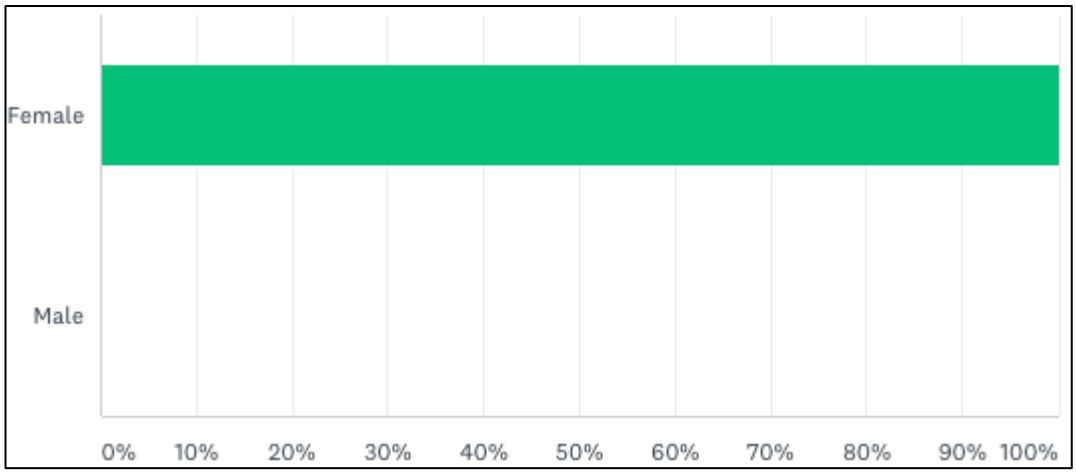

Figure 5. Overview of the respondents
Source: (Field Data, 2019), author's calculations

It is evident from the findings of the investigation that the respondents were female educators. Furthermore, the discoveries showed that the data collected from the gender organization were one-sided, so the information gathered was not seen to reflect thoughts from a mixed-gender arrangement (Mafang'ha, 2016).

5.1.2. The Teachers' Age

In order to determine the teachers' ages, respondents were asked to indicate their age. The distribution of their age is shown in the following table (*Ibid.*):

Table 2. The Age of Teachers

Age	Frequency	Percentage
Under 25	0	0.00%
25-34	1	14.29%
35-44	3	42.86%
45-54	3	42.86%
Over 55	0	0.00%
Total	7	100.00 %

Source: (Field Data, 2019), author's calculations

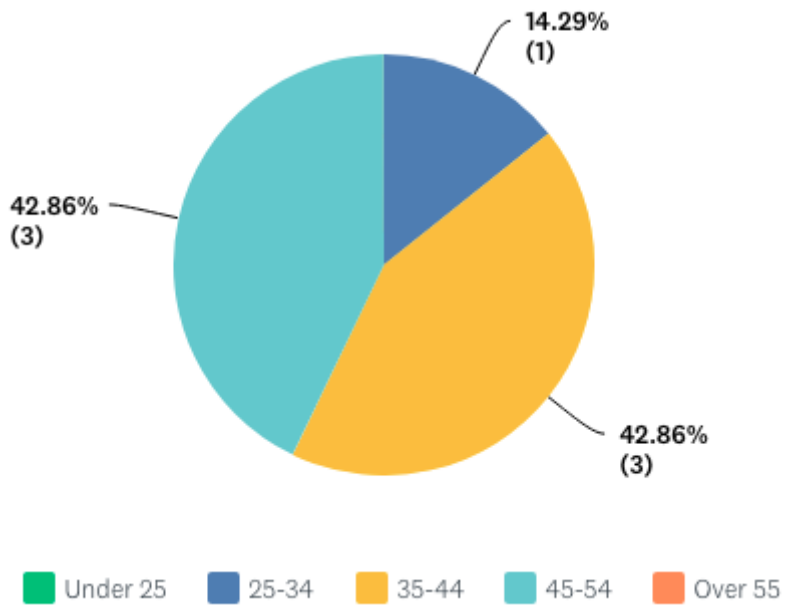

Figure 6. The Age of Teachers
Source: (Field Data, 2019), author's calculations

The figure above shows that in the 35-44 year-old and 45-54 year-old age groups there were 42.86 percent of teachers. Only 14.29% of respondents were in the age group of 25-34 years. Most teachers were therefore under the age of 55.

5.1.3. Highest level of education for respondents

The respondents were asked to indicate their highest level of education (Kareji 2016; Mafang'ha 2016). The survey found that, respectively, 42.86 percent of respondents held postgraduate and master degrees, and only 14.29 percent had bachelor degrees.

Table 3. The highest level of education for respondents

Teacher's qualification	Frequency	Percentage
Trained teacher's certificate	0	0.00%
Diploma/associate degree	0	0.00%
Bachelor's degree	3	42.86%
Postgraduate diploma	1	14.29%
Master's degree	3	42.86%
Total	7	100.00 %

Source: (Field Data, 2019), author's calculations

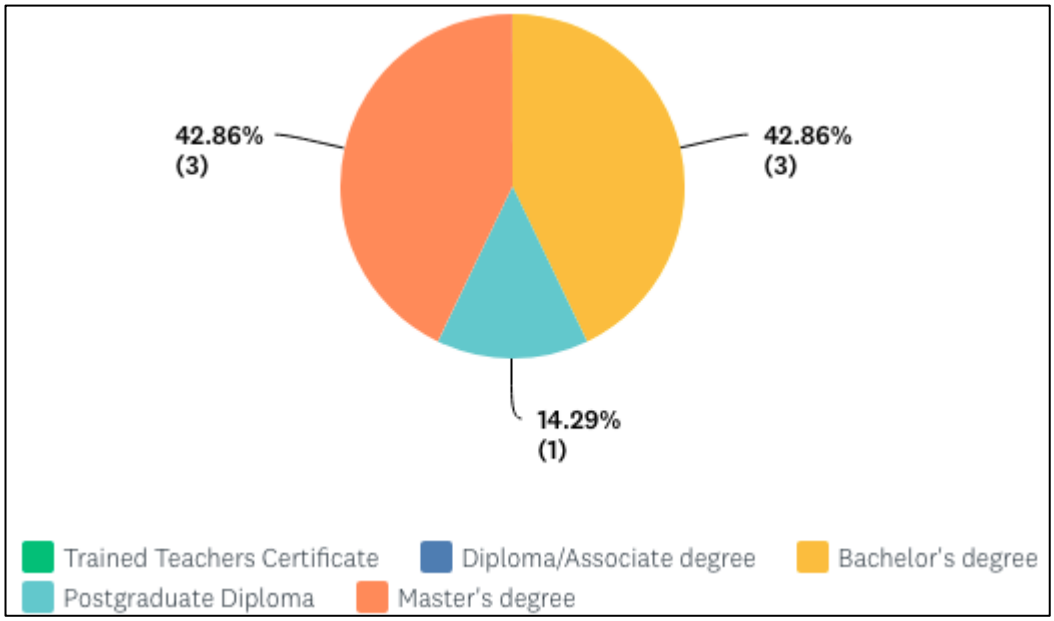

Figure 7. The highest level of education for respondents
Source: (Field Data, 2019), author's calculations

The survey results indicated that the respondents are high school teachers who are qualified in their respective disciplines (Mafang'ha, 2016).

5.1.4. Teaching experience of respondents

In order to find out their teaching experience, the researcher grouped the respondents into several periods (*Ibid.,* 41). The results are 28.57 percent for 21-25 years, 42.86 percent for 16-20 years, 14.29 percent for 11-15 years and 4-6 years respectively, and the results are as follows:

Table 4. The teaching experience of the respondents

Experience in years	**Frequency**	**Percentage**
Less than one year	0	0.00%
1-3 years	0	0.00%
4-6 years	1	14.29%
7-10 years	0	0.00%
11-15 years	1	14.29%
16-20 years	3	42.86%
21-25 years	2	28.57%
More than 26 years	0	0.00%
Total	7	100.00 %

Source: (Field Data, 2019), author's calculations

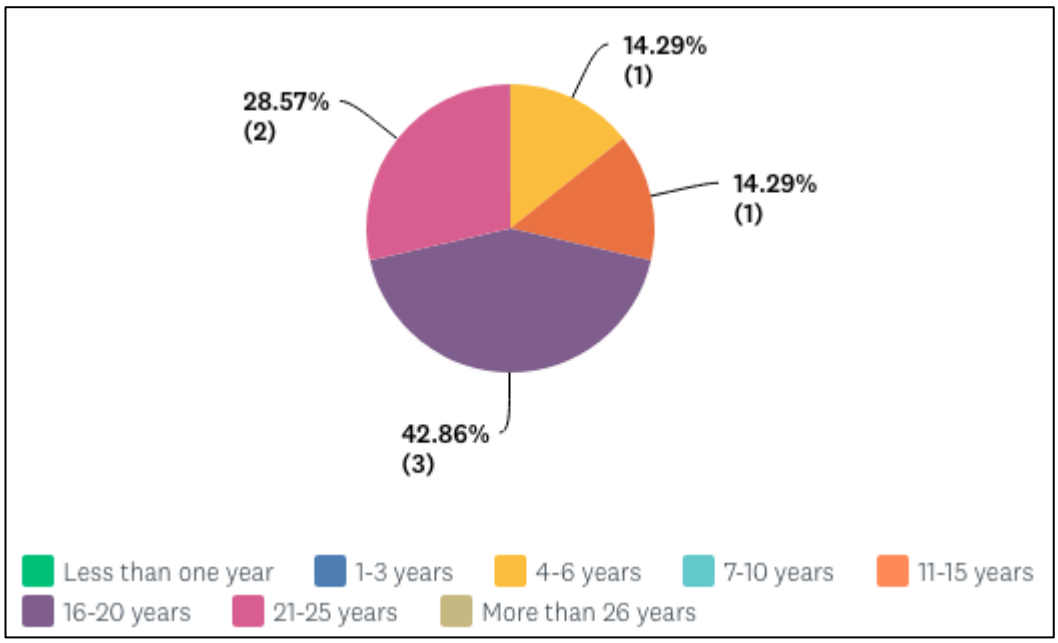

Figure 8. The teaching experience of the respondents
Source: (Field Data, 2019), author's calculations

It can be seen that all respondents have been teaching for at least four years, and after some time when teaching experience is gained, educators who have been teaching for a longer periods are better equipped to integrate ICT in the teaching and learning process (as supported by Dudzinski *et al.* 2000). (Mafang'ha, 2016) Then again, in terms of teaching experience, more experienced educators are considered to be more effiecient and effective that their less experienced counterparts

(Clotfelter *et al.* 2010; Laronde 2010). As such, the data provided by the respondents can be reliable on the grounds that they possess a wealth of teaching experience and can therefore integrate ICT to improve the teaching and learning process in their respective lessons and classes (Mafang'ha, 2016).

5.1.5. ICT tools/resources available in the schools of the respondents

The results are as follows in finding out what ICT tools / resources are available in the respondent's schools.

Table 5. ICT tools / resources at the respondent's schools (Kareji, 2016)

ICT tools	**Frequency**	**Percentage**
Internet connectivity	6	85.71 %
It room or computer lab	7	100.00%
Promethean/smart board	1	14.29%
Computers	7	100.00%
Tablets	0	0.00%
Smartphones	3	42.86%
LCD projectors	6	85.71 %
Television	3	42.86%
Radio	2	28.57%
Email services	4	57.14%

Source: (Field Data, 2019), author's calculations

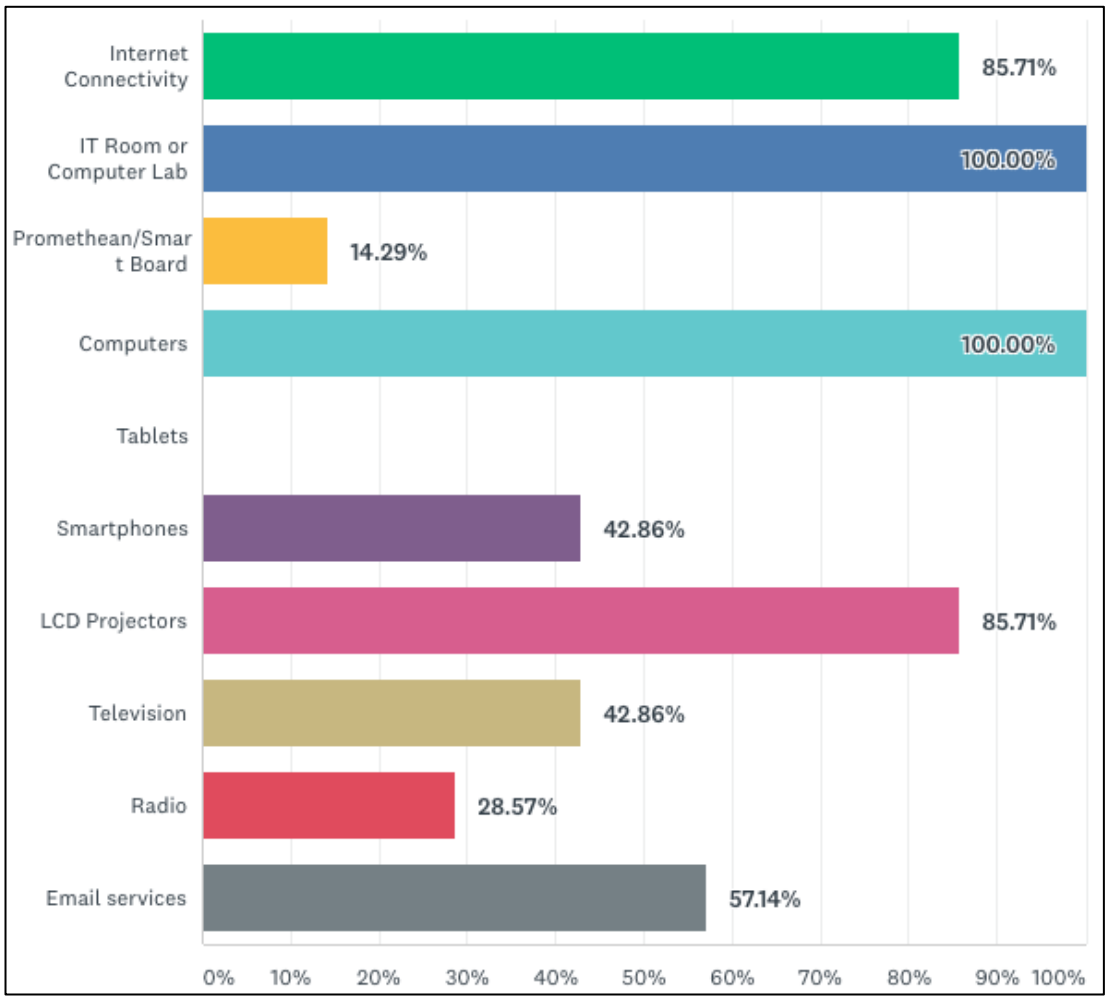

Figure 9. ICT tools / resources at the respondent's schools
Source: (Field Data, 2019), author's calculations

It can be concluded from the survey findings that most schools in the population sample are equipped with ICT tools/resources to facilitate ICT integration into the teaching and learning process.

5.1.6. ICT expertise level of the respondents

In finding out the teachers' level of technology expertise (Mafang'ha 2016; Yancy 2013), it was found that 5 out of 7 respondents, i.e. 71.43 percent of the sample population, were extremely confident using Word processing, with only 3 out of 7 respondents (i.e. 42.86 percent of the sample population) using Spreadsheets for data analysis being extremely confident. 4 out of 7 respondents, i.e. 57.14 percent, were extremely confident in using Presentation software such as PowerPoint, while only 3 out of 7 respondents (i.e. 42.86 percent of the sample population) were extremely confident in working with graphical peripherals such as scanners, digital cameras, etc. What's

more, the same percentage of the sample population (i.e. 42.86 percent or 3 out of 7 respondents) was extremely confident Searching the Internet Using' keywords' to narrow search results effectively. The remaining results can be found below:

Table 6. Respondents ' level of ICT expertise

	Extremely confident	Very confident	Somewhat confident	Not so confident	Not at all confident
Word processing	71.43% 5	0.00% 0	14.29% 1	0.00% 0	14.29% 1
Spreadsheets (for data analysis)	42.86% 3	28.57% 2	14.29% 1	14.29% 1	0.00% 0
Presentation software (e.g. PowerPoint)	57.14% 4	28.57% 2	0.00% 0	14.29% 1	0.00% 0
Graphical peripherals (e.g. scanners, digital cameras, etc.)	42.86% 3	14.29% 1	28.57% 2	0.00% 0	14.29% 1
Search the Internet Effectively using 'keywords' to narrow search results	42.86% 3	42.86% 3	14.29% 1	0.00% 0	0.00% 0

Source: (Field Data, 2019), author's calculations

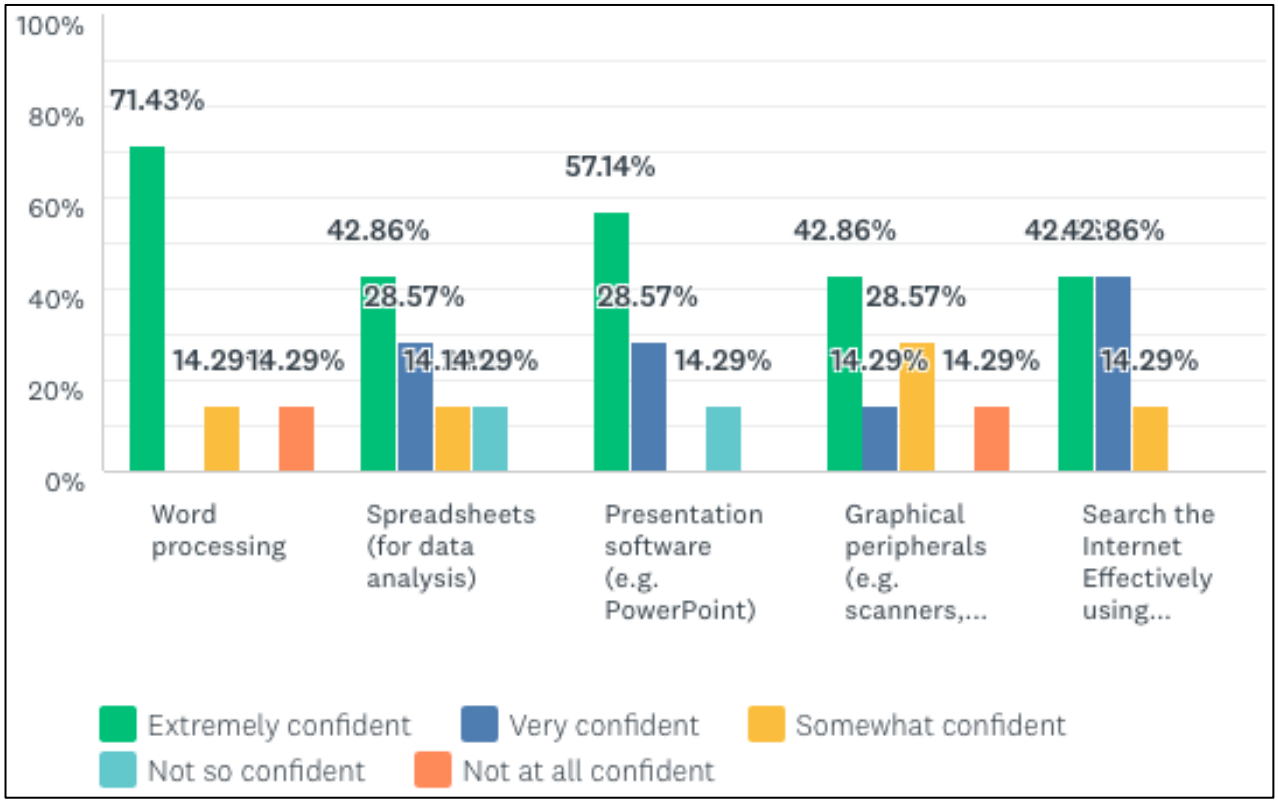

Figure 10. Respondents ' level of ICT expertise
Source: (Field Data, 2019), author's calculations

5.1.7. Use of ICT to teach

5.1.7.1. Planning and Executing Technology-Supported Instruction

Regarding the' Supported Technology Planning and Execution Instruction, 4 out of 7 respondents, i.e. 57.14 percent of the sample population, were strongly in agreement with the statement that they always consider whether the technology could improve their teaching or student learning when planning lessons. While only 5 out of 7 respondents (i.e. 71.43 percent of the sample population) agreed they make selections when choosing education technologies only after investigating their effectiveness. Four out of seven respondents, i.e. 57.14 percent, strongly agreed that they were comfortably prepared for classes in which students use technology during lessons. Moreover, only 4 out of 7 respondents, i.e. 57.14 percent agreed to use technology on a regular basis to enhance classroom learning. Finally, only 5 out of 7 respondents (i.e. 71.43 percent of the sample population) agreed that they can easily coordinate learning exercises when their students use technology. The remaining results are below:

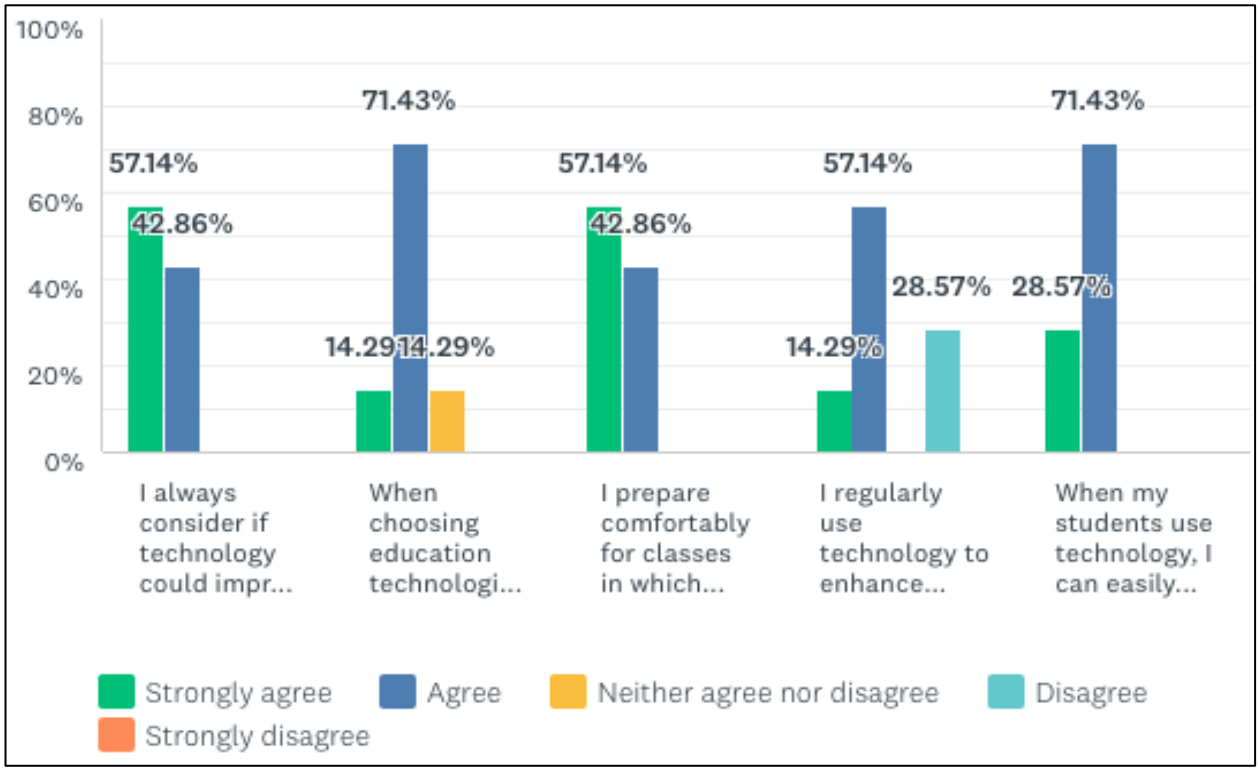

Figure 11. Use of ICT to teach, plan and execute technology-based training
Source: (Field Data, 2019), author's calculations

Table 7. Use of ICT to teach, plan and execute technology-based training

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I always consider if technology could improve my teaching or student learning when planning my lessons.	57.14% 4	42.86% 3	0.00% 0	0.00% 0	0.00% 0
When choosing education technologies, I make my selections once I investigate their effectiveness.	14.29% 1	71.43% 5	14.29% 1	0.00% 0	0.00% 0
I prepare comfortably for classes in which students use technology during the lessons.	57.14% 4	42.86% 3	0.00% 0	0.00% 0	0.00% 0
I regularly use technology to enhance learning in my classroom.	14.29% 1	57.14% 4	0.00% 0	28.57% 2	0.00% 0
When my students use technology, I can easily coordinate learning exercises.	28.57% 2	71.43% 5	0.00% 0	0.00% 0	0.00% 0

Source: (Field Data, 2019), author's calculations

5.1.7.2. Technology and Assessment

Only 2 out of 7 respondents, i.e. 28.57 percent from the sample population, were strongly in agreement with the statement that they are using technology to manage information on student evaluation. While only 3 out of 7 respondents (i.e. 42.86 percent of the sample population) agreed to use effective methods to evaluate technology-based student work. Four out of seven respondents, i.e. 57.14 percent, strongly agreed that they were willing to use technology to gather, explore and interpret information about student progress. The rest of the results are as follows:

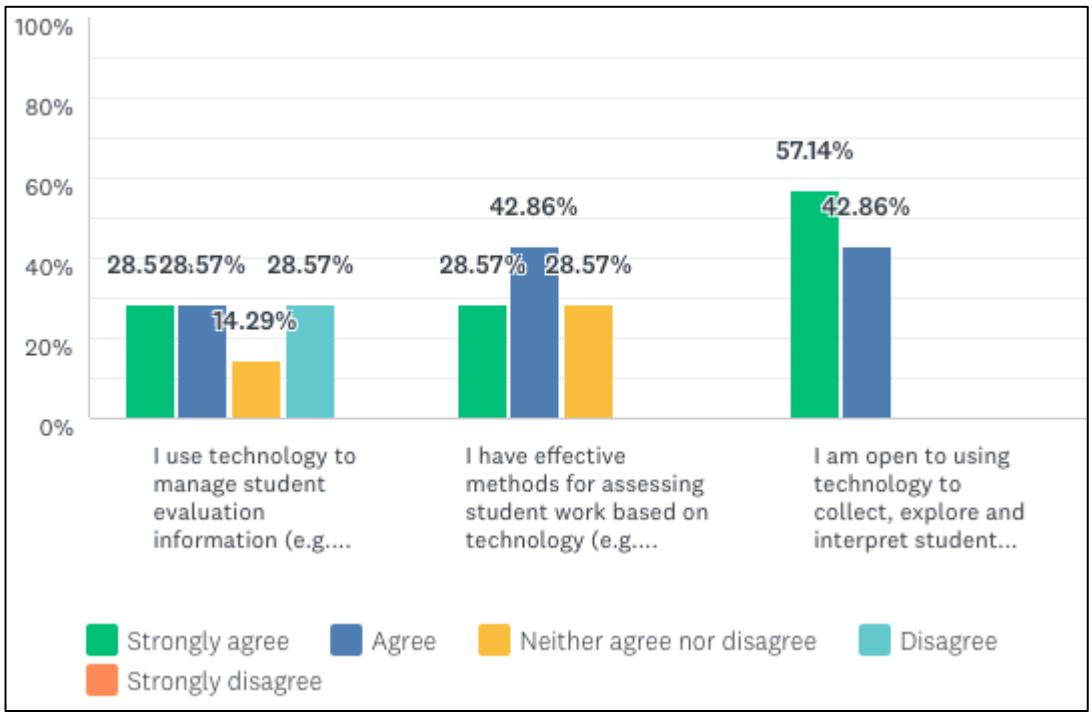

Figure 12. Use of ICT for teaching, technology and evaluation
Source: (Field Data, 2019), author's calculations

Table 8. Use of ICT for teaching, technology and evaluation

	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
I use technology to manage student evaluation information (e.g. using educational technology platforms such as GradeQuick, PowerSchool or MySchool for custom reporting, classroom attendance management, etc.).	28.57% 2	28.57% 2	14.29% 1	28.57% 2	0.00% 0
I have effective methods for assessing student work based on technology (e.g. grading student work involving online research or where the item is a webpage or video).	28.57% 2	42.86% 3	28.57% 2	0.00% 0	0.00% 0
I am open to using technology to collect, explore and interpret student progress information (e.g. by creating charts to display performance patterns or by using handheld devices to collect student data as they learn, etc.).	57.14% 4	42.86% 3	0.00% 0	0.00% 0	0.00% 0

Source: (Field Data, 2019), author's calculations

5.1.8. Students use ICT to demonstrate learning in their classes

The results shown below are on students using ICT to demonstrate learning in their classes.

Table 9. Students use of ICT in their classrooms to demonstrate learning

ICT usage	Frequency	Percentage
Word-processing or pdf documents	6	85.71%
Presentations (e.g. Powerpoint)	7	100.00%
Video or audio products	5	71.43%
Websites	3	42.86%
Electronic art (e.g. Digital photography, drawing graphics software	5	71.43%
Journals, newspapers or magazines (electronic or print)	3	42.86%

Source: (Field Data, 2019), author's calculations

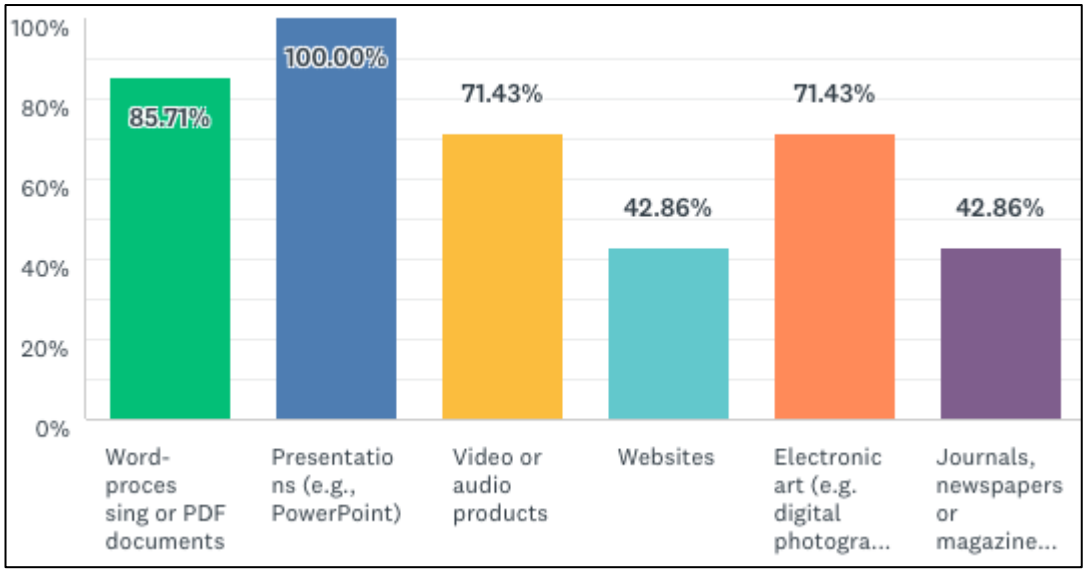

Figure 13. Students use of ICT in classrooms to demonstrate learning
Source: (Field Data, 2019), author's calculations

It can be seen, according to the above figures, that students of the respondents use ICT to demonstrate learning in their classes, and more so it can be generalized that using ICT simplifies the process of teaching and learning.

5.2. Qualitative data presentation from open-ended interviews

This section presents the study's qualitative results. In order to gain insight into the factors influencing the implementation and use of ICT in secondary schools in Georgetown, semi-structured interviews were used to explore the following areas: use of ICT in lessons (i.e. how technology is used to motivate students in the classroom), the importance and benefits of using technology in the classroom, as well as the impediments to technology use. First, all three interviewees were asked a series of similar questions and their answers are grouped as follows:

5.2.1. Use of ICT in Lessons

When asked about using ICT in lessons to motivate students in the classroom, the interviewees provided the following answers:
"I use a lot of educational videos in my classes because I find that my students are more motivated to learn through visual media, particularly video materials."

"I usually try to think about alternative ways of using technology, and since my students have smartphones, I tend to use it to my advantage and use creativity to plan and integrate it into some of my lessons. I also find that using different technological devices can boost student motivation."

The connection between the interviewees' overall response and the theoretical framework was also highlighted. This is because ICTs can upgrade teaching by enhancing student motivation and responsibility, securing basic skills and enhancing teacher training (Noor-Ul-Amin 2013; Yancy 2013). In addition, ICTs empower students to search for the data they need and allow them to adapt even more appropriately by providing access to a wide range of new educational methodologies to educators. Essentially, as they progress through the education system, students gradually become responsible for their own learning. (Jeffels, 2019)

5.2.2. The Importance of Using Technology

The study interviewees were questioned about their perceptions of the importance of integrating ICT into the process of teaching and learning. They agreed that ICT for teaching and learning is indeed necessary and confirmed this in the following statements:
"Using a variety of technological devices helps me to motivate my students and keep them interested."

"It's important to use technology in the classroom because if my lessons are mundane, I find that using technology increases my teaching motivation because I think I'm more creative. As a teacher, I also want my students to be creative, and more importantly, using technology makes it possible for them to learn more about my subject."

"Yes, I think it's important to use technology because as a PE teacher I usually motivate students to do independent research on my subject because if they use technology, doing research is much more interesting for them."

The use of ICT in teaching and learning is critical because it gives teachers and students the opportunity to work, store, control and recover data. It also encourages dynamic learning and self-responsibility and motivates teachers and students. (Ali *et al.* 2013; Laronde 2010) More often than not, ICT is utilized as a vehicle for instructing and adapting autonomously of the subject and is in itself an instructing and learning device, all the more so as a medium through which educators can teach and learn (Al Mofarreh 2016; Bhattacharjee, Deb 2016; Laronde 2010).

5.2.3. Benefits of Using Technology

In response to a question relating to the benefits of using ICT in the classroom, the respondents suggested that

"The use of technology in the classroom has so many advantages, but for me, because I use a lot of visual media in my lessons, I think the main benefit here is that there are so many educational videos online. This is a big plus that saves me time from having to make my own videos and the online resources are limitless."

"Nowadays, many students are obsessed with their phones and most of them have smartphones. If I had time to prepare lessons using technology, I would use apps because I think it is a great way to teach PE as it will be easier to transfer my knowledge to students, and it will also be easier to motivate them to become interested in the subject."

"I usually break up my routine because I don't want my students to get bored with technology, and this can happen if the same approach is used all the time. It works because I see the difference in my subject with my students' external exam results."

One of the benefits of using ICT is that student thinking, including reasoning, understanding, and creativity, can also be developed in a variety of ways. In addition, ICTs can be used to allow students to express themselves and use a variety of tools requiring different forms of expression, such as databases, tablets and expert systems; (Briggs 2015; Kennah 2016; Laronde 2010) and to better understand concepts by experiencing distinctive types of teaching (Kennah 2016; Kwesi, 2015).

Moreover, according to the U.S. Department of Education, "[Technology has the ability to change teaching by introducing a new model of connected teaching, connecting teachers with their students, and enabling them to improve their own teaching and tailored learning]" (Leslie, 2017). In short, technology can improve teacher-student connections; and as teachers incorporate technology into their subject areas, they develop their roles into advisors, experts, and mentors (Al Mofarreh 2016; Laronde 2010; Wantulok, 2015).

5.2.4. Impediments to Technology Use

This study also attempted to understand the impediments of the use of technology, and the interviewees expressed their concerns by saying:
"There are not enough computers connected to the internet at my school and there is no technical support. Integrating ICT into the curriculum is difficult because I have no models on how to use ICT to learn in my subject."

"I don't feel my ICT skills are adequate and, in my lessons, I only use a lot of videos. That's why I find it hard to integrate ICT into the curriculum because I don't have any training on how to use different ICT tools to learn. There are also no interactive whiteboards in my school and the computers are old."

"I don't think teachers have enough technical support because I don't have the skills to use certain ICT tools in my school. For example, there is only one interactive whiteboard, and most of my colleagues have not been trained on how to use it. ICT is important, but I would like to have school training sessions on how to use ICT to learn. Also, beyond mathematics and science, there is not much content or material to teach using ICT."

The theoretical framework indicated that while technology helps students progress, improving the teaching and learning process can be a 'contraint multiplier' for teachers; and the above barriers to

technology use can be construed as such. However, in the context of digital transformation trends in education, secondary teachers in Georgetown primarily use ICT for blended and possibly student-led learning, as they are keen to relate the value of learning student ownership, and blended learning customizes exercises that allow students to focus on discovery and make their own inferences (Kinaanath 2013; Kolbakova, 2014).

Although student-led learning has long been used by teachers in their classrooms, 21st-century instruction has brought student-led learning with various ICT tools and resources into a whole new dimension (Al Mofarreh 2016, Kennah 2016; Kinaanath 2013; Laronde 2010; Lopez, 2018; Tochukwu 2015). Moreover, the widespread use of digital innovation in today's world is changing the needs of current students as they are seeking open doors to learn beyond the usual classroom-based methodology (Jain 2018; Lopez 2018; Laronde 2010), and educational institutions need to create alternative teaching models to combat the situation (Burns 2018; Jain 2018; Laronde 2010).

Blended learning programs that incorporate face-to-face teaching backed up by ICT resources can be a great way for teachers to make sure their students get the best of both options (Burns 2018; Jain 2018; Kinaanath 2013; Laronde 2010; Lopez 2018; O'Neill 2018). In addition, learning is digitally transformed in an educational context by creating a mixed learning experience that consolidates current technology with customary classroom-based techniques (Burns 2018; Laronde 2010; Lopez 2018; O'Neill 2018).

These digital education solutions can also be of great benefit to a wide range of students, including those attending classroom-based courses that are more conventional in the Guyanese context (Lopez 2018; Newman 2018), as they can provide teachers with the opportunity to improve educational models to better connect with students and provide a level playing field for students from different backgrounds (Jain, 2018; Laronde 2010).

To put it plainly, adopting new educational technologies will also enable Guyanese teachers to make dramatic improvements to both the students' academic delivery and assessment process. Besides providing a better learning experience for students, it can also improve job prospects. In turn, this helps improve student performance, lower dropout rates, and increase enrollment. In short, ICT usage can add significant value to Guyanese educators' current pedagogical practices at this juncture. (*Ibid.*)

5.3. Chapter Summary

This chapter presented quantitative and qualitative findings from an online survey as well as semi-structured interviews with high school teachers attached to the state-funded schools of Georgetown. The data were analyzed using the SurveyMonkey ® analytics tool and referenced against the theoretical framework by categorical aggregation (Yancy, 2013) or direct interpretation to obtain a somewhat accurate representation of ICT use in Georgetown's educational district.

On that note, the next chapter will discuss the broad themes derived from research questions and theoretical framework (*Ibid*.).

6. DISCUSSION

This chapter deals with the themes derived from the theoretical framework and data analysis and is organized based on research questions (Yancy, 2013).

6.1. Introduction

This study examined whether high school education in Georgetown Guyana has been digitally transformed by the use of ICT tools and/or resources. This study focused on digital transformation in education and key ICT patterns as well as synchronization of ICT and academic education. Digital transformation trends in education have been used as a conceptual framework to determine whether the use of ICT tools and/or resources has transformed secondary education in Georgetown. The research also focused on the awareness of teachers about the usefulness and use of ICT tools, as well as other factors such as the ability to use ICT tools, use purpose, etc.

Based on current literature research by the researcher, this study appears to be the first of its kind to be carried out in Guyana's education sector. All study participants actively participated in the investigation and this may indicate that the importance of ICT in schools is recognized by educational leaders and teachers in Guyana. By using an online survey and interviews, participants generated data primarily aimed at gathering teachers' views and opinions on their experiences of teaching using ICT. The answers to the research questions posed in this study are derived from the third theme in the theoretical framework discussed in Chapter Two: how ICT helps education, why ICT is needed in teaching and learning, and the significance of ICT tools; as well as quantitative and qualitative data analyzed in Chapter 5.

6.1.1. How relevant are ICT tools in the process of teaching and learning?

ICT is a teaching and learning tool in itself, more a medium through which teachers can educate and students can learn (Al Mofarreh 2016; Bakare 2014; Bhattacharjee, Deb 2016; Kennah 2016; Laronde 2010). ICT can develop student thinking in a variety of ways, including reasoning, understanding, and creativity, as well as allowing students to express themselves (Briggs 2015;

Kennah 2016). Technology can improve connections between teachers and students, and as teachers incorporate technology into their subject areas, they develop their roles into advisors, experts, and mentors. Generally speaking, technology makes learning and education meaningful and fun, (Jatileni, Jatileni 2018; Laronde 2010; Wantulok, 2015) and when used in this way, it can be said to expand education (Al Mofarreh 2016; Jatileni, Jatileni 2018; Khan T.A. 2019).

Integrating technology in teaching and learning can help break the boundaries for people with disabilities and facilitate their access to more advanced custom curriculum educational programs such as those for special education programs. In addition, specific software and equipment are designed to empower students with special needs to obtain modern and up-to-date education along with the necessary information for their online courses. (Dikusar 2018; Kolbakova 2014, Smits 2013)

In short, ICT takes on a remarkable job for students to achieve better understanding, learning, and education, while teachers try to keep up-to-date and improve their teaching skills (Laronde 2010; Watson 2017). Essentially, learning with ICTS tends to support students as they inquire, process and store data on learning-related issues. In addition, with such assistance, students will generally develop basic ICT skills. In addition, technology, by and large, help students, and when utilized adequately, mobile devices alongside their applications will help get students ready for their future callings. Lastly, the integration of technology into the classroom is a powerful method to interact with students of all learning styles. (Bakare 2014; Kolbakova 2014; Jatileni, Jatileni 2018; Laronde 2010; Mareco 2017)

6.1.2. Why are ICT tools used by teachers and students?

ICTs are transformative tools and can increase movement to a student-focused environment when used properly (Al Mofarreh 2016; Laronde 2010; Thijs *et al.* 2001; Tochukwu 2015; Yancy 2013), and by enhancing student motivation and responsibility, securing basic skills and enhancing teacher training, ICTs can upgrade teaching (Al Mofarreh 2016; Laronde 2010; Noor-Ul-Amin 2013; Yancy 2013). ICT has a significant learning job due to its ability to change and its ability to build relationships between students (Al Mofarreh 2016; Laronde 2010; Shahmir *et al.* 2011). Students also use their ICT skills to build their language and related skills, as the goal of ICT tools is to provide the skills they need to use technology to become independent learners (Al Mofarreh 2016; Importance of Information … 2016; Laronde 2010; Tochukwu 2015).

Another vital impact on the use of ICT in subjects and classes is also the number and scope of ICT resources available to educators (Al Mofarreh 2016; Cox *et al.* 2004; Laronde 2010; Yancy 2013); and while research has shown that ICTs can foster better learning for students and better teaching strategies, it is now being used in education to help students adapt even more appropriately by providing access to a wide range of digital resources. These innovations are also used to improve the productivity of educators' managerial tasks. (Al Mofarreh 2016; Flecknoe 2002; Laronde 2010; Yancy 2013)

In short, ICT provides self-managed learning and access to a variety of outstanding learning materials. It also enhances learning by mixing sound, video, images, content and movement, as well as learning upgrades through interaction and coordinated effort. In addition, ICT has in many ways changed the lives of both students and teachers, and while its presence has begun, the ideal effect is sadly lacking despite the fact that ICT education plays a key role in today's society. (Al Mofarreh 2016; Desai 2010; Haq 2006; Kareji 2016; Laronde 2010; Yancy 2013). To put it bluntly, the use of ICT tools in the teaching and learning process has many positive advantages, and since ICTS as a critical research area has gained considerable attention, its nature has profoundly transformed education in recent decades (Advantages of Using ICT … 2014; Almadhour 2010; Al Mofarreh 2016; Laronde 2010; Tochukwu 2015).

6.1.3. How did the use of ICTs digitally transform secondary education in Georgetown Guyana?

From the quantitative data obtained in the online survey, it is evident that in the Georgetown education district the first two stages of digitization (i.e. digital skills, digital use) are prevalent because the level of ICT expertise of the respondents indicated that most of them had confidence in their digital skills.

With regard to the second stage of ‘digital use’ where all users know and have reasonable confidence in digital tools, survey data indicated that 3 out of 7 respondents (i.e. 42.86 percent of the sample population) were 'extremely confident' in working with graphical peripherals such as scanners, digital cameras, etc. Only 1 out of 7 respondents (i.e. 14.29 percent of the sample population) was ‘very confident’, while 2 out of 7 respondents (i.e. 28.57 percent of the sample population) were ‘somewhat confident.’ In total, 6 out of 7 respondents (i.e. 85.71 percent of the sample population) reported having 'reasonable confidence' in digital tools.

On the other hand, with regard to the use of ICT to teach, more specifically in the Planning and Executing Technology-Supported Instruction, only 1 out of 7 respondents (i.e. 14.29 percent of the sample population) 'strongly agreed' to using technology on a regular basis to improve classroom learning, whereas 4 out of 7 respondents (i.e. 57.14 percent of the sample population) simply ‘agreed’. Only 2 out of 7 respondents (i.e. 28.57 percent of the sample population) 'strongly agreed' that when their students use technology they can easily coordinate learning exercises, whereas only 5 out of 7 respondents (i.e. 71.43 percent of the sample population) simply' agreed.'

In total, the survey found that 5 out of 7 respondents (i.e. 71.43 percent of the sample population) used technology on a regular basis to improve classroom learning, while all 7 respondents (i.e. 100 percent of the sample population) indicated that learning exercises can be easily coordinated when their students use technology. As such, it is obvious that for the respondents, digital education solutions are and have become an integral and normal part of the workplace (Al Mofarreh 2016; Laronde 2010).

There is, however, some evidence in the context of 'real digitization' or digital transformation as well. This is because, for Technology and Assessment, the online survey revealed that 2 out of 7 respondents (i.e. 28.57 percent of the sample population) were 'strongly in agreement' with the statement that they are using technology to manage student evaluation information, while 28.57 percent were 'in agreement.' A total of 4 out of 7 respondents (i.e. 57.14 percent of the sample population) were 'in agreement' with the statement.

Furthermore, from the qualitative data obtained from the interviews and in the context of digital transformation trends in education, secondary teachers in Georgetown primarily use ICTs for blended and possibly student-led learning. This is because they are keen to relate the value of learning student ownership, and what's more blended learning customizes exercises that allow students to focus on discovery and make their own inferences (Kinaanath 2013; Kolbakova, 2014). As such, it is evident that Guyanese teachers in Georgetown have started to 'test' the digital tools they have at their disposal, and thus digital transformation is prompted in a sense by using these new technologies to enrich their environment.

6.2. Chapter Summary

This chapter presented a discussion of the research questions which was derived from the theoretical framework and data analysis chapters (Yancy, 2013). The chapter then answered the research questions the importance of ICT to facilitate teaching and learning in secondary schools, the benefits of using ICT tools, whether ICT usage digitally transformed secondary education in Georgetown Guyana. The chapter following will present conclusions for this research and recommendations for future studies. (*Ibid.*)

7. CONCLUSION AND RECOMMENDATIONS

The purpose of this research was to determine whether the usage of ICT tools and/or resources has digitally transformed secondary education in Georgetown Guyana, by using an exploratory case study to make relevant recommendations.

The main goal was to address the following questions:
1. How relevant are ICT tools in the process of teaching and learning?
2. Why are ICT tools used by teachers and students?
3. How did the use of ICTs digitally transform secondary education in Georgetown Guyana?

7.1. Use of ICT to facilitate teaching in selected secondary schools in Georgetown Guyana

The investigation shows that ICT is being used for the educator's benefit (as discussed in previous chapter section 6.1.3). A minute summary of the responses of the interviewees can also be found in Appendix 1.

7.1.1. Case Study Implication and Recommendations

From the previous chapter, it can be inferred that there is a direct link between educators ' training and their use of ICT to facilitate teaching (Al Mofarreh 2016; Haq 2006; Laronde 2010). The main ramification is that some are still inclined to more conventional methods because of the obstacles they face when using ICT in teaching, despite being aware of the benefits of using ICT in teaching and broadly supporting its use. (Laronde 2010; Mafang'ha 2016; Yancy 2013)

Moreover, these constraints reduce their ability to fully integrate ICT in the process of teaching and learning. Such boundaries can therefore be overcome by expanding access to ICT facilities (PCs, web accessibility, software, email services, etc.), teacher training, etc., as such acts can bridge the digital divide between Georgetown and other districts of education and initiate the

acceleration of digital transformation in education. (Al Mofarreh 2016; Laronde 2010; Mafang'ha 2016; Yancy 2013)

To put it plainly, while the Ministry of Education in Guyana is taking significant steps to bridge the gap of digital inclusion in the educational districts of the nation, there is an inherent need to upgrade the technical skills of in-service educators (i.e. the need to be properly trained in ICT use) (Kolbakova 2014); and by providing in-service training and appropriate ICT facilities, school administrators can both provide ICT training and professional development workshops. In this regard, while ICT training for pre-service teachers at the Cyril Potter College of Education (CPCE) is now mandatory, both the government and the Ministry of Education should seek to develop additional or supplementary ICT training initiatives for in-service teachers in public schools by providing ICT specialized staff in schools to ensure that research facilities work and are used for this purpose.

Furthermore, since the respondents were from selected schools in Georgetown Guyana, the researcher suggests that a comparative report with all state-funded secondary schools in Georgetown should be made to get a more accurate view of Georgetown's path to digital transformation in secondary education. Comparative studies should also be possible in other neighboring educational districts or in the Commonwealth Caribbean to generally uncover teachers ' experiences of the difficulties they face when using ICT in teaching and learning, and to determine their level of digital transformation.

8. LIST OF REFERENCES

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Appendix 1. Interview Questions

Do you currently use or have you ever used ICT in your lessons?

If yes, please explain how you use technology to motivate your students in the classroom.

If no, please explain why.

Is using technology in the classroom important?

If yes, please explain the importance of integrating ICT in the teaching and learning process.

What are the benefits of using ICT in the classroom?

What Impedes Your Use of Technology in Teaching?

Interview Questions	*Respondent 1 Comments*	*Respondent 2 Comments*	*Respondent 3 Comments*
Do you currently use or have you ever used ICT in your lessons?	Yes	Yes, but not often.	Yes
If yes, please explain how you use technology to motivate your students in the classroom.	"I use a lot of educational videos in my classes because I find that my students are more motivated to learn through visual media, particularly video materials."	N/A	"I usually try to think about alternative ways of using technology, and since my students have smartphones, I tend to use it to my advantage and use creativity to plan and integrate it into some of my lessons. I also find that using different technological devices can boost student motivation."
If no, please explain why.	N/A	"I am a physical education teacher and most of my classes are outdoors because there is a lot of sports involved in the subject. Now I have very little time to plan for lessons where I can use technology because of my work schedule."	N/A
Is using technology in the classroom important? If yes, please explain the importance of integrating ICT in the teaching and learning process.	"It's important to use technology in the classroom because if my lessons are mundane, I find that using technology increases my teaching motivation because I think I'm more creative. As a teacher, I also want my students to be creative, and more importantly, using technology makes it possible for them to learn more about my subject."	"Yes, I think it's important to use technology because as a PE teacher I usually motivate students to do independent research on my subject because if they use technology, doing research is much more interesting for them."	"Using a variety of technological devices helps me to motivate my students and keep them interested."
What are the benefits of using ICT in the classroom?	"The use of technology in the classroom has so many advantages, but for me, because I use a lot of visual media in my lessons, I think the main benefit here is that there are so many educational videos online. This is a big plus that saves me time from having to make my own videos and the online resources are limitless."	"Nowadays, many students are obsessed with their phones and most of them have smartphones. If I had time to prepare lessons using technology, I would use apps because I think it is a great way to teach PE as it will be easier to transfer my knowledge to students, and it will also be easier to motivate them to become interested in the subject."	"I usually break up my routine because I don't want my students to get bored with technology, and this can happen if the same approach is used all the time. It works because I see the difference in my subject with my students' external exam results."
What Impedes Your Use of Technology in Teaching?	"I don't feel my ICT skills are adequate and, in my lessons, I only use a lot of videos. That's why I find it hard to integrate ICT into the curriculum because I don't have any training on how to use different ICT tools to learn. There are also no interactive whiteboards in my school and the computers are old."	"There are not enough computers connected to the internet at my school and there is no technical support. Integrating ICT into the curriculum is difficult because I have no models on how to use ICT to learn in my subject."	"I don't think teachers have enough technical support because I don't have the skills to use certain ICT tools in my school. For example, there is only one interactive whiteboard, and most of my colleagues have not been trained on how to use it. ICT is important, but I would like to have school training sessions on how to use ICT to learn. Also, beyond mathematics and science, there is not much content or material to teach using ICT."

Appendix 2. Online Survey

A case study on the use of ICT in Georgetown secondary schools

To My Fellow Professional Educators,

My name is Amelia Abdool, and I am a Guyanese teacher from Georgetown. I started my career as an IT and Technical Drawing teacher at the New Campbellville Secondary School, and I am currently participating in a Master's program at Tallinn University of Technology in Estonia (Northern Europe).

I am studying Technology Governance and Digital Transformation (http:/technologygovernance.eu/) and in order to graduate I have to complete a research project. I have chosen to do a case study on the use of ICT in secondary schools in Georgetown, and I kindly ask for your help and support to complete this survey.

Despite the Ministry of Education's enormous emphasis on integrating technology into the classroom, as educators, we still face the challenge of how students' learning process can be elevated. I think any improvement in the teaching and learning process would be extremely slow and outdated if this issue is not addressed.

This brief survey is made up of 10 questions that take about four (4) minutes to complete.

I would be more than happy to send you a summary of the results if you have any questions or if you are interested. If necessary, please contact me on Facebook or by email (shiyevina.abdool@ac-strasbourg.fr).

Your involvement in this research is entirely voluntary and ALL responses are confidential. Thank you again for your time and participation.

1. Please select your school from the dropdown list below:

2. Please indicate your gender.

- ◯ Female
- ◯ Male

3. Please indicate your age range.

- ◯ Under 25
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ Over 55

4. What is your highest education level?

- ◯ Trained Teachers Certificate
- ◯ Diploma/Associate degree
- ◯ Bachelor's degree
- ◯ Postgraduate Diploma
- ◯ Master's degree

5. How long have you been teaching (including this school year)?

- ◯ Less than one year
- ◯ 1-3 years
- ◯ 4-6 years
- ◯ 7-10 years
- ◯ 11-15 years
- ◯ 16-20 years
- ◯ 21-25 years
- ◯ More than 26 years

6. What are the different ICT tools/resources available at your school? Please Select all that Apply.

- ☐ Internet Connectivity
- ☐ IT Room or Computer Lab
- ☐ Promethean/Smart Board
- ☐ Computers
- ☐ Tablets
- ☐ Smartphones
- ☐ LCD Projectors
- ☐ Television
- ☐ Radio
- ☐ Email services

7. Which best portrays your expertise level with each of the following technologies?

	Extremely confident	Very confident	Somewhat confident	Not so confident	Not at all confident
Word processing	◯	◯	◯	◯	◯
Spreadsheets (for data analysis)	◯	◯	◯	◯	◯
Presentation software (e.g. PowerPoint)	◯	◯	◯	◯	◯
Graphical peripherals (e.g. scanners, digital cameras, etc.)	◯	◯	◯	◯	◯
Search the Internet Effectively using 'keywords' to narrow search results	◯	◯	◯	◯	◯

8. With regard to 'Planning and Executing Technology-Supported Instruction,' to what extent do you agree or disagree with the following statements?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I always consider if technology could improve my teaching or student learning when planning my lessons.	○	○	○	○	○
When choosing education technologies, I make my selections once I investigate their effectiveness.	○	○	○	○	○
I prepare comfortably for classes in which students use technology during the lessons.	○	○	○	○	○
I regularly use technology to enhance learning in my classroom.	○	○	○	○	○
When my students use technology, I can easily coordinate learning exercises.	○	○	○	○	○

9. Please indicate your level of agreement with the following statements for Technology and Assessment.

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I use technology to manage student evaluation information (e.g. using educational technology platforms such as GradeQuick, PowerSchool or MySchool for custom reporting, classroom attendance management, etc.).	○	○	○	○	○
I have effective methods for assessing student work based on technology (e.g. grading student work involving online research or where the item is a webpage or video).	○	○	○	○	○
I am open to using technology to collect, explore and interpret student progress information (e.g. by creating charts to display performance patterns or by using handheld devices to	○	○	○	○	○

10. Which of the following items are used by students in their classes to demonstrate their learning? Please Select all that Apply.

- ☐ Word-processing or PDF documents
- ☐ Presentations (e.g., PowerPoint)
- ☐ Video or audio products
- ☐ Websites
- ☐ Electronic art (e.g. digital photography, Drawing graphics software)
- ☐ Journals, newspapers or magazines (electronic or print)

Appendix 3. Background of the Researcher

A young multi-ethnic married couple of trained teachers welcomed their first child (i.e. the researcher) at the Medical Arts Center in Georgetown Guyana one early spring morning in the mid-1980s. The researcher would spend the next twenty years crossing the Caribbean islands before settling in the United States, given her parents ' profession.

Beginning with the economic instability of Guyana in the 1980s, in 1989, the father of the researcher migrated to Trinidad. The mother of the researcher and her two children at the time (including the researcher) followed later in 1990. Both the researcher and her sibling were homeschooled during the Trinidad period and only attended government schools when the family came back to Guyana during the latter half of 1991.

Following a change in the political climate in Guyana, along with a newly elected government in 1992, the parents of the researcher attended the University of Guyana to read for a Bachelor of Science degree in Environmental Science, while being seconded to government schools as science and math teachers. After her parents graduated from university in 1997, the family of the researcher migrated to the Turks and Caicos Islands, a British Overseas Territory in the Caribbean (geographically adjacent to the very bottom of the Bahama Island chain).

The family arrived shortly before the death of the late Diana, Princess of Wales, in the nation's capital of Cockburn Town on the island of Grand Turk. Both parents of the researcher were seconded to the Helena J. Robinson High School, attended by the researcher from 1997-1999. During this time, the father of the researcher served as Head of the Department of Science at the School and as an external marker for the Caribbean Secondary Education Certificate (CSEC) exams, teaching a myriad of subjects including Physics, Chemistry, Biology and Integrated Science; while the mother of the researcher taught Geography and Social Studies. The parents of the researcher sought dual transfers to Clement Howell High School on Providenciales Island, the largest island in the Turks and Caicos island chain, in mid-1999. Again, the parents of the researcher taught the same subjects and held the same positions they had previously held.

Between 1997 and 2000, a multitude of efficient and effective educators from various backgrounds and nationalities taught the researcher, mainly from Trinidad, Jamaica, Turks and Caicos, Venezuela, UK (especially England and Scotland), Guyana, St. Vincent, USA, and The Bahamas.

It was also during this period that, after being exposed to quality, broad-based academic direction, and leadership, the researcher developed a passion for teaching and learning that remains one of the key catalysts for success in many educational institutions today.

In 2001, the family migrated to The Commonwealth of the Bahamas where they spent eight years between the big island of Andros and the island of New Providence (i.e. the home of the nation's capital Nassau), serving as educators in both the public and private education system. The example set by the efficient and effective teachers and parents of the researcher who served as exemplary role models initially prompted her to pursue a teaching career in addition to developing a keen interest in ICT and math; so much so that the researcher sat the Cambridge GCE O'level and Caribbean Secondary Education Certificate (CSEC) examinations externally with the guidance and tutelage of both her parents and teachers.

Subsequently, the researcher enrolled in university to read for a Bachelor's Degree in Computer Science (where 50% of the courses were math-oriented). In addition to Public Administration, Innovation/Industrial Policy, Development Economics in Estonia (which also included a year of studies at the University of Strasbourg in France as part of the Erasmus Exchange Program), the researcher also pursued graduate studies in Mathematics Education and Economic Policy Analysis and Innovation Management.

The researcher has over thirteen years of combined teaching and compliance experience in the education and financial sectors, six of which she served as a Middle and High School Math, ICT and Engineering Drawing Teacher in Guyana, the Bahamas, France, and Italy (briefly), respectively.

For the purpose of this study and drawing on the researcher's teaching experience in Guyana, the narrative is as follows:

In the spring of 2006, the researcher became an employee of the Ministry of Education and was seconded to the New Campbellville Secondary School in Georgetown Guyana, where she served as the acting Head of the Information Technology Department and ICT Coordinator in an unofficial capacity. One of the main responsibilities of the researcher was organizing and using a variety of teaching techniques, strategies, materials, and integrating technology into her lessons to maximize each child's learning, individually and in group settings.

This was because she also pursued a Graduate Diploma in Math Education at university simultaneously and would often be evaluated as part of the teaching practices by university lecturers every semester. This was often very difficult, especially when it came to ICT resources, simply because the school's computer lab had only eight non-networked PCs, and there were no LCD projectors and services like the internet and email. What's more, the average class size was 30 and so, unfortunately, all the researcher's lessons in grades 7-10 were held in the classroom, while grade 11 classes were held in the computer lab as these students were to sit the Caribbean Secondary Education Certificate exams.

More often than not, in addition to PowerPoint in the computer lab, the researcher spent most of the time teaching only practical lessons of using Word Processing, Database and Spreadsheet software applications to fulfill the requirement of the CSEC Information Technology (IT) curriculum. It was also coupled with the fact that very few students had computers at home back then and many lacked access to the internet. This was a nationwide issue as very few households had active telephone lines from the Guyana Telephone and Telegraph (GT&T) company to obtain an internet connection. What's more, depending on the geographical location, there were extremely long waiting times to obtain a landline, ranging from years to decades. Broadband was extremely expensive and many were unable to afford it. As such, internet cafes where customers pay to use computer terminals to access the internet were the only major medium for students and teachers to conduct academic research.

Moreover, the researcher was unable to assign practical homework, but all homework was based on the theoretical aspect not covered in the classroom. Surprisingly enough, the Grade 11 exam class worked well with this strategy. What's more, in the preceding academic year, when grade 11 students were in grade 10, their previous IT teacher changed careers in the middle of the Spring term and the subject was subsequently withdrawn from their academic curriculum that term since a new IT teacher had yet to be appointed by the Ministry of Education.

As a result of this predicament, in June 2007, both the researcher and her students were in dire straits to complete the Caribbean Secondary Education Certificate (CSEC) exam curriculum. In addition, many of the students had tremendous trouble solving practical questions from past CSEC IT examination papers. After discussing the situation at the time with the Head of the Business Department and the researcher’s school-appointed mentor, it was decided that the students would

sit the newly introduced CSEC Electronic Document Preparation and Management (EDPM) exam. This new curriculum was relatively easy to implement, and it was easy to teach both the theoretical and practical aspects. What's more, the students were able to complete the practical assignments and exam coursework on time and with minimal supervision.

The biggest hurdle was when twenty-two grade 11 students had to write the Caribbean Secondary Education Certificate (CSEC) exams in June 2007 in a laboratory with only eight computers. Unfortunately, the classrooms of the school were not equipped with PCs or ICT tools if any, and very few teachers owned laptops. Nevertheless, apart from her personal laptop, the researcher was able to obtain two additional laptops and a desktop computer from university friends for her students, and they were then able to sit the exams in 2 groups.

From this experience, the researcher observed that, despite the willingness of teachers to do so, the lack of ICT tools and resources made it virtually impossible to integrate technology into the classroom. The researcher also assumes that many of her former colleagues would have had similar ICT integration beliefs and values back then. Case in point, the lack of ICT tools in the New Campbellville Secondary School made technology integration non-existent during the secondment period of the researcher. Unfortunately, after graduating from university, the researcher left Guyana again, and since her tenure there she has made an active attempt to integrate technology into her classroom by searching for solutions to ICT problems which may have arisen during lessons and has maintained ICT integration wherever possible.

Given the background of the researcher (i.e. being the eldest child of two seasoned teachers, both of whom have approximately 40 years of teaching experience), which resulted in a significant part of her childhood and adulthood traveling and living in an international arena; in addition to her innate desire to serve young people today by providing them with a quality broad-based, innovative academic education through quality lectures, discussions, assignments, and evaluations, the researcher gained the ability to develop complete curricula for a variety of courses in her instructional career and to influence student improvement.

The researcher found that the method of facilitating rather than dictating is a highly beneficial teaching style, and learned that if students build their own learning experiences they will not only retain information for longer, but also become more confident in their abilities. Lesson planning, needs assessment, and visually engaging learning techniques are just a few areas where the

researcher has gained experience and comprehensive understanding. She improved her communication, creativity, and motivational skills throughout her academic career. The commitment of the researcher to foster collaborative and exciting educational environments positions her in promoting and successfully developing productive and accomplished students.

As such, for this case study to be undertaken, the researcher believes that this experience both augments and validates its motivational background. In short, it would give Guyanese teachers a unique perspective in their future classes.