



Online Informal Learning and 21st Century Skills Among Secondary School Students: The Mauritian Context

By

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DEDICATION

This thesis is dedicated, above all, to my Almighty for giving me the courage and patience to complete this long PhD journey. My heartfelt gratitude goes to my loved ones, including my parents, who never gave up on me and without whom I would not have completed my PhD; my husband; my three children, Aditya, Aahana, and Aparna; and my supervisors, who have guided me from the beginning till the end of my PhD journey. This is a fantastic accomplishment after a lengthy delay. I was frequently unhappy and lost my way, and I never imagined I could finish my thesis.

DECLARATION

I, Bharatee Pentiah (218046886), declare that

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The work described in this thesis was carried out at the School of Education, University of KwaZulu-Natal, from April 2019 under the supervision of Professor Craig Blewett, Professor Desmond Govender and Dr. Ajay Ramphul.


Ethical clearance No. HSS/0587/019D was granted prior to undertaking the fieldwork.

Signature of Candidate:



Date: 6th July 2023

As the candidate's supervisors we, agree to the submission of this thesis.

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ABSTRACT

Informal learning refers to most human learning that takes place outside of the official educational system. In this technological era, every secondary student is exposed to digital or online tools in either for academic purposes or for their leisure activities or for learning something new on any topic of interest informally. What has not been explored yet is the extent to which secondary school learners can acquire 21st Century Skills through Online Informal Learning in the absence of a formal school setting. 21st Century skills are abilities and competencies that today's students need to possess to become global citizens in this competing working market. Since technology plays a vital role in the learning process of students outside their school settings, it can also act as an important medium for them to communicate, collaborate, and develop their 21st Century Skills such as creativity, digital literacy, and critical thinking.

In response to the underexplored gap in the literature, the researcher embarked on an explorative investigation of the development of 21CS through Online Informal Learning of secondary school students using Web 2.0 tools. To adequately address the phenomenon under study, the first research question aimed to explore the various kinds of OIL that are available to secondary school pupils. The second and third research questions were formulated to investigate how secondary school students grow and acquire 21CS through OIL. To further the objectives of the study, qualitative and quantitative methods were integrated to provide a more complete comprehension of the phenomenon and provide answers to the research questions.

By analysing the literature review, the researcher designed a conceptual framework underpinned by the six components of Engeström's Activity Theory, the P21 (Framework for 21st Century Learning), and the three dimensions of Fenwick and Tennant (2004). In a mixed-method explanatory sequential research process, data were derived from secondary school pupils who utilised internet technologies in informal contexts in semi-structured interviews, surveys, and focus group interviews. In the quantitative phase, 310 questionnaires were collected from secondary school students between 11 to 18 years old. The data were then aligned with the conceptual framework. Further, data analysis and trend and correlation detection were performed using quantitative and qualitative models to understand how and why informal online learning (OIL) affects the abilities of 21st century secondary school learners.

The findings revealed that certain online resources are utilised for online informal learning while others are used for both informal and formal learning. Furthermore, it was also discovered that social networking sites and instant messaging technologies contribute to online informal learning. The data gathered from the learners' replies identified the following types of Online Informal Learning among secondary school students: self-directed learning, collaborative learning, explorative learning, accidental Online Informal Learning, self-discovery learning, and intentional learning.

The study contributes valuable insights into the potential of OIL to complement formal education and promote critical thinking for lifelong learning. Moreover, the research identifies the pedagogical approaches that are effective in OIL environments. The findings of this study can help educators understand how OIL assists secondary school learners in similar contexts across the world. Significantly, the model proposed in the study provides a framework for future research in this area regarding the use of online informal tools as a foundation to promote learning.

Keywords: Online Informal Learning, Informal learning, 21st century, 21st century skills, secondary school students, Web 2.0 tools, mixed-methods research

LIST OF ABBREVIATIONS

21CS	21 st Century Skills
AT	Activity Theory
AI	Artificial Intelligence
DUL	Digital unstructured learning
IL	Informal Learning
JILN	Joint Interactive Learning Networks
OIL	Online Informal Learning
OIA	Online Informal Activity
OITL	Online Informal Tacit Learning
OIS	Online Informal Socialisation
P21	Partnership for 21st Century Learning/Skills
MoEHRSR	Ministry of Education, Human Resources and Scientific Research
NCF	National Curriculum Framework
ICT	Information and Communication Technology
KSAVE	Knowledge, Skills, Attitudes, Values and Ethics
OECD	Organization for Economic Cooperation and Development
SNS	Social Networking Sites

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CHAPTER 1

INTRODUCTION AND RESEARCH BACKGROUND

1.1 Introduction

Can students be equipped with 21st century skills (21CS) while learning informally through Web 2.0 tools? If this is the case, how and why do these students acquire these 21CS through Online Informal Learning (OIL) the way they do? Every secondary student in the current, quickly developing technological era is exposed to digital or online tools for a variety of reasons. How students might learn 21CS through OIL in an informal context, remains a significant question.

The key issue is that very little is known about how 21CS abilities are acquired through casual online activity. Online casual learners are aware of vocabulary gains because they notice, memorise, and frequently reuse expressive language chunks, as revealed in a pilot study by Sockett and Toffoli (2012). The study corroborates Sockett's (2013) finding that engaging in web conversations and hearing stories can help kids become more fluent listeners. Nevertheless, only a few studies have unequivocally demonstrated the connection between acquiring digital knowledge and developing digital literacy. Thus, the study sought to determine how Web tools and interactive mentorship programs can aid students in developing 21CS.

The study focused on Mauritian secondary school students from grades 7 to 13 to explore how they performed during OIL when they used Web tools, what digital tools were used, and how and why they developed 21CS. The study can add to the existing corpus of literature by providing the Mauritian school system with new ways to complement its efforts of assisting students to acquire 21CS through OIL. Moreover, limited research has been conducted on Internet Learning as an instructional approach and how students conceptualise C21 abilities. As a result, the study can be instrumental in filling the research gaps between OIL and the development of 21CS among students.

The first section of the thesis introduces and provides the study's synopsis. It begins by outlining the context for the study and then addresses the problem statement, the research aims and objectives, and the research questions being answered. The study's delineation and conceptual

underpinnings are followed by its justification, context, and contribution to the body of literature. A layout of the thesis's organisation and a synopsis of the chapter serve as the chapter's conclusion.

1.2 Background to the Research

With the rapid development of technology, students have gained easier access to the internet and more exposure to technical tools, opening up informal learning (IL) to all. In their daily life, using online technologies has become essential. The broad adoption of a range of Web 2.0 developments, particularly social networking apps, has resulted in fundamental shifts in learning methods. As a result, secondary school students can now learn independently by using Web 2.0 technologies instead of relying on their teachers.

In the era of artificial intelligence (AI), the value of 21CS has increased. One sector where AI is set to make substantial changes and provide new opportunities is education, according to Dziatkovskii (2023). He postulates that the greatest difficulty presented by AI is related to the lessons that modern learners must acquire. As a result, future citizens will require the following qualities more than ever: creativity, critical thinking, interpersonal skills like conflict resolution, and intrapersonal abilities like adaptation. Therefore, it is imperative for learners to acquire 21CS to become independent learners.

Today's youth must acquire certain competencies and skills to equip themselves for the demands of the 21st Century. 21CS is defined as “the combination of knowledge, skill, literacy, and expertise that are necessary for individuals to be successful in work and in daily life” by Partnership for 21st Century Skills (P21, 2011). Contemporary education studies endorse the integration of 21CS to prime students for the post-secondary world (Shumen & Calisici, 2017). Consequently, the incorporation of 21CS is emphasised in the 21st century curriculum.

To comply with UNESCO's Position Paper on Education Post-2015, Mauritius introduced a National Curriculum Framework (NCF) in 2015 that outlines what all children aged 5 to 14/15 should learn both in and outside of school. Globally, education systems are highly institutionalised, chronologically graded and hierarchically structured, ranging from pre-primary school to the university level. Formal education is mainly linked to schools and training institutions (Plavšić

and Diković, 2016). Formal education opportunities have always contributed to promoting lifelong learning and the “basic education” of “all” modern societies.

Nonetheless, even if the present school system is aimed at preparing today’s youth to meet the novel challenges of life’s demands arising from social and technological developments, it is not preparing the new generation for life with 21CS. Therefore, the question raised is whether the new generation can acquire those 21CS while learning informally using Web 2.0 tools through OIL. Bonk and Lee (2017) iterated that the development of 21CS and the recent advent of OIL have rekindled an interest in self-directed learning. OIL has gained great importance since it is believed that students can engage themselves in 21CS through OIL. However, there are relatively few studies of the experiences of online informal learners as they move through IL channels (Curtis, 2013; Song and Bonk, 2016), their engagement and acquisition of 21CS (Moyer, 2016). Considering this, it is critical for researchers to investigate how OIL affects the development of 21CS.

As a small island nation, Mauritius is still working to establish a formal education system that will provide all students with the opportunity to develop a variety of abilities, dispositions, and skills to ensure their success in both furthering their education and in their respective professional lives, while preventing a smooth transition to better educational opportunities. The most recent educational reform in Mauritius, the Nine Years of Continuous Basic Education reform, emphasised 21CS (Ministry of Education, Human Resources and Scientific Research (MoEHRSR), 2016, p. 8). It emphasises that while literacy and numeracy abilities are still crucial, they will not be sufficient in the future. The educational system must generate a generation of adolescents and adults with the necessary knowledge, abilities, attitudes, and values to survive in the new century. The capacity for critical thought, flexibility and creativity, teamwork ability, effective communication, and ICT proficiency are among the fundamental competencies that learners need to possess.

Workers with 21CS are currently in demand in Mauritius, and a higher level of education is expected to be provided to them. Learners are prepared to be better students in the 21st century by teaching them skills and fostering the development of effective communication abilities (Hureream & Bahadur, 2019). As a result, they will become more skilled in the new global economy, increasing their employability in rising sectors of the Mauritian economy. The

traditional classroom or the formal environment of schools, despite the Mauritian government's efforts to include 21CS in its current curriculum, hinders the development of such abilities. Therefore, it is crucial to develop fresh, imaginative strategies to provide our students with the 21CS they need to thrive as global citizens.

To ensure that children in Mauritius have access to a first-class education, the government of Mauritius made modifications to the educational system. To improve their learning, Mauritian students can now access a range of multimedia devices and platforms for relevant educational resources (Hurereeram & Bahadur, 2019). They have the option to learn independently at any-time, anywhere. OIL, often known as Web 2.0, is the process through which learners acquire knowledge via the Internet and digital technology (Sockett, 2013). According to Stevens (2010), Tissot (2004), Rieder (2003), and Sockett (2013), these individuals most often learn incidentally with interaction and enjoyment as their main objectives.

The pertinent question here was that if 21CS can be developed by students in a formal school setting using technology, why can it not be developed in informal settings through OIL? These casual learners themselves might not even be aware of how they acquired their 21CS. Cross views IL as deliberate actions taken to acquire job-related skills (2006, in Sockett, 2013). Therefore, determining how high school students learn 21CS through unstructured digital training using Web 2.0 resources was the present study's primary goal. The current investigation was carried out in a public secondary school in a remote part of Mauritius. The participants were secondary school students ranging from grades 7 to 13 and age groups 11 to 18 years to allow data collection among different age groups and to have a wider range of data.

1.3 Problem Statement

High school graduates are deficient in many important skills needed to compete in the global market. Because of the tremendous breakthroughs in science and technology, every country must certainly address the globalisation of education. The development of students' 21CS is one of the main emphases of today's educational difficulties, as asserted by Tindowen (2017). To be successful in today's intricate and international market, one must have the 21CS which includes the ability to solve complex and non-routine problems, collaborate and communicate effectively

with others, independently learn fresh expertise and knowledge, and quickly adapt to changing situations (Gewertz, 2008).

Thanks to a multitude of internet resources, IL has become more prevalent (Song & Bonk, 2016). The youth of today, according to Resta and Carroll (2010), interact with online networks that provide a range of learning resources that go well beyond the confines of their schools and beyond the limitations of a certain teacher's ability. IL can occur wherever they want it to. Less is understood, though, about how these opportunities affect young students and their 21CS (Martin et al., 2016). Additionally, the potential for IL in online resources has only been partially explored (Burlington, 2016).

The prevalence of new online behaviours in students' daily digital lives should be the subject of reasoned conversations, despite the lack of supporting statistics. A study is also required, claim Zçakir, Sümeg and Alişici (2017), to ascertain how technological advancements impact the acquisition of 21CS. I advise that further research be conducted to determine exactly the type of computer activities pupils engage in, in contrast to how often they use them, and the impact of these actions on the acquisition of 21CS. Similarly, Selwyn (2007) believes that such new ICT applications, as we have observed, undoubtedly represent a fundamental change in how young people interact with online technology. There are numerous techniques available for information synthesis. One of my study goals is to build modern abilities to learn, so it is crucial to understand how these internet resources are implicitly utilised as a digital, unstructured study aid. The present study, therefore, also aims to assess how Web 2.0 resources and interactive mentoring programs can help students build 21CS.

1.4 Aim and Objectives

Goals, objectives, and research questions are essential to make the entire study easier to grasp, analyse, and write. The study set out to investigate the extent to which 21CS can be developed among secondary school learners through Online Informal Learning using Web 2.0 tools in secondary school learners in Mauritius.

Goals must be broken down into objectives for further study because they are too expansive in nature (Noddings, 2007). The study addressed the following goals derived from the aim:

1. To explore the forms of online informal learning that exist among secondary school learners
2. To understand critically how and why online informal learning influences secondary school learners' 21st century skills the way they do
3. To contribute theoretically to the field of online informal learning in secondary education

1.5 Research Questions

Whereas aims and objectives are significant and developed from research intents, research questions offer concise statements of what study participants should respond to (Noddings, 2007). Arising from the problem statement, three research questions were developed to explore the extent to which 21CS can be developed among secondary school learners through Online Informal Learning using Web 2.0 tools in secondary school learners in Mauritius. Hence, the research questions were derived from the objectives in Section 1.4 of the study.

The primary research question was formulated to investigate the various kinds of OIL that are available to school pupils. The second and third research questions were formulated to investigate how secondary school students grow and acquire 21CS through OIL. Through the data produced, the study aimed to answer the following questions:

RQ1: What forms of Online Informal Learning exist among secondary school learners?

RQ2: How does Online Informal Learning influence secondary school learners' 21st century skills?

RQ3: Why does Online Informal Learning influence secondary school learners' 21st century skills the way it does?

1.6 Context of the Study

Prestigious committees, lawmakers, industry executives, and education professionals started sounding the same alarm about the need for 21st century learning and 21CS over 20 years ago. The emphasis on traditional memorisation and rote learning methods does not adequately prepare children for a rapidly evolving, increasingly computerised, and information-rich future (Boss, 2019). The consensus among educators, school reformers, college professors, and employers is that 21CS skills are indispensable for success across all academic and employment fields today (Care et al., 2016).

Importantly, Rotherham and Willingham (2010) acknowledge that secondary school learners are becoming less dependent on routine-based learning and memorisation. To prepare Mauritian secondary school learners for local and foreign markets, 21CS, such as problem-solving, creativity, critical thinking, socio-emotional skills, and communication, are highly desired. Care, Anderson and Kim (2016) opine that the training goals of nations around the world are expanding further than teaching learners basic academic skills like reading and mathematics to incorporate 21CS like teamwork, critical analysis, and solving problems. As a result, efforts are being made to incorporate 21CS into educational systems globally to provide students with these tools.

To date, many interpretations of IL have been offered by important evaluations of the research and conceptual paradigm. Misko (2008) and Schugurensky (2000) argue that in both high school and college students, knowledge acquisition is expressly addressed. Each academic field gives a unique perspective on education and a variety of e-learning definitions. According to earlier research conducted by Heo and Lee (2013) and Livingstone (2001), IL is any endeavour involving the acquisition of knowledge, understanding, or skills but does not use wholly artificial educational criteria. IL takes place outside of official settings, is self-directed, and is unrelated to any particular programme or group of people. Furthermore, Trinder (2017, p. 12) describes IL as learning that comes from daily activities connected to a job, family, or leisure.

Previous studies, including those of Livingstone (2000) and Tudor (2013), have documented that IL can typically take place anywhere. However, a hidden curriculum does not describe the subject, or the tools needed for efficient learning. Researchers have offered several characteristics of formal, non-formal, and informal learning. These characteristics indicate that a covert curriculum

is more amorphous, spontaneous and beginner than classroom teaching, which typically takes place in institutions (such as universities and colleges) and is frequently evaluated. Non-formal learning takes place outside the classroom, for example, on school-led museum trips.

A common type of IL is Online IL (OIL) supported by Internet technologies (Yu & Mao, 2005). The level of personal autonomy, ease of learning, and diversity are believed to distinguish in-person learning from online learning. Evidently, online learning offers more advantages. Yet, the currently available work mainly focuses on mechanical determinants of online learning persistence and satisfaction (Ge et al., 2022; Kear et al., 2014) and ignores the connection between IL and innovation.

OIL is seen as particularly important among secondary school students in terms of unstructured learning. Digital unstructured learning is described by Colorado and Eberle (2010) and Rappel (2017) as the use of written, visual, auditory, and visual expressions of the World Wide Web as ingredients for unstructured classroom instruction. Furthermore, they assert that OIL is associated with commercial learning systems that recognise a personalised and social basis, as opposed to traditional static forms of learning. Portable tools, including wireless technology, are used at every level of education because of the phenomenal development of the Internet (Karahoca et al., 2016; Maldague et al., 2016). Koc and Boyuk (2013) contend that the development of the Internet has led to greater integration of expert machines and robotic technologies that make human life easier.

Recent studies have emphasised digital unstructured learning more and more as a new phenomenon of university student teaching and acquisition of knowledge in the technological age (Chan et al., 2015; Huang & Oh, 2016; He & Zhu, 2017). Innovation has altered how people learn since the introduction of the Internet and the widespread usage of mobile devices. At present, Noy et al. (2016) maintain that IL is particularly influenced by technologies that are often used to enhance learning. However, Sockett (2014) stipulate that when the above definitions refer to casual online English learning, the learning takes place in informal settings and involves user participation in a wide variety of online activities conducted primarily for pleasure, conversation, or data gathering rather than English learning itself. It is important to note that the latter goal may be an unintended side effect of activities.

Globally, almost all actions serve the pursuit of professional or private goals. Joint (shared) Interactive Learning Networks (JILN) as social browsing technologies are becoming more and more common in our daily lives. These networks are created by the connection between units, as confirmed by Siemens (2004). JILN are used today by college students to learn and impart knowledge. However, informal networks typically foster more interesting, independent, and curiosity-based experiences (Dabbagh & Kitsantas, 2012; Siemens, 2004). Web 2.0 is described by Rollett, Lux, Strohmaier, Dösinger and Tochtermann (2007, p. 93). as a “co-creative platform that enables people to communicate, work together, exchange and publicise new opinions and suggestions”.

Over the past 20 years, despite not being designed specifically for educational objectives, social media, wikis, and other Web 2.0 elements have witnessed a significant increase in interest in pedagogical research (Escobar-Rodriguez, Carvajal-Trujillo & Monge-Lozano, 2014; Angelaina & Jimoyiannis 2012). The increase has been attributed to the various educational advantages they have been shown to offer, such as numerous chances to exchange materials and information, identity teaching, student engagement, and lifelong learning, according to Angelaina and Jimoyiannis (2012) and Adu Gyamfi (2017).

It is speculated by Schugurensky (2000) that Web 2.0’s primary purpose is as “locations to understand” for educational institutions and individuals, including identity and entirely unrelated learning, to learn better. A benefit of OIL that is frequently highlighted is that it allows for seamless learning to take place on the go, giving the student the power to direct every aspect of their experiences via a mobile device. Sharples et al. (2010) concur that because learners can easily and independently use the technology to achieve these goals, it is believed that these benefits of the OIL are excellent for promoting IL. Therefore, the main aim of my study was to conceptualise how online learning affects the growth and acquisition of 21CS by secondary school students.

1.7 Understanding Some Key Concepts that Underpin the Study

The preliminary literature assessment enabled the researcher to establish a more theoretical framework for the investigation. It supported the research investigation and demonstrated the gaps in the available material.

1.7.1 Understanding 21st Century Skills

The term 21st century skills refers to competencies that may be required for success in the classroom, the workplace, and in daily living in the modern world (Partnership for 21st Century Learning (P21), 2015; Binkley et al., 2012). To better educate all learners for the more challenging educational demands of modern life and jobs, various countries around the world have undertaken several broad content, teaching, and testing reforms. These innovations have been highlighted in the 21CS literature review. The success of pupils depends heavily on 21CS.

Scholars have recently contributed to several definitions of 21CS. For instance, 21CS are a broad range of knowledge, abilities, personality attributes, and behavioural patterns that are believed to be necessary for success in the modern world, specifically in collegiate programmes, modern professions, and modern workplaces. These competencies could be used in all intellectual fields of study and all academic, professional, and civic environments throughout a child's entire education (Abbott, 2015; Moyer, 2016; Rotherham & Willingham, 2009).

The 21CS are essential for success in the modern world, according to employers, educators, college professors, school reformers, and others. They also apply across all academic fields. 21CS are multidisciplinary, transferable, cross-disciplinary, and transversal. Even while some of these names might be quite interchangeable, they might also have additional, more specific meanings (Moyer, 2016). In the age of AI, Dziatkovskii (2023) argues AI can potentially significantly alter and generate new prospects in the education sector. Critical thinking, interpersonal competencies like conflict resolution and creativity, and intrapersonal abilities like adaptation are at the top of the list. The largest challenge right now, though, is getting pupils to learn what they need to.

1.7.2 21st Century Skills among secondary school learners

Students in secondary schools are gradually becoming less dependent on rotations or routine-based knowledge. Global demands require them to get ready for both domestic and international markets. According to Rotherham and Willingham (2010), 21CS like creativity, critical thinking, communication, problem-solving, and socio-emotional competencies are highly sought after. Global training objectives incorporate 21CS-like teamwork, critical analysis, and problem-solving in addition to learning traditional academic skills like reading and mathematics (Care et al., 2016). To give learners the necessary tools, efforts are being made to incorporate 21CS into educational

systems to provide learners with necessary the tools. However, the unexamined question is: How do secondary school learners use online tools for OIL, and for what purposes?

1.7.3 Online Informal Learning

Numerous scholars, including Evans et al. (2020), Watkins et al. (2014), and Manuti et al. (2015) offered their interpretations of IL. These interpretations result from critical analyses of research and conceptual paradigms across several disciplines. IL is defined as any action that involves the pursuit of knowledge, understanding, or skills without fully contrived educational requirements (Heo & Lee, 2013; Livingstone, 2001). Moreover, IL takes place outside of the classroom, is self-directed, and is unrelated to any specific organisation or programme.

Trinder (2017, p.12) supports the viewpoint mentioned above by defining IL as a learning process that arises from daily life. He goes on to say that IL lacks structure, does not result in certification, and is typically unintended. Numerous academic fields have investigated how students acquire knowledge, including those that deal with it specifically in high school and college (Misko, 2008; Schugurensky, 2000). Each academic field gives a unique perspective on education and a variety of e-learning definitions.

IL can occur nearly anywhere. According to Tudor (2013) and Livingstone (2000), a hidden curriculum fails to stipulate the material or resources required for efficient learning. A number of traits for formal, non-formal, and informal learning have been suggested based on the findings of various investigations. These traits show that a concealed curriculum differs from classroom education, which often takes place in institutions (such as universities and colleges) and is frequently evaluated, in that it is more fluid, spontaneous, and beginner oriented. Non-formal education takes place in settings other than the classroom, like field trips organised by the school to museums.

A prevalent type of IL is considered to be neighbourhood online IL (OIL) which is assisted by internet technologies (Yu & Mao, 2005). The degree of personal autonomy, ease of learning, and diversity are believed to separate in-person learning from online learning. Additionally, online learning offers more benefits. However, Kear et al. (2014) and Ge et al. (2017) argue that the work that is currently available focuses mostly on mechanical determinants of the durability and

satisfaction of online instruction, ignoring the connection between online instruction and innovation.

1.7.4 Importance of OIL among secondary school learners

According to Colorado and Eberle (2010) and Rappel (2017), digital unstructured learning (DUL) involves the use of written, visual, audio, and visual expressions from the World Wide Web as components of unstructured classroom instruction. Contrary to static types of learning, commercial learning systems that accept a base that is both personalised and social relate to OIL (Garrison, 2017; Rappel, 2017).

In the modern era, DUL is a relatively new phenomenon for teaching and learning among university students. As a result, it has received more attention in recent studies (Chan et al., 2015; He & Zhu, 2017; Huang & Oh, 2016). Innovation has radically altered how people study ever since the introduction of the Internet and the widespread usage of cell phones. Currently, technologies that are frequently used to promote learning have had a significant impact on IL (Noy et al., 2016). According to Sockett (2014), the aforementioned definitions relate to informal online English learning.

Furthermore, IL occurs in informal settings and involves users engaging in a range of online activities, most of which are for pleasure, discussion, or information collecting rather than English learning, though the latter may be an unexpected side effect of these types of activities. As browser social technologies become more and more pervasive in our daily lives, nearly all IL actions have professional or personal purposes and joint interactive learning networks (JILN). JILNs are formed by linking various entities (Siemens, 2004). College students utilise them today to educate themselves and pass on knowledge.

Nonetheless, Dabbagh and Kitsantas (2012) and Siemens (2004) observe that informal networks typically foster more interesting, independent, and curiosity-based experiences. Similarly, Rollett et al. (2007, p. 93) define JILN Web 2.0 as a co-creative platform that enables people to communicate, collaborate, share, and publish new opinions and suggestions. Over the past 20 years, despite not being designed particularly for educational objectives, social media, wikis, and other Web 2.0 elements have witnessed a significant increase in interest in pedagogical research (Angelaina & Jimoyiannis 2012; Escobar-Rodriguez et al., 2014). The increase is due to the

numerous educational benefits they offer such as numerous opportunities for the exchange of materials and information, identity teaching, student engagement, study, and lifelong learning (Angelaina & Jimoyiannis, 2012; Gyamfi, 2017).

Schugurensky (2000) speculates that Web 2.0's primary purpose is as "locations to understand" for educational institutions and individuals, including identity and entirely unrelated learning, to learn better. A benefit of OIL that is frequently highlighted is that it allows for seamless learning to take place on the go, giving the student the power to direct every aspect of their experiences via a mobile device. Since learners can easily and independently utilise the technology for these goals, it is believed that these advantages of OIL are excellent for promoting IL (Sharples et al., 2010). Thus, the main goal of my research was to conceptualise how online learning affects the growth and acquisition of 21CS by secondary school students.

1.8 Research Approach and Methodology

A pragmatic paradigm was used to help the researcher address the research questions in the present study (Mayberry, 2014). The paradigmatic approach enables researchers to utilise various methods and paradigms to concentrate on shared meanings and seek shared goals. The present case study used a mixed-method explanatory sequential research process approach to flexibly utilise various data collection methods (Gall, Gall & Borg, 2007; Teddlie & Tashakkori, 2009; Yin, 2009). First, the researcher collected quantitative data using a questionnaire, followed by qualitative approaches through semi-structured interviews and group interviews. Out of 380 questionnaires issued, 310 questionnaires were collected. Only a subsample of learners who performed OIL from step one was selected in a qualitative data generation method. Primary and secondary data were collected, analysed, and integrated to draw conclusions from both sets of results in a multi-method approach (Brierley, 2017; Johnson & Onwuegbuzie, 2004; Tashakkori & Creswell, 2007).

1.9 Conceptual Framework

By analysing the literature review, the researcher developed a conceptual framework study comprised of the P21 21st Century Skills framework, Activity Theory (AT), and Tennant and Fenwick's (2004) framework. The conceptual framework permitted the researcher to investigate

the extent to which 21CS can be developed among secondary school students through OIL using Web 2.0 tools in secondary school students in Mauritius.

1.9.1 Activity Theory

Using tools and artefacts, AT seeks to theoretically analyse and comprehend human interaction (Hashim & Jones, 2014). Heo and Lee (2013) argue that students' actions may ultimately benefit them in better understanding, skills, and dispositions related to 21CS. The rationale behind selecting AT is that it refers to virtual interactive learning outcomes through social media and online actions to an interplay of human influences within a given environment. Secondary students acquire 21CS with digital instructional components that are interdependent and constantly rebuilding. The AT technique breathes life into the system and promotes meaningful education for students. AT clarifies the learning processes that happen after a specific student acts in a particular context by connecting the personal and social levels. Therefore, AT was used in this research as an assessment technique to examine the unstructured educational process of high school students defining and contrasting the elements of activity in online spaces (such as blogs and SNSs). The schema depicted in Figure 1.1 shows the conceptual framework used in this study.

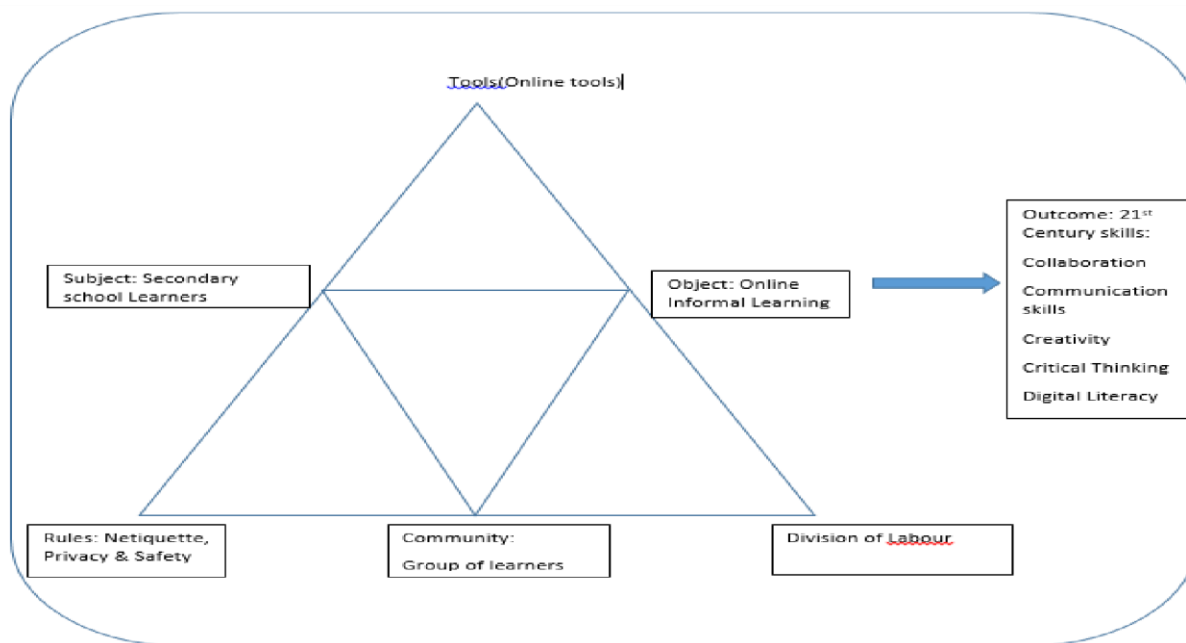


Figure 1.1

Conceptual Framework of the Study

1.10 Delimitations of the Study

The research was conducted at a public high school in a remote region of Mauritius and was limited to a boys' school spanning grades 7-13. The school was selected based on the researcher's familiarity with the area and the accessibility of the college. Additionally, the research focused on OIL's creation of 21CS among only secondary school students. Due to time constraints and the age range of the children, only five skills were included in the study, namely collaboration skills, creativity, digital literacy, critical thinking, and communication skills. The study was further limited to participants using Web 2.0 tools to allow the researcher to study the process of OIL and the development of 21CS. However, the researcher ensured that the results were both valid and reliable.

1.12 Significance of the Study

In the present mixed-methods study, the aim was to explore the extent to which 21CS can be developed among secondary school students in Mauritius through OIL using Web 2.0 tools. The focus was on Mauritian secondary school students from 7th to 13th graders to find out how they performed during OIL using Web 2.0 tools, what digital tools were used, and how and why they developed 21CS. The findings should significantly advance the body of literature by giving the Mauritian education system more options to supplement current initiatives to help students acquire 21CS through OIL. An awareness of the extent to which 21CS can be developed among secondary school students through OIL using Web 2.0 tools could help the Mauritian school system to better align with the UNESCO Position Paper on Education after 2015. Further, there is limited published data on Internet learning as a classroom approach and how students conceptualise C21 skills. Therefore, the study fills the research gaps between OIL and the development of 21CS among students.

1.13 Concept Definitions

The following essential terms associated with OIL and 21CS were used for the research study.

Analytical Skills

Throughout the dissertation, the ability to analyse complicated situations, research open-ended questions, assess various perspectives or data sources, and arrive at a logical conclusion derived from the data and reasoning is referred to as analytical skills (Ravitz, Hixson, English & Mergendoller, 2012).

Collaboration Skills

Collaboration skills refer to students' ability to solve problems and provide answers. It also includes the capacity to work compassionately and productively in teams to accomplish a common objective and shared accountability for task completion (Ravitz et al., 2012).

Language Skills

According to Ravitz et al. (2012), language skills can be defined as students' organisation of their ideas, information, and conclusions. It is referred to as having language skills that they can successfully communicate both verbally and in writing, as well as using a range of mediums.

Imagination and Innovation Skills

Imagination and innovation skills are used in the present study to describe learners who can develop and improve answers to challenging problems or assignments through synthesis and/or analysis, as well as to combine or convey this knowledge in novel or creative ways (Ravitz et al., 2012).

Self-direction Abilities

Self-directed learners can control their education by picking their own learning goals and strategies, as well as by evaluating their own work and responding to feedback (Ravitz et al., 2012).

Digital Literacy Abilities

In this thesis, digital literacy refers to learners' capacity to organise their learning and create goods by utilising the right internet technology (Ravitz et al., 2012).

1.14 Structure of the Thesis

The thesis has been structured as follows:

Chapter 1: Introduction and Background to the Study

In Chapter 1, the introduction, background of the study, the problem statement with research questions, and the aim and objectives were presented. The context and rationale for the study, an overview of the literature review, an overview of the research methodology and the conceptual framework were also included. Further, this chapter briefly described the delimitations and the significance of the study.

Chapter 2: Literature Review

Chapter 2 includes an extensive literature review with theoretical frameworks underpinning the study. It provides a comprehensive analysis of the existing theoretical and empirical literature on the emergence of 21CS over time, the existing international 21CS framework, 21CS and the roadmap for secondary education in Mauritius, the transition from formal to informal learning and the emergence of 21CS through OIL in secondary school learners.

Chapter 3: Conceptual and Theoretical Framework

The ideas and models underlying the study are discussed in Chapter 3. These theories include the 21st Century Skills Framework (P21) and Engeström's Activity Theory and how they influenced my research.

Chapter 4: Research Methodology

The research technique for the study, which was based on the pragmatic paradigm, is described in Chapter 4. The study's participants were chosen using a purposeful sampling method. The conceptual framework, research paradigm, research approach, research design, research procedure, and ethical considerations are all presented.

Chapter 5: Analysis of Quantitative Findings

The major concerns that resulted from the quantitative data are the subject of Chapter 5. Data obtained through organised interviews and survey questionnaires are summarised in the report. Patterns, similarities, differences, and themes informed by the analysed data are presented.

Chapter 6: Analysis of Qualitative Findings

Chapter 6 focuses on the key themes that emerged from the qualitative data. Summarised results of data that was gathered using survey questionnaires and structured interviews are also provided. Patterns, similarities, differences, and themes informed by the analysed data are presented in this chapter.

Chapter 7: Discussion of Findings

The study results are interpreted and discussed in Chapter 7. To comprehend and explain the findings, I draw on the underlying hypotheses of the investigations and pertinent literature. It focuses on the insights and conclusions drawn from the analysed data. Gaps identified in the study are highlighted.

Chapter 8: Implications, Recommendations and Future Directions

The concluding chapter provides a summary of the research results, the report findings, and comments are given. Topics for future studies are suggested and the implications, recommendations, and conclusions of the study are outlined.

1.15 Synthesis

Chapter 1 provided an overview of the study titled Online Informal Learning and 21st century skills among Secondary School Students: The Mauritian Context. The study's background, rationale, context, problem statement, research questions, aims and objectives, literature review, research methods, conceptual framework, study delimitations, significance, and definition of important terms were all outlined. The literature review is thoroughly described in the following chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The overview of the research was discussed in Chapter 1. Chapter 2 focuses on the review of existing literature that provided insight into reviewing the literature on digital unstructured training and 21 Century Skills. In reviewing both national and international literature, gaps in the current literature about these two phenomena and pertinent information are identified relating to the study at hand. To expound on the phenomena of 21CS, this chapter presents themes such as the emergence of 21CS over time, the existing 21CS international framework, the move from formal to informal learning, and the emergence of 21CS through Online Informal Learning (OIL) among secondary school learners in the literature, thus establishing a reason for the thesis's path.

2.2 Emergence of 21st Century Skills Over Time

Today's global economy requires a different understanding and set of skills than those traditionally addressed by the education systems of the 19th and 20th centuries. According to Suto (2013), internationalisation, multiculturalism and networking are more widespread than ever. With the rapid changes in the workplace and technology, the ability to tackle difficult integrative situations, to collect and analyse data from different sources requires a whole new set of wisdom, skills, and mental patterns (Bao, 2019; Tanenbaum, 2016).

Globalisation and rapid technological progress are leading to unprecedented social, economic, and ecological challenges worldwide. Against this background, children who start school in 2018 and leave school in 2030 must be adequately prepared for the challenges of tomorrow and involved in all facets of life. In his work, *21 Lessons for the 21st Century*, Joshua Noah Harari examines how colleges continue to prioritise memorisation and traditional intellectual success over the cultivation of analytical skills and competence, which will become increasingly important for later prosperity (as cited in World Economic Forum, 2020). However, Schleicher (2015) states that comprehensive reforms in curriculum, delivery, and evaluation have been made in various countries across the world to make sure that all students are equipped for the higher academic demands of life and

work. In this regard, 21CS is a much-discussed topic in contemporary education (Kutlu & Kartal, 2018).

Chalkiadaki (2018) asserts that 21st century talent includes a wide range of skills and qualifications, including collaboration (especially in heterogeneous groups), the growth of analytical and communication abilities, as well as social and civic participation. Furthermore, Joynes et al. (2019) advocate that it should also include:

- imagination;
- abstract thinking;
- rational thinking;
- task identity;
- responsibility for citizenship at national and international levels;
- recognising and developing personal characteristics;
- understanding and accepting diversity;
- recognising and accepting interdependencies;
- using interactive tools and communicating in the mother tongue and foreign language;
- math and science skills;
- digital skills;
- initiative and entrepreneurial skills;
- accountability;
- leadership;
- cultural awareness and expression; and
- physical fitness.

The phrase “21st century talent” refers to a broad variety of abilities necessary for success in the workplace, in school, and daily life (21st Century Education Alliance (P21), 2015; Binkley et al., 2012). To be successful in today’s rapidly changing world, learners need these skills. Different circumstances call for different 21CS. For example, Rotherham and Willingham (2009), Moyer (2016) and Abbott (2015) all agree that 21st century skills (21CS) are a wide range of information,

talents, and work ethic and consequentially considered critical to success in the current climate, particularly in collegiate programs, modern jobs, and industries. It is a method that can be applied in all academic subjects and industrial and political situations.

The digital revolution has shifted the emphasis on remembering and memorising to a rapidly evolving information-rich era where students need to be agile (Boss, 2019). It is therefore imperative to develop 21CS that can be applied to all academic fields to be competitive in today's society. Skills that are applied cross-curricular, interdisciplinary and are both transferable and transversal can be referred to as applied skills. Even though some of these names may well be synonymous, Moyer (2016) observes they can also have other, more specific meanings.

According to Kutlu and Kartal (2018), traditional pedagogical practices such as rote learning and superficial learning are becoming less important. The basic idea of 21CS includes social skills such as cooperation, interaction, and commitment in addition to real concern skills, thinking skills, analytical and imaginative thinking skills, executive functions, and cognitive sub-skills which include tenacity, identity, ambition, but also flexibility dilemma.

Children are now facing distinct difficulties due to the upcoming and rapid changes that machine intelligence (AI) is bringing to almost every element of life (Siraj et al., 2018). To prepare students adequately for the upcoming changes in their lives, Tucker (2017) suggests that development and skills must be adapted to the new demands of the world of work. To change the core question of what it means to be intellectual in a machine learning-enhanced world, it is critical that we look beyond recent trends to identify the skilled workforce the world will need. A skilled workforce will help us determine how machine learning will impact education, including what sort of expertise and 21CS new generations will need.

A 2015 WEF report claims that promoting social and emotional literacy through technology means focusing on the skills children need in the present, and this underscores the value of emotional and social education in schools (as cited in World Economic Forum, 2016). Students need more than traditional academic learning to adjust to the 21st century. It helps them develop competencies such as communication, collaboration, and problem-solving. A combination of emotional and social competence and mastery of traditional skills will enable students to thrive in the rapidly evolving digital economy.

21CS are divided into three groups by Trilling and Fadel (2009), namely the ability to learn and innovate, the ability to use digital media, and personal and professional development. As Schneider and Bakhshi (2017) explain in a separate NESTA report, automation is not the only factor influencing the future of work, but also changes in urbanisation, rising inequality, political uncertainty, technological development, and globalisation. Higher cognitive skills, interpersonal skills and the capacity for teamwork are highlighted as essential components of 21st century education.

Artificial Intelligence (AI) and 21CS have a significant association, according to a QS Asia News Network report from 2018. One of the biggest challenges AI poses in education is what students need to learn when learning with AI in the new era. As a result, education is a sector where great changes and new opportunities are possible. There is a need to develop citizens who can think critically, be creative, resolve conflicts and be flexible, because these skills are needed in the new age.

Critics, including Messias et al. (2018), have argued that the education system needs to be redefined. A concept called Education 4.0 (Puncreobutr, 2016) has recently been developed, which refers to changes applicable to the 4th Industrial Revolution (IndiaToday, 2019). In Education 4.0, the goal is to develop individuals capable of being creative and innovative (Puncreobutr, 2016). Among the 21CS that students and educators must master to be successful in Education 4.0. These include collaboration, leadership, emotional intelligence, teamwork, digital literacy, creativity, effective communication, global citizenship, entrepreneurship, problem-solving, and innovative competencies. Similarly, developing a nation of intelligence requires critical thinking skills, creativity, innovation, and understanding of cross-cultural differences, media literacy skills, professional skills, and study skills (Puncreobutr, 2016). However, Bao (2019) points out that despite the widespread consensus on the ten essential skills, research on how the ten essential 21CS interact and evolve over time is lacking.

2.3 Existing 21st Century Skills International Framework

The 21CS framework was developed independently by several organisations worldwide (Binkley, 2010). To help individuals develop their understanding of 21CS, numerous frameworks have been developed with support from international organisations, governments, and consultancies,

according to Reynolds (2018). Additionally, the skills required to be successful in the workplace have changed significantly over the past three decades. Care and Kim (2015) demonstrated how pervasive explicit identification has become in nations' efforts to equip their students. Education in many countries is becoming more inclusive than just focusing on academic achievement (Care et al., 2018).

Several countries worldwide, including Mauritius, have revised their national curricula by emphasising 21st century learning needs in their newly revised curriculum documents. According to the MoEHRSR of Mauritius, the current government strives to provide all students with the information, fundamental abilities, and attitudes necessary to ensure their success in the future (2016). Various frameworks have been developed to promote and discuss 21CS. These frameworks include skills related to information and communication technology, critical thinking, collaboration, communication, creativity, productivity, problem-solving, and social and cultural responsibility (Dede, 2010; Ferrari, et al., 2012; Voogt & Roblin, 2012; Van Laar, 2019).

In the “Assessment and Teaching of 21 Century Skills (ATC21S)” project, hierarchical skills are developed that play a critical role in collaboration and problem-solving (Griffin & Care, 2014). New skills, as well as a new emphasis on older skills, are required because of the role played by technology in the workplace and daily life. As shown in Figure 2.1 below, the KSAVE framework has been adapted from Griffin and Care (2014) as a part of the ATC21S project.



Figure 1.1

KSAVE Framework (Mawas & Muntean, 2018)

As part of the Innovators Integration Framework (KSAVE, 2018), developed by the Institute of Technology, four sets of skills were defined that would enable individuals to demonstrate new ways of working, new ways of thinking, and new tools for living in the modern world created by technology. Learning to learn is an integral part of metacognition as it involves a range of skills such as creativity and innovation, critical thinking, problem-solving and learning to learn. As a team learner, communication, collaboration, and teamwork are important components of success. To be an effective worker, it is necessary to understand information technology and be knowledgeable in information. Mawas and Muntean state that the phrase “living in the real world” refers to a shift in focus towards citizenship and responsibility in a local and global context, as well as aspects of career development, parenting, community engagement, and other social responsibilities (2018).

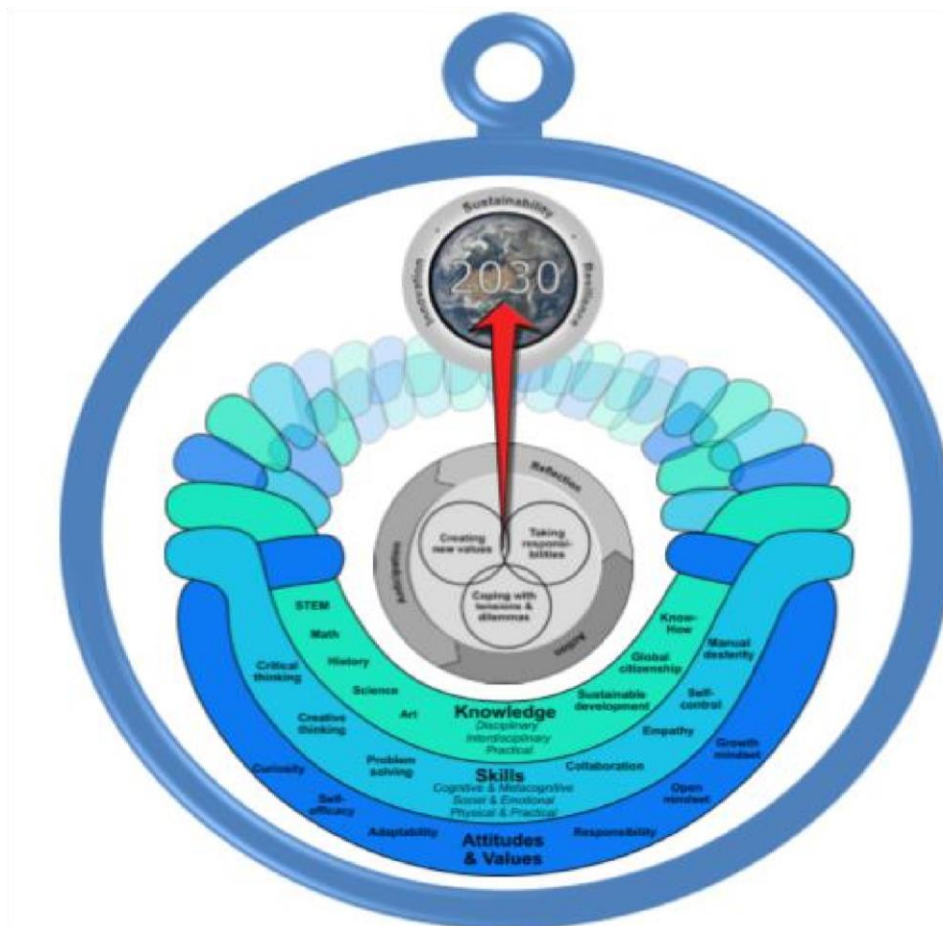


Figure 2.2

The OECD Framework 2030 (Organisation for Economic Co-operation and Development, 2019)

A definition of 21CS was created by the Organization for Economic Co-operation and Development (OECD) (2019). Mawas and Muntean (2018) maintain that these key competencies are classified into three groups, namely interpersonal interaction with members of heterogeneous social groups, autonomous action, and interactive use of tools. They contend that autonomous action is crucial for individuals to shape their lives responsibly and meaningfully. The interactive use of tools represents the social and professional demands of the global economy and modern society at large.

By focusing on the need to take back and reframe 21CS for 2030, the OECD Framework for Key Competencies (2019) seeks to improve curriculum design and development processes by applying an evidence-based and systematic approach to contribute. They believe that collaboration, the use of digital tools and user interaction are key skills for young people. In its Global Competence

Framework, the OECD emphasises the importance of empathy in user interaction (it is central to user analysis in design thinking). Partnerships 21 (P21) is another framework that aims to support lifelong learning through the development of 21CS and support for relational learning. Education experts, business leaders, and educators have collaborated to develop a framework that outlines the knowledge, support systems, expertise, and skills students need to navigate life, school, and work. The framework consists of four key components (see Figure 2.3): (1) Personal and Professional Development Skills, (2) The Skills of Learning and Innovating, (3) Digital Skills, Information Technology Skills, Advertising Skills, and (4) Themes and Matters Relevant to the 21st Century.

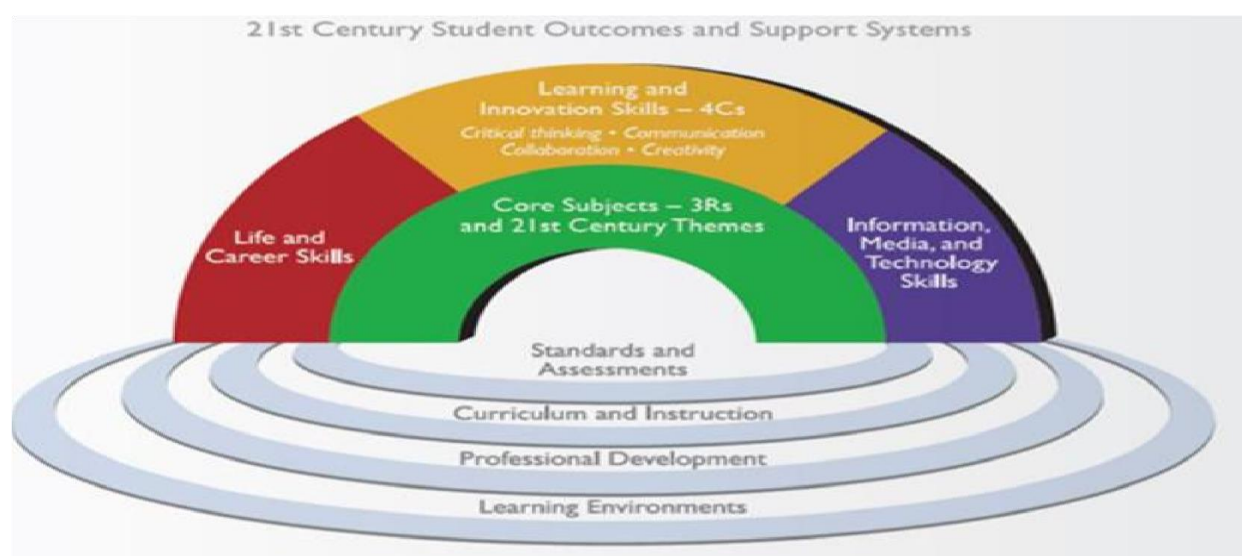


Figure 2.3

21st Century Student Outcomes and Support System

Mawas and Muntean (2018) argue that to navigate complex work and life environments, students need a firm foundation for life and career skills. Our modern society is characterised by an abundance of technology, media, and technology-driven environments, which provide access to a great deal of information, rapid technological developments, and the ability to collaborate and contribute individually at unprecedented levels. Information, media, and technology skills are extremely important. Schools can encourage greater levels of knowledge of academic content by integrating transdisciplinary ideas from the 21st century into the following important subjects: “economic literacy”, “environmental literacy”, “global awareness”, “financial literacy”, “business

literacy”, “health literacy”, and “civic literacy”. Similarly, Van Laar (2019) concurs that with input from education experts and business leaders, the P21 is the only international 21st century framework of skills that defines the twenty-first century’s vision for education, which ensures that students are prepared for life as citizens and workers.

A common group vision for education has been created by the Partnership for 21st Century Learning (P21, 2015), called the Framework for 21st Century Learning. In this framework, students are required to gain and master specific knowledge, skills, expertise, and literacies to thrive in their careers and lives. It combines knowledge of the subject, particular abilities, literacies, and expertise. Since P21 focuses on conceptualising 21CS rather than on assessing them, the research project focused on the P21 framework. Students should gain the skills necessary for success in the world and the knowledge and abilities to flourish in the modern world as we know it today, such as creativity, critical thinking, problem-solving, communication, and collaboration.

Despite the diversity of skills classifications, these skills include “problem-solving”, “collaboration”, “communication”, “learning-to-learn”, “learning-to-live” “innovation”, “creativity”, “critical thinking”, “interpersonal skills”, and those that promote social and personal development (Chu et al., 2017, pp. 17-32; Queensland Curriculum and Assessment Authority, 2015, pp. 4-11). Luka and Seniut (2019) emphasise assembly decisions decentralised, sharing information, and working as a team (as cited in Binkley et al., 2012, p. 17). In summary, 21CS are the competencies and skills that the youth will need to remain competitive in a knowledge-based economy (Ananiadou & Claro, 2009, p. 8; Luka & Seniut, 2019).

In light of this, the focus of the research project was on the four Cs of the 21CS: creativity, critical thinking (problem-solving), communication, and collaboration. They are described next.

2.3.1 Creativity

One can consider a creative skill to be relevant when it applies to a specific situation, for example, designing a machine, formulating a chemical model, or creating artwork with design software. In Smith and Smith’s (2010) view, the researcher’s creativity and education are often combined when solving problems, enhancing learners’ creativity, and innovating teaching-learning processes. As stated by Robert Sternberg of Tufts University (2007), successful individuals possess creative skills that allow them to envision a way. The importance of both analytical intellectual skills, and practical intellectual skills, which enable them to implement their visions and convince others of

their importance, and wisdom, which ensures that their vision is not self-centred. The concept of creativity is a crucial skill that is becoming increasingly important in the 21st century. It is possible, for example, to produce and share content using Web 2.0 technology in several ways. It is becoming increasingly commonplace for users to create and remix content (Mills et al., 2017; Lessig, 2008), challenging traditional teaching and learning relationships through creative practices.

2.3.1.1 Think Creatively.

In the P21 21CS Framework (2015), the first 21CS, creative thinking, involves the use of various idea-generation techniques (for example, brainstorming). Additionally, it involves identifying and developing new and worthwhile concepts (both incremental and radical) and improving and maximising original ideas through the development, refinement, analysis, and evaluation of creative endeavours.

2.3.1.2 Engage in Creative Collaboration with Others.

Creative collaboration is the ability to effectively develop, implement and communicate new ideas with others, integrate group suggestions and criticism of work and remain open to new and diverse perspectives (P21, 2015). More 21CS show creativity and originality in their work and recognise the limits of the real world when implementing new ideas. Learners also need to observe failure as a learning experience and appreciate that innovation and creativity are cyclical, long-term processes marked by modest successes and repeated failures.

2.3.2 Critical Thinking

There has long been a perception in society that it is crucial to have the capacity for critical thought. Based on Singh's (2014) opinion, not only those who succeed academically but also those who do not need this type of learning experience. One of the most crucial things to include in one's education is critical thinking. You can never learn well if you cannot think critically. Students who master critical thinking techniques also gain other abilities as a result, including the capacity to concentrate for longer periods, a greater comprehension of analytical techniques, and enhanced thinking abilities (Dubey & Ratnaparkhi, 2017). Self-directed learning is essential for the creation of fresh concepts and solutions in the classroom and for critically evaluating one's learning experience and individual processes, making effective decisions, and solving problems, according

to Videnovik and Karadimce (2018). An adaptation of the P21 (2011) which follows, provides a detailed definition of critical thinking.

2.3.2.1 Reason Effectively.

The use of inductive and deductive reasoning can vary depending on the situation. Inductive reasoning entails the induction of rules by identifying patterns among devices, categorising new data through exploration of virtual places, and deriving inferences from the knowledge obtained about gadgets and digital games. Deductive reasoning entails generalising information obtained from virtual spaces, applying logic to solve (digital) problems step-by-step, and transferring knowledge from one device to another (Weber & Grief, 2023).

2.3.2.2 Use Systems Thinking.

Learners must be able to identify the interactions between parts of a system to determine how they contribute to consequences in complicated environments.

2.3.2.3 Judgements / Decisions.

Learners must be able to analyse and evaluate all evidence, arguments, claims, and beliefs to ensure that they are accurate and efficient. Furthermore, learners must analyse and evaluate major alternative viewpoints to arrive at an informed conclusion. Judgement also requires learners to make connections between the information presented and the arguments presented through an analysis of the information, and then make optimal use of the information to analyse the information and draw conclusions. Judgement helps the learners to critically analyse learning experiences.

2.3.2.4 Solve Problems.

The ability to solve unfamiliar situations creatively and conventionally is a skill that learners must master. This will help them uncover important concerns and suggest better solutions, as well as clarify different viewpoints and lead to deeper knowledge.

2.3.3 Communication

Traditionally, both in business and in society, qualities such as being able to properly convey one's opinions and inspire others through speaking have been valued. In the twenty-first century, these abilities have transformed and are now more crucial than ever. Today's learners need to

comprehend and analyse the vast volume of communication they encounter every day. In this context, the concept of learning and how to articulate thoughts and ideas through using various forms of communication develop communication competencies, including written, oral, and nonverbal, for many teams and environments. Therefore, learners must listen effectively. Soland et al. (2013) reported that developing empathy, building trust, resolving conflicts, and negotiating are all based on communication.

Furthermore, communication skills are defined within the framework of the 21st Century Skills Partnership (P21, 2011). According to P21, learners should communicate ideas and thoughts clearly through oral, written, and non-verbal communication and contexts. To understand the meaning, listen effectively and consider knowledge, values, attitudes, and emotions, they must acquire the skills necessary to use communication in a number of contexts, such as instructing, informing, motivating, and persuading. They must also evaluate the impact and effectiveness of multiple mediums and technologies *a priori* and use multiple mediums and technologies to communicate effectively in different settings (including multicultural and multilingual environments).

2.3.4 Collaboration

Various 21CS frameworks place collaboration in three categories: learning skills (P21, 2015), interpersonal skills (NRC, 2011), and a working style (ATC21s, 2015; Child & Shaw, 2016).

According to the National Education Association (2010), “Collaborating in the classroom is crucial because it is inherent in how we accomplish tasks in our civic and professional lives”. Our world is increasingly connected, and sites like Wikipedia are emphasising the benefits of collaboration. ATC21s (2014) and P21 (2015) describe collaboration as a way of working, an interpersonal skill to know how individuals think and a way to develop a learning ability.

As described by Surowiecki (2004), groups are remarkably intelligent under the right circumstances, and they often outperform the smartest individuals within them. He argues that “The best forecasts will be produced by numerous diverse individuals and the most intelligent decisions will be made by those individuals with the greatest skill set.” Collaboration enhances student learning in today’s global society because it enables students to generate more knowledge.

As the term suggests, collaboration is the capacity to work respectfully and effectively in a diverse team environment. Importantly, they must be flexible and helpful in attaining their goal. Similarly, Smit's (2016) viewpoint is that successful cooperation requires that each team member shares responsibility and therefore values each other.

2.3.4.1 Collaborate with Others.

Collaboration requires that learners acquire experience working effectively, respectfully, and with a variety of people. Learners must be adaptable and prepared to make necessary concessions to reach a shared goal. Furthermore, they must put team members' individual contributions at the centre of the collaborative work and take ownership of the outcomes. According to Griffin and Care (2014), Table 2.4 illustrates a comparison between different 21CS.

Table 2.4

Comparison of Organisations Defining 21CS

ATC21S	UNESCO	OECD	P21	European Commission
Ways of thinking creativity and innovation critical thinking, problem solving, decision making learning to learn, metacognition	Learning to know		Learning and innovation creativity critical thinking problem solving	Learning to learn
Ways of working communication collaboration	Learning to do	Interact in heterogeneous groups relate well to others co-operate, work in teams manage and resolve conflicts	communication collaboration	communication in mother tongue and foreign languages
Tools for working information literacy ICT literacy	Learning to do	Use tools interactively use language, symbols and texts interactively use knowledge and information interactively use technology interactively	Information media and technology information literacy media literacy ICT literacy	mathematical, science and technology competences digital competence
Living in the world citizenship - local and global life and career personal and social responsibility - including cultural awareness and competence	Learning to be Learning to live together	Act autonomously act within the big picture form and conduct life plans and personal projects defend and assert rights, interests, limits and needs	Life and career flexibility and adaptability initiative and self-direction social and cross-cultural skills productivity and accountability leadership and responsibility	social and civic competences initiative and entrepreneurship cultural awareness and expression
Binkley et al.	Delors et al.	OECD 2005	www.p21.org	Gordon et al.

2.4 21st Century Skills and the Secondary Education Roadmap in Mauritius

Care and Kim (2018) conducted a large-scale mapping study to determine how widespread the movement to explicitly identify 21CS has become among nations. Rapid technological advances characterise the 21st century. Digital technologies have become ubiquitous in our lives,

significantly transforming our lifestyles and the way we interact with others (Chu et al., 2017). In addition to active learning, group collaboration is utilised through multiple communication technologies, as well as learning from authentic situations, analysing the information, using technology, critical thinking, problem-solving, and research rather than memorisation.

Over the past four decades, the use of the term 21st Century Skills has increased significantly (Lucas, 2019). Lucas (2019) argues that the development of creativity, problem-solving, socioemotional abilities, communication, and critical thinking are some of the essential skills that secondary school learners need to be flexible and able to adapt quickly to the changing job market and global needs (Care, et al. 2016) consider it vital for countries to reinforce 21CS such as critical thinking, problem-solving, and collaboration in their learning outcomes alongside traditional academic skills including numeracy and literacy. Educators are working to incorporate 21CS into curricula so students can thrive in the 21st century.

These competencies are becoming increasingly crucial for education with the rise of the Internet and an interconnected society. Using multimedia and interactive technologies has become indispensable in educating the secondary school students of the 21st Century. Accordingly, Mauritius has been undergoing nine years of continuous education reform since 2015 as part of the government's initiative to move from an economically stagnant country to one that has a forward-looking future, is environmentally sustainable, economically dynamic, and innovative. According to the MoEHR SR (2016), this project will provide the country with cutting-edge technology, global connections, high-level competencies, and contemporary infrastructure. The goal of the reform is to provide a quality education that ensures all children have equal opportunities to acquire the core skills needed to succeed in upper secondary education and become valuable 21st century citizens.

The development of information, skills, and attitudes specific to the 21st century is a vital element of sustainable development. Mauritian workplace requirements of the 21st century is no longer determined by what new recruits know; rather, they are determined by what they can do with the knowledge they possess. The importance of literacy and numeracy skills will therefore continue to grow, but they will no longer suffice. "As part of the Mauritian educational system, young adults must possess the following core competencies in order to develop the right knowledge, skills, attitude, and values." These skills include "critical thinking", "adaptability", "creativity",

“collaboration skills”, “communication skills”, and proficiency with information and communication technologies (MoEHRSR, 2015).

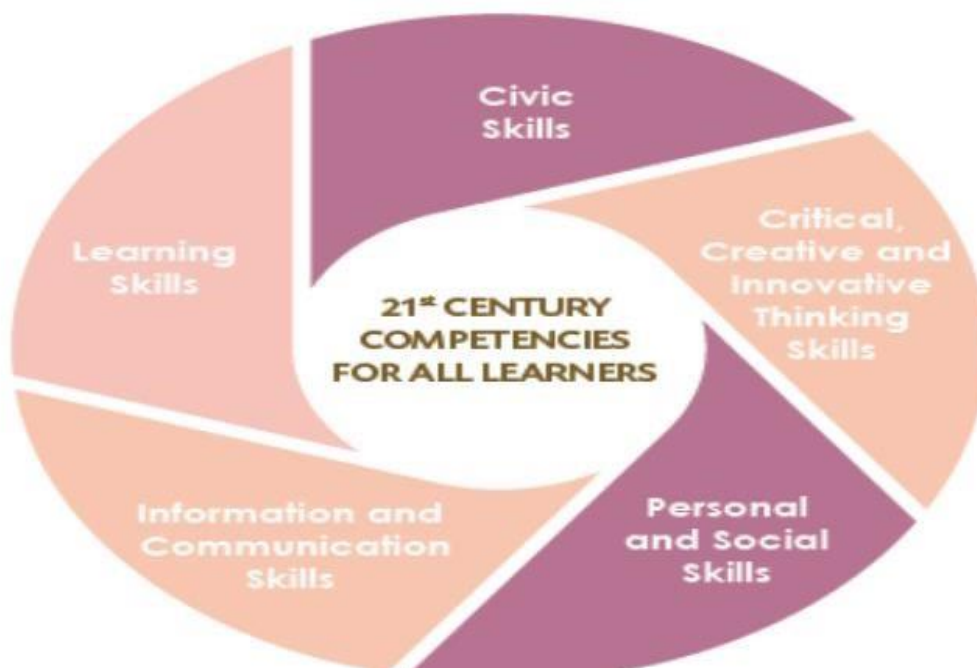


Figure 2.2

21st Century Competencies for all Learners

Mauritius has been reported to have near-universal enrolment in both pre-primary and primary schools, a high rate of transition to secondary education, and gender parity in school enrolment. However, not every student learns and acquires 21CS in the same way. The concept of intelligence itself has evolved to solve problems. Because of teamwork and cooperation, problem-solving has always been a collaborative process. In support, Love (2021) states “It is today, however, possible for strangers separated by space and time to collaborate using open-source programs, wikis, blogs, and other Web 2.0 technologies”. In the 21st century, we are required to resolve issues effectively and creatively by working with computers, a large amount of information, ambiguous situations, and others from different backgrounds (National Education Association, 2010). By using OIL as a method of acquiring 21CS, in the investigation, the aim was to assess whether secondary school students can achieve 21CS using this method. So, having identified the four most critical 21CS for secondary school students, the researcher investigated the possibility of acquiring these 21CS through informal learning (IL) and reviewed further research on acquiring 21CS via OIL.

2.5 Moving from Formal to Informal Learning

2.5.1. Understanding informal learning

A school is seen as a sociocultural institution in that its organisation and accreditation are dependent on society's vision of the purpose of learning as put forth by Livingstone and Sefton-Green (2016, p. 30). Moreover, research has indicated that children are too frequently seen through the lens of who they may or should become in the traditional school paradigm, which is built on curriculum, one-way communication, and individual evaluation (Erstad & Sefton-Green, 2013; Jonnaert et al., 2006; Livingstone & Sefton-Green, 2016). Therefore, it is deemed important by Cain (2011) to note that IL experiences take place outside of the formal educational setting and provide opportunities for students to engage with academic material without the constraints of the formal curriculum. A variety of definitions of IL are provided by major literature reviews and theoretical frameworks from multiple disciplines.

Similarly, Livingstone (2001, p. 5) defines IL as activities that seek to acquire understanding, knowledge, and skills without relying on externally imposed curriculum standards. Learning that occurs outside the classroom is informal, learner-controlled, and independent of courses or institutions. IL, according to Trinder (2017, p. 12), is learning that happens as an outcome of regular activities related to family, leisure, and work. Additionally, the programme lacks structure (to learn time, learning goals, and learning assistance) and does not result in a completion certificate. There are instances when IL takes place intentionally, but most of the time it does not (or is 'accidental' or 'random').

IL has been studied in several areas, including those directly devoted to IL (Misko, 2008; Schugurensky, 2000) as well as those focused on adult learning (Livingstone, 1999; Merriam, Caffarella & Baumgartner, 2006) and work-based learning (Noe, Clarke & Klein, 2014; Hann & Caputo, 2012; Manuti, Pastore, Scardigno, Giancaspro & Morciano, 2015; Eraut, 2007, 2009). IL is defined differently in each of these fields and from a unique perspective. A common method used in adult and lifelong learning literature and IL is to examine IL from the standpoint of a singular learner. In contrast, a common method used in workplace learning literature is to examine IL from the standpoint of the organisation. The present study respects the diversity of opinions in

the literature by evaluating the fundamental ideas of the current literature and offering a perspective on how to approach these notions.

Schugurensky (2000) categorises IL into intentionality and awareness: self-directed learning, socialisation, and incidental learning. Self-directed learning falls at one end of the IL spectrum, socialisation at the opposite end, and incidental learning in the middle. In a study of secondary school students, it was found that they engage in self-directed OIL, whether intentionally or unintentionally, alone or in a group, without the guidance of an educator or mediator. IL is when their learning is purposeful and intentional as they attempt to gain knowledge even before the learning process begins, and they are aware of what they have learned.

The materials and subjects used in IL are not specified (Livingstone, 2000; Tudor, 2013). Furthermore, Todd et al. (2019) argue that a wide range of learning spaces are available to students at any time, anywhere. Several features have been proposed by researchers that distinguish nonformal, formal, and informal learning. These qualities imply that IL is typically more amorphous, voluntary, and learner-led than formal learning, which typically occurs in institutions (such as schools or universities) and is frequently tested. Out-of-school learning that is structured and not formal is non-formal, such as field trips to museums or visits to science centres organised by the school according to Gilbert (2010), and Marsick and Watkins (2001), thus possessing elements of both formal and informal learning.

Consequently, IL can be characterised as a process in which the individual is in control of his or her own learning process and the setting of goals. Informally, teenagers do not always know what they are taught in the classroom. It has become increasingly relevant as the evolution of the media and society continues (Pereira et al., 2019). Touré et al. (2017) contend that developing skills necessary for future teenagers to function effectively in their professional environments is one of the most important outcomes. Therefore, Scolari (2018) considers young people participating in a variety of IL opportunities as a key element of this culture.

Research by Mills et al. (2014) explored IL to engage in activities outside of the classroom. It has been argued that mobile access and information behaviour, i.e., information search and information exchange, are key factors that have contributed to the transition from formal to informal learning in the modern world. Wang and Shen's (2012) view are that informal learning

occurs under self-government and ad hoc conditions [and] is incidental, sporadic, and occasion-related (pp. 563-4).

In conclusion, IL is characterised by learner control. Learners are in charge of their own learning and can choose their own objectives. However, Kear et al. (2014) and Ge et al. (2017) argue that IL which is currently available focuses mostly on mechanical determinants of the durability and satisfaction of online instruction ignoring the connection between online instruction and innovation.

2.5.2. Emergence of Online Informal Learning in the 21st Century

Children and adults are playing, accessing information, communicating, and learning differently due to the digital revolution, as stated by Caena and Redecker (2019). Today's young adults are more connected than ever, using the internet to play games, chat, and socialise with a significant increase in its use among secondary school learners (Schleicher, 2019). Internet usage has risen in both official educational settings and private ones (He & Zhu, 2017). Technology has facilitated access to content and IL spaces and, therefore, IL is becoming more relevant for learners in schools. Technology plays a central role in the learning process of students today and is used more and more in their lives.

Today, individuals can access a variety of educational and leisure resources freely with no predetermined learning objectives. Moreover, they can customise them based on their learning needs (Huang & Oh, 2016). With the aid of emerging online technologies, learning is becoming more informal and self-directed (Song & Bonk, 2016).

As a result, it is safe to conclude that OIL has been developed. OIL is defined by Rappel (2017) as the usage of textual, graphic, audio, and video representations of the World Wide Web as components for IL. A dynamic and transactional learning environment is established in OIL, which recognises a framework that is both individual and social at the same time (Garrison, 2017; Rappel, 2017). Rappel (2017) additionally maintains that as online learning is an isolated process, learners are required to take responsibility for their own self-direction in incorporating autonomous and social aspects of learning.

Studies conducted by Mehrvarz (2021), Chan et al. (2015), and Huang and Oh (2016) established that recent studies have focused more on digital IL in higher education as a new trend of pervasive

learning among university students in the current digital era. Darko-Adjei (2019) also confirmed that technological advancements such as the internet and the proliferation of smartphones, have spurred a dramatic transformation in how people learn. Today, IL has benefited from several sorts of regularly utilised technology for learning facilitation (Noy et al., 2016). He and Zhu (2016) define learning prospects and environments facilitated by technology associated with IL settings as OIL.

Almost all students engage in online learning networks in response to their personal or professional interests as web-based social technologies proliferate. Siemens (2004) refers to all technologies that facilitate learning, whether that is informal or formal, as learning networks. They are used by today's college students to gain sharing knowledge. Typically, informal networks facilitate ageing, self-directed, and curiosity-based experiences in most cases (Dabbagh & Kitsantas, 2012; Ghislandi, Lerardi, Leo, & Spalazzi, 2013; Siemens, 2004). Specifically, Rollett et al. (2007, p. 93) define Web 2.0 as a collaborative medium facilitating communication, collaboration, and the exchange of ideas and thoughts.

Despite not being designed specifically for educational purposes, Web 2.0 technologies, such as wikis, social networking, and many others, have received intense and growing attention from educational researchers over the last two decades (Angelaina & Jimoyiannis, 2012; EscobarRodriguez et al., 2014, Sonmez & Cakir, 2021). They are advantageous to educators because of the numerous options they offer for the exchange of material and resources, for independent and group learning, and for pervasive, lifelong learning (Angelaina & Jimoyiannis, 2012; Gyamfi, 2017).

Online learning has consistently been discussed as enabling seamless learning to take place on any device, with the learner empowered to control all aspects of their learning experience via the mobile device. Because of the flexibility and independence with which learners can use the device for these purposes, Sharples et al. (2010) consider online learning as ideally suited to facilitate IL. Therefore, the main objective of the study is to conceptualise how OIL influences the development and acquisition of 21CS by secondary school students. Puncreobutr (2016) refers to conceptualisation as Education 4.0, a new challenge to redefine education.

In a study conducted on young people's learning from digital media outside of school, Pereira et al. (2019) state that our society's predominance of the highly academic approach to learning

persists. Moreover, I discovered that IL is mostly driven by the wants of youth and peer pressure. Aside from the internet and self-discovery, colleagues and family members are sources of knowledge that are crucial. Schools must cultivate skills and competencies developed through IL strategies. As a result, students' daily lives are increasingly dependent on digital technology. Outside and inside of the university environment, He and Zhu (2017) recognise a clear trend towards a transformative approach to learning and studying.

As per Erstad and Sefton-Green (2013, p. 89), "the beliefs regarding the effects of digital and online media are alleged to create a new generation". As its first users, they have contributed to the expectation that there exists a discrepancy between what is expected of the young and what they are presented with daily to guide and teach them.

2.6 Emergence of 21st Century Skills Through Online Informal Learning among Secondary School Learners

The Director of OECD's Directorate for Education and Skills, Andreas Schleicher, commented in 2019, "Education is more than just teaching students something; it is important to provide them with the tools they need to navigate themselves in a complex, volatile, and uncertain world through the development of a reliable compass and navigational tools." Our common ideals, intellectual and moral maturity, and accountability must come first if we are to make the world a better place. We must also start with our imagination, awareness, knowledge, and talents. Currently, individuals learn formally via a variety of methods (Lai & Smith, 2017). Online surfing for information is a common practice among secondary school students [CB1].

As new technologies emerge at a high rate and our world undergoes rapid technological changes, Mawas and Muntean (2018) argue that school learners must continuously improve their skills, knowledge, and competencies. In addition to serving as a tool for traditional assessments, ICT offers new opportunities to assess skills that were previously difficult to assess. Besides developing new skills, ICT also improves the quality of life in the 21st century. In school education, digital resources and communication tools are increasingly used because of the popularity of digital technology.

For students to benefit from digital learning, they must be able to choose and analyse accurate information from a variety of sources (Trilling & Fadel, 2009). As a key component of 21CS,

Hoffman (2010) and Rotherham and Willingham (2009) state that these competencies are necessary to enable students to effectively gain knowledge and advance learning for 21CS. Therefore, according to Wong and Looi, (2011), Kouromanous and Avraamidou (2014) and Sharples, 2015, it is imperative that research be conducted to examine the interrelationships between IL and 21CS.

Kong et al. (2014) report in their research paper that students in school education nowadays have a wide range of channels through which they can access digital resources and communicate with their peers for e-learning purposes. Technology-supported learning provides learners with a wide range of opportunities to apply 21CS. As found by Kong et al. (2014), by giving students personal computing appliances with wireless networks for gaining access to digital resources and digital learning tools/platforms for measuring and storing learning data, teachers may help students develop 21CS both within and outside of digital classrooms. Thus, one goal of the research is to conceptualise how the online type of learning affects the growth and acquisition of 21CS by learners in secondary schools.

2.7 Gaps in the Literature

Critical thinking, creativity, inventiveness, awareness of cross-cultural diversity, media literacy, professional skills, and study skills are among the 21CS needed to create a nation of intelligence (Puncreobutr, 2016). However, in reviewing the literature, little research on OIL as a teaching strategy and the reasons behind and ways in which secondary school students conceptualise 21CS through OIL was found. Furthermore, despite the broad consensus among different scientists about the ten essential skills, research on how the ten essential 21CS interact and change over time is lacking (Bao, 2019). The research also revealed that although Tennant and Fenwick developed frameworks for adult IL, there are no frameworks for secondary school learners that are related to OIL and the conceptualisation of 21CS. The connection between the conceptualisation of 21CS and the behaviour exhibited by the student is critical to understanding the skills and how they can be evoked and enhanced. Therefore, the current study aimed to fill the research gaps between OIL and the development of 21CS among secondary school students.

2.8 Synthesis

This chapter dissected the literature to answer the research question: to what extent 21CS can be developed among secondary school learners in Mauritius through Online Informal Learning using Web 2.0? The literature reviewed the emergence of 21CS over time, existing 21st Century Skills international frameworks, moving from formal to informal learning, and the emergence of 21st Century Skills through Online Informal Learning among secondary school learners. Gaps identified in the literature included the type of computer activities learners engage in, in contrast to how often they use them, and the impact of these actions and technological advances on the acquisition of 21CS. In Chapter 3, the conceptual framework that guided the research process will be discussed.

CHAPTER 3

CONCEPTUAL FRAMEWORK

3.1 Introduction

The preceding chapter critically analysed and reviewed the literature. Consequently, the gaps between Online Informal Learning (OIL) and 21st century skills (21CS) were identified. In this chapter, the conceptual principles that underpin OIL and 21CS research are outlined. Activity Theory (AT), the P21 21st century skills framework and the Tennant and Fenwick Adult Informal Learning framework are all incorporated. In addition, an analytical lens of how and why OIL can be used to acquire 21CS is also presented for the study.

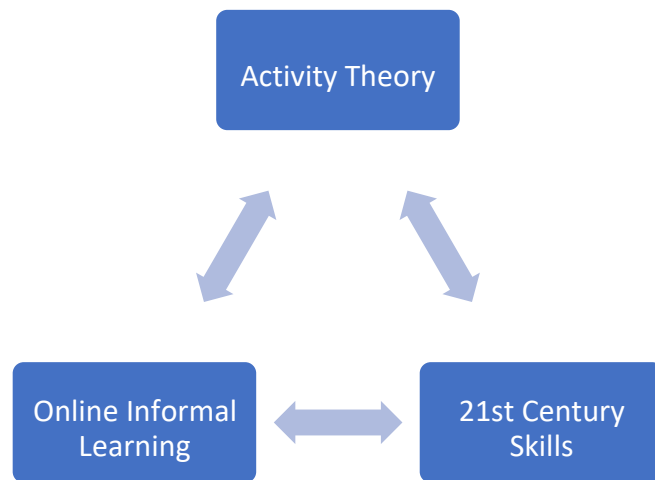


Figure 3.1

Conceptual Framework

3.2 Engeström's Activity Theory

Our conception of learning outcomes must keep pace with technological developments for us to continue to benefit from the current wave of transformation in educational provision. Therefore, García-Sánchez and Burbules (2017) argue that the relationship between human work and learning

has important ramifications for contemporary learning strategies that use cooperation and digital resources.

Engeström (2000) rewrote the socio-technical system as a framework that comprises six components: object, subject, community, tools, rules, and division of labour, which refers to the roles and responsibilities of the members of the community. An activity triangle (AT) [2015] was devised by Engeström, who added rules, communities, and labour divisions. AT's psychological and multidisciplinary framework interlinks the individual and social levels, allowing us to study human practice (Barab, Evans & Beak, 2004; Kuutti, 1996; Heo & Lee, 2013). In this chapter, the learning processes that arise because of specific actions taken by students within a specific context are discussed. These activities ultimately result in continued knowledge, skills, and attitudes being acquired by the learners because of the learning process, based on Heo and Lee's (2013) findings.

A triangular structure of an activity system with six components was devised by Engeström (1987): Subject, Object, Tools, Community, Division of Labour, and Rules. These six elements each carry out a specific task, cooperate to make up an activity and connect to other elements. The term "Subject" refers to the analysis's actors, who may be distinct individuals or sub-groups. An activity's goal and the product(s) it is intended to produce are referred to as the activity's Object. With the use of mediating artefacts (sometimes referred to as Tools), the Objective is then shaped and converted into results. In a sociocultural framework, a Community is made up of many people who have similar overarching Objectives. The Division of Labour is the arrangement of duties and obligations within a Community. Finally, Rules are the explicit and tacit laws, customs, and guidelines that limit how individuals behave and interact within an activity system (Heo & Lee, 2013, p. 78).

Activity Theory (AT) was developed by the Russian psychologist Lev Vygotsky when he identified that the development of the psyche is heavily dependent on "purposeful human activity", facilitated by signs and tools. As a result, individual development is strongly influenced by society and culture (Bennett, 2019). In addition, Leontiev and Luria are also major theorists who have made significant contributions to this theory, as well as many other scholars and new researchers (Mironenko, 2013; Yasnitsky, 2016).

As a theoretical and practical framework for teaching and learning, the AT has been expanded to include settings of learning connected to technology. Most of the research on learning activities in formal and non-formal education systems has focused on tracking and diagnosing these procedures (Jonassen & Rhorer-Murphy, 1999; Collis & Margaryan, 2004; Barab, Schatz & Scheckler, 2004).

Among the numerous studies published, Lim and Hang (2003), Mwanza-Simwami (2001) and Zurita and Nussbaum (2007) are related to the aims of the study. Therefore, AT was used as a theoretical lens to explore how and why OIL develops secondary school students' 21CS.

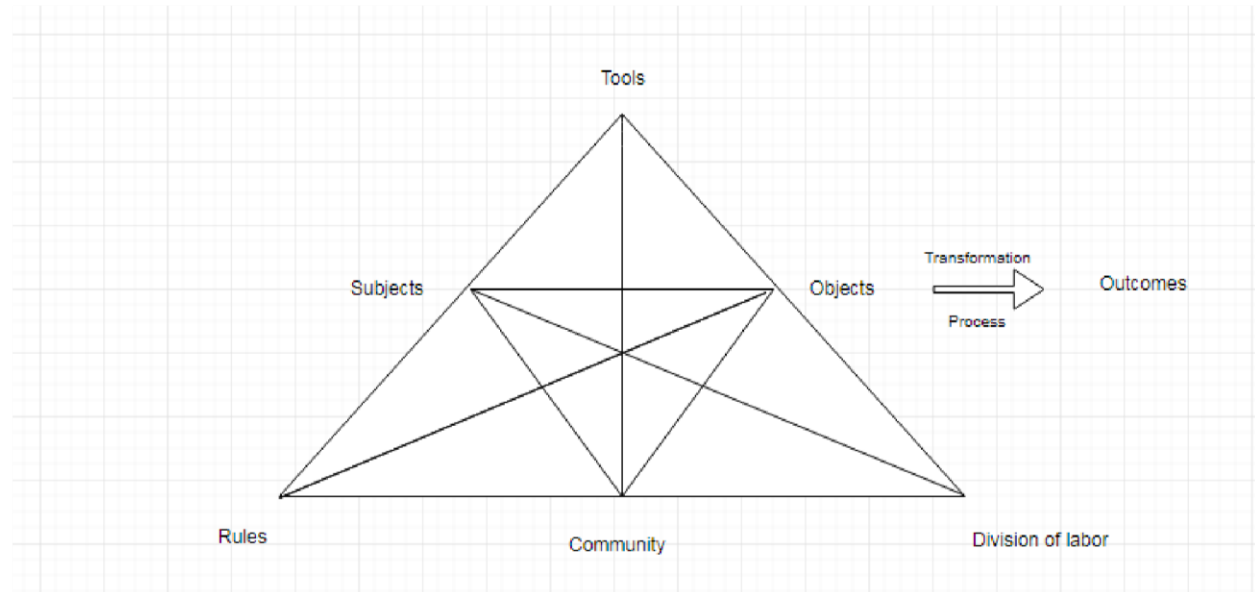


Figure 3.2

Activity Triangle Model (Engeström, 1987, p. 78)

Ekundayo et al. (2012), Heo and Lee (2013) and Pham, Tan and Lee (2018) outline the main tenets of AT as follows:

Activities as basic units of analysis: For the analysis of an activity to be meaningful, it needs to be evaluated contextually to establish it as a unit of analysis. Since activities are dynamic entities rather than static or predetermined, their history plays a key role in how each activity evolves.

Their components continually change and evolve unevenly rather than in a linear manner. Thus, each activity can be described as having an individual history.

Artefacts and mediation: The components of a certain activity are mediated by a set of artefacts that serve as a link between them rather than direct the components of that activity. For studying human practices, this framework uses the activity unit as its basic unit. Activity refers to what and how learners gain knowledge and skills using online tools, as well as why and how those students gain these 21CS via these online tools (Anderson, 2003; Rahimah, 2019). As learners interact with the environment, this reflects and motivates their actions as well (Anderson, 2003).

A noteworthy point is that, in the activity system, every element is constantly interconnected with the others. Therefore, Rahimah's (2019) view that AT must be considered overall as a collaborative approach for constructing knowledge, as the interaction between these four mediators is fundamental to the process of knowledge construction was adopted.

3.2.1 In what ways is Activity Theory related to OIL and 21CS of secondary school learners?

In the present study, we have utilised a theory known as social constructivist Activity Theory (AT), developed by Vygotsky, to understand how human activity works and how the individual is connected to the social environment. As society's behaviours change, so does the theoretical framework for the study. There have been changes in individuals and their communication strategies throughout history, as well as variations in the results from society to society (García-Sánchez & Burbules, 2017). It was the work of Kaptelinin and Nardi (2006) that suggested that humans are governed by their everyday experiences and by how those experiences can be mediated by the tools and systems with which they are equipped. There is a general stream of thought in AT today that involves the close relationship between certain types of activity and technological applications and devices (García-Sánchez & Burbules, 2017).

A more recent study, authored by Kapitonein and Nardi (2012), proposed that AT could be used as a theory of consciousness that explains how mental processes such as memory, decision-making, classification, generalisation, and abstraction are a consequence of interpersonal interaction and the application of appropriate tools used in these interactions. The impact of technologies on social interactions, mental functions, and educational processes can, therefore, be seen from an analytical standpoint. AT is a valuable tool for analysing change and growth in the

workplace. Karanasios and Allen (2018) maintain that it can also be used for understanding the role technology plays in influencing work and work processes without overemphasising the social or material aspects of work.

Dirk (2013) contends that the study of knowledge transfer among activity systems is thus supported by AT, which explains how knowledge flows from one context to another by understanding how knowledge transfers from one context to another. In addition, it helps to clarify how people learn in one activity system and transfers that knowledge to another activity system by clarifying the nature of learning. As Younk (2019) explains, the “theory of expansive learning puts the primacy on communities as learners, on transformation and creation of culture, on horizontal movement and hybridisation, and the formation of theoretical concepts”. Therefore, Engeström’s (2010) development of the frameworks of AT and expansive learning is appropriate for the current study.

With OIL, the activity involves the interaction of human activity through the Internet, as well as social interactions through social networks. The activity arises from interactions performed through the Internet. In addition, the features of this group (secondary school learners), its objectives (acquisition of 21CS through online informal learning), and its tools (online learning tools) are all connected and continuously reconstitute each other. Heo and Lee (2013) postulate that, by doing so, the system becomes alive, making it more meaningful to learners and enabling them to learn meaningfully. Because of the AT, it can be explained that students learn in particular ways due to their actions and actions in specific contexts, which ultimately results in the development of 21CS because of their actions. In addition, using the AT framework, it will be feasible to examine and evaluate the variables affecting students’ acquisition of knowledge application abilities in relation to the variables affecting their acquisition (Bagarukayo et al., 2016) as a function of the factors that influence them.

In Engeström’s (2000) theoretical perspective on learning, learning is regarded as a social practice and activity. A theoretical approach to consciousness is based on the observation that consciousness arises from ordinary activities and is transformed by the practice of those activities (Arnseth, 2008). In a collective activity, the subject and environment interact because of a collective activity (Bagarukayo et al., 2016).

Using the AT framework, the present study investigates the informal learning processes occurring in secondary school environments by characterising and comparing the components of social networks and blogs which are used for informal learning environments in which secondary school learners engage. To facilitate the process, the participants were given a range of scenarios in which they could utilise the Web 2.0 tools.

In sum, considering the combination of theories examined in the research, the researcher could examine the studies methodically. It allowed the researcher to evaluate in a detailed manner how OIL can be utilised in secondary schools to help students gain 21CS.

3.3 Conceptual Framework: Engeström Activity Theory, P21 21st Century Skills Framework and Tennant and Fenwick

Engeström (1987; 1999; 2001) emphasises mediating resources and the communal aspect of activity throughout his examination of the human mind in society. In Chu Wan's (2013) study, the role of online tools in mediating informal online activities and the interaction between students and online tools as mediators for online informal activities was also emphasised.

P21 produced an authoritative description of 21CS. A theoretical lens was used in conjunction with the P21 framework (P21, 2015) to conceptualise how and why OIL impacts secondary school learners' 21CS. The learning context and pedagogic strategies were described using AT by Hodgkinson-Williams and Deacon in 2013. The nature of OIL, the use of online tools and communities, content, and context, and 21CS through online activities were emphasised in the study. The schema depicted in Figure 3.3 depicts how AT was used as a theoretical lens in the present study.

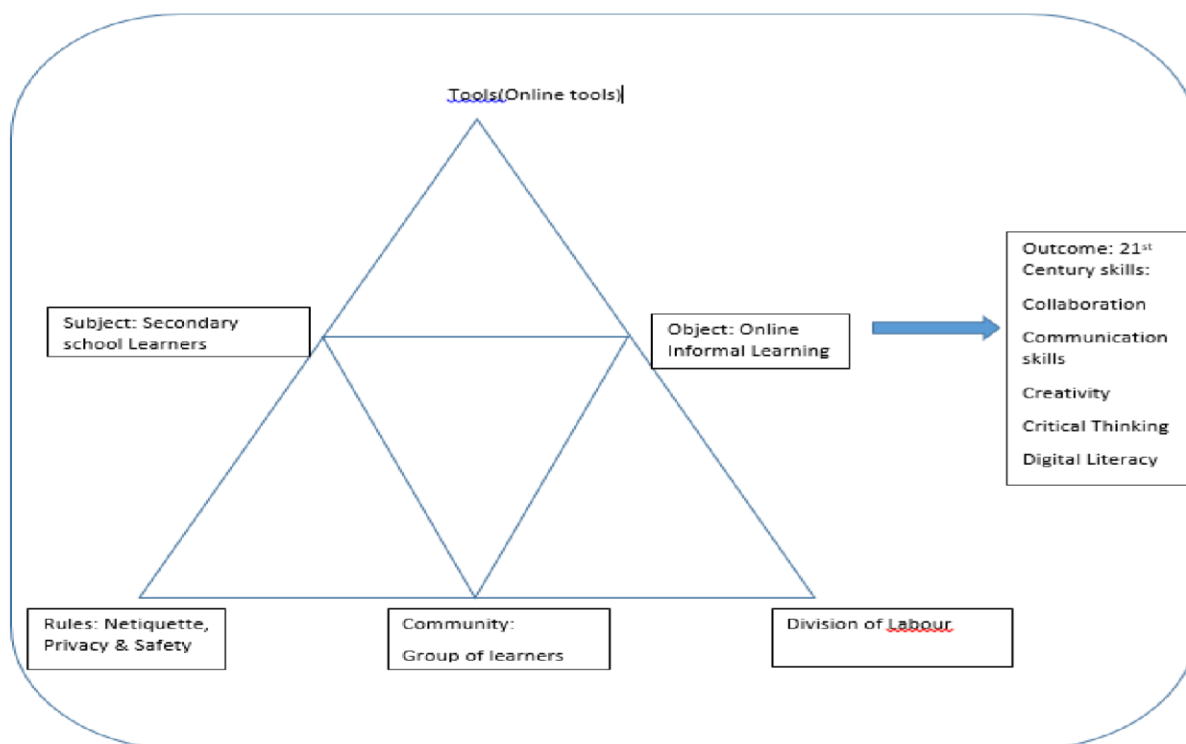


Figure 3.3

Activity System Diagram for the Present Study

The study aimed to explore whether the use of online tools by learners to gain knowledge in a social setting constitutes OIL as an action (Bagarukayo et al., 2016). Learners' interaction with the material and the collaboration between teachers, learners, and tools are essential if learners are to gain an understanding of the material. Furthermore, the author described how AT can be applied to see how and why online tools like Facebook are used to develop the skills of learners to understand how and why they are used.

The AT framework was used as a tool for analysis in conjunction with the P21 framework to investigate secondary school learners' OIL processes and their influence on 21CS. According to Rambe (2012), Therefore, the OIL environment functions as an activity system through which individuals' involvement in various places of interaction (forum debates, private inbox chats, chat groups, blogs, and wall postings) lead to the emergence of intellectual consciousness of academic discourses.

For the study, using the AT as a lens, activity systems components comprised the following elements:

3.3.1 Subjects

There is a connection between the Web 2.0 application user and the facilitator of an online activity. During the study, secondary school students from various grades took part in the study, using some of the web-based spaces in their daily lives such as blogs and social networking sites (for example, Facebook). Rambe (2012) states that it is important to note that the community in an OIL environment includes secondary learners, their peers, educators, senior students, and the extended learning community where they exchange information and ideas.

3.3.2 Tools

In web-based spaces, Heo and Lee (2013) argue that the users can engage in activities that are mediated by artefacts with features that can be used by them. For example, WhatsApp is a messaging app that provides the typical features of text messages, links to other resources, videos, and images. Facebook also has certain features that can be used to customise the homepage of an individual, similar to those found on blogs. An individual space within the Web 2.0 environment includes several interactive features, such as commenting on a post, sending a message, and replying to the message, which corresponds to the characteristics of Web 2.0. It is possible to interact more easily with the users through these functions. As secondary students go online informally, technological tools facilitate academic and social conversations through the aforementioned interactional spaces. Semiotic tools (text messages, emoticons, symbols, pictures, and graphics) help networked communities communicate messages and intentions (Rambe, 2012).

3.3.3 Objective

There is an Objective in the activity in which an Object is to be achieved, which implies a motivation for the activity in the form of an Objective. The present study used the AT to determine whether OIL affects the 21CS of secondary school students and whether it would influence the students' 21CS. It was observed that secondary school students have a much stronger affinity for reflection and collaborative activities such as contributing some posts, commenting on peers' views, etc.) than for independent reflection and participating in collaborative conversations, for

example, when the subjects work together to gain knowledge and learn in a meaningful way (Object) (Rambe, 2012).

3.3.4 Outcome

By determining the Outcome of the research project, users could determine whether their participation in OIL tools influenced their 21CS namely, collaboration, creativity, communication skills, and critical thinking (Afandi et al., 2019). The Outcome represented the final state users achieved through their participation in activities within these web-based spaces.

3.3.5 Community

There is a sense of Community in each web-based space formed by the individuals who participate in it. The Community in which the activities are being undertaken is a sociocultural context in which they are taking place. According to Heo and Lee (2013), the subjects are implicitly and explicitly interconnected throughout the Community, and the connection between the various activity system components guarantees that the subjects trade significant contributions through the articulated engagement that occurs inside the Community. As part of the informal learning environment, secondary school learners joined a broader learning Community that included their peers and other learners with whom they shared information and knowledge using online tools in a learning Community of IL.

3.3.6 Rules

It is important to note that various cultural norms, Rules, and regulations that are either implicit or explicit in nature control web-based behaviours inside an activity system. In order to ensure that users have a respectful and safe environment for their activities, WhatsApp and Facebook providers have instituted Rules, regulations, and codes of conduct. Aside from these explicit regulations, individual users' (Subjects') objectives also had to be met within the context of the communal ethical considerations, specifically, the implicit rules, which form part of these explicit regulations. It is often said that these are called "netiquette" which is a compound word made up of "netizen (net + citizen)" and "etiquette". The term netiquette, as stated by Heo and Lee (2013), is commonly used for most online spaces because the primary objective of all these activities is to encourage user-to-user social contact. All subjects (secondary school students) in the OIL environment for the current study were required to abide by Rules and regulations when using

various online tools, such as a code of ethics, signing up for various online tools, and joining the discussion group for networked contact to occur (Rambe, 2012).

3.3.7 Division of Labour (roles)

Throughout the web-based learning environment, individual school learners are linked to each other, and these intricate connections can be viewed as representations of individual roles within each online community, as well as the Division of Labour within these communities. The degree of engagement that individual users have in activities (i.e., personal and social) varies depending on the Objectives they have for using the web-based spaces (Heo & Lee, 2013) depending on their goals for using the space.

Practise should be thought of as a transition of activity systems, according to Bagarukayo et al. (2016). For the present research, AT was utilised as a theoretical lens to assess the interactions with online tools to achieve OIL and develop 21CS. AT will therefore help users to better understand the role online tools have in developing 21CS through OIL and to establish whether transformation happened in learners by analysing OIL activities. As asserted by Bagarukayo et al. (2016), the theory closes the theory-praxis divide and shows how using internet technologies may generate mental changes for OIL and development. Therefore, to moderate the OIL activity system's impact on secondary school students' 21CS, all its components will be examined.

3.4 Synthesis

The main objectives of the research were to analyse what 21CS secondary school learners acquire when performing online informal learning, and how and why they acquire these 21CS. The AT framework allowed the researcher to apply a more precise analytical lens to the phenomenon that is online informal learning and 21CS to obtain a deeper understanding (Rahimah, 2019). Through the AT lens, participation conceptions are represented by taking the concept of participation beyond individual actions and mental processes, and Reinartz's (2009) claim that activity systems are the minimum meaningful unit of analysis. The research methodology, the chosen design, and the data collation techniques used to explore in greater detail the research questions that served as the direction for the investigation, as well as to apply these constructs to explore the findings of the investigation, will be covered in more detail in the next chapter.

CHAPTER 4

METHODOLOGY

4.1 Introduction

In Chapter 3, a conceptual framework constructed using the available literature reviewed was reviewed and justified. A summary of the research's methodology is included in this chapter, the collection of the data, and the study design and procedures. Data analysis and trend and correlation detection are performed using quantitative and qualitative models to understand how and why informal online learning (OIL) affects the competencies of secondary school learners in the 21st century.

The selected research methodology aimed at attending to the following critical inquiries:

1. What forms of Online Informal Learning occur among secondary school learners to acquire 21st century skills?
2. How does Online Informal Learning influence secondary school learners' 21st century skills?
3. Why does Online Informal Learning influence secondary school learners' 21st century skills?

By assessing and analysing data from both the quantitative and qualitative data collected, these questions were answered. These research questions guided the study and formed the basis for designing the data collection instruments.

4.2 Research Paradigm

The conceptual or intellectual foundation of a study is defined by Khatri (2020) as the philosophical underpinnings of the research activity. Research studies are normally governed by one or more research paradigms, which refer to a set of philosophical principles that researchers use to guide their understanding of truth, reality, and the research question as well as their comprehension of the study in particular (Dawadi et al., 2021).

Pragmatism, interpretivism, positivism, and post-positivism are the four main research paradigms. The positivist paradigm is defined by Kivunja and Kuyini (2017) as a philosophical worldview that only scientific knowledge based on observation and measurement can reveal the truth about reality. It has its foundation in the academic method of inquiry, which was initially put forth by a French philosopher, Auguste Comte (1798-1857).

A paradigm can be defined as a theoretical framework that is selected to structure a particular research project. Mackenzie and Knipe (2006) state that it is a paradigm that defines the requirements, motivational factors, and expectations for the particular research project and the purpose and outcomes of the project. Researchers usually guide their research study by one or more research paradigms, which describe their philosophical perspective on the truth and reality, and the subject (Dawadi et al., 2021). The paradigm helps researchers to identify the research methods that are best suited to their study, as well as the types of data they should collect and analyse. It also helps to provide structure and direction for their research, as well as an understanding of the theories and assumptions that are guiding the research.

Positivist paradigms are characterised by the application of a methodology that aims to find a way to understand the relationships between various phenomena regarding time and context, according to Okesina (2020) and Shah and Al-Bargi (2013). Therefore, a pragmatic paradigm grounded in the explanatory aim and research questions was adopted for the current study (Creswell, 2014). According to Okesina (2020), the pragmatic paradigm offers the best answer to the research question by incorporating a variety of approaches that are combined to provide the best answer. An example of an approach to research using this type of paradigm employs a combination of worldviews to tackle problem research and contribute to knowledge by using approaches that are more practical and employ a combination of research approaches. The term research paradigm, thus, denotes a philosophical stance regarding reality or the universe that describes how we approach reality to understand it from the perspective of a person or group of people (Maxwell, 2005).

Research paradigms attend to basic faith-based assumptions including “beliefs about the nature of truth (ontology), the relationship between the knower and the known (epistemology), and methodological assumptions” (Maree, 2010). Khatri (2020) states that these elements constitute each paradigm’s basic assumptions, beliefs, norms, and values. Similarly, Okesina (2020) states

that the research paradigm for the study defines the “researcher’s philosophical orientation, or perspective, or thought, or school of thought, or set of shared beliefs, which may influence” the selection of study subjects, the method of study, or how to interpret the results of the study. The paradigm provides a framework and the underlying assumptions that guide the research process. Therefore, the research paradigm should also be consistent with the research methodology used.

According to Okesina (2020), the researcher should have a clear understanding of the research paradigm and its implications for the research as this agreement specifies how data will be collected and analysed so that the collected information can be analysed to comprehend the research problem more fully. Data collection procedures should be clearly outlined, such as who will be involved in collecting the data and what methods should be used. Additionally, Ayooluwa (2016) opines that the agreement should provide guidelines for how the data should be analysed, such as which statistical tests should be used and how the results should be interpreted.

Researchers use ontologies, epistemologies, axiologies, and a method to construct a research paradigm that is related to his/her presumptions about just how truth is experienced and interpreted. According to Dawadi et al. (2021), these assumptions guide the research process.

4.2.1 Ontological assumptions

According to Ayooluwa (2016), hypotheses about the nature of the world are referred to as ontologies. Ontology helps distinguish between what is real and what isn’t by examining the researcher’s fundamental beliefs about the nature of being and existence (Dawadi et al., 2021). Understanding how meaning was created from the data obtained from the survey questionnaire completed by the respondents requires philosophical assumptions about the nature of reality. These presumptions guided the researcher’s thinking about the study topic, its significance, and potential solutions to appreciate the problem at hand to react to the research question and resolve it. Without the ontological component, the researcher could not reach meaningful conclusions. To understand how OIL contributes to acquiring 21CS, singular and multiple conceptions of OIL were explored to gauge learner perceptions. The quantitative dimension satisfied the singular notions of truth and the qualitative dimension ensured that multiple conceptions of and approaches to acquiring 21CS through OIL were explored.

4.2.2. Epistemological assumptions

To discover the truth and/or knowledge, researchers can adapt different approaches based on their purpose (Dawadi et al., 2021). Hypotheses regarding how reality is understood are referred to as epistemology (Ayooluwa, 2016). Therefore, epistemology helps to determine how we can know what is real or what counts as knowledge in terms of the research questions (Dawadi et al., 2021). Epistemology includes objective and subjective truths. However, the present study used an approach supported by Wium and Louw (2018) who assert that describing mixed-methods research occupies a middle ground since knowledge is inherently subjective. Interactivity was attained by verifying knowledge claims through the corroboration of multiple sources of evidence in the study, providing the basis for the validity of the study (Mascolo & Kallio, 2018).

Ontology and epistemology are related and complementary to each other. Both serve to validate the research's findings and inform the research process (Cohen et al., 2007; Dawadi et al., 2021). Together, they provide a framework for understanding the methodology and for determining the validity of the study's results.

4.2.3 Axiological assumptions

The term “axiology” refers to the ethical concerns that must be considered while developing a study. For the current study, participants were requested to partake in the study, were given permission letters to sign, and anonymity was guaranteed by the researcher. For the survey, each participant was numerically coded, and the data was kept confidential to maintain anonymity. Fictitious names were also given to the individuals who agreed to participate in the semi-structured discussions.

4.2.4 Methodological assumptions

The fourth philosophical assumption is the methodology. There have been new methodologies created that blend and integrate qualitative and quantitative research methods, which provide more options for addressing certain research topics, according to Wium and Louw (2018). Studies where specific concerns need to be evaluated require measuring, comparing, and counting rely on quantitative research. Conversely, qualitative techniques are more appropriate where explanations for specific occurrences are required. Additionally, several factors should be considered that can influence the choice of methods, including the research objective and the phenomena under study choosing a methodology that is appropriate for the situation (Ayooluwa, 2016).

Teddlie and Tashakkori (2009) maintain that there are four types of mixed-methods research designs: 1) triangulation, 2) embedded, 3) explanatory, and 4) exploratory. The study predominantly utilised the explanatory model. The explanatory design, also known as the sequential design, is a two-stage mixed-method design, as stated by Creswell and Clark (2007). To begin with, data collection and analysis of quantitative data for the design is completed first, followed by the collection and analysis of qualitative data. Accordingly, the first step was quantitative data collection, followed by qualitative data collection. The mixed method approach was used to obtain a clearer picture from the quantitative data, and then to use the qualitative data to provide a richer understanding and explanation of the study in question.

According to Creswell and Clark (2011), a mixed-methods approach enables researchers to examine a subject from a variety of perspectives to develop a more comprehensive knowledge of an issue. Additionally, combining qualitative and quantitative data can help identify underlying themes and patterns that may go unnoticed if only one method is used. Mixed methods allow participants to express themselves and share their personal encounters right through the research process. They can also give participants different ways to explore the evidence and answer questions thoroughly (Wisdom & Creswell, 2013). As a result, it is possible to identify connections and contradictions between qualitative and quantitative data using mixed methods.

Additionally, the use of mixed methods can provide participants with a way to express themselves, which can increase the research results' validity. Mixed methods can foster better intellectual engagement and enhance research experiences by subjecting researchers to other viewpoints on the topics they are investigating (Wisdom & Creswell, 2013). Mixed methods allow researchers to think outside the box, challenge their assumptions and biases, and gain a better understanding of their research subject.

4.2.4.1 Types of Mixed Methods.

Dawadi et al. (2021) argue that mixed-methods approaches are their own research methodologies. As contended by Creswell and Plano Clark (2011), philosophical presuppositions and research methodologies define mixed-methods research. By using philosophical presumptions as a methodology, data can be gathered from several sources in a single study. To explore the potential and apply parallel, layered (embedded) methods, researchers use mixed methods to investigate a variety of themes (Creswell & Plano Clark, 2011).

Mixed methods research combines qualitative and quantitative data to provide a more complete comprehension of a particular phenomenon (Guest & Flemming, 2015). The mixed method approach allows researchers to triangulate data, compare results across different data, and use the strengths of each approach (quantitative and qualitative) to answer research questions. By comparing qualitative and quantitative data, researchers can gain insights into the relationships between various variables and uncover patterns that may not be obvious from either type of data alone. It can help researchers identify areas where further exploration is needed and can lead to more accurate results. Data integration and data connection models are shown in Table 4.1, as adapted from Halcomb and Hickman (2015) and Dawadi et al. (2021), along with the characteristics of each design.

Table 4.1

Designs Using Mixed Methods

Mixed Method Type	Research Process
Explanatory and sequential	A quantitative analysis is conducted first, followed by a qualitative analysis that explains the quantitative analysis QUAN → QUAL
Exploratory sequential	Qualitative data are collected and analysed first, then quantitative data are collected and used to test findings empirically QUAL → QUAN

Exploratory sequential	Qualitative data are collected and analysed first, then quantitative data are collected and used to test findings empirically QUAL → QUAN
Parallel	Concurrent collection and analysis of qualitative and quantitative data QUAL + QUAN
Embedded	A quantitative or qualitative study design can either be used as its main design or with an alternative paradigm incorporated into the study to answer a complementary question QUAL + <u>quan</u> or QUAN + qual

Embedded	A quantitative or qualitative study design can either be used as its main design or with an alternative paradigm incorporated into the study to answer a complementary question QUAL + <u>quan</u> or QUAN + qual
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Note. QUAN = quantitative; QUAL = qualitative

4.2.4.2 Explanatory Sequential Design.

The results of the investigation were explained using a sequential mixed-methods approach. The qualitative data acquired following the quantitative data collection provided a qualitative interpretation of the quantitative results. The data were then evaluated by the researcher to establish the connections between the variables and spot patterns in the data. The study's findings were then analysed to provide a more thorough grasp of the research subject. The researcher could gain a more complete understanding of the phenomenon by using both statistical and qualitative data. Using only quantitative data would have made it impossible for the researcher to capture the complexity of the phenomenon.

Furthermore, by utilising mixed methods, the researcher could draw more meaningful conclusions from the data. The data collected gave a more comprehensive idea of the research topic and enabled a deeper understanding of the phenomenon. The authors Schoonenboom and Johnson (2017), Creswell and Clark (2018), Wisdom and Creswell (2013), and Shorten and Smith (2017) proposed that the findings of the research suggest that an explanatory sequential mixed-methods design can be a powerful tool for researchers. According to Wisdom and Creswell (2013), a researcher uses qualitative data to explain a quantitative finding.

4.3 Researcher positionality

“A researcher’s positionality is how they choose to approach a given research study”, as defined by Savin-Baden and Major (2013, p.71). It affects both how research is directed, its findings, and results (Rowe, 2014). As it involves recognising the researcher’s biases, which can influence data collection, data interpretation, and the conclusions drawn from the study, positionality is a crucial concept in research. The research process can be negatively affected by the researcher’s biases, so it is of utmost importance for researchers to be aware of them.

Research choices in *prima instantiapertractis* are also influenced by researcher positionality (Malterud, 2001; Grix, 2019). Furthermore, a researcher’s positionality is determined by their cultural and social identity, which includes their gender, class, race, and other factors. A researcher’s identity can shape the researcher’s perspective and how they interact with the research participants and the data they collect. Researchers need to be aware of their positionality in order to be mindful of any potential biases that might influence collecting data, data interpretation, and the conclusions drawn from the study. Researchers can identify and develop their positionality in three primary ways by locating themselves within “three areas: (1) the subject under investigation, (2) the research participants, and (3) the research context and process”, according to Savin-Baden and Najor (2013). Identifying personal positions that may influence research is the first step toward locating themselves in relation to the topic.

Researchers also take into account how participants view themselves, how others see them, how they are situated regarding the participants and other factors. Additionally, researchers should acknowledge that as individuals, they might not fully understand how others and we construct our identities, and that it might not be possible without careful consideration and in-depth analysis. Through the research, researchers can learn more about how our experiences, interpersonal

relationships, and the environment shape both their own and other people's identities. It is crucial to understand that identities may be far more complicated than we initially think. To comprehend how the study setting and the researcher's personality will affect their research, it is crucial that researchers are aware of the research context and process setting.

For the present study, the researcher positioned herself by first locating herself in relation to the two phenomena of OIL and 21CS. Second, the researcher located herself in relation to the participants in terms of how information might be gathered from them to address the study's questions and also ensured the participants' privacy during the survey and the interviews.

As an ICT educator for about 20 years, the researcher has witnessed how secondary school students learn a lot either informally or to compensate for their academic learning outside school settings. The researcher has also identified the importance and the lack of 21CS in secondary school students who are leaving school to join the workforce. After having read current literature about the two phenomena, the researcher studied the relationship between these two phenomena and how and why secondary learners acquire 21CS through OIL. The process assisted the researcher in identifying her own biases concerning OIL and 21CS to prevent making assumptions and assuming that OIL will lead to 21CS acquisition. By doing so, the researcher would have been able to identify potential blind spots or errors in her research, as well as ensure that she was looking at the issue from an unbiased point of view. Additionally, it would have enabled her to ensure that the conclusions she drew from her research were not based on her own assumptions, but on the actual data collected (Pyneandee, 2018).

Therefore, the methods used for data collection, coding, analysis, and interpretation was a very important part of the study. The researcher had to guarantee the privacy and confidentiality of the details and responses from each participant while collecting data utilising questionnaires, semi-structured interviews, and focus group interviews. It was also important to inform participants about keeping their privacy and confidentiality before collecting data. As stated by Pyneandee (2018), the researcher had to be careful to have an open mind throughout the interviews, to ask questions when necessary, and to avoid making assumptions: to test hypotheses while staying focused on her study topic.

4.4 Research Approach

The study used a pragmatic paradigm to answer the research questions (Mayberry et al., 2014). Mayberry et al. (2014) and Morgan (2007) support the pragmatic approach as it “encourages researchers who use different methods in different paradigms to place an emphasis on shared meanings and pursuing joint action”. As a result, Gall et al. (2007), Teddlie and Tashakkori (2009) and Yin (2009) agree that the researcher could explore certain issues flexibly by combining qualitative and quantitative techniques, or a mixed-methods approach. According to Wium and Louw (2018), using both qualitative and quantitative data, mixed-methods research gathers and examines information, combines the results, and draws conclusions. However, the mixed method approach uses both methodologies simultaneously to capitalise on each one’s advantages rather than just gathering and studying both types of data. The researcher first collected quantitative data using a questionnaire, which was combined with qualitative approaches through semi-structured interviews and group interviews. 380 questionnaires were issued, out of which 310 questionnaires were collected. Only a sub-sample of learners who performed OIL from step one was selected in a qualitative data generation method. Primary and secondary data were collected, analysed, and integrated to draw conclusions from both sets of results.

4.5 Research Design

The design selected for the study is described by Creswell (2013) as a sequential, mixed-methods explanatory research strategy wherein quantitative data were gathered and examined qualitatively to provide answers to the research questions. The research design facilitated the exploration of certain issues by combining these techniques in a mixed-methods approach (Gall et al., 2007; Teddlie & Tashakkori, 2009; Yin, 2009). To answer the research questions, qualitative information was gathered through conducting focus groups and semi-structured interviews (see Appendices 2 & 3). Creswell (2013) suggests focus group discussions to provide extensive insight into the ideas and beliefs of a group of people. Semi-structured interviews involve asking predetermined questions and then allowing the interviewee to provide more in-depth answers to the questions. Both were useful for gathering qualitative data. The quantitative data were generated by analysing existing records and documents, as well as by disseminating a survey questionnaire to a sample of the target population (see Appendix 3). The mixed methods strategy uses qualitative data to interpret quantitative findings and explain them (Creswell, 2013).

Each section provided specific information related to the research project, providing readers with systematic knowledge of the research methodology, the data-gathering process, the methods that were used for analysis, and the ethics considered. The organised structure enabled readers to follow the research project easily and make informed decisions about the research. The different stages followed in the research are depicted in Table 4.2.

Table 4.2

The Stages of Research for this Study

Stages of Research	Method of Data Collection used	Data results
<pre> graph TD A[Quantitative Data] --> B[Quantitative analysis] B --> C([Linking Quantitative]) C --> D[Qualitative. Data] D --> E[Qualitative. Data] E --> F([Linking Quantitative]) </pre>	<p>Questionnaires</p> <p>Data screening, SPSS software</p> <p>Purposive sampling for selection of participants for qualitative phase</p> <p>Interviews that are semi-structured, Focus group interviews.</p> <p>Content analysis</p> <p>Quantitative analysis is the process of examining data and then drawing conclusions</p>	<p>Demographic and quantitative data</p> <p>Descriptive statistics; inferential statistics</p> <p>Selected participants for qualitative data collection</p> <p>Interview transcripts</p> <p>Emerging themes</p> <p>Discussion, implications, and further research</p>
	<p>from that data. It involves collecting data, summarising it, and examining the relationships between variables. Qualitative analysing data is the method of evaluation.to gain insight, understanding, and meaning. It involves looking for patterns, trends, and relationships between data points.</p>	

To identify what factors influence secondary school students' 21CS through OIL, the study described the procedures for data collection and analysis in a mixed-methods technique, employing both quantitative and qualitative methodologies. A mixed-methods strategy can be used to study research problems utilising both qualitative and quantitative techniques, according to Gall et al. (2007) and Yin (2009). Both descriptive and inferential statistical methods were employed to analyse the data. The study supplied solutions to the study's queries and led to conclusions that explained how OIL affected 21CS (Teddlie & Tashakkori, 2009). In the study, both methodologies were used to give the researcher the chance to respond to the research questions over the course of three years (Mayberry, 2014).

Explanatory designs, also known as sequential designs, are described by Creswell and Clark (2007) as a type of mixed-methods research design using a two-stage methodology. Prior to collecting and analysing qualitative data, quantitative data are first gathered and analysed. It seemed most appropriate to use a paradigm that combines quantitative and qualitative data gathering to make sense of the data gathered for the present study (Teddlie & Tashakkori, 2009). It was thought that the approach would help the quantitative data paint a clearer picture making it easier for me to comprehend and describe the study.

According to Onwuegbuzie and Johnson (2006), depending on the type of mixed-methods research design, the process or schedule for data collection might be parallel, sequential, or concurrent. As a result, the first technique of data collecting involved distributing questionnaires to secondary learners in various age groups. Interviews with students who use OIL provided further insight into the research phenomenon. Data were gathered in order. Sequential data gathering is done in two steps, with both steps being equally important. The first step informs the second. The results from step one can be compared to those from step two using another method, though (Creswell, 2009).

Table 4.3

Data Collection, Analysis, and Research Questions Alignment

	Questions for research	Methodology for collecting data	Analyses of data
RQ1	What forms of Online Informal Learning occur among secondary school learners to acquire 21st century skills?	Questionnaires Semi-structured interviews Group Interviews	Descriptive analysis (Gall et al., 2006) Thematic analysis (Creswell & Creswell, 2018)
RQ2	How does Online Informal Learning influence secondary school learners' 21st century skills the way they do?	Questionnaires Semi-structured interviews Focus Group Interviews	Descriptive analysis (Gall et al., 2006) Thematic analysis (Creswell & Creswell, 2018)
RQ3	Why does Online Informal Learning influence secondary school learners' 21st century skills the way they do?	Semi-structured interviews Focus Group Interviews	Thematic analysis (Creswell & Creswell, 2018)

During the initial phase of the study, I first collected quantitative data using a questionnaire, which was followed by a second qualitative phase. In the quantitative phase, I chose to use a large convenience sample to get sufficient effect sizes for model testing. A subset of secondary students from step one was selected from various age groups to participate in a qualitative data-generating approach for the second phase.

4.6 Research Procedure

There were two phases of the study: the first was to collect quantitative data by using a questionnaire, and the second step was to obtain qualitative data. To obtain an effect size large enough for model testing, the researcher recruited a large convenience sample for the quantitative phase. A sub-sample of secondary learners representing a variety of age groups was selected for the second step to be included in a qualitative data collection procedure. A qualitative phase

explored how secondary school students can engage in OIL. Furthermore, the qualitative phase included examining how OIL contributes to students' acquisition of 21CS.

The second phase employed a qualitative methodology to acquire text data through focus groups and semi-structured interviews. The third research question, along with the first and second research questions, were all addressed at this stage of the study. OIL has become a popular method of acquiring 21CS among secondary school learners. In support, Pyneandee (2018) states that the qualitative phase explores the views of participants in greater depth to enhance and explain the statistical results.

4.6.1 Sampling

Participants were selected based on purposive sampling, which involves handpicking participants according to particular categories, making the process selective and theoretically biased (Cohen, Manion & Morrison, 2000). There were two levels of sampling based on criteria. The first was to select secondary school learners who use online media for non-academic and academic objectives. The second group of participants was filtered from the first group to investigate what 21CS are acquired by secondary learners. Participant groups of different age groups ranging from grades 7 to 13 were selected from among secondary school learners of the same institution. How and why 21CS is acquired by secondary school students was the focus of the study.

The categories for purposive sampling were:

- Participants were selected from secondary school learners of **different ages** (grades 7 to grade 13)
- Participants were selected from **a state secondary school**

These purposive categories enabled me to select participants who were better prepared to aid with pertinent research (Etikan, Musa & Alkassim, 2016) on the phenomena of OIL and 21CS.

4.6.2 Data Collection Tools

Data were collected over a period of six months (see Appendix 1). Data production tools were selected and aligned with the conceptual framework, critical questions, and research design. Data production methods consisted of survey questionnaires that were disseminated to participants

requesting data related to biographical, language, and schooling, as well as to gather data about what 21CS are acquired by learners.

The data studied students in grades 7 through 13 from secondary schools. To capture descriptive data about secondary school students, how they use online tools for Online Informal Learning, and if OIL can provide them with 21CS, a single survey instrument was used, which included both closed-ended and open-ended questions. The survey instrument was distributed to students in the aforementioned grades, and the responses were obtained and analysed. These results were used to gain insights into how online tools are used for OIL, and its ability to develop 21CS. Four parts made up the questionnaire.

Section A consisted of personal and demographic details such as age, gender, grade, whether the student has internet access, whether the student currently uses online tools to access the internet and which online tools they used to access the internet.

Section B collected data about student opinions and experiences with using online tools for OIL to investigate students' personal experiences of the use of online tools as a means of OIL. For example, Section B comprised which online tools students use outside school and the extent to which students use them, which online tools students use to help with their studies or to learn, which online tools they use to help their studies or to learn something informally and when. The researcher also sought to collect data on the reasons why secondary school students use online tools.

Section C was the most important part since it aimed at collecting data about the acquisition of 21CS through OIL tools. It aimed to elaborate on the use of OIL tools to acquire 21CS. Secondary school learners were asked to choose options with the aid of a five-point Likert scale, with answers ranging from "Almost Never" to "Almost Daily".

4.6.2.1 Quantitative Analysis.

Statistical analyses were conducted by using SPSS. The first and second research questions were addressed using descriptive statistics. Descriptive statistics, including means and standard deviations, were computed using SPSS to analyse demographic and personal information. Tables and graphs were used to present frequency data. The results were significant if $p < 0.05$ was reached. For age, gender, grade, internet accessibility, whether the student currently utilises online

tools to access the internet, and which online tools the student utilises to access the internet, numerical summaries, frequencies, and percentages were calculated. This type of analysis allowed the researcher to compare the means of the different groups to assess if there was a significant difference between them. The correlations allowed the researcher to understand the relationships between the different variables, and the numerical summaries provided a more detailed look at the data. The significance of the results is determined by the p-value, and if it is less than 0.05, then the results are considered statistically significant.

A chi-square good-fitting test was used to conduct univariate analysis on categorical variables to determine the bias in the data to compare the frequency of selection of the response options. All responses were assumed to be equally selected under the null hypothesis.

ANOVA's non-parametric counterpart, the Kruskal-Wallis Test, was one of the additional tests. The Mann-Whitney U Test, a non-parametric equivalent to the independent samples t-test, and the Binomial Test, which assesses whether a significant portion of respondents chooses one of two responses, are tests for multiple independent samples that compare two or more groups of cases in one variable.

4.6.3 Phase of Quality Assessment

Semi-structured interviews were selected for qualitative data collection. To respond to research questions 2 and 3, they were conducted after the survey questionnaires had been analysed.

4.6.3.1 Methodology for Selecting Qualitative Research Participants.

At the conclusion of the survey, respondents were given the option of participating in semi-structured interviews or a focus group interview on 21CS for OIL. Separate communications were made with those who responded with an interest before setting up interviews. Each participant received a gift as a thank you for taking part. The participants were informed of the survey and interview results. According to Creswell and Plano Clark (2007), there are instances where participants in the qualitative phase of an explanatory mixed-methods study should have also been involved in the preliminary phase of quantitative research. Due to their participation in the quantitative phase, a small number of secondary school students were chosen for the qualitative phase. If selected for the survey, respondents were informed by email.

Participants were scheduled for 45–60-minute semi-structured dialogical interviews at their convenience (see Appendix 2). As a semi-structured interview often generates unexpected complexities and highlights broader research dilemmas, it was an appropriate method for the present study (Brown & Danaher, 2017, p. 1).

The researcher could attend to the research inquiries because of the interview questions, notably the inquiry of how and why OIL affects 21CS in secondary school students.

4.3.3.2 Group Interviews.

By interviewing a group of students, the researcher could get a wider range of perspectives and experiences, which allowed them to understand how and why OIL influences 21CS in secondary school students. Additionally, it enabled the researcher to contrast and examine various points of view to better understand the subject.

The participants were scheduled for one 45–60-minute in-depth group interview (see Appendix 2). The group interview questions assisted in answering my research questions: how and why OIL influences the 21CS of secondary school learners? In the group interview, the researcher used a set of already prepared questions to guide the interview process. To gather more in-depth replies, the researcher added additional questions on the spot.

4.6.3.3 Qualitative Analysis of Data.

A word processor was used to process the interview scripts. Transcription of the interviews was carried out by the researcher. To analyse, identify, and report repeated patterns in the qualitative data set, thematic analysis was used, as suggested by Braun and Clarke (2006). To conduct the study, the transcription and the qualitative data set were coded according to the themes identified from the interviews. Kiger and Varpio (2020) state that data should then be analysed to find patterns and relationships between the themes. Finally, the results were reported and discussed, with the aim of understanding the underlying meanings of the responses (Braun & Clarke, 2006).

The researcher was uncertain which themes should be kept, discarded, or otherwise modified in the final analysis. Using these themes, key research questions were answered, and connections were made between data items. These connections provided the researcher with insight into the phenomenon being studied and enabled them to draw valid conclusions about the topic. Subsequently, the findings of the study could be synthesised to generate meaningful interpretations

of the data (Kiger & Varpio, 2020). The research questions were focused on the themes identified in the literature review and guided the data collection process. Using qualitative and quantitative analyses, the researcher could identify patterns and relationships in the data that revealed meaningful insights into the phenomenon being studied. The patterns enabled the researcher to draw valid conclusions and generate interpretations of the data supported by the research findings. Policy choices and more research on the subject can be informed by the revelations and interpretations offered by the study.

Additionally, the results of the research can be shared to help others gain more development of the phenomenon. For example, the findings can be published in a journal, presented at a conference, or discussed in the media to facilitate an understanding of the topic. Furthermore, it is important to define and name the themes. A thematic map was created by the researcher by rereading the entire dataset and re-coding for new or modified themes that fall under these themes, then revising the theme map according to those changes. Braun and Clarke (2006) developed a thematic map and a descriptive account of each theme. They then delineated the importance of each subject to the research issue. Braun and Clarke (2006) summarise the results in the concluding stage of their study and report. A “separate stage” is often viewed as distinct from the final step of presenting findings, according to King (2004). Furthermore, Kiger and Varpio (2020) state that the report transcended merely describing codes and themes.

4.7 Ethical Considerations, Validity and Reliability, and Permission for Research

Participants were invited to partake in the study and provided with a permission letter to sign (see Appendix 2). Those who agreed to participate were assured that their rights would be protected and that they would be guaranteed certain rights. For the survey, each participant was numerically coded, and the data was kept confidential to maintain anonymity. Fictitious names were also given to the individuals who agreed to participate in the semi-structured discussions.

As mixed-methods research combines both qualitative and quantitative sources, Creswell and Plano Clark (2007) urge that it is of great importance to identify and remove any problems that may arise during the data collection, analysis, and interpretation phases of mixed-methods research (as cited in Pyneandee, 2018). Some of the risks of inadequate data analysis and interpretation were considered during the preparation of the study.

The following factors threatened the validity of this particular study: (1) collecting quantitative and qualitative data with inappropriate sample sizes; (2) selecting insufficient participants to explain significant results during the continuation phase; (3) focusing the qualitative phase on weak quantitative results (Creswell and Clark, 2007; Pyneandee, 2018). As a result, it is essential that researchers take caution when designing studies to ensure they avoid such potential threats to validity. To avoid such potential threats to validity, researchers must take caution to ensure their studies are well designed, consisting of appropriate sample sizes for both quantitative and qualitative data, selecting an adequate number of participants to explain significant results, and providing strong quantitative results to support the qualitative phase (Creswell & Clark, 2007; Pyneandee, 2018). Furthermore, the qualitative strand was analysed by two independent coders to establish intercoder reliability.

4.8 Synthesis

Chapter 4 started by summarising the research paradigm and methodological aspects of the study's design. The research approach and design were justified by a theoretical foundation. Next, the research procedure was detailed next which included sampling, data collection tools and phase of quality assessment. The discussion was concluded with the ethical considerations and permissions that had to be obtained for the study. Detailed descriptions were also provided of the methodology and design employed to answer these questions.

CHAPTER 5

ANALYSIS OF QUANTITATIVE FINDINGS

5.1 Introduction

The techniques utilised to conduct the research, data gathering, and how the study was conceived and conducted were all explained in Chapter 4. Data analysis and trend and correlation detection were performed using quantitative and qualitative models to gain a better understanding of how and why Online Informal Learning (OIL) influences the 21st Century Skills (21CS) of secondary school students, guided by the purpose of the study. The study primarily used the explanatory model, beginning with quantitative data. Furthermore, the researcher summarises the key findings from the quantitative study.

The research study used a mixed-methods approach, including questionnaires, and semi-structured and focus group interviews. Questionnaires were disseminated to secondary school learners from grades 7 to 13. Semi-structured and focus group interviews were conducted among a range of learners in the same secondary school. The data collected from questionnaires were sorted, edited, coded, and then analysed using descriptive statistics and the Statistical Package for Social Sciences (SPSS) version 27. For this reason, the researcher had to identify, classify, and assign a character or number symbol to the data, using one pre-coded technique. For each of the tested hypotheses, $p=0.05$ was utilised as the significance level. Tables containing frequencies and percentages, pie charts, and bar charts were used to display the survey's findings. Moreover, interview data was analysed using thematic analysis. As a result, the following chapter is organised according to the research questions, important elements of the theories adopted, and the tested hypotheses.

The survey was made available to 380 secondary school learners in a state secondary school. A response rate of 73% was achieved with 310 students properly completing and returning the surveys. The participants were primarily from a boys' state secondary school. In addition, groups of 8 learners were invited for semi-structured interviews and focus group interviews.

The survey questionnaires were administered to secondary school learners following an approval letter obtained from the Ministry of Education, Tertiary Education, Science and Technology.

Approval was also obtained from the rector of the school before starting the data collection. Using both descriptive and inferential statistics, the findings are shown next.

5.2 Respondents' Demographic Profile

In this section, detailed information about the demographic makeup of the survey participants is provided. The demographic data covered topics including age group, grade, whether participants had access to the internet at home or not, and the online resources they used to access the internet. The respondents' demographic data are presented in Table 5.1.

5.2.1 Distribution of Respondents (Secondary School Learners) by Age Group

Table 5.1

Distribution of Respondents by Age Group

Age groups	Frequency	Percent (%)
11-12	47	15.2
13	42	13.5
14-15	95	30.6
16-17	73	23.5
18 and above	53	17.1
Total	310	100.0

Note. $N = 310$ is the total number of usable completed questionnaires out of 380 copies of questionnaires issued to secondary school learners.

The distribution of learners by age presented in Table 5.1 shows that about 17.1 % were within the age bracket of 18 years and above, 23.5% were 16 to 17 years old, 30.6% were 14 to 15 years old, 13.5% were 13 years old, and about 15.2% were aged 11 and above. The table indicates that the

preponderance of participants (about 30.6%) were between the age range of 13 to 15 years. However, the category of 13-year-olds received the least responses. The findings implied that most of the learners in the study were above 14 years of age.

5.2.2 Distribution of Respondents (Secondary School Learners) by Grade

Table 5.2

Distribution of Respondents by Grade

Grade	Frequency	Percent
7	33	10.6
8	63	20.3
9	78	25.2
10	11	3.5
11	44	14.2
12	59	19.0
13	22	7.1
Total	310	100.0

Note. $N = 310$ is the total number of usable completed questionnaires out of 380 copies of questionnaires issued to secondary school learners.

The distribution of learners by grade presented in Table 5.2 illustrates that about 10.6% were in grade 7, 20.3% were in grade 8, 25.2% were in grade 9, only 3.5% were in grade 10, 14.2% were in grade 11, 19.0% were in grade 12, and 7.1% were in grade 13. Most of the respondents were in grade 9, whereas the least number of respondents were in grade 10.

5.2.3 Distribution of respondents (secondary school learners) who use online tools at home

To learn informally online, it is essential for the participants to be equipped with online facilities. Therefore, participants were questioned about their usage of online resources and access to the internet at home. The findings indicated that the vast majority (99%) of secondary school students had access to the internet at home, which is a positive indication that most of the participants use online tools for informal learning.

5.2.4 Distribution of Respondents by which online tools do they use and access regularly

Respondents were asked which online tools they own and regularly access. The inquiry aimed to provide the researcher with information on the respondents' methods for using internet resources for OIL. The findings in Figure 5.1 show the responses of the secondary school students who participated in the study.

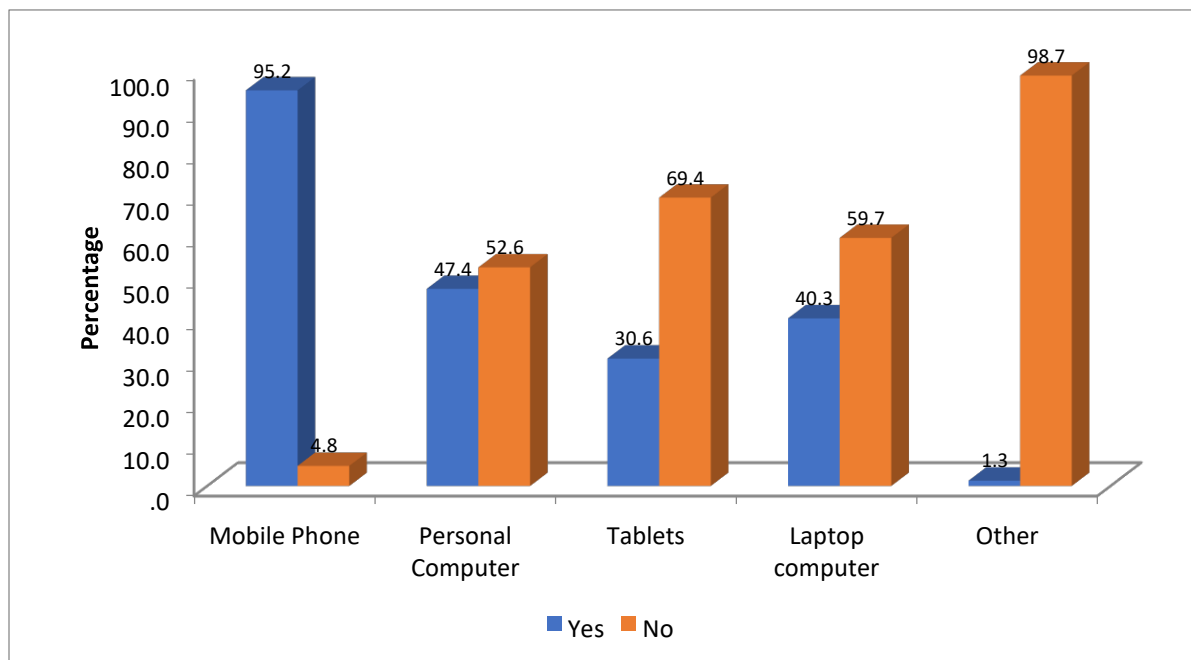


Figure 5.1

Distribution of Respondents by Which Online Tools They Use and Access Regularly

The results in Figure 5.1 indicate that a noteworthy proportion of respondents (95.2%) use a mobile phone. Moreover, it appears that laptops (40.3%), tablets (30.6%), or personal computers (47.4%)

are less used by the respondents as online tools for online learning. Likewise, Ahmad (2020) asserts that the millennial population now prefers using mobile devices with internet access, such as smartphones and tablets, for their different online activities. However, 98.7% of respondents do not prefer to use other online tools. Moreover, 69.4% of respondents do not prefer to use tablets as online tools for informal learning. Similarly, 59.7% of respondents do not use laptops as online tools for informal online activities.

5.3 Findings Based on Research Questions

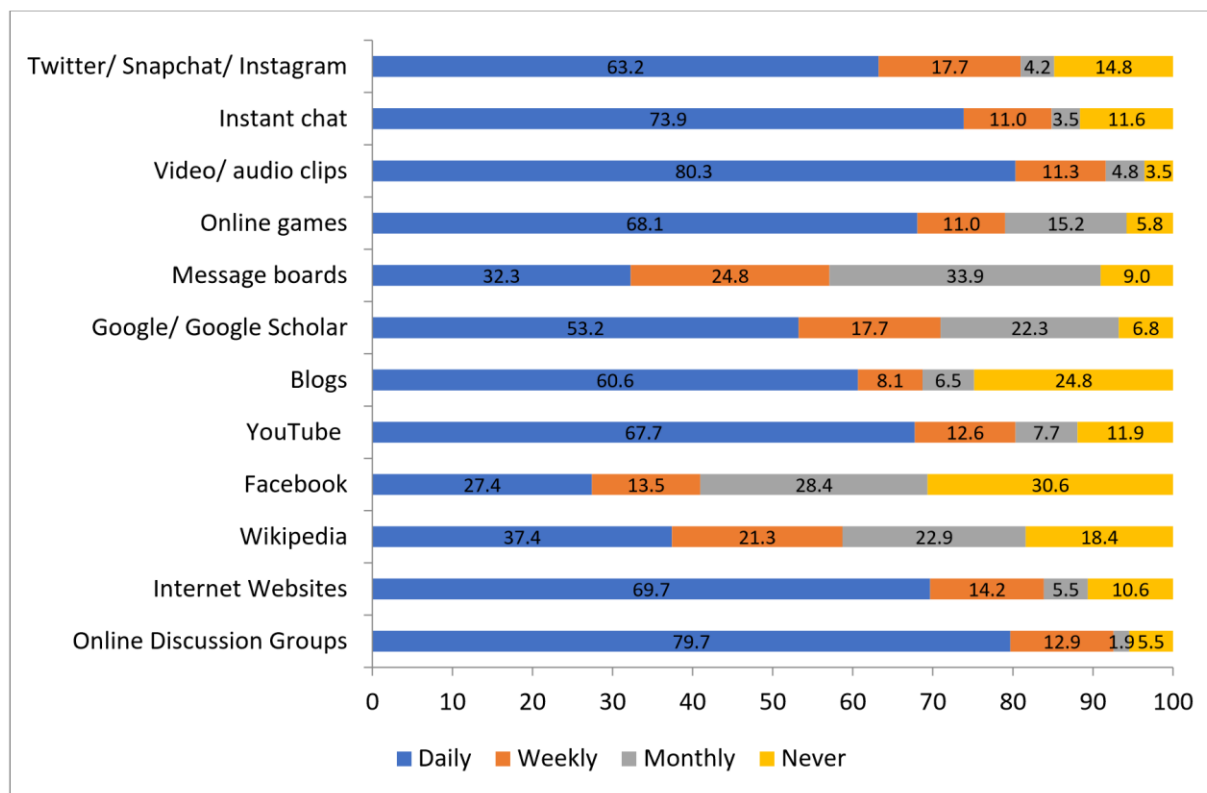
The purpose of this section's survey was to uncover what respondents' experiences and perceptions of the use of online tools for OIL were; to determine the extent to which secondary school learners in Mauritius use online tools for Online Informal Learning, and for what reasons; and to determine the extent to which 21CS can be acquired through OIL tools.

5.3.1 Learners' experiences and perceptions of the use of online tools as a means for OIL

The first research question sought to establish which online tools secondary school learners used to learn online. The aim was to investigate the different online technologies used by secondary school learners, how frequently they used these technologies, how conducive they have been to IL overall, and how useful they are for the development of 21CS.

5.3.1.1 Different online technologies used by secondary school learners used by respondents outside school and the frequency of use.

Participants were asked to specify which online technologies they used informally outside school and the extent to which they used them. The results are provided in Figure 5.2.



Note. *N=310 is the total number of valid completed questionnaires out of 380 copies of surveys

Figure 5.2

Distribution of Respondents by Frequency of Online Technologies Used Informally

The results in Figure 5.2 present the different online technologies used by secondary school learners. It reveals that the majority (where N=310) were familiar with them daily rather than weekly or monthly and never including video/audio clips (80.3%), online discussion groups (79.7%), Instant chat (73.9%), Internet websites (69.7%), Online games (68.1%), and YouTube (67.7%). Among the SNSs, respondents were most familiar with Online Discussion groups through WhatsApp (79.7), YouTube (67.7%), and Twitter, Snapchat, and Instagram (63.2%). The lowest number of participants was familiar with Facebook (27.4%). It was mainly because laws in Mauritius require people under the age of 18 to obtain parental consent before creating an account on some of the most popular platforms, many of which are useful for young people to access educational resources, communities, political discussions, and more (Kelley, 2023). Among wikis, it is noted that only 37.4% of respondents used Wikipedia for online learning. It was therefore concluded that most of the secondary school learners were familiar with online technologies such as watching videos and audio clips online on YouTube, communicating using online discussion

groups, using social media sites (especially WhatsApp, Twitter, Snapchat, Instagram), and instant messaging.

Additionally, a Chi-square goodness-of-fit test was done to test whether any of the response options were selected significantly more/less often than the others. Table 5.3 shows the results obtained from the Chi-square goodness-of-fit test.

Table 5.3

Results obtained from the Chi-square goodness-of-fit test for distribution of Respondents by Online Technologies Used Informally

X ²	df				p-value		
	Daily	Weekly	Monthly	Never			
Online discussion groups	247 (79.7)	40 (12.9)	6 (1.9)	17 (5.5)	502.05 2	3	<.0005 *
Internet Websites	216 (69.7)	44 (14.2)	17 (5.5)	33 (10.6)	334.77 4	3	<.0005 *
Wikipedia	116 (37.4)	66 (21.3)	71 (22.9)	57 (18.4)	26.800	3	<.0005 *
Facebook	85 (27.4)	42 (13.5)	88 (28.4)	95 (30.6)	22.361	3	<.0005 *
YouTube	210 (67.7)	39 (12.6)	24 (7.7)	37 (11.9)	303.75 5	3	<.0005 *
Blogs	188 (60.6)	25 (8.1)	20 (6.5)	77 (24.8)	235.78 1	3	<.0005 *
Google/ Google Scholar	165 (53.2)	55 (17.7)	69 (22.3)	21 (6.8)	147.44 5	3	<.0005 *

Message Boards	100 (32.3)	77 (24.8)	105 (33.9)	28 (9.0)	47.910	3	<.0005 *
Online games	211 (68.1)	34 (11.0)	47 (15.2)	18 (5.8)	312.06 5	3	<.0005 *
Video/ audio clips	249 (80.3)	35 (11.3)	15 (4.8)	11 (3.5)	510.28 4	3	<.0005 *
Instant Chats	229 (73.9)	34 (11.0)	11 (3.5)	36 (11.6)	399.85 8	3	<.0005 *
Twitter/ Snapchat/ Instagram	196 (63.2)	55 (17.7)	13 (4.2)	46 (14.8)	254.20 6	3	<.0005 *

Note. * Indicates a significance level of 95%

The results obtained from the Chi-square goodness-of-fit test were used to assess which of the online technologies respondents selected significantly more often indicated that they used online discussion groups (79.7%) and internet websites (69.7%) than other online tools on a daily basis. Other online technologies which were more significantly selected on a daily basis were YouTube (67.7%) and online games (68.1%). All differences were significant at $p < .0005$ level.

5.3.1.2 Different online technologies used by secondary school learners for informal learning.

Participants were asked which online tools they used that helped them to learn informally or useful in their studies and the extent to which they used them. The results are shown in Figure 5.3.

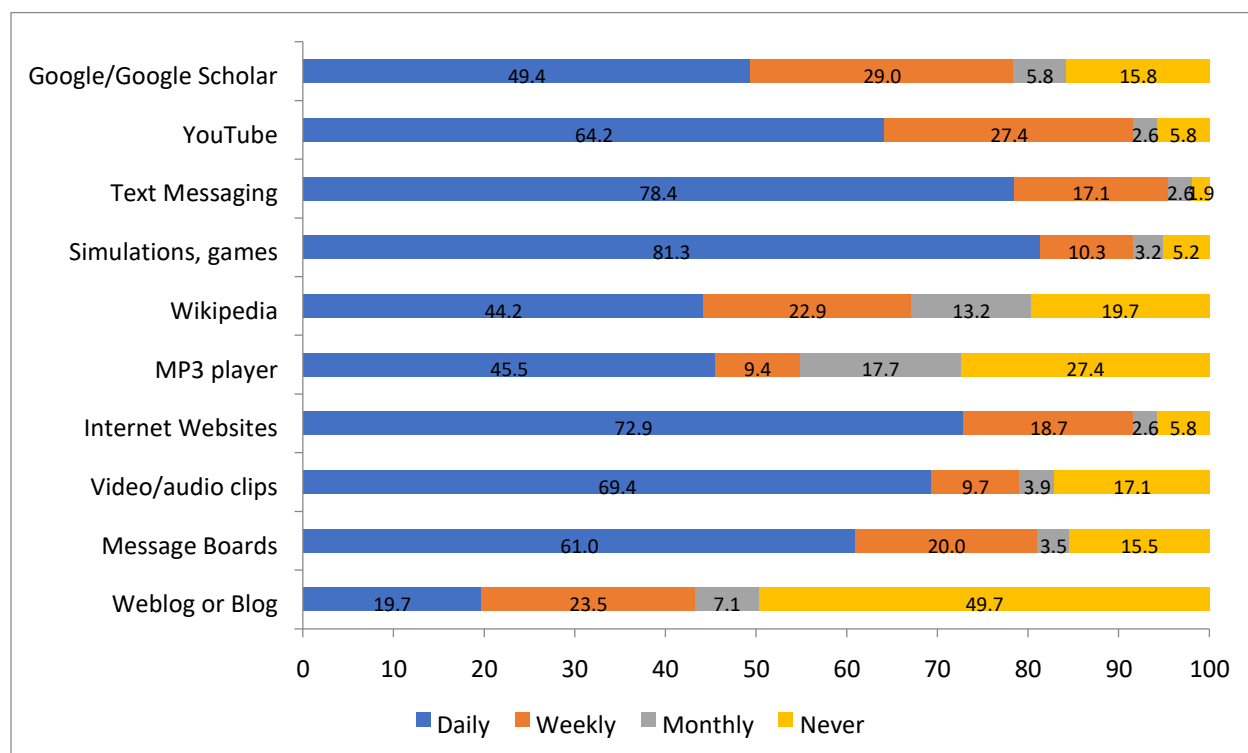


Figure 5.3

Distribution of Respondents by Extent of OIL

The results presented in Figure 5.3 on different online tools used by secondary school learners, which are also used for informal learning and academic work, showed that most of the respondents (where N=310) used online tools used them daily rather than weekly, monthly or never. The majority of respondents learned informally through simulations or games (81.3%), text messaging (78.4%), internet websites (72.9%), and video/ audio clips (69.4%). Among the SNSs, respondents were most familiar with YouTube (64.2%) and message boards (61.0%). The least number of respondents used Wikipedia (44.2%), Google (49.4%), MP3 player (45.5%), and blogs (19.7%) for informal learning. Therefore, it can be deduced that most secondary school learners use online technologies for OIL and academic pursuits through online games; text messaging through WhatsApp, Twitter, Snapchat and Instagram; internet websites by watching video or audio clips on YouTube and Netflix; and message boards.

A Chi-square goodness-of-fit test was also done to test whether any of the response options were selected significantly more/less often than the others. Table 5.4 shows the results obtained from the Chi-square goodness-of-fit test.

Table 5.4

Results obtained from the Chi-square goodness-of-fit test for distribution of Respondents by Extent of OIL

Item	Responses as Frequency (%)				X ²	df	p-value
	Daily	Weekly	Monthly	Never			
Weblog or Blog	61 (19.1)	73 (23.5)	22 (7.1)	154 (49.7)	119.03 2	3	<.0005 *
Message boards	189 (61.0)	62 (20.0)	11 (3.5)	48 (15.5)	231.80 6	3	<.0005 *
Video/ Audio clips	215 (69.4)	30 (9.7)	12 (3.9)	53 (17.1)	336.16 8	3	<.0005 *
Internet Websites	226 (72.9)	58 (18.7)	8 (2.6)	18 (5.8)	397.45 8	3	<.0005 *
MP3 Player	141 (45.5)	29 (9.4)	55 (17.7)	85 (27.4)	89.639	3	<.0005 *
Wikipedia	137 (44.2)	71 (22.9)	41 (13.2)	61 (19.7)	66.629	3	<.0005 *
Simulations, games	252 (81.3)	32 (10.3)	10 (3.2)	16 (5.2)	527.21 3	3	<.0005 *
Text messaging	243 (78.4)	53 (17.1)	8 (2.6)	6 (1.9)	489.45 8	3	<.0005 *
YouTube	199 (64.2)	85 (27.4)	8 (2.6)	18 (5.8)	299.21 3	3	<.0005 *
Google/Google Scholar	153 (49.4)	90 (29.0)	18 (5.8)	49 (15.8)	131.72 9	3	<.0005 *

Note. * Indicates a significance level of 95%

The results obtained from the Chi-square goodness-of-fit test to test to which online tools secondary school learners selected significantly more often to perform online Informal Learning on a daily basis. Scores were significantly higher for Test messaging (78.4%), simulations and games (81.3%), Internet Websites (72.9%) and Video/ audio clips (69.4%). All differences were significant at $p < .0005$ level.

5.3.2 Reasons for Using Different Online Technologies

Respondents were asked to indicate their reasons for using different online technologies during online informal activities. The respondents were asked why they use online technologies with the option to choose among several reasons, namely sharing information, personal interests or hobbies, self-expression and self-reflection, maintaining relationships, developing expertise, fun, interpersonal communication, developing self- identity and/or observing others' lives. The results are provided in Figure 5.4.

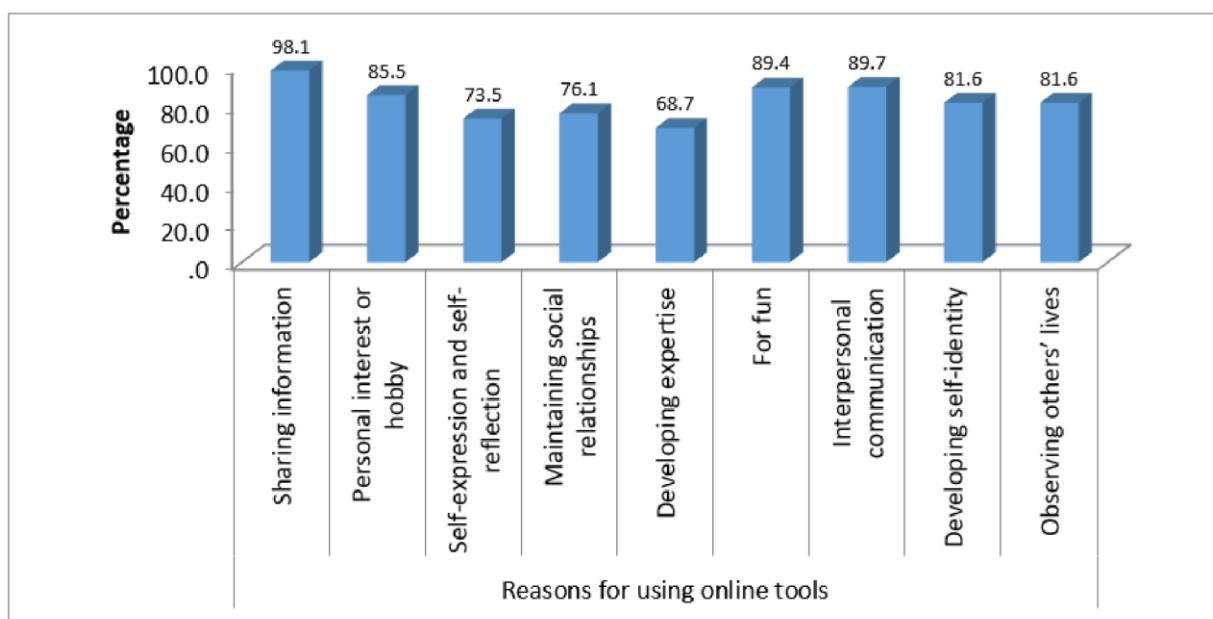


Figure 5.4

Respondents' Reasons for Using Different Online Technologies

The results presented in Figure 5.4 reveal that the reasons secondary school learners used different OIL tools, to varying degrees, were for sharing information (98%), for interpersonal communication (90%), for fun (89%), for personal interests or hobbies (85%), for developing self-

identity and observing other people's lives (82%), for maintain social relationships (76%), for self-expression and self-reflection (74%), and developing expertise (69%). Therefore, it can be said that most of the secondary school learners used online technologies for sharing information and interpersonal communication. The least number of respondents chose to develop expertise as the reason for using online technologies.

A binomial test was also performed to have an in-depth analysis of the response from the participants. The results are presented in Table 5.5.

Table 5.5

Binomial Test results on respondents' Reasons for Using Different Online Technologies

Item	Frequency (%)		n	p-value
	Yes	No		
Sharing information	304 (98%)	6 (2%)	310	<.0005*
Personal interest or hobby	265 (85%)	45 (15%)	310	<.0005*
Self-expression and self-reflection	228 (74%)	82 (26%)	310	<.0005*
Maintaining social relationships	236 (76%)	74 (24%)	310	<.0005*
Developing expertise	213 (69%)	97 (31%)	310	<.0005*
For fun	277 (89%)	33 (11%)	310	<.0005*
Interpersonal communication	278 (90%)	32 (10%)	310	<.0005*
Developing self-identity	253 (82%)	57 (18%)	310	<.0005*
Observing others' lives	253 (82%)	57(18%)	310	<.0005*

Note. * Indicates a significance level of 95%

The Binomial Test results on respondents' reasons for using different online technologies confirmed that a significant proportion of respondents use online tools for all the reasons mentioned in Table 5.5 since the p-value was <0.0005 for all reasons used for online technologies.

5.4 Acquisition of 21st Century Skills through Online Informal Learning Tools

The study sought to investigate whether secondary school learners can acquire 21CS using OIL tools. Four key 21CS, including critical thinking, communication, collaboration, and creativity, were chosen for the survey questions. Consequently, the quantitative data provided answers to study questions 1 and 2. How OIL tools were utilised to obtain the four main 21CS was a question posed to respondents.

5.4.1 Acquisition of critical thinking skills through Online Informal Learning tools

The second research question aimed to determine how secondary school learners acquire critical thinking skills through OIL tools. The frequency of the secondary school learners' OIL activities was measured using questionnaires. The respondents had to choose among five options, namely nearly almost never, a few times yearly, 1-3 times monthly, 1-3 times weekly and almost daily. The scale for the acquisition of critical thinking skills through OIL comprised six variables. These six items included: CRIT1.1 Compare information from different sources before completing a task or an assignment; CRIT1.2 Draw conclusion based on analysis of numbers, facts or relevant information; CRIT1.3 Summarise or create your interpretation of what you have read or were being taught; CRIT1.4 Analyse competing arguments, perspectives or solutions to the problem; CRIT1.5 Develop a persuasive argument based on supportive evidence or reasoning; and CRIT1.6 Try to solve complex problems or answer questions that have no single correct solution or answer. The frequency of the topics connected to critical thinking is seen in Figure 5.5.

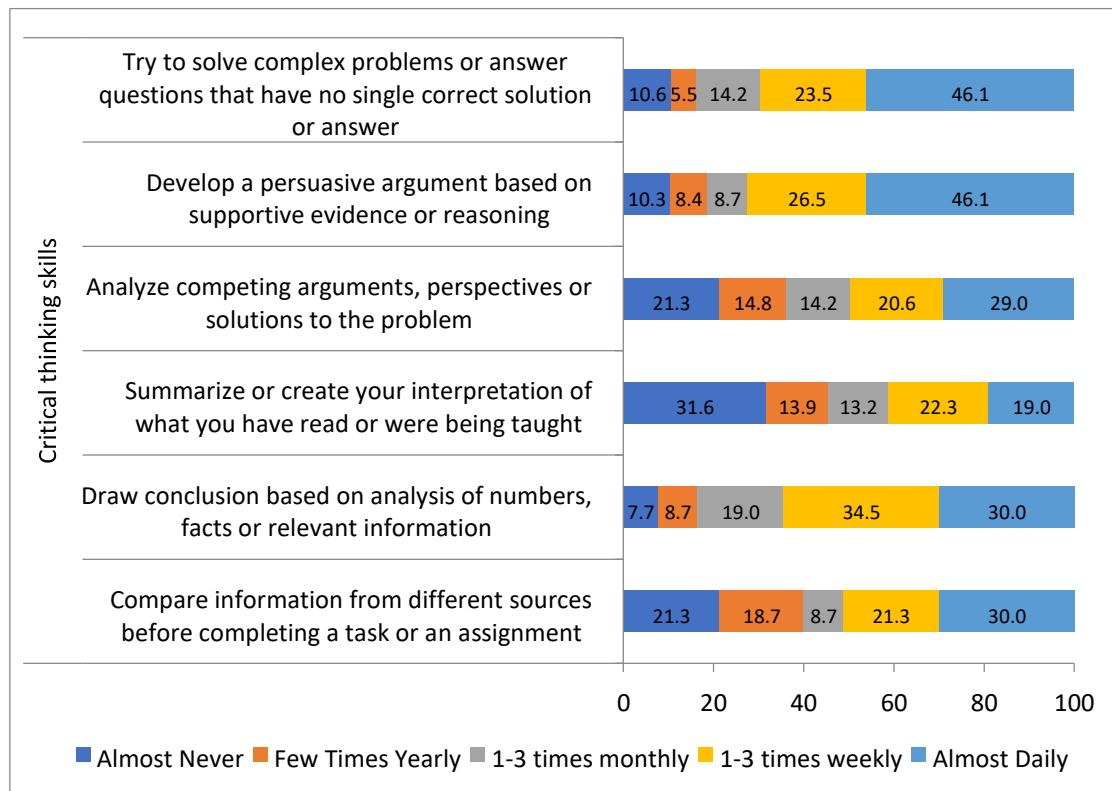


Figure 5.5

Frequency of the Themes Associated with Critical Thinking Skills

The results showed that 30% of the respondents could acquire critical thinking skills by comparing information from different sources before completing a task or an assignment almost daily. Respondents could also develop critical thinking skills by drawing conclusions based on analysis of numbers, facts, or relevant information almost daily (30%). However, most respondents (31.6%) almost never summarise or create their interpretation of what they have read or were being taught. Interestingly, respondents (46.1%) could develop their critical thinking skills by using online tools almost daily to develop persuasive arguments based on supportive evidence or reasoning or to try to solve complex problems or answer questions that have no single correct solution or answer.

The six dependent variables were further analysed to determine the extent to which secondary school learners could achieve critical thinking skills. Each of these variables' internal consistency was assessed using Cronbach's alpha and assessment instrument. An alpha value of $>.7$ indicates that the items are consistently measuring the same construct, and the grouping is reliable. Ursachi

et al. (2015) confirm this finding stating that an accepted rule is that an alpha value of 0.60.7 indicates an acceptable level of reliability, and 0.8 or greater a very good level. Therefore, for this analysis, Cronbach's alpha was 0.616, which was considered an acceptable level of reliability. Moreover, the researcher continued to use the data and the analysis since the alpha values between 0.6 and 0.7 verified the correlation between the variables. The qualitative data further provided the depth that was required to answer some of the research questions. A summary is provided in Table 5.6.

Table 5.6

Construct Reliability and Validity: Critical Thinking Skills

Construct	Label	Cronbach's alpha
Critical thinking skills	CRIT	.616

The statements presented in Table 5.5 were a fair measure (0.616) or indication towards measuring the construct: critical thinking skills. As such, it can be assumed that because of the almost daily use of online tools when engaged in OIL, secondary school learners can develop their critical thinking skills to compare information from different sources before completing a task or an assignment (51.3%), draw conclusions based on analysis of numbers, facts or relevant information (64.5%), summarise or create their interpretation of what they have read or were being taught (41.3%), analyse competing arguments, perspectives or solutions to the problem (49.6%), develop a persuasive argument based on supportive evidence or reasoning (72.6%), and try to solve complex problems or answer questions that have no single correct solution or answer (69.6%). Therefore, it can be concluded that the use of online technologies to perform different online tasks contributes to some extent to the critical thinking skills of secondary school learners.

5.4.1.1 Online Tools Used to Acquire Critical Thinking Skills.

Figure 5.6 represents the different online tools used for acquiring critical thinking skills.

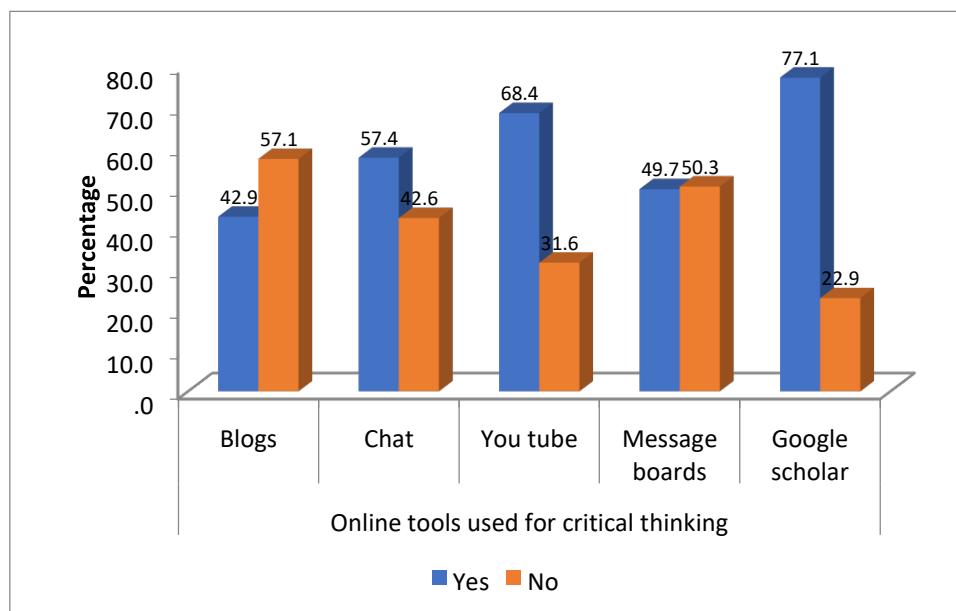


Figure 5.6

Different Online Tools Used for Acquiring Critical Thinking Skills

Data analysis revealed that the online tools that were used by the respondents to achieve critical thinking skills are Google (77.1%), YouTube (68.4%), and Chat (57.4%). The least used online tools were blogs (42.9%) and message boards (49.7%).

5.4.2 Acquisition of Collaborative Skills through Online Informal Learning tools

The second research question was aimed at determining how OIL influences the collaborative skills of secondary school learners. The scale for the acquisition of collaborative skills through OIL consisted of five variables. The respondents had to choose among five options, namely almost never, a few times yearly, 1-3 times monthly, 1-3 times weekly and almost daily. The five variables for collaborative skills included: COLL1.1 Work in pairs or small groups to complete a task together; COLL1.2 Work with other learners to understand a chapter at school through online tools; COLL1.3 Do assignments using contributions from each student in a group; COLL1.4 Present your group work to other people online or in a chat group; and COLL1.5 Work as a team to solve a problem.

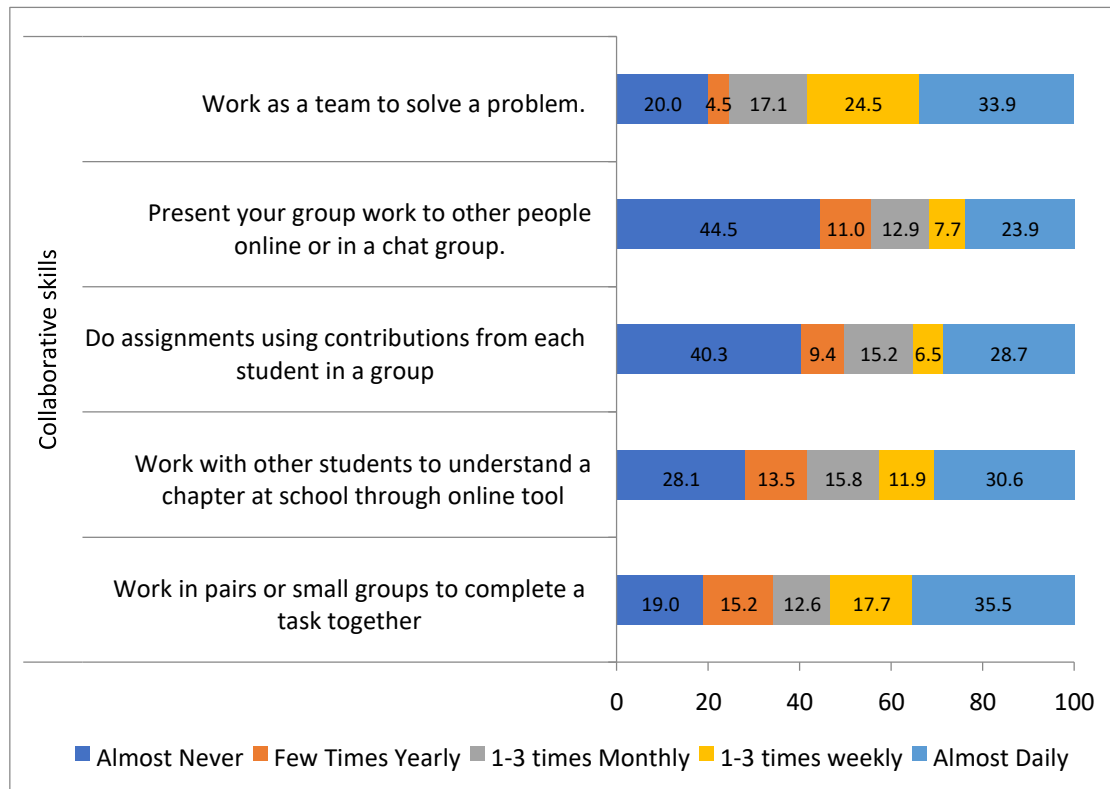


Figure 3.7

Frequency of the Variables Associated with Collaborative Skills

The results as presented in Figure 5.7. revealed that secondary school learners could develop their collaborative skills by using online tools daily and weekly to work in pairs or small groups to complete a task together (53.2%), work with other learners to understand a chapter at school through an online tool (42.5%), do assignments using contributions from each student in a group (35.2%), present their group work to other people online or in a chat group (31.6%), and work as a team to solve a problem (58.4%). Therefore, it can be assumed that the use of online technologies to perform different online tasks could contribute but to a lower extent to the collaborative skills of secondary school learners.

The five dependent variables were further analysed to establish the extent to which secondary school students achieve collaborative skills. To determine whether combining these factors will yield a valid single measure, Cronbach's alpha was calculated. An alpha value of $>.7$ indicates that

the items consistently measure the same construct, and the grouping is reliable. Cronbach's alpha for this analysis was 0.607, which was deemed an acceptable degree of reliability by the researcher who elected to continue utilising the data and analysis because the alpha values were between 0.6 and 0.7. The analysis was backed up with qualitative data which provided more depth to answer some of the research questions.

Table 5.7

Construct Validity and Reliability: Collaborative Skills

Construct	Label	Items included	Cronbach's alpha
Collaborative skills	COLL	1 3 and 4	0.607

The statements presented in Table 5.6 were a fair measure (0.607) or indication towards measuring the construct: collaborative skills since some items were dropped to improve reliability. The items (2 and 5) which were dropped did not correlate high enough with the group of items as a whole and negatively affected the alpha value/ reliability. As such, it can be assumed that because of the almost daily use of online tools when engaged in OIL, secondary school learners can develop their collaborative skills by using online tools daily and weekly to work in pairs or small groups to complete a task together (53.2%), work with other learners to understand a chapter at school through an online tool (42.5%), do assignments using contributions from each student in a group (35.2%), present their group work to other people online or in a chat group (31.6%), and work as a team to solve a problem (58.4%). Therefore, it can be concluded that the use of online technologies to perform different online tasks contributes to some extent to the collaborative skills of secondary school learners.

5.4.2.1 Online Tools Used to Acquire Collaborative Skills.

The results for different online tools used for acquiring collaborative skills are depicted in Figure 5.8.

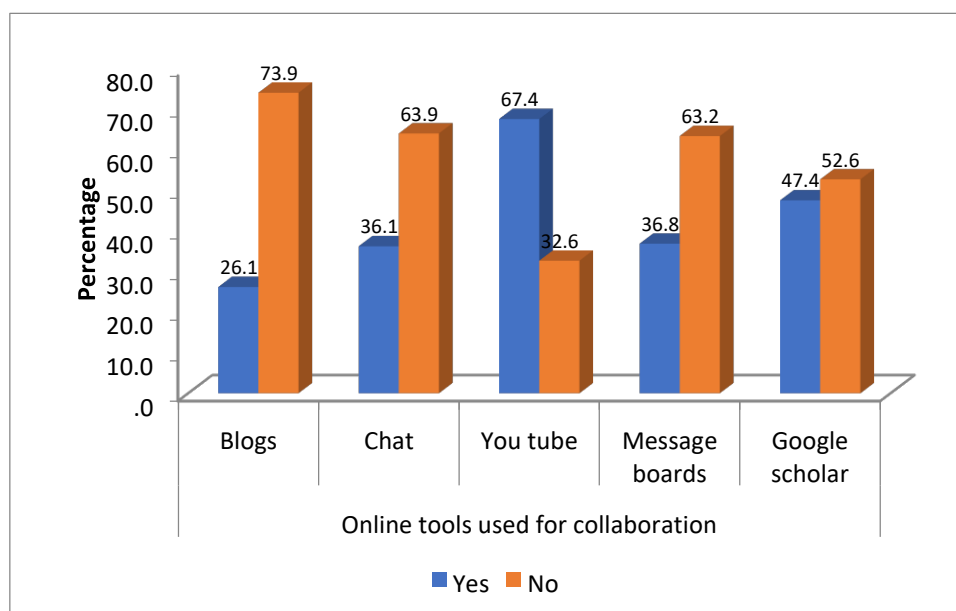


Figure 5.8

Different Online Tools for Acquiring Collaborative Skills

The analysis revealed that the online tools that were mostly used by the respondents to achieve collaborative skills based on the five variables are YouTube (67.4%), Google (47.4%) and message boards (36.8%), in decreasing order of preference. The least used online tools for collaborative work were chat (36.1%) and blogs (26.1%). The analysis revealed that YouTube is the most used Web 2.0 tool used by a significant proportion of secondary school learners.

5.4.3 Acquisition of Communication Skills through Online Informal Learning tools

The following section describes how OIL influences the communication skills of secondary school learners. The scale for the acquisition of communication skills through OIL consisted of two variables. The respondents had to choose among five options, namely almost never, a few times yearly, 1-3 times monthly, 1-3 times weekly and almost daily. The two variables for collaborative skills included: COMM1.1 Convey your ideas using online media other than a written paper, and COMM1.2 Prepare and submit your work online to the teacher or others. Figure 5.9. illustrates the frequency of the variables associated with communication skills.

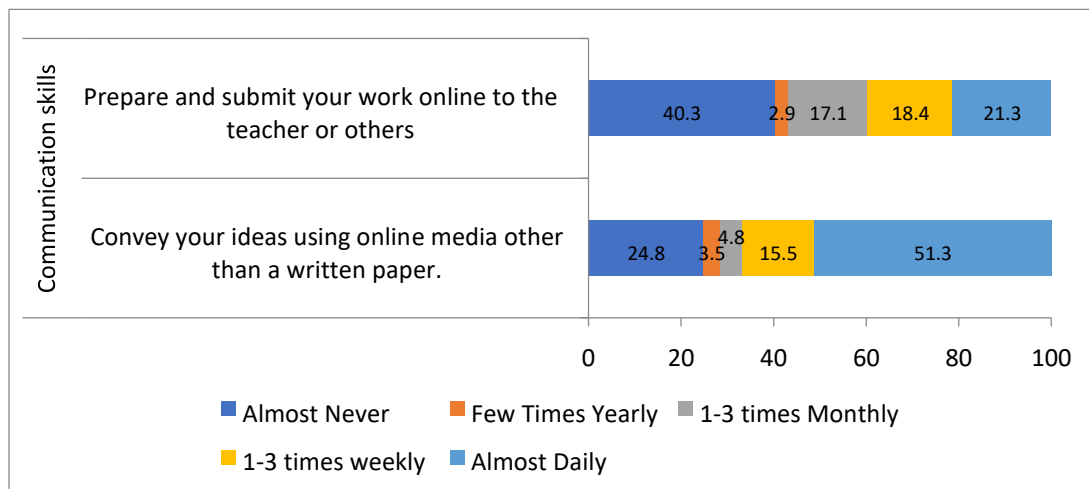


Figure 5.9

Frequency of the Variables Associated with Communication Skills

The analysis of the two independent variables revealed that 66.8% of the respondents convey their ideas using online media other than written paper, whereas only 39.7% of the respondents prepare and submit their work online to the teacher or others.

5.4.3.1 Online Tools Used to Acquire Communication Skills.

The results for the different online tools used for acquiring communication skills are shown in Figure 5.10.

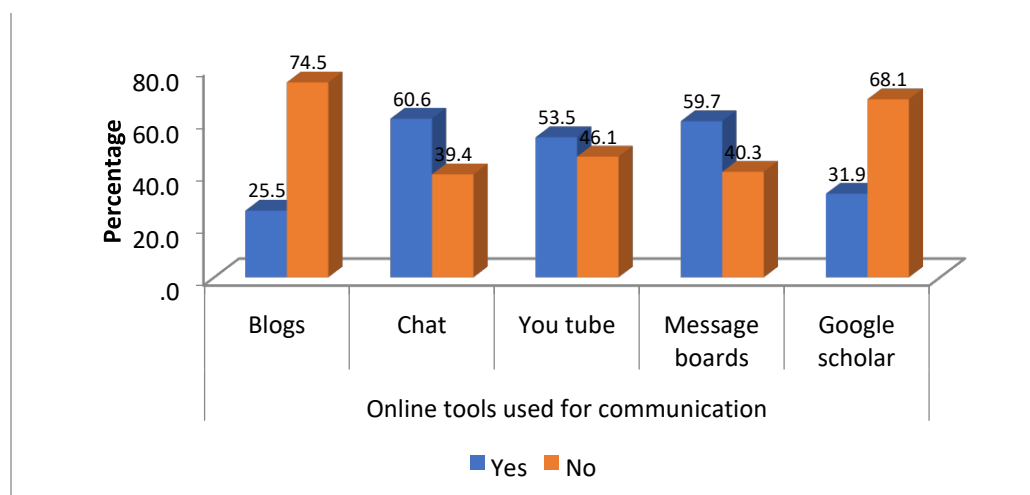


Figure 5.10

Online Tools Used for Acquiring Communication Skills

The analysis revealed that the online tools that were mostly used by the respondents to acquire communication skills were Chat groups (60.6%) like WhatsApp and Instagram, Message boards (59.7%), and YouTube (53.5%). The least used online tools were Google Scholar (31.9%) and blogs (25.5%). Message boards and chat are used significantly more for communication than other online tools.

5.4.4 Acquisition of Creative Skills through Online Informal Learning tools

The second research question aimed at determining how OIL affects the creative skills of secondary school learners. The scale for the acquisition of creative skills through OIL comprised four variables. The respondents had to choose from five options, namely almost never, a few times yearly, 1-3 times monthly, 1-3 times weekly and almost daily. The four variables for creative skills included: CREAT1.1 Use idea creation techniques such as brainstorming or concept mapping; CREAT1.2 Generate your ideas about how to confront a problem or question; CREAT1.3 Test out different ideas and work to improve them; and CREAT1.4 Invent a solution to complex, open-ended question or problem. Figure 5.11 illustrates the frequency of the variables associated with creative skills.

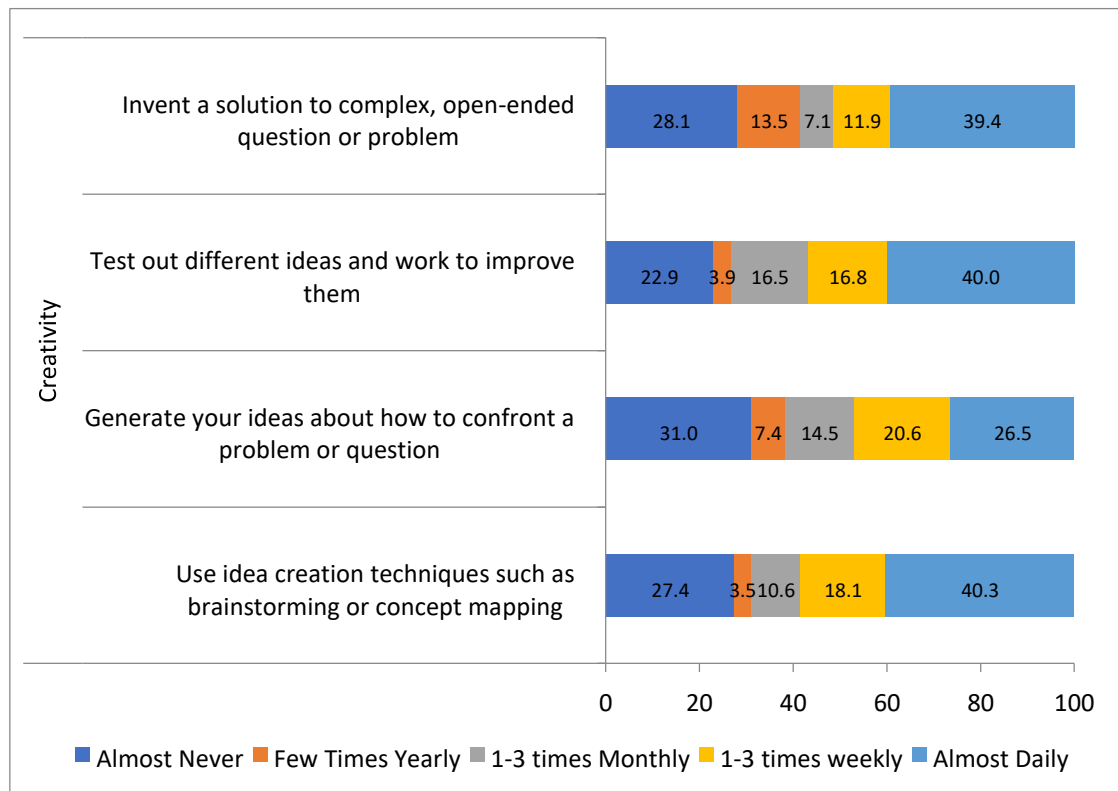


Figure 5.11

Frequency of the Variables Associated with Creative Skills

The four independent variables were further analysed to establish the extent to which secondary school students develop creative skills. According to Figure 5.11, 51.3% of the respondents use online tools to find a solution to complex, open-ended questions or problems daily and weekly, 56.8% of the respondents test out different ideas and work to improve them using online tools, 46.5% of the respondents generate their ideas about how to confront a problem or question and 58.4% of respondents use creation techniques such as brainstorming from online tools to solve different problems.

5.4.4.1 Online Tools Used to Develop Creative Skills.

The different online tools used for acquiring creative skills are presented in Figure 5.12.

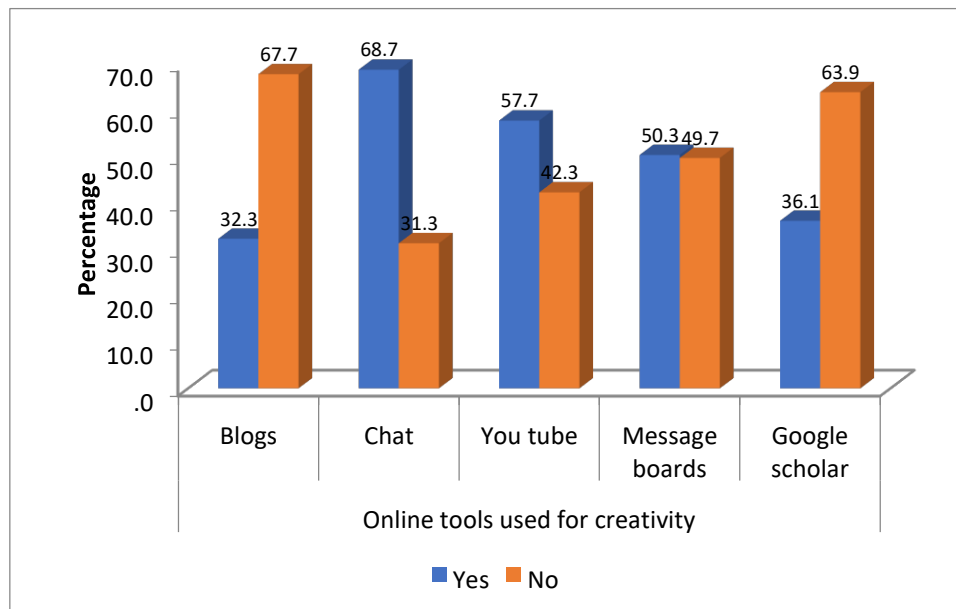


Figure 5.12

Different Online Tools Used for Acquiring Creative Skills

The analysis revealed that the online tools that were used by the respondents to achieve creative skills based on the four variables are chat (68.7%), YouTube (57.7%), and message boards (50.3%). The least used online tools were Google (36.1%) and blogs (32.3%). Furthermore, the data revealed that the majority of secondary school learners felt that YouTube and Chat (as Web 2.0 tools) enhanced their creative skills.

Single measures were obtained for critical thinking and collaboration only. More research was needed to discover whether one of these activities was performed much more frequently than the other.

Table 5.8*Wilcoxon Signed Ranks Test*

	Mean	N	Std. Deviation	Std. Error Mean
CRITICAL THINKING SKILLS	3.5032	310	.96437	.05477
COLLABORATION	2.8828	310	1.22110	.06935

The data analysed reflected that critical thinking (median frequency = 3.5) was engaged in significantly more often online than collaboration (median frequency = 2.9), $p < .0005$.

Further analysis, namely the Kruskal Wallis and the Mann Whitney post hoc tests, were conducted to see if the two constructs, critical thinking skills and collaboration skills, differ across various ages. It revealed a significant variation in using online tools for critical thinking across age groups, $p < .0005$. The results indicated that 16–17-year-olds used these tools for critical thinking significantly less often than all other age groups, $p < .005$ in each case. There was a significant difference in using online tools for collaboration across age groups, $p < .0005$. In particular, 16 to 17-year-olds used these tools for critical thinking significantly more often than all other age groups, $p < .005$ in each case.

5.5 Acquisition of 21st Century Skills through Online Informal Learning

Further analysis was needed to determine whether secondary school learners could acquire 21CS through OIL. A reliable measure was obtained for critical thinking and collaboration derived from the reliability coefficient. The Cronbach's alpha for other constructs for a reliable measure was obtained. However, when all statements are considered, Cronbach's alpha was determined for each construct, and the statements that produced the optimal combination were chosen for a coefficient near to or greater than 0.7. Table 5.9 shows Cronbach's alpha coefficients when all the statements were selected and when some statements were selected.

Table 5.9*Cronbach's Alpha Coefficient Values of Items*

Construct	All items included	Some items included	
	Cronbach's alpha	Items	Cronbach's alpha
Critical thinking	.795	1 2 4 5 .716 3 6 .595	
Collaborative	.659	1 3 4 .707 2 5 .612	
Communication	-1.125		
Creativity	.257	1 2 .505 3 4 .041	

Using Cronbach's alpha coefficient, a value was determined for 21CS for each participant. For example, if a participant engaged daily in collaborative, creativity, critical thinking, and communication skills, then that participant would have scored 5 for each statement. All those values were added together and divided by the number of statements to obtain a value for 21CS. Therefore, the frequency scores of all the constructs, namely 6 CRIT (Critical Thinking skills); 5 COLL (Collaborative skills); 2 COMM (Communication skills); and 4 CREAT (Creative skills) items were added up. An ordinal score (based on the response scale) was produced which was divided by 17 (number of items included) to deduce where on the response scale each secondary learner was. The construct was called SKILL_21C. The value ranged from 1= almost never to 5 = almost daily. SKILL_21C was correlated with the use of online tools (questions 7 and 8 of the questionnaire). For communication skills, the two items used to measure did not combine to form a reliable single measure. Evidently, they were not consistently measuring communication skills. The value (-1.125) was negative due to a negative average covariance among items. In Table 5.10, correlations were also found using Spearman's rho correlation.

Table 5.10

*Spearman's
Correlation*

SKILLS_21C		
Spearman's rho		
B7.1 Online Discussion Groups	Correlation Coefficient	-.148**
	Sig. (2-tailed)	.009
	N	310
B7.2 Internet Websites	Correlation Coefficient	-.088
	Sig. (2-tailed)	.121
	N	310
B7.3 Wikipedia	Correlation Coefficient	.087
	Sig. (2-tailed)	.128
	N	310
B7.4 Facebook	Correlation Coefficient	-.069
	Sig. (2-tailed)	.229
	N	310
B7.5 YouTube	Correlation Coefficient	-.152**
	Sig. (2-tailed)	.007

	N	310
	Correlation Coefficient	-.061
B7.6 Blogs	Sig. (2-tailed)	.287
	N	310
	Correlation Coefficient	-.129*
B7.7 Google/ Google Scholar	Sig. (2-tailed)	.023
	N	310
	Correlation Coefficient	-.067
B7.8 Message boards	Sig. (2-tailed)	.242
	N	310
	Correlation Coefficient	.059
B7.9 Online games	Sig. (2-tailed)	.298
	N	310
	Correlation Coefficient	.022
B7.10 Video/ audio clips	Sig. (2-tailed)	.702
	N	310
B7.11 Instant chat	Correlation Coefficient	.011

B7.12 Twitter/ Snapchat/ Instagram	Sig. (2-tailed)	.845
	N	310
	Correlation Coefficient	-.022
	Sig. (2-tailed)	.695
	N	310

During the SPSS analysis, it was noted that the scale for the usage (Q7 and Q8) was 1 = daily to 4= never, so it changed in the opposite direction of the SKILL_21C score. Therefore, according to the analysis, a negative correlation meant that a high usage of a tool was associated with a high skill level. However, a positive correlation meant that a high skill level was associated with a low usage of online tools. According to Spearman's correlation test, 21CS were weakly correlated with the use of online discussion groups, $\rho = -.148$, $p=.009$); YouTube ($\rho = -.152$, $p=.007$); and Google/Google Scholar ($\rho = -.129$, $p=.023$). The researcher concluded that there was a high skill level associated with high usage of online discussion groups, YouTube, and Google/ Google Scholar.

The same analysis was performed again, but this time, the four constructs were assigned independent ordinal scores. These four were labelled: CTS (Critical Thinking skills); COLS (Collaboration Skills); COMS (Communication skills); and CS (Creative skills). Then the correlations were repeated. Spearman's rho test results are presented in Table 5.11.

During the SPSS analysis, it was noted that the scale used for the usage (Q7 and 8) was 1 = daily to 4= never, so it changed in the opposite direction of the critical thinking skills score. So, according to the analysis, a negative correlation meant that high usage of Web 2.0 tools was associated with a high skill level; positive correlation meant that high skill level was associated with low usage of a tool. According to Spearman's correlation test, critical thinking skills were weakly correlated with the use of online discussion groups, ($\rho = -.209$, $p=.000$); Facebook ($\rho = -.116$, $p=.042$); and online games ($\rho = -.137$, $p=.016$). Therefore, the finding indicated that

there was a high critical thinking skill level associated with high usage of online discussion groups, Facebook, and online games.

Regarding collaboration skills, Spearman's correlation test showed that there was a high collaboration skill level associated with a high usage of YouTube ($\rho = -.152$, $p=.008$); and Google/ Google Scholar ($\rho = -.193$, $p=.001$). There was also a high communication skills level associated with high usage of internet websites ($\rho = -.134$, $p=.018$) and YouTube ($\rho = -.197$, $p=.000$). A high creativity level was mainly linked to high usage of internet websites ($\rho = -.121$, $p=.033$) and online games ($\rho = -.184$, $p=.001$).

Table 5.11

Spearman's rho Test Results

			CTS	COLS	COMS	CS
Spearman's rho	B7.1 Online Discussion Groups	Correlation Coefficient	-.209**	-.109	.079	-.003
		Sig. (2-tailed)	.000	.056	.167	.959
		N	310	310	310	310
	B7.2 Internet Websites	Correlation Coefficient	-.049	-.002	-.134*	-.121*
		Sig. (2-tailed)	.389	.977	.018	.033
		N	310	310	310	310
	B7.3 Wikipedia	Correlation Coefficient	.025	.044	.037	.101
		Sig. (2-tailed)	.657	.436	.521	.076
		N	310	310	310	310
	B7.4 Facebook	Correlation Coefficient	-.116*	-.104	-.027	.066
		Sig. (2-tailed)	.042	.066	.637	.247
		N	310	310	310	310
	B7.5 YouTube	Correlation Coefficient	-.080	-.152**	-.197**	-.008
		Sig. (2-tailed)	.160	.008	.000	.892
		N	310	310	310	310
	B7.6 Blogs	Correlation Coefficient	-.003	-.043	-.100	-.042
		Sig. (2-tailed)	.954	.447	.080	.466

	N	310	310	310	310
B7.7 Google/ Google Scholar	Correlation Coefficient	.057	-.193**	.013	-.168**
	Sig. (2-tailed)	.318	.001	.825	.003
	N	310	310	310	310
B7.8 Message boards	Correlation Coefficient	-.054	-.014	-.065	-.042
	Sig. (2-tailed)	.341	.803	.255	.462
	N	310	310	310	310
B7.9 Online games	Correlation Coefficient	-.137*	.064	.014	.184**
	Sig. (2-tailed)	.016	.261	.802	.001
	N	310	310	310	310
B7.10 Video/ audio clips	Correlation Coefficient	.084	-.048	-.065	.041
	Sig. (2-tailed)	.141	.397	.257	.476
	N	310	310	310	310
B7.11 Instant chat	Correlation Coefficient	.062	-.054	-.049	.046
	Sig. (2-tailed)	.277	.342	.391	.419
	N	310	310	310	310
B7.12 Twitter/ Snapchat/ Instagram	Correlation Coefficient	.054	-.038	-.057	-.058
	Sig. (2-tailed)	.348	.500	.320	.311

	N	310	310	310	310
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Table 5.12 depicts Spearman's rho tests to analyse which Web 2.0 tools support secondary school students in acquiring different 21CS when they perform OIL.

Table 5.12

Spearman's rho Analysis of Which Web 2.0 Tools Help to Acquire C21 During OIL

			CTS	COLS	COMS	CS
Spearman's rho						
B8.1 Weblog or Blog	Correlation		.022	-.070	-.063	-.084
	Coefficient					
	Sig. (2-tailed)		.699	.216	.266	.139
	N		310	310	310	310
B8.2 Message Boards	Correlation		-.013	-.132*	-.022	-.004
	Coefficient					
	Sig. (2-tailed)		.819	.020	.695	.940
	N		310	310	310	310
B8.3 Video/audio clips	Correlation		.007	-.160**	-.081	-.035
	Coefficient					
	Sig. (2-tailed)		.907	.005	.157	.544
	N		310	310	310	310
B8.4 Internet Websites	Correlation		-.143*	-.086	-.043	-.112*
	Coefficient					
	Sig. (2-tailed)		.012	.129	.455	.049
	N		310	310	310	310

B8.5 MP3 player	Correlation Coefficient	.063	-.114*	-.025	-.095
	Sig. (2-tailed)	.269	.045	.660	.095
	N	310	310	310	310
B8.6 Wikipedia	Correlation Coefficient	.018	.068	.050	.020
	Sig. (2-tailed)	.751	.234	.378	.724
	N	310	310	310	310
B8.7 Simulations, games	Correlation Coefficient	-.022	-.016	.060	.104
	Sig. (2-tailed)	.698	.785	.294	.067
	N	310	310	310	310
B8.8 Text Messaging	Correlation Coefficient	-.060	-.079	.111	.183**
	Sig. (2-tailed)	.292	.164	.051	.001
	N	310	310	310	310
B8.9 YouTube	Correlation Coefficient	-.080	-.114*	.009	.026
	Sig. (2-tailed)	.162	.045	.876	.649
	N	310	310	310	310
B8.10 Google/Google Scholar	Correlation Coefficient	-.213**	.056	.030	.137*
	Sig. (2-tailed)	.000	.324	.594	.016
	N	310	310	310	310

According to Spearman's correlation test, a high value associated with one variable is associated with a low value for the other variable. Therefore, secondary school learners can acquire a high

level of critical thinking skills when they perform OIL through internet websites ($\rho = -.143$, $p=.012$) and Google/ Google Scholar ($\rho = -.213$, $p=.000$).

Spearman's correlation test showed that a high Collaboration skill level was acquired when learning informally online using message boards ($\rho = -.132$, $p=.020$); video/audio clips ($\rho = -.160$, $p=.001$); MP3 players ($\rho = -.114$, $p=.045$); and YouTube ($\rho = -.114$, $p=.045$). High Creativity level was mainly linked to high usage of internet websites for OIL ($\rho = -.112$, $p=.045$) and text messaging ($\rho = -.183$, $p=.001$) and Google/ Google Scholar ($\rho = -.137$, $p = .016$).

5.6 Overall Implications of Quantitative Analysis

The results depicted in the present chapter are derived from the quantitative analysis carried out on questionnaires given to secondary school learners to investigate the forms of OIL used by secondary school learners and whether 21CS can be acquired using online tools. 380 questionnaires were distributed to participants in a state secondary school. The participants were boys in the age groups between 11 and 18 or from grades 7 to 13. The quantitative study's results indicated that 99% of the participants had internet access at home and owned online tools that they used regularly. A significant proportion of respondents (95.2%) used/owned a mobile phone to surf online.

The quantitative findings on different online technologies used by secondary school learners revealed that the majority (where $N=310$) used online tools daily rather than on a weekly or monthly basis including video/audio clips (80.3%), online discussion groups (79.7%), Instant chat (73.9%), Internet websites (69.7%), Online games (68.1%), and YouTube (67.7%). Among the SNSs, respondents were most familiar with Online Discussion groups through WhatsApp (79.7%), YouTube (67.7%), Twitter, Snapchat, and Instagram (63.2%). The lowest number of respondents was conversant with Facebook (27.4%). It was mostly due to federal legislation prohibiting Facebook from enabling minors under 13 to open accounts without their parents' or guardians' permission. It can, therefore, be concluded that most of the secondary school learners were familiar with online technologies such as watching video and audio clips online on YouTube, communicating using online discussion groups using social media sites (most especially WhatsApp, Twitter, Snapchat, and Instagram), and instant messaging.

The first research objective of the study was to investigate forms of Online Informal Learning (OIL) and different online tools used by secondary school learners. The results of the quantitative study showed that most participants learned informally through simulations or games (81.3%), text messaging (78.4%), internet websites (72.9%), and video/ audio clips (69.4%). Among the SNSs, respondents were most familiar with YouTube (64.2%) and message boards (61.0%) for OIL. It was therefore deduced that most of the secondary school learners used online technologies for OIL either for academic purposes or during their leisure time through online games; text messaging through WhatsApp, Twitter, Snapchat and Instagram; internet websites by watching video or audio clips through YouTube and Netflix; and message boards.

Moreover, most respondents used online technologies to learn informally by sharing information (98%), for interpersonal communication (90%), for fun (89%), for personal interests or hobbies (85%), for developing self-identity and observing other people's lives (82%), for maintaining social relationships (76%), for self-expression and self-reflection (74%), and for developing expertise (69%).

The study also aimed to find whether OIL could assist in the development of 21CS of secondary school learners. Four major 21CS were selected for the survey questionnaire namely (critical thinking skills, communication skills, collaborative skills, and creative skills) and analysed individually.

The data analysis showed that the participants developed their critical thinking skills by using online tools daily and weekly. To obtain the answer, the researcher compared information from different sources before completing a task or an assignment (51.3%), drawing conclusions based on analysis of numbers, facts or relevant information (64.5%), summarising or creating their interpretation of what they have read or were being taught (41.3%), analysing competing arguments, perspectives or solutions to the problem (49.6%), developing a persuasive argument based on supportive evidence or reasoning (72.6%), and trying to solve complex problems or answer questions that have no single correct solution or answer (69.6%). The online tools that were used the most by the respondents to achieve critical thinking skills based on the six variables are Google (77.1%), YouTube (68.4%), and Chat (57.4%). The least used online tools were blogs (42.9%) and message boards (49.7%).

The data also demonstrated that secondary school students might improve their teamwork abilities by using online resources on a daily and weekly basis and cooperating in pairs or small groups to finish a task (53.2%), collaborate with other learners to understand a chapter at school through online tools (42.5%), complete assignments using contributions from each student in a group (35.2%), present their group work to other people online or in a chat group (31.6%), and working as a team to solve a problem (58.4%). The online tools that were mostly used by the respondents to achieve critical thinking skills were YouTube (67.4%), Google (47.4%), and message boards (36.8%). The least used online tools were chat (36.1%) and blogs (26.1%). The analysis revealed that YouTube is a Web 2.0 tool used by a significant proportion of secondary school learners.

Moreover, the participants also developed their communication skills through OIL by sharing their ideas through online media other than written papers (66.8%). However, only 39.7% could develop their communication skills by using online tools to prepare and submit their work online to their teachers or others. The analysis revealed that the online tools that were used by the respondents to achieve communication skills were Chat groups (60.6%) like WhatsApp and Instagram, Message boards (59.7%), and YouTube (53.5%). The least online tools used were Google Scholar (31.9%) and blogs (25.5%). Message boards and chat were used significantly more for communication than other online tools.

The quantitative data was further analysed to establish the extent to which secondary school students gain creative skills through OIL. 51.3% of the respondents use online informal learning tools to find a solution to complex, open-ended questions or problems daily and weekly, 56.8% of the respondents test different ideas and work to improve them using online tools, and 58.4% of respondents use creation techniques such as brainstorming from online tools to solve different problems. Therefore, it was concluded that creativity can be developed through Online Informal Learning when secondary school learners perform online activities daily or weekly. The online tools that were used by the respondents to achieve creative skills were chat (68.7%), YouTube (57.7%), and message boards (50.3%). The least online tools used were Google (36.1%) and blogs (32.3%). The analysis revealed that YouTube and chat groups were the only Web 2.0 tools used by a significant proportion of secondary school learners.

A deeper analysis of the quantitative data showed that critical thinking (average frequency = 3.5) was performed significantly more often online than collaboration (average frequency = 2.9), $p < .0005$. The Kruskal Wallis and the Mann-Whitney post hoc tests were carried out to see if the

two constructs' critical thinking skills and collaboration skills differ across ages. The tests showed that there was a significant difference in using online tools for critical thinking across age groups, $p < .0005$. In particular, 16 to 17-year-old participants used these tools for critical thinking significantly less often than all other age groups, $p < .005$ in each case. There was a significant difference in using online tools for collaboration across age groups, $p < .0005$. Participants from 16 to 17-years-old participants used these tools for critical thinking significantly more often than all other age groups, $p < .005$ in each case.

The data was also examined to determine whether people could obtain all four 21CS simultaneously by using OIL. Spearman's rho test results exhibited a high 21CS level associated with high usage of online discussion groups, YouTube, and Google/ Google Scholar. Moreover, Spearman's rho test results concluded that there was a high critical thinking skill level associated with high usage of online discussion groups, Facebook, and online games.

Finally, Spearman's rho correlation test revealed that high usage of YouTube, Google, and Google Scholar was associated with high levels of collaboration skills. A high communication skills level was also associated with a high usage of internet websites and YouTube. A high creativity level was mainly linked to the high usage of internet websites for online informal learning and text messaging and Google/ Google Scholar.

5.7 Synthesis

In this chapter, the quantitative data of the study was analysed. Valuable insights were offered by data analysis using SPSS version 27 to attend to the first and second research questions, namely "What forms of OIL exist among secondary school learners?", and "How does OIL influence secondary school learners' 21CS?" In Chapter 6, the qualitative results will be analysed. The results would then be amalgamated with the quantitative results to provide a more profound explanation of why secondary school learners acquire 21CS through OIL.

CHAPTER 6

ANALYSIS OF QUALITATIVE FINDINGS

6.1 Introduction

In the previous chapter (5), the quantitative findings were analysed using SPSS version 27, and the researcher attempted to answer the first and second research questions. The following chapter analyses the qualitative data of the study. The results are then integrated with the quantitative results to unpack the research objectives. The qualitative data was mainly obtained through semi-structured and focus group interviews. The participants were chosen from among those who responded to the questionnaires, and they were divided into groups based on their ages and grade levels. The method was similar to the quantitative survey on the development of 21st Century Skills (21CS) through Online Informal Learning among secondary school learners from age groups 11 to above 18 years old. The interview transcripts were entered into Microsoft Word for transcription and theme analysis. The interview data generated patterns, themes, and analytical categories (Patton, 1990). Semi-structured interviews, theme and category elaboration, examination of each theme, and the participants' divergent viewpoints on some themes were all used in the qualitative data analysis. Findings from this phase of the study will be merged with the results derived from the quantitative phase to give a more profound explanation of why secondary school learners acquire 21CS through Online Informal Learning (OIL).

6.2 Data Collection

Seven semi-structured interviews with secondary school students in grades 7 through 13 were conducted, as well as one focus group interview:

- To understand how they acquire 21st century skills through Online Informal Learning
- To have an in-depth explanation of why secondary learners acquire 21st century skills through Online Informal Learning.

Each interview lasted between 20 to 30 minutes. All the interviews that were conducted were recorded, transcribed, and word-processed. The interview data were then analysed manually using content analysis.

Semi-structured interviews were used to gather data on the different forms of OIL tools that secondary schools use and how and why secondary school learners acquire 21CS through OIL. The schedule for the interview questions is attached in Appendix 1. The interview questions were based on the three main research questions. Furthermore, interviews were categorised according to different grades (7-13). Different questions not forming part of the interview schedule were used to guide the interviewees and to extract more data from them.

6.2.1 Interview Consent Form

The interviewees received a consent form before the study began. The interview consent form was developed specifically for the research. It describes the research, the objectives and whether they approve of being interviewed for the study. The interview consent is attached in Appendix 2.

6.2.2 Profile of the Interviewees

To provide a clear picture of the participants' backgrounds and to better understand the discourse that follows, this section provides their profiles from the semi-structured interviews. Participants will maintain their anonymity under the agreement made before the study's start.

Forty-nine participants were selected from the same sample of the quantitative study. All participants selected for the semi-structured interviews were secondary school learners from a state secondary school in Mauritius (seven participants per grade from grades 7-13). Amongst the forty-nine participants, seven of them gave their consent for a further focus group interview to enable a more in-depth analysis.

6.3 Methods for Qualitative Data Analysis

To increase the researcher's comprehension of the phenomenon being studied, qualitative data analysis entails organising and carefully going over interview transcripts (Ritchie et al., 2013). The main objective of the qualitative analysis was to gain a deeper understanding of how and why secondary school learners acquire 21CS through OIL (Patton, 1990). Le Compte and Schensul, (1999) explain that data must first be transformed into outcomes to be relevant for developing programmes, troubleshooting issues, or describing scenarios. Analysis is defined as the action of doing this. A researcher distils mountains of data into brief assertions that characterise, clarify, or make a prediction about the subject they have investigated. As a result, the information gleaned

from the semi-structured interviews was examined and turned into brief statements that assisted the researcher in responding to the research questions posed at the start of the study.

6.3.1 Data Analysis

Textual, non-numerical, and unstructured data constitute qualitative data. To order and make sense of them, coding is a critical part of the study. The concept of coding has been discussed in studies in relation to data compression, condensation, distillation, grouping, and classification. Coding's primary purpose is to provide researchers with access to all the data they have collected, to help them understand newly emergent phenomena, and occasionally to produce a theory based on the data (Bosit, 2003). The qualitative data were analysed in order to "identify, classify and categorise the main patterns in the data using a content analysis" (Downe_Wamboldt, 1992). Inductive analytics were employed at this stage of analysis as suggested by Downe_Wamboldt, (1992), so "the patterns, themes and divisions of analysis are derived from the data."

According to Hsieh and Shannon (2005), The following steps are involved in qualitative analysis: (a) initial investigation of data through the reading of transcriptions and memos; (b) coding of data through text segmentation and classification; (c) using codes to construct subjects by combining similar codes; (d) linking and connecting of themes; and (e) narration. A visual data presentation was created to demonstrate the linkages of data items in expanding the conceptual framework.

6.3.2 Content Analysis

6.3.2.1 Themes.

The data from the interview were categorised using the constant comparative method to identify categories that were relevant to the three main research questions. The interviews were transcribed using Microsoft Word. They were then read several times to identify and relate themes and categories. Key phrases and notes were added in the right margin of the transcripts. Colour coding was used to highlight each relevant section and merge them to create themes and categories (Rossman & Rallis, 2012). The researcher could retain the original meaning of the interviewees' responses because of inductive content analysis. For the creation of subjects and categories, the researcher also employed the ongoing comparison technique. The data was compared for each topic and category.

After further research into each issue, the main themes and categories that the topics connected to were developed. The different keywords and codes were combined into an idea map. The codes and themes used to address the study questions were then categorised using the idea map. The idea map was utilised to analyse qualitative data to respond to the three study questions, primarily how and why secondary school students acquire 21CS through OIL. As the researcher colour coded each interview into sections and identified codes, numerous themes emerged from the interview analysis. Table 6.1 presents some main themes that emerged from the analysis.

Table 6.1

Themes Identified in Interview Analysis

Improves concentration
Improves interest in subjects
Enhances Curiosity
Knowledge Acquisition
Portability- Can learn anywhere/ anytime
Improve language learning/writing
Interaction with peers within non-school settings
Socialisation
Communication skills
Leadership
Social skills
Creativity Development
Improvement in Collaboration and teamwork
Ability to think critically
Improving Media Literacy and Technology skills
Improve Productivity
Flexibility
Information Literacy
Self-Learning
Subject Engagement
Cognitive Engagement
Social and collaborative Engagement
Broad Learning Spectrum
Expressing emotions/ management of feelings
Improve/Deepen relationships
Comfortability
Lack of parental control

Distraction
Preference to formal learning
Addiction to OIL
Stress due to connectivity problems
Non-respect of privacy
Bullying through communication/ group chat
Failure in managing way of learning

6.3.2.2 Categories.

The themes identified in Table 6.1 enabled the researcher to gain a deeper analysis and understanding of the phenomenon under study. Similar and related themes were then grouped under different categories (see Table 6.2). For the researcher, the first stages of coding, identifying themes, and relating them to categories was one of the longest and slowest processes of the study. Similarly, Dey (1993) agrees that the initial phases tend to be hesitant and sluggish. Decisions steadily improved in confidence and consistency as the researcher worked to categorise the data into nodes and to make each category clearer (Tenenche, 2018).

Throughout the study's analysis, the researcher compared similar themes identified in the focus group and semi-structured interviews. Similar themes were then grouped into different core categories pertaining to the theoretical framework used in the study, which is the Activity Theory (AT). The fundamental categories and their properties for each of the six elements of the AT triangle are "subject" (6.4.1), "object" (6.4.2), "tools" (6.4.3), "community" (6.4.4), "rules" (6.4.5) and "division of labour" (6.4.6). The six different categories, which are also components of Activity systems, were inspected according to their definition as detailed in Table 6.2. A category that did not form a part of the six elements of the Theoretical Framework is psychological reasons and negative barriers.

Table 6.2*Categories and Themes according to the Six Elements of an Activity System*

Categories	Research Questions Asked	Themes
Subject	Who is engaging in the activity taking place in an informal online space?	Secondary school learners Online community Network of learners of similar interest Friends and relatives Teachers Parents Facilitators
Tools	What means are the subjects using to engage in this online informal activity?	Wide availability of various online tools Social Network sites Search Engines WhatsApp groups Online Communities YouTube Use of multimedia tools (text, images, videos, links, emojis) during OIL Ease of learning/ Comfortability with online tools Media variety and richness of data

Object(s)	Why are the subjects engaging in the online informal activity?	Sharing information
		No rigid time for learning like formal
		Learning for fun
		Learning for personal interest/ as a hobby
		Become expert in a field
		Interest in learning more to improve academic performance
		Curious to learn something
		Interaction with peers within non-school settings
		Socialisation/ Maintain relationships
		Expressing emotions/ feelings
		Express views or reflections
		Portability- Can learn anywhere/ anytime
		Group/ Teamwork
		Flexibility of learning
		Comfortability in learning online
		Get peer/emotional support through online informal activity
Outcome	What is the outcome of their online informal activity?	language learning/writing
		Improve Academic performance
		Improve/Deepen relationships
		Enhance curiosity
		Knowledge acquisition
		Ability to think critically
		Improving media literacy and technology skills
		Flexibility of learning

	Self-learning
	Information literacy
	Motivation
	Self determination
	Improve communication
	Social and collaborative Engagement
	Non respect of privacy
	Improve creativity
	Improve concentration
	Improve interest in academic / Nonacademic subjects
	Improve language learning/writing
	Interaction with peers within non-school settings
	Improved socialisation
	Communication skills
	Leadership
	Social skills
	Creativity Development
	Improvement in collaboration and teamwork
	Ability to think critically

		Improving Media Literacy and Technology skills
		Improve Productivity
		Information Literacy
		More engagement in academic subject
		Improve/Deepen relationships
		Lack of parental control
		Distraction
		Addiction to OIL
		Stress due to connectivity problems
		Non respect of privacy
		Bullying through communication/ group chat
		Failure in managing way of learning
Community	What is the environment in which the online Informal activity is taking place?	Online Community Social Networks Blogs WhatsApp groups
Rules	What are the cultural norms, rules, or regulations, if any, that govern the activity?	Proper use of ethics Use of copyrights Respecting others' privacy Use of proper language Respect of peers' emotions and feelings Safety Use of Netiquette when sharing information
Division of Labour	What role does each agent fulfil?	Working as a team, role of a reader, role of an online viewer, giving online views/ reactions, writing/posting messages in informal online space, sharing information to other peers on the group

		Online reader, communicator, observer, presenter
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6.4 Findings from Qualitative Analysis

The aim of grouping the similar themes in categories was to relate concepts of the theoretical framework used in the study with the data gathered during the focus group and semi-structured interviews to answer the following research questions:

- How do secondary school learners acquire 21 century skills through Online Informal Learning?
- Why do secondary school learners acquire 21 century skills through Online Informal Learning the way they do?

6.4.1 Subject

The Subject is the principal agent of the activity taking place in an online informal space. It is the starting point for OIL activities since without it, no such informal activity would be initiated. The research question that was asked for this category is “Who is engaging in the activity taking place in an informal online space?”

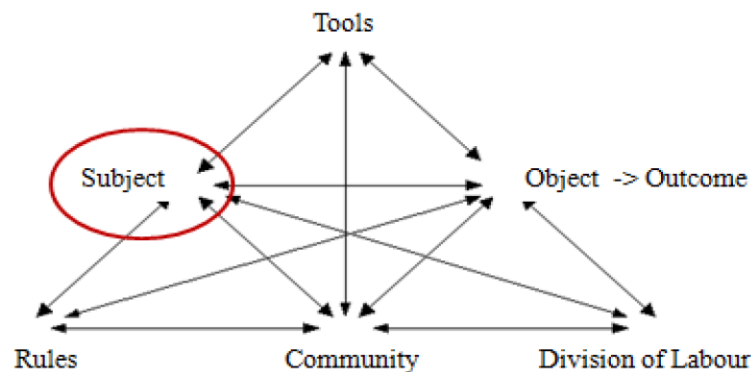


Figure 4

The Role of the Subject in Online Informal Activities

From the qualitative analysis, it was found that the principal agents of Online Informal Activities are mainly the secondary school learners themselves. Secondary school learners are responsible for using an online informal environment through which they can acquire knowledge, select their sources of information and work autonomously. The conclusion is supported by Participants 11C and 7D, who stated,

I use a lot of time on online tools for my work and for entertainment. [Participant 11C]

I learn many things on YouTube. I also like watching videos on the computer. [Participant 7D]

Other subjects, such as other learners of similar interests, friends and relatives, teachers, parents, facilitators, and members of online communities, also contribute to the subject's OIL process. Participants 7A, 9C, 11B and 12A had the following to add:

We can also work in groups and communicate. [Participant 7A]

When we play online games, then we play in groups or when we share notes, then we do it in groups. [Participant 9C]

WhatsApp is very important to keep in contact with my friends and to know what is happening in the world. [Participant 11B]

I use online tools for fun, to learn, to help friends and to interact with my friends and teachers. [Participant 12A]

6.4.2 Tools

Tools mediate different online informal activities. To engage with objects and accomplish desired outcomes, Subjects utilise tools. when secondary school students interact with these Online Informal tools as supported by Heo and Lee (2013).

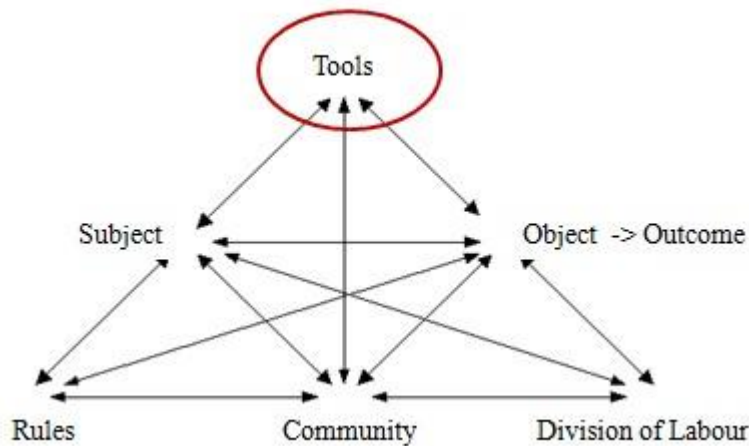


Figure 5

The Role of Tools in Online Informal Activities

The research question that was asked for the qualitative analysis was “What means are the subjects using to engage in this online informal activity?” According to the results obtained from the qualitative data analysis, all participants in all grades supported that there are a variety of online tools available for learning outside the school settings.

Using Instagram, Google, Messenger, YouTube, Facebook, Snapchat, Movie Store, WhatsApp, Play Store, TikTok, and Viber, all participants from grades 7 through 13 replied to OIL. These applications were utilised by most of the population to learn informally, they used these tools to learn things outside their school settings. For example, Participant 7A iterated:

I mainly use YouTube, Twitter, Google, Facebook, Snapchat, and eBay when I go online at home.

Participants in grades 10-13 stated that they use different online sites to learn things informally, for example, Facebook for sharing information, WhatsApp (photos, notes, songs, games), YouTube (for watching music and videos), self-discovery learning connected to schoolwork, and for additional knowledge (listen to music as a hobby). Participant 12E commented,

I use Google Classroom extensively, Zoom for group classes, WhatsApp for chatting, Google for searching for information both related to schoolwork and self-learning and YouTube to watch videos. I listen to music during my free time, Yahoo, WhatsApp, Facebook to watch photos, videos, Instagram to see photos, chat with friends. I also use WhatsApp and YouTube to check tutorials and videos about other things to understand better what we learned at school.

In the same vein, the devices used by grades 7 to 9 respondents to access the present services and tools are smartwatches, smartphones, smart TVs, laptops, and tablets. However, most of the respondents ranging from grades 7 to grade 13 replied that their mobile phones are their main tool used to access and learn things online and communicate with their friends because of the ease of use and availability of Wi-Fi.

6.4.2.1 Ease of Learning/ Comfortability with Online Tools.

Compared to learning at school, participants stated that they were more at ease when learning at home or anywhere else. Participants revealed that they prefer to learn online and are extremely attracted to OIL tools and learning on their own especially when it concerns general knowledge. Some participants stated that it is very important for their subject-general paper based on evaluating learners' general knowledge. The statement is further supported by the participants' comments that follow:

I find a lot of things that I like, and I learn it the way I feel is easier for me. [Participant 11B]

Learning is easier and faster since we have all the information at our disposal online. [Participant 12C]

Yes, I learn a lot of things happening in my country, and I find it easier to read online newspapers to know what is happening in my country instead of reading a newspaper. [Participant 11D]

We can get information quickly. Apart from what the teacher taught us at school, we can work in groups, learn to draw different things by ourselves. [Participant 10E]

I use online tools to learn a lot of new words for my English and French and Yes; I use online tools for my projects to look for photos and more information as well as I learn better when I read more on the internet than in a book. [Participant 12A]

When we communicate with our friends and work in groups on WhatsApp, we can also give our views and tell what we think on WhatsApp, it is easier to describe our views and thoughts on different things. I can learn whenever I want and on any topic. If I haven't understood a topic, I can still learn it by looking for notes on the internet. [Participant 11A]

It is evident in the preceding statements that the participants are more comfortable learning on their own instead of the traditional methods or using formal learning or structured ways of learning at school.

6.4.2.2 Media Variety and Richness of Data.

Informal learning is learning which takes place outside of a formal, structured classroom setting. Informal education can take many forms, such as viewing videos, studying independently, reading articles, participating in forums and chat rooms, supporting performance events, and playing games. A lot of participants stated that they prefer to learn informally online since they get a wider range of textual, audio, and video information through a variety of online tools. This finding is supported by the following participants' statements:

We can get information quickly. Apart from what the teacher taught us at school, we can work in groups, learn to draw different things by ourselves. [Participant 11C]

The notes that we get from our teacher are very little sometimes, so I prefer to learn online because I get a variety of notes that I can choose from and learn. [Participant 13B]

There are a lot of websites that I visit to complement what I learned at school. [Participant 10]

Learners can get all the high-quality materials they need to do a project. We can get additional notes apart from the ones we get at school, provide me with feedback, guide me in my lessons and do group tutorials through WhatsApp and Facebook. [Participant 13A]

I often learn something that I didn't know before while just surfing through different online tools. This encourages me to look for more on other websites. [Participant 10C]

The various multimedia makes learning more interesting, and it encourages me to learn more. [Participant 11B]

I can also share videos, pictures etc. [Participant 7C]

To better comprehend things and work, internet tools such as WhatsApp groups may also be used to interact. In addition, movies, tutorials, and websites may help you learn a lot about the topics. [Participant 12A]

6.4.3 Rules

Rules are defined as “norms, conventions and values and they represent a way of minimising conflicts in an online informal activity system” (Heo & Lee, 2013). For the qualitative analysis, the research question asked was “What are the cultural norms, rules, or regulations that govern the online informal activity?”

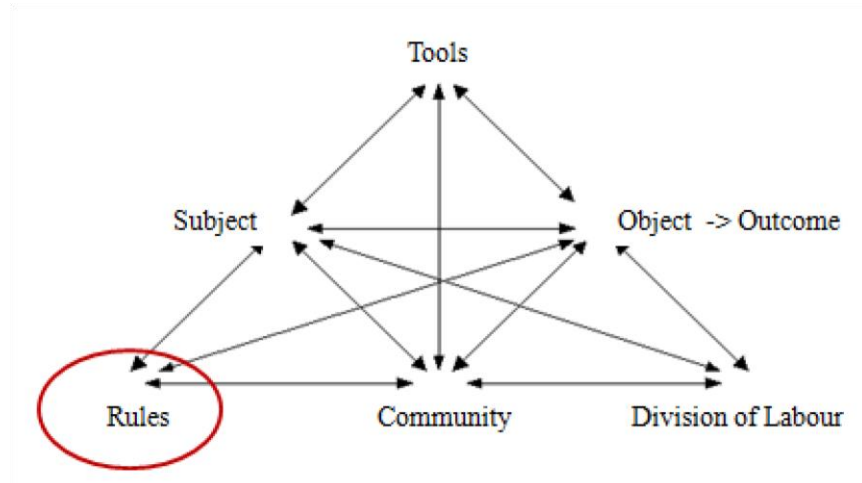


Figure 6

The Role of Rules in Online Informal Activities

The different themes that came out when analysing the rules element of the AT were proper use of ethics, use of copyrights, respecting others' privacy, use of proper language, respect of peers' emotions and feelings, safety and use of netiquette when sharing information.

Participants expressed both negative and positive views when applying proper netiquette during OIL like expressing their emotions and how they feel less stressed and relaxed when they are communicating through online tools. Many participants also stated that they like to express their feelings with the use of emojis. It can be supported by the comments which follow by Participants 8D, 7A, 9D and 12B,

I feel less shy to give my opinions on chat groups rather than in class. [Participant 8D]

I share interesting videos from YouTube with my friends. Do not forget smileys and emojis. I only use text, pictures, and notes. However, I am also scared that someone may copy my work or ideas and put it in their own work. [Participant 7A]

I can also type very quickly. And use emojis. I can communicate with my friends but by respecting their privacy at the same time. [Participant 9C]

I feel less stressed to communicate over WhatsApp and write my messages with funny, sad or any other emojis and I want to express my feelings. [Participant 9D]

I can express myself better in Creole, English or French...easier in Creole. With the emojis and so on. [Participant 12B]

We can easily communicate with our friends and chat. It is easier to tell our views in text messages or using emojis. [Participant 13B]

We are less scared because the teacher and friends are not in front of us. [Participant 8A]

When we chat, some friends do not know how to talk. They do not respect others since they think that they can talk however they want and what they want. [Participant 9D]

There are certain negative obstacles mentioned by study participants when they disobey OIA guidelines, in addition to the good effects of OI. Some negative barriers encountered by learners during OIL are a lack of or too much parental control:

My parents are trying to block YouTube for me due to the pressure of studies. I am also trying to avoid any kind of distraction. [Participant 11A]

I have fun but learn a little at the same time. That's why my parents took my mobile away. [Participant 9C]

Participant 10A also admitted to being easily distracted,

Sometimes we can control what we learn but other times we get easily distracted.

Several students experienced stress due to connectivity problems or picked up a lack of respect for privacy. The finding was supported by the comments below:

When we chat, some friends do not know how to talk. They do not respect others. [Participant 9D]

They also do not respect other people's privacy. Low connection problems. I am also sometimes addicted to the internet. We tend to spend too much time, hence neglecting other things. [Participant 13 B]

I get stressed when I get connectivity problems. [Participant 11A]

We can easily get distracted and neglect our studies. Sometimes we do not get internet, or it is too slow. [Participant 11B]

A preference for formal learning and addiction to OIL was noted by other participants:

I had a lot of problems with my parents since I was spending too much time on the internet and mobile. So, we may get addicted to social media sites and games. [Participant 7B]

We can spend a lot of time surfing and learning nothing. [Participant 11D]

It takes time to look for things online. Then our schoolwork is neglected. [Participant 12A]

If we spend too much time on online tools, our school grades might be affected. [Participant 13A]

No, sometimes, I get more confused when I learn something online instead of at school. [Participant 8B]

I waste too much time on the net. [Participant 7C]

No, I prefer the help of my teacher to learn my subjects. [Participant 7E]

Physical problems, bullying through communication or group chat, health problems, failure to manage the way of learning and confusion due to the abundance of data were other barriers mentioned. Participant 13B responded,

However, it also has side effects that is we have physical problems such as eye pain and back pain if we spend too much time online.

6.4.4 Community

Secondary school learners also stated that they learn informally using online tools in groups or using online communities with the subject who are the secondary school learners as participants. Communities often distribute work among members of a certain OIA system, have shared Objects or interests, and are managed by Rules.

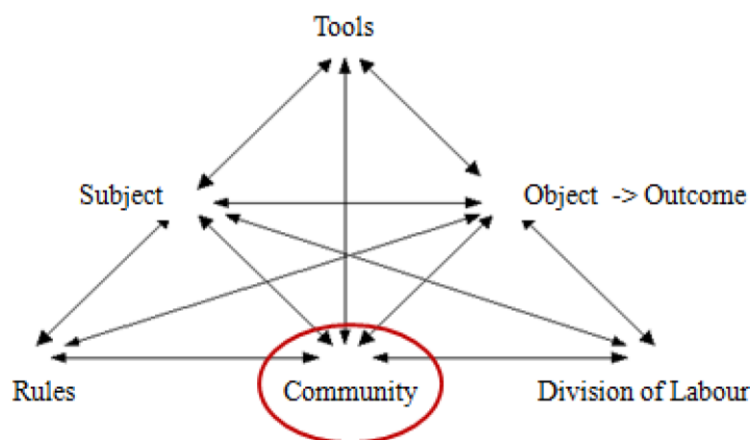


Figure 7

The Role of Community in Online Informal Activities

6.4.4.1 Interaction with Peers within Non-School Settings.

Many learners pointed out that Online tools also enable them to communicate or even socialise with other peers at their school or at other schools after school time or even during the weekends.

News is instantly available. We also share a lot of things of interest in the group, for example, songs, notes, videos, news. No school communiqué. [Participant 8B]

We can communicate with families and friends and work in groups even after school. [Participant 7A]

I also tell my views when I chat in groups. It improves my intelligence. When I tell my thoughts and views when I chat online. I chat a lot with my friends online when we do not have the time to talk at school. [Participant 12C]

When we play online games, then we play in groups to spend time together or when we share notes, then we do it in groups. [Participant 9B]

Yes, we are more comfortable to talk and express our views in online groups than in class. [Participant 11A]

6.4.4.2 Learn better within social groups rather than individually.

According to several participants, they tend to learn better within social groups rather than individually or even at school. The finding is further corroborated by the following statements:

We work in groups and learn more among ourselves by sharing what we know and learn what we do not know. [Participant 7B]

When we communicate with our friends and work in groups on WhatsApp, we can also give our views and tell what we think. On WhatsApp, it is easier to describe our views and thoughts on different things. [Participant 9D]

When we work in groups, we get more ideas from our friends. We learn more how to do things quicker and share our ideas. [Participant 11B]

We can also work in groups, not only wait to work at school but also at home after school. [Participant 9A]

We can also work in groups for a project or to discuss about something since at school we don't get time. [Participant 11B]

I chat every day on WhatsApp for work in groups and sharing notes. [Participant 8D]

It has helped me a lot at school when I communicate and work in groups, share ideas online with my friends. [Participant 8D]

When I work in groups, I can understand better a topic. I feel less shy to give my opinions on chat groups rather than in class. [Participant 10E]

By working questions in groups, we can better understand a chapter in class. [Participant 11B]

The use of OIL for Community was also attested by the following participants:

I use Google Classroom extensively, Zoom for group classes, WhatsApp for chatting, Google for searching of information both related to schoolwork and self-learning, Youtube to watch videos, listen to music during my free time, Yahoo, WhatsApp, Facebook to look at photos, videos, Instagram to see photos, chat with friends. I also use WhatsApp and YouTube to check tutorials and videos about other things to understand better what we learned at school. [Participant 12E]

When we play online games, then we play in groups or when we share notes, then we do it in groups. [Participant 9C]

We can get information quickly. Apart from what the teacher taught us at school, we can work in groups, learn to draw different things by ourselves [Participant 10E].

When we communicate with our friends and work in groups on WhatsApp, we can also give our views and tell what we think on WhatsApp, it is easier to describe our views and thoughts on different things. [Participant 13A].

Learners can get all the high-quality materials they need to do a project. We can get additional notes apart from the ones we get at school. It provides me with feedback, guides me in my lessons and do group tutorials through WhatsApp and Facebook. [Participant 13A]

News is instantly available. We also share a lot of things of interest in the group, for example songs, notes, videos, news for example No school communiqué. [Participant 8B]

We can communicate with families and friends; work in groups even after school [Participant 7A].

We can also work in groups for a project or to discuss something since at school we don't get time. [Participant 11B]

6.4.5 Division of Labour

Division of Labour is connected to how an activity system is set up, including its Roles, responsibilities, and power structures. The research question that was asked for this element of the OIA system is what role each agent plays in the OIL system. From the qualitative analysis, it can be perceived that secondary school students work most of the time as a team to engage in project work or to better understand concepts taught at school or to communicate. They also participate in the Online Informal Reader as readers and online viewers, giving online views/reactions, writing/posting messages, and sharing information with other peers in the group. Therefore, secondary school learners can be online readers, communicators, observers, or presenters.

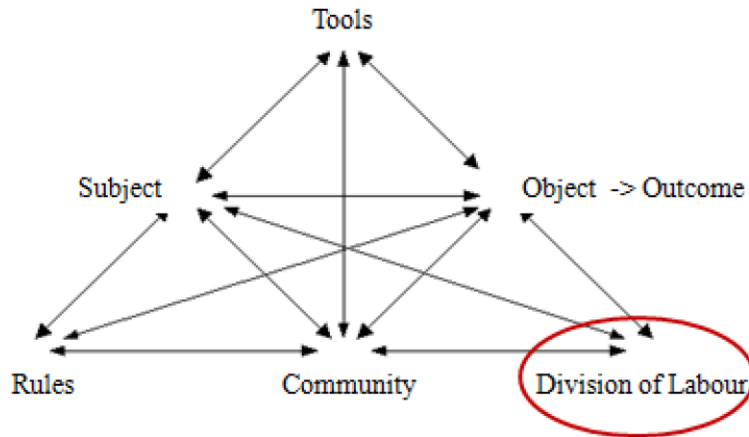


Figure 8

The Role of Division of Labour in Online Informal Activities

Many participants expressed the fact that they usually share responsibilities when there is a specific project to do at school. Each member of the group is then assigned part of the work to do informally online at home, where they combine and share what they have learned afterwards.

The finding can be supported by the comments provided below:

It usually encourages me to go and find out more and more on the internet on different things when we get projects at school. We go and do research on the internet where we learn a lot of things. We usually divide the work, work on our own at home looking for information and solutions on the internet and share our ideas at school. [Participant 13A]

Learning online at home is one of the main things I do, especially when we get group projects in design and technology. Each one of us does a small part of the work. Then we merge it all together. Usually, there is a leader in the group all the time. [Participant 10A]

I look for photos and more information for my projects with online tools. My friends in my group also look for the same. Each one of us looks for a particular topic, then we put them together for our project. [Participant 8B]

6.4.6 Object(s)

The Object of the Online Informal activity is the physical or symbolic object towards which secondary school learners move with the purpose of attaining 21CS. The research question that applies to this category is “Why are the subjects engaging in the online informal activity?”

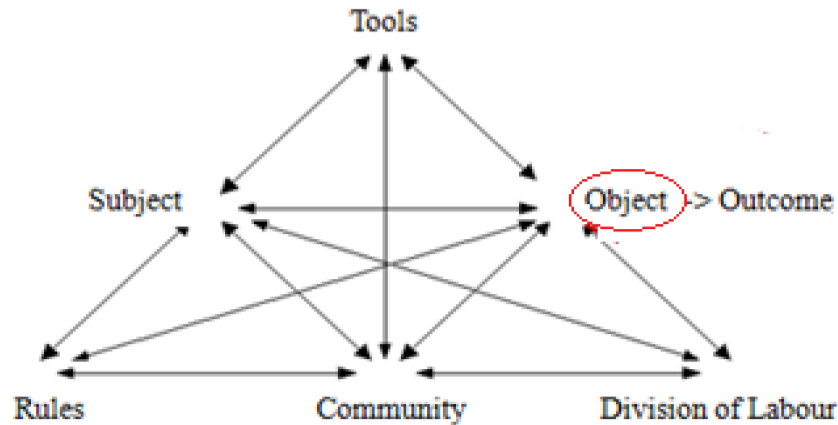


Figure 9

The Role of Object(s) in Online Informal Activities

Many secondary school learners stated that they use online tools for the following objectives: to share information, learn for fun, for personal interest or as a hobby, to become an expert in a specific field, to improve their academic performance, to enhance curiosity, to interact with peers within non-school settings, to socialise/maintain relationships, to express one's emotions/feelings, express views or reflections, for teamwork, to get peer/emotional support through OIA, to promote interest in non- school subjects, to improve language learning/ writing and preference to formal learning.

6.4.6.1 Curiosity.

Several learners stated that they use online tools to learn more and more through curiosity. They are always curious to know what is happening in the country, in the outside world or even to learn how to repair or cook food. The sentiment is further expressed in the comments that follow:

I am more encouraged and curious to look for answers on the net and to communicate through Zoom since reading one thing always leads us to other interesting things.
[Participant 10A]

I am always curious to learn new things and watch new videos on YouTube, Instagram, and Facebook ... laugh... When I watch one video, I always want to watch another one.
[Participant 10B]

I always want to learn more and more things about mobile phone repair hacks and PC repair by watching it on YouTube. [Participant 12C]

6.4.6.2 Improvement in Concentration.

Very few learners believe that there is an improvement in concentration when they learn online informally. They added that they only use their concentration when playing games online. The following comments reflect this experience:

Playing games helps me to think more of different strategies and helps me to concentrate.
[Participant 10D]

I concentrate better. I need to think well to know which moves to take when I play games.
[Participant 10D]

6.4.6.3 Improvement in Language Learning/Writing.

The participants were questioned whether OIL could improve their language in both reading and writing. Many participants supported the fact that OIL contributes to improving the way they read and write. The sentiment is supported by the various participants' comments:

During my leisure time, I watch documentary films online to enrich my English or French.
[Participant 10A]

Use online tools to learn a lot of new words for my English and French. I also use online tools for my projects to look for photos and more information. I learn better when I read more on the internet than in a book. [Participant 8B]

I usually learn English and French when I watch videos on YouTube. I prefer to watch videos on YouTube than to read to learn something. [Participant 10B]

If we want to improve our French, we need to watch and read French stuff online. To some extent, I know how to write the words and how to better talk in French. Also, for English. [Participant 10D]

It has helped me improve your oral skills and the way I write when I communicate both in terms of creole, French or English. [Participant 12A]

There are also Google Docs which I use for school such as English essay writing. Yes, and also French. [Participant 13B]

Some learners mentioned that reading online also improved their general knowledge at the same time:

I learn about things that are not usually talked about at school, for example, news around the world and discovering things. Online news on BBC news to learn about what is happening around the world. [Participant 13E]

We can improve our general knowledge by reading things on the net. For example, I learned about historical events in other countries, and their different cultures. [Participant 13E]

6.4.6.4 Learning for Fun.

Some participants stated that they use online tools and social media during their leisure time by reading for fun. They are learning new things and enriching their knowledge. The viewpoint is expressed in the comments below:

It is another way of learning. More fun while watching videos and learning at the same time than listening to the teacher in class. [Participant 8B]

I have fun but learn a little at the same time. [Participant 10C]

I think learning online is part and parcel of our education since it is also important while having fun. [Participant 11C]

Other participants have fun chatting with friends or playing games online as expressed by the following participants:

More entertainment online through online games. It is more fun while looking and learning for things faster using online tools. [Participant 11E].

I use online tools for fun, to learn, to help friends and to interact with my friends and teachers. [Participant 12C]

I use it a lot for fun every day- listening to songs, watching on YouTube, and chat with friends. [Participant 11A]

Often, we have a discussion about a school topic on WhatsApp. We also chat to have fun. [Participant 7B]

6.4.6.5 Subject Engagement.

Over and above informal learning and online tools such as video tutorials, websites, and online notes can help in better understanding the subjects and coursework as well. Such online tools are of greater help to be used in understanding coursework and subjects. The finding is supported by Participants 13A and 10A,

Yes, it encouraged me to go and find out more and more on the internet about different things that I didn't understand. When we get projects at school, we go and do research on the internet where we learn a lot of things. [Participant 13A]

I have learnt how to cook different food at home. Learning online at home has also encouraged me to complete my work from school, especially when we get projects in Design and Technology. [Participant 10A]

6.4.6.6 Interaction with Peers within Non-School Settings.

Many learners pointed out that online tools also enable them to communicate or even socialise with other peers at their school or other schools after school time or even during the weekends. These include Participants 8B and 7A,

News is instantly available. We also share a lot of things of interest in the group, for example songs, notes, videos, news for example No school communiqué. [Participant 8B]

We can communicate with families and friends and work in groups even after school. [Participant 7A]

6.4.7 Outcome–Online Informal Learning and 21st Century Skills Development

6.4.7.1 Development of Communication Skills through OIL.

OIL is the unplanned learning that happens daily when individuals use the internet even to communicate. The results from the interviews have demonstrated that communication skills are improved using OIL and through a variety of online tools. The following comments from the participants validate the finding:

Yes, I communicate a lot because when I use online tools, we also communicate with our friends and teachers using several methods, either through text or emojis or still through a voice message. [Participant 11A]

I prefer to communicate using WhatsApp because we can easily type and send pictures, etc. Everyone prefers to communicate through WhatsApp since it is very easy to use. [Participant 8C]

I have learnt how to better communicate with my friends by sharing notes and other things through WhatsApp, Instagram on my own by trial and error. [Participant 7B]

I can communicate more with my friends by sending photos and videos. It is also quicker than to phone or talk at school since I get more time to chat. [Participant 10A]

I communicate a lot through WhatsApp. Now I am used to trying and communicating using the WhatsApp features. [Participant 11D]

Communication through WhatsApp is important since sometimes we cannot talk at school because of limited time. [Participant 7E]

Yes. Of course. For example. At first, I didn't know how to use WhatsApp, so I tried to learn it by myself. Now I can use it very well. I can also type very quickly. And use emojis. [Participant 10E]

6.4.7.2 Development of Creativity through OIL.

Many participants have similar views that using online tools to learn outside school settings helps motivate their creativity, especially when cooking, drawing or still in project-based assignments. They had similar views about their creativity being improved using OIL platforms, including social media apps (Facebook, Instagram). The finding is further supported by the following comments:

It helps us in doing our projects, FNT, design, to get different photos, to learn on our own how to build things by watching tutorials on YouTube. I learn how to draw a different kind of creatures to improve my art skills. I also like cooking, so I learn how to cook food for example, I learned how to make milkshake for my whole family last week. [Participant 12A]

Yes, I have become more creative by looking for videos on how to draw and I learnt how to draw things or build a house for my design project work. [Participant 13A]

Technology is better than when we do or learn something manually, like at school. Like if we are doing a project, we get a lot of creative and innovative ideas on google and YouTube that help us to complete our project so that we can get more marks. [Participant 12A]

Creative in how we can look for a lot of things that interest us not related to our studies. [Participant 13B]

Yes, now I know how to cook a lot of food by looking at video channels on YouTube. I am interested in how to cook and decorate my plates. [Participant 13E]

But I learn a lot of informal things on YouTube by watching videos. It improves my creativity. Understanding is the key. [Participant 10B]

My football techniques have improved through YouTube, Instagram. [Participant 12A]

6.4.7.3 Development of critical thinking skills through OIL.

One of the four Cs, critical thinking, has become increasingly important in the twenty-first century since we are constantly exposed to a wealth of fresh information. Many participants are also of the opinion that OIL contributes to the enhancement of their critical thinking abilities. The finding is supported by the comments that follow:

By looking for the solutions on YouTube or on Google, we learn by ourselves how to solve a problem. [Participant 7A]

Yes, last time, I was having a problem with my mobile. So, I went on YouTube to look for the solution and repaired it myself. [Participant 11A]

As we got more and more interested in the subject, sometimes we don't need to look for help from our teachers. We can look for the answer ourselves. [Participant 9D]

I also take my time to learn things because in class we do not understand quickly. So, by reading on the net or watching tutorials on YouTube we better understand things. [Participant 11D]

6.4.7.4 Development of collaboration skills through OIL.

Many secondary school students believed that OIL might enable students to participate in instructional activities, communicate with one another, and work together to improve learning outcomes. The theory is validated by the following comments:

We often work in groups for a project or to discuss something since at school we don't get time and when we work together, we do the work quicker and better. [Participant 7B]

I chat every day on WhatsApp to work in groups and sharing notes since when we share notes among ourselves; we help each other to understand better. [Participant 9C]

When I learn something together with my friends, it stays in my mind longer. [Participant 10E]

When we work in groups, we can understand better a topic. [Participant 10D]

Yes, we share a lot of notes, pictures, and videos online with our friends when we work in groups. This is a way to show that we are contributing to the project work a lot by sharing a lot of interesting things related to schoolwork and others as well. I use WhatsApp a lot to share pictures, videos, and notes. [Participant 11A]

6.4.7.5 Development of social skills through OIL.

In order to communicate and connect with people, social skills are a combination of verbal communication strategies and non-verbal behaviours (such as listening, extending greetings, speaking, etc.) (Dereli, 2009; Samanci, 2010). Using and interpreting social signals, such as displaying and recognising facial emotions, is a necessary part of social interaction (Ekman, 1993; Izard, 1992). During the analysis, the researcher could identify that OIL could improve learners' social skills. The finding is further validated by the comments below:

I mainly use WhatsApp to chat with friends. [Participant 7A]

At first, I didn't know how to use WhatsApp, so I tried to learn it by myself. Now I can use it very well. [Participant 8B]

I can also type very quickly. And use emojis. [Participant 8C]

I can communicate with my friends. [Participant 9A]

We feel less stressed to communicate over WhatsApp and write my messages with funny emojis. [Participant 9D]

I can easily communicate with both my friends and my teachers to ask them for something. I prefer to communicate using WhatsApp because we can easily type and send pictures,

etc. Everyone prefers to communicate through WhatsApp, since it is very easy. [Participants 11A, B, E]

For me, WhatsApp is very important to keep contact with my friends and to know what is happening in the world. [Participant 12A]

I like to go on Instagram, Viber, and Facebook to socialise and to get to know other people. I get to know a lot of people when I play PubG online. I can express myself better in Creole, English or French... easier in Creole. With the emojis and so on. [Participant 13C]

6.4.7.6 Development of Self-directed Learning / Flexibility in Learning.

A very interesting theme which emerged from the qualitative analysis is self-directed learning or flexible learning using online tools where secondary school learners state that they can use online tools to learn informally anywhere and anytime without the help of their teacher. Some participants also stated that they can also self-manage their time while learning informally online. This is corroborated by the comments that follow:

I can use the internet to search for something, read or watch. [Participant 7A]

We get easily and quickly the answers anytime and anywhere we want, even during school time or after school. [Participant 7C]

We can refer back to our notes since we already have it on our online tool. [Participant 8B]

I can work and on my own. I don't need to ask anyone. [Participant 10A]

Instead of waiting for school time to ask our teachers questions, we can do it during the day at home. [Participant 8A]

Even during recess, now I spend my time watching a video or reading something online by using mobile data on my smartphone. I also often do it in the bus while travelling. [Participant 9E]

There are many things that I learn to use by myself online by looking for the solutions on the internet. [Participant 10A]

From the comfort of our home or outdoors, we can communicate better on Whatsapp or Instagram. [Participant 10A]

I usually learn without the help of anyone. I am conscious that we need to learn by ourselves. [Participant 11B]

We can learn a lot of things by ourselves. We can also share notes and chat messages among our friends. [Participant 11D]

These tools make us do things quicker and we work like professionals. [Participant 12A]

By self-managing my time. I can learn on my own without the help of my teachers and within school time. [Participant 13A]

I also learnt how to upload and download files on YouTube. Group work as well. Self-discipline and responsibility to learn things by ourselves. [Participant 13B]

6.4.7.7 Development of Information Literacy through OIL.

Information literacy suggests that a person is knowledgeable to identify the type and extent of information required, access information effectively and efficiently, critically assess information and its sources, and incorporate some information into his or her knowledge base. It also suggests that a person is knowledgeable to use information effectively to achieve a specific goal and

understands the economic, legal, and social problems around the use of information (Adebayo, 2017). Many participants stated that they have a lot of information:

It also boosts our general knowledge and, of course, our intellectual capabilities.
[Participant 7A]

We can also acquire a lot of knowledge through more research online. [Participant 7C]

Also, if we don't know something, for example, when we search on this specific topic, we find more concepts on this topic. [Participant 9A]

We can get all sorts of information. I learn how to draw things on my own. News is instantly available. [Participant 10D]

It helps us to complete our projects at school by looking for additional information and ideas. It gives us more details when we have something to do without the help of our teacher, on our own when I go on the internet. [Participant 11A]

6.4.7.8 Development of Digital/ Technological Literacy through OIL.

For study, personal development, communication, employment, and teamwork, one must be digitally literate (Lee, 2014). Many participants stated that OIL has helped them to improve their digital/ Technological skills since they have done a lot of self-learning on the use of digital devices online and how to perform online learning at home. The following participant's comments support this finding:

We communicate better with our group friends. Hence, it improves our typing skills and the way we use our online devices. [Participant 7B]

Learning online has helped me to use my PC and mobile better. Now I can make better use of technology. [Participant 13C]

I also use online tools to learn animations and play computer games during my leisure times. Chat with friends. I can share photos with my friends on WhatsApp and Instagram. I also want to say how I learnt how to make a digital thermometer on my own for my biology class. [Participant 13E]

6.4.7.9 Development of Peer/ Emotional Support.

According to many participants, OIL could also help in improving or deepening the relationships among friends in a group or while communicating. Some participants also get peer or emotional support from their friends when in need, as was clear in the following comments:

I usually chat with some of my teachers to discuss problems related to my study of course. They are always here to help me. [Participant 13C]

Most of the time, I get the help and advice of my friends when I do not understand something. [Participant 13E]

6.5 Overall Implications of the Qualitative Analysis

The findings of the research demonstrated the beneficial impact of OIL on the digital competence of the learners, their collaborative performance, social abilities, and communication skills. While online casual learning had a direct beneficial impact on the communication abilities of learners, it had more influence on their performance in their official courses with digital experience. The current research has clearly demonstrated the beneficial effect of OIL on subject engagement, self-learning, cognitive engagement, social, and collaborative engagement, adeptness to the information and retention of domain-specific knowledge of learning by learners in various educational settings.

Informal learning takes the form of self-initiated activities carried out by individuals in a work environment, leading to the development of knowledge and skills, and the fulfilment of a job or task. Informal learning consists of meaningful activities that are based on previous experience and existing knowledge structures and therefore enable the creation, as examined in the present research, of new tacit knowledge to explicit knowledge. It is more probable that learners will participate in the creation of new experiences, find alternative solutions to issues via cognitive learning, and acquire skills in informal online learning.

The focus of informal online learning is on shifting explicit information from teaching to teacher, usually linked to a time-space gap between the structured learning event and the application of knowledge or skills. Further assistance for performance is frequently required to bridge the gap between current knowledge and abilities and anticipated performance in this situation. “Humans learn when they see the need to know, and the proof is that they can accomplish something that they could not do previously” states Boileau (2011).

6.6 Synthesis

In Chapter 6, the qualitative data of the study were analysed. Semi-structured interviews were used to get information about the various OIL tools used by secondary school students. Data analysis and content analysis were done. The results were explicated from the qualitative analysis grouped under the different categories, including Subject, Tools, Rules, Division of Labour, Object (s) and Outcome. In conclusion, the overall implications of the qualitative analysis were examined. In Chapter 7, the findings of the study will be discussed.

CHAPTER SEVEN

DISCUSSION OF FINDINGS

7.1 Introduction

In the preceding chapter (6), the qualitative data of the study were analysed, and findings from this phase of the study were aligned with the results derived from the quantitative phase in Chapter 5 to give a clear, lucid explanation of why and how secondary school learners acquire 21st Century Skills (21CS) through Online Informal Learning (OIL). As advocated by Harris (1996), citizens in the information era must be able to manage, analyse, evaluate, cross-reference, and turn information into 21CS in addition to knowing how to access it.

In Chapter 4, the study applied a sequential exploratory mixed-methods design, commencing with a descriptive analysis of data gleaned from questionnaires completed by secondary school learners in Grades 7-13. The results were then incisively dissected by engaging qualitative methods. Since the aim of the study was to gain an in-depth understanding of why and how secondary school learners acquire 21CS through OIL using online tools and social media, the research findings (quantitative and qualitative) were discussed in terms of the themes that were identified during data analysis.

The present chapter discusses the parallel findings of the quantitative and qualitative surveys by aligning them to the aim, objectives and research questions listed in the first chapter. The research questions are restated below:

1. What forms of Online Informal Learning occur among secondary school learners through utilising online tools?
2. How do secondary school learners acquire 21st century skills through Online Informal Learning?

3. Why do secondary school learners acquire 21st century skills through Online Informal Learning the way they do?

The findings are discussed and compared with previous research studies while being aligned to the Activity Theory (AT) and the P21 21st Century Skills Framework presented in Chapter 3. The purpose of this exercise is to establish a connection between existing knowledge and the knowledge gained from the study with the possibility of proposing a new framework. Activity, according to the AT, refers to *what* and *how* learners gain skills and knowledge by utilising online tools. Additionally, questions such as *why* and *how* such learners gain these 21CS via utilising online tools were explored (Anderson, 2003; Rahimah, 2019). Therefore, the aim of the study was to investigate why and how secondary school learners acquire 21CS through OIL.

7.2 Discussion of the Main Findings and Their Significance

The section discusses the results obtained from both the quantitative and the qualitative analyses by linking them with the conceptual framework and the relevant literature. Accordingly, the purpose of the analysis was to investigate learners' perceptions of the use of online tools for OIL which included determining the extent to which Mauritian secondary school learners use online tools for OIL. Also, an examination of how 21CS was acquired through OIL tools was executed. The connection between the conceptualisation of 21CS, and the behaviour demonstrated by the learner, was critical for understanding the acquired skills, and how they were elicited and enhanced. The connection assisted me in understanding how Web 2.0 resources and interactive mentoring programmes helped learners build 21CS.

7.2.1 What forms of Online Informal Learning occur among secondary school learners through online tools?

The first research question aimed at examining the forms of OIL that occur among secondary school learners when they utilise online tools. Informal learning (IL) occurs when learning is purposeful and conscious as learners seek to gain knowledge even before the learning process begins, and when they are aware of what they have learned (Schugurensky, 2000). Schugurensky (2000) categorises IL into three types based on intentionality and awareness: self-directed learning,

socialisation, and incidental or self-discovery learning. As the use of social media continues to expand (Madden et al., 2012; Ofcom, 2014; Brenner & Smith, 2013), learners in secondary education can actively participate in digital cultures (Jenkins et al., 2009), potentially leading to advantages such as collaborative learning, acquisition of new abilities, and increased self-determination (Greenhow & Lewin, 2016).

For the study, the quantitative analysis involved 310 secondary school learners across different grades (7-13). When the participants were asked about their OIL experience and specifically which tools they used and how often they used them, the data revealed that the majority of secondary school learners were acquainted with online tools on a daily basis rather than on a weekly or on a monthly basis with video/audio clips (80.3%), online discussion groups (79.7%), Instant chat (73.9%), Internet websites (69.7%) and Online games (68.1%), YouTube (67.7%).

Regarding Social Networking Sites (SNSs), the respondents were most familiar with online discussion groups through WhatsApp (79.7%), YouTube (67.7%) and Instagram (63.2%). Only 27.4% of the respondents indicated they used Facebook as part of their learning process. All interview participants from grades 7 to 13 also responded to learning informally using Web 2.0 tools, for example, Snapchat, Instagram, WhatsApp, Google, YouTube, Play Store, Facebook, TikTok, Messenger, Movie Store, and Viber. The findings of this research study indicated that some OIL tools are utilised for informal learning, however, others are employed for both formal and informal learning. Social networking sites and instant messaging tools were also found to contribute to online informal learning. The finding corroborates Chalkiadaki's (2018) claim in the literature review (see Section 2.2) that social and civic engagement matters in acquiring 21CS during OIL.

Secondary school learners use social networking tools to make new friends and share school-related notes and videos, which helps them adapt to new learning settings. According to Kapp (2007), instant messaging encourages informal learning when users discuss ideas and viewpoints outside of the official educational setting. These results are consistent with Yoo and Kim's (2003) findings, which suggest that secondary school students commonly utilise Web 2.0 tools or social media sites like Facebook, YouTube, and blogs to participate in unstructured, informal, non-

classroom situated learning that is just as significant as official learning in educational settings. However, it is used for a wider range of purposes.

The data also suggested that there is a deviation in using online tools for OIL across various secondary school grades (7-13). Lower secondary school learners use online tools mainly for informal learning to share information, share photos, songs, and games, whereas older secondary school learners use them mainly to share information but also to complement formal learning. Most secondary school learners commented that OIL has become an essential component of their lives since whatever is being learnt in their formal settings is not enough for them to complete their learning. Participant 12E stated,

I use Google Classroom extensively, Zoom for group classes, WhatsApp for chatting, Google for searching for information both related to schoolwork and self-learning, YouTube to watch videos; I listen to music during my free time, Yahoo, WhatsApp, Facebook to watch photos, videos, Instagram to see photos, chat with friends. I also use WhatsApp and YouTube to check tutorials and videos about other things to understand better what we learnt at school.

From the learners' responses, various forms of OIL that take place among secondary school learners were identified. These will be described next.

7.2.1.1 Self-directed Learning.

Secondary school learners are responsible for using an online informal environment through which they can acquire knowledge, select their sources of information and work autonomously. Self-directed learning is not only connected to schoolwork but also to the acquisition of additional knowledge. The data revealed that learners use Google Classroom, Zoom for group classes, WhatsApp for chatting, and Google for intensively searching information, both for schoolwork and self-learning. They use YouTube to watch videos and listen to music during their free time, and Yahoo, WhatsApp, and Facebook to look at photos and watch videos, Instagram to see photos and chat with friends.

They also use WhatsApp and YouTube to watch tutorials and videos to better understand what they learned at school.

The quantitative and qualitative results both align with prior research conducted by Al-Samarraie and Saeed (2018), Hassan et al. (2021) and Wang, Chen and Khan (2014). These studies concluded that most online tools used by secondary school learners, including Social Networking Sites (SNSs), such as Twitter, wikis, blogs, WhatsApp, and Skype are used for discussion and sharing of informal education and non-educational purposes. The comments from the participants also indicated that the use of online tools has a favourable effect on the formation of active and self-regulating study habits in students' solo and group work projects as previously stated by Venkatesh, Croteau and Rabah (2014) as well as on the development of their 21CS. It is seen as a faster way to obtain information and the use of online tools facilitates the learning process. Self-directed OIL promotes information literacy, a critical 21CS.

7.2.1.2 Collaborative Learning.

OIL activities teach students how to work together, produce digital material, think critically, expand the time-space of discourse in the classroom, and foster trust between students and instructors. The mixed method analysed both supported the theory that most secondary school learners used online technologies for OIL and academic purposes through online games; text messaging through WhatsApp, Twitter, Snapchat and Instagram; internet websites by watching video or audio clips through YouTube and Netflix; and message boards. Social media platforms are increasingly utilised by learners for both formal and informal purposes. These include organising group work by finding partners, creating groups, and sharing tasks.

Other subjects such as other learners of similar interests, friends and relatives, teachers, parents, facilitators, and members of online communities also contribute to the subject's OIL process. Learners use social media to generate ideas, communicate with teachers and peers through group discussions, and inquiries, and receive feedback. Additionally, social media is used for sharing information, resources, and links relevant to their studies. Learners document their progress and share it with audiences beyond the classroom. Furthermore, Greenhow and Lewin (2016) contend that social media platforms are used for sharing project outcomes, including presentations, and for peer and teacher assessments and evaluations. Participant 11A stated,

I can learn whenever I want and on any topic. If I haven't understood a topic, I can still learn it by looking for notes on the internet.

Division of Labour promotes collaboration. As noted in AT Chapter 3, the Division of Labour here signifies the organisation of duties and responsibilities within the community (Heo & Lee, 2013, p. 78).

With the help of online tools, secondary school learners can communicate values, norms and actions that are deemed important in society and develop social skills through shared activities and interactions (Aycicek, 2021; Bain, 1985; Läänemets et al., 2018). Moreover, some comments from the subjects confirmed that these online tools have “have allowed people with common interests to meet, share ideas and collaborate in innovative ways” (Nedeva & Deneva, 2012; Hassan et al., 2021). A variety of educational resources are used in conjunction with OIL initiatives to meet the demands of modern education and advance 21st century skills as stated by Hoic-Bozic, Dlab and Mornar (2015). AT asserts that the development of the psyche is heavily dependent on purposeful human activity. As a result, Benett (2019) argues that individual development is strongly influenced by society and culture.

Subjects were encouraged to indicate the reasons for using different online technologies in the quantitative and qualitative analyses. The reasons for using different OIL tools by secondary school learners, as revealed by the quantitative results, were for sharing information (98%), for interpersonal communication (90%), for fun (89%), for personal interest or hobbies (85%), for developing self-identity and observing other people's lives (82%), for maintaining social relationships (76%), for self-expression and self-reflection (74%), developing expertise (69). AT defines a community as a sociocultural environment made up of several people who have similar overarching goals. It promotes problem-solving, interpersonal skills and conflict-resolution skills (see Section 2.4). Accordingly, AT asserts that the development of the psyche is heavily dependent on purposeful human activity, which is clearly demonstrated, according to Benett (2019).

7.2.1.3 Explorative Learning.

Various responses from participants as outlined in Chapter 6 indicate that learners feel more comfortable learning by themselves using online tools instead of the old physical ways or using formal learning or structured ways of learning at school. The analysis phase of the study also revealed that online tools used by secondary school learners were mainly used to learn informally outside the school settings or simply to complement what they have learned at school. For example, Participant 7A stated,

I use mainly YouTube, Twitter, Google, Facebook, Snapchat, and eBay when I go online at home.

Participants in grades 10 to 13 stated that they use different online sites to learn things informally, for example, Facebook for sharing information, WhatsApp (photos, notes, songs, games), YouTube (for watching music and videos), self-discovery learning connected to schoolwork and also for additional knowledge, listen to music as a hobby. Participant 12E commented,

I use Google Classroom extensively, Zoom for group classes, WhatsApp for chatting, Google for searching for information both related to schoolwork and self-learning, YouTube to watch videos; I listen to music during my free time, Yahoo, WhatsApp, Facebook to watch photos, videos, Instagram to see photos, chat with friends. I also use WhatsApp and YouTube to check tutorials and videos about other things to understand better what we learned at school.

Older participants in grades 10 through 13 used a variety of online resources to learn things formally, including Facebook for information sharing, WhatsApp (photos, notes, songs, and games), YouTube (for watching music and videos), self-discovery learning related to schoolwork and for additional knowledge, and music listening as a hobby. Allaste et al. (2021) and Leask (2009) have both recognised the value of OIL as a complement to formal education. OIL can help students successfully complete the formal curriculum's goals in several ways (Wiebe et al., 2013, p. 3). Some students may learn better in casual settings, as claimed by Affeldt et al. (2018).

7.2.1.4 Incidental Online Informal Learning.

Other secondary school students engaged in incidental OIL when they used online resources to obtain learning experiences. Schugurensky (2000) states that these experiences occurred when the students had no prior intention of learning anything from them, but they later realised that they had learned something. Incidental OIL was, therefore, shown to be deliberate yet inadvertent.

One of the main forms of OIL where secondary school students may learn 21CS when using various online technologies is socialisation. According to Schugurensky (2000), “Socialisation (tacit learning) refers to the internalisation of values, attitudes, behaviours, skills, etc. that take place during daily life while engaging in online informal learning.” In addition to not having any prior purpose in learning them, secondary school students are also unaware that they have learned anything. Socialisation using online technologies was primarily identified as Online Informal Socialisation (OIS) or Online Informal Tacit Learning (OITL) for the study.

The hypothesis that all types of OIL can result in the acquisition of new information or competencies was validated by evidence from all these forms. Furthermore, the results from the secondary school students’ research supported the idea that OIS occurred because of the interaction and communication between various actors both within and between them. The interaction and dialogue between different actors, both inside and between them. The connection and conversation increased communication, personal familiarity, and problem-solving abilities, all of which are factors in 21CS (Gupta & Govindarajan, 2000). In a similar vein, Schugurensky (2000) found that “awareness that unintentional and unconscious learning experiences took place (through socialisation) among secondary school learners could occur immediately after the learning experience or many years after it, and the process of retrospective recognition can be internally generated or externally led”. In the same vein, the findings provide additional evidence that learning obtained using any of the aforementioned online learning tools (OIL) aid in advancing learning (Schugurensky, 2000).

7.2.1.5 Self-discovery Learning.

The majority of secondary school students are quite familiar with online technologies, including watching video and audio clips on YouTube, interacting in online discussion groups using social

media sites (most notably WhatsApp, Twitter, Snapchat, and Instagram), and instant messaging. Previous studies have supported the findings of the study. Additionally, John and Yunus (2021) claim that students are already accustomed to using social media for entertainment and communication. As a result, it is simpler for kids to use social media tools like TikTok, YouTube, Instagram, Skype, Facebook, WhatsApp, WeChat, and Telegram to learn new skills like language and speaking.

According to John and Yunus (2021), WhatsApp can significantly improve oral communication among secondary school students outside of the classroom. They use online resources that assist them in informal learning or that are helpful for their studies, and this is how much they use these resources. Participants in Grades 10 through 13 reported that they use various online resources, such as Facebook for information sharing, WhatsApp (photos, notes, songs, and games), YouTube (for watching music and videos), self-discovery learning related to schoolwork, as well as for additional knowledge, and listening to music as a hobby, to learn things informally.

The statistics showed that individuals felt more comfortable learning at home or elsewhere. The finding supported Tan's (2013) research, which found that an IL environment is "open-ended, nonthreatening, enjoyable, and explorative" and may be created utilising internet resources. The result is similar to the research of Mather and Sarkens (2018), who found that learners' preferences for learning styles can be categorised into three groups: flexibility of time, location, and convenience of juggling personal, social, and academic life. The finding is further supported by Trinder's (2017) assertion in Section 2.5.1 that informal learning is the learning that results from day-to-day activities related to work, family, and leisure.

Participants admitted that they prefer to learn on their own using online resources, particularly when it comes to general knowledge. Some participants stated that general knowledge evaluation is an important part of their subject-general papers. Everyone is free to share videos, music, pictures, and text on a variety of different Web 2.0 tools, according to Halili (2018), "Online Informal tools give space for learners to share information and build two-way communication." The comments below further confirmed these findings:

I find a lot of things that I like, and I learn it the way I feel is easier for me. [Participant 11B].

Learning is easier and faster since we have all the information at our disposal online. [Participant 12C]

Yes, I learn a lot of things happening in my country, and I find it easier to read online newspapers to know what is happening in my country instead of reading a newspaper. [Participant 11D]

We can get information quickly. Apart from what the teacher taught us at school, we can work in groups, and learn to draw different things by ourselves. [Participant 10E]

The statistics also showed that secondary school students had a far larger preference for informal learning than for solo and group projects. The study helped to clarify the fact that, in addition to the fact that OIL has grown to be a crucial component of learning for students at all phases, strong evidence exists from the study and an earlier study by Dabbagh and Kitsantas (2011) that “online tools and social media are increasingly supporting at home”. Unintentional learning encourages interpersonal interaction and 21CS problem-solving.

7.2.1.6 Intentional Learning.

Most participants claimed that utilising internet resources, they prefer to study independently, specifically when it comes to general knowledge, which some said was crucial for their subject because general papers are based on evaluating learners’ general knowledge while also gaining deeper insight and expertise in specialised fields. According to some participants, they are highly at ease utilising these internet tools, as shown by the following statements:

I use online tools to learn a lot of new words for my English and French and Yes, I use online tools for my projects to look for photos and more information as well as I learn better when I read more on the internet than in a book. [Participant 12A]

When we communicate with our friends and work in groups on WhatsApp, we can also give our views and tell what we think on WhatsApp. It is easier to describe our views and thoughts on different things. [Participant 11A]

I can learn whenever I want and on any topic. If I haven't understood a topic, I can still learn it by looking for notes on the internet. [Participant 11A]

The research additionally showed that high school students who use online resources for OIL learn by cognitive learning, which is learning using reasoning, intuition, or perception (Yang et al., 2011). According to Alaraj (2012), students tend to develop their cognitive structures by utilising a variety of content types and online tools. As a result, this exercise develops critical thinking abilities. Additionally, since Web 2.0 tools promote knowledge cooperation and knowledge exchange in addition to communication and cooperation, learners develop communication growth and development, which are also 21CS.

The study's findings thus contributed to a deeper knowledge of the range of learning opportunities and forms that can be facilitated by various online technologies. Numerous studies have shown that if the learner explicitly defines the objectives and procedures of OIL in advance (intentional online informal learning) or chooses them as the opportunity for learning arises (unintentional online informal learning), the online resources used to support the learning will also be self-directed. Clough (2009) explains that the variety of potential online learning tools expands along with technological advancements.

7.2.1.7 Activity Theory.

In order to ascertain whether OIL has an overall impact on secondary school students' 21CS and whether it will have an impact on the learners' 21CS, the study applied the Activity Theory (AT).

All the vertices of the AT were thoroughly examined to determine the many types of OIL that take place among secondary school students by using online resources, using the theoretical lens as

examined in Chapter 6 to study the power of an OIL system. It was shown that all six of the AT's components, as stated by Heo and Lee (2011) in Chapter 3, are interconnected and function as a cohesive system to create the OIL process and support the creation of 21CS. Similar findings were presented by Heo and Lee (2013) and Schugurensky (2000), who claimed that secondary school students use online tools as “a collaborative medium that allows users to communicate, work together, share and publish their ideas and thought”.

The different activity triangles in Chapter 6 (see Figure 7.1) were used to support the theory that different sub-online informal activity triangles work together to help secondary school learners to learn informally through online tools. Similarly, Doubleday and Wille (2014) cite AT as a framework for comprehending how the many aspects of the activity affected one another. Heo and Lee (2013) confirmed that for different forms of individual OIL to occur, it was found that the sub-triangle subject- tools- object shows the systemic relations between a secondary school learner and his/her OIL environment (see Figure 7.1).

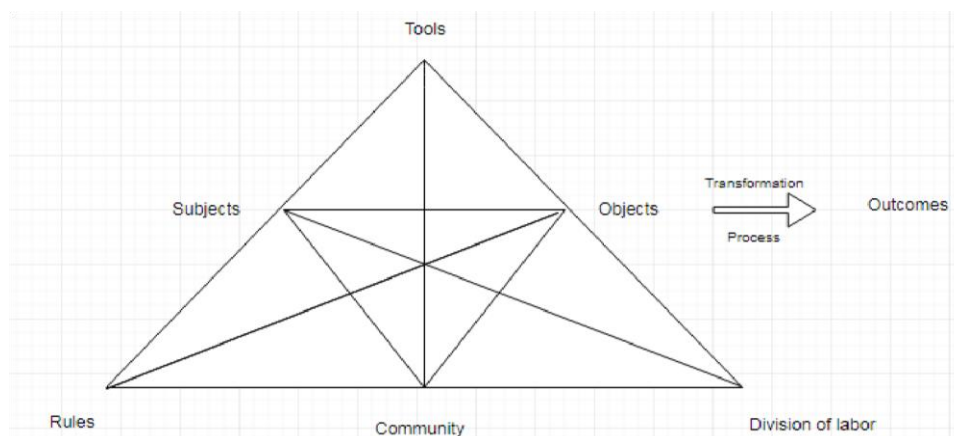


Figure 10

Activity Triangle Model (Engeström, 1987, p. 78)

In Figure 7.1, Subjects who are the main agents of the OIL are responsible for activating the OIL environment through which they acquire knowledge, work autonomously and perform self-directed or incidental, informal learning. The finding is supported by Participants 11C and 7D who stated,

I use a lot of time on online tools for my work and for entertainment. [11C]

I learn many things on YouTube. I also like to watch videos on the computer. [7D]

Tools as another element of the Online Informal activity are used by subjects to interact with objects for different forms of learning to occur, as confirmed by various comments from different participants:

We can also work in groups and communicate. [Participant 7A]

When we play online games, then we play in groups or when we share notes, then we do it in groups. [Participant 9C]

WhatsApp is very important to keep in contact with my friends and to know what is happening in the world. [Participant 11B]

The Object is one of the most important components for the sub-triangle of each OIL to occur individually. The act of learning anything formally using online resources becomes the study's Object, whether it be physically or symbolically. Additionally, it was found that the actions could be motivated by curiosity, deliberate learning, accidental learning, learning for fun, or even by engaging in academic subjects at school.

Moreover, the study also revealed that different forms of learning could occur when secondary school learners learn in groups. Here, the study supported the findings of Heo and Lee (2013) by revealing that the Sub- triangle Subject- Object- Community. Secondary school learners (Subjects)

who usually have the same interests and have common objects work in groups or as an online community to learn online informally. The objectives here are mainly to communicate or even socialise with other subjects outside the school setting. OIS or OITL occurs in the area where multiple secondary school students engage in informal learning using a variety of online resources by communicating with one another or even by socialising to learn things informally. The results of the study also demonstrated that adolescents in secondary schools learn better in social groups than they do alone.

However, two additional components of the Activity System—the Division of Labour and Rules—must be in place for the various forms of OIL to take place. The results showed that each participant in the activity system has a function to fulfil inside the OIL system. They can take part in the OIL process by reading or watching it online, commenting on it, writing, or sending messages, or exchanging information with their peers in the neighbourhood. The analysis of the qualitative study also showed that secondary school learners have different roles to play in terms of secondary school learners' patterns of behaviours. Heo and Lee (2013) agree that secondary school students' tasks, roles, and power relationships in the Online Informal Activity (OIA) system can also be categorised as secondary school students have different roles to play in terms of their patterns of behaviour, namely Knowledge Creators (Writers), Information Organisers (Collectors), and Information Seekers (Readers).

The findings of the study also showed that OIL can only take place when suitable rules are followed, which is one of the components of the Activity system. Without this component, many conflicts would arise in an OIL activity system. Thus, it was found that norms, conventions, and values (Kain and Wardle, 2002) such use of ethics, use of copyrights, respect for others' privacy, use of proper language, respect for other peers' emotions and feelings, and safe use of netiquette, as is demonstrated by Participant 10D's comment,

We need to respect each other, especially everyone's privacy, and use proper language when chatting. It is very important not to copy people's work or ideas or share confidential things with others outside the group. This is not ethical.

Failure to adhere to these rules in the system may result in negative barriers or conflicts such as distraction, lack of or too much parental control, addiction to OIL, stress due to connectivity problems, non-respect of privacy, bullying through communication or group chat or confusion.

7.2.2 How does Online Informal Learning influence secondary school learners' 21st Century Skills?

The youth must possess the information, abilities, and attitudes required to participate actively in and contribute to the development of society in the twenty-first century (Lin et al., 2021). According to Chai et al. (2020a), Frameworks for 21CS underline the value of involving students in creative thinking, critical thinking, and authentic problem-solving. Furthermore, Chai et al. (2020b) contend that both classroom-based and extracurricular learning communities should assist students in acquiring the collaboration and communication skills necessary for problem-solving, which promotes learning and innovation. The section outlines the 21CS, including critical thinking, cooperation, communication, creativity, and digital literacy, that students may acquire through OIL.

The acquisition of 21CS is crucial for learners to succeed in the modern era (Hoffman, 2010; Rotherham & Willingham, 2009). The survey's four main skill categories were critical thinking, communication, cooperation, and creativity. The finding is aligned with Section 2.4's proposal from the Mauritian MoEHRSR (2015). The results of the interviews supported those of the survey, and the AT framework was represented in both the quantitative and qualitative analyses. Moreover, the AT framework considers the viewpoints of the students, including how they use online resources, what roles they play, what the regulations are, and what they hope to learn. One of the outcomes is the 21CS discussed above. According to Lau and Gardner (2019), this kind of autonomous learning can raise student motivation and spur more active learning.

For students to excel in the complicated and ever-changing digital environment, 21CS are crucial. OIL has proven to be a successful method for fostering 21CS among high school students. According to the results, OIL offers a favourable environment for the acquisition of 21CS. Onyema et al. (2019) maintain that these abilities are acquired by learners through a variety of activities, such as online discussions, research, and problem-solving. After both the qualitative and

quantitative analyses in chapters 5 and 6, various comments from participants showed that learners acquire 21CS skills through OIL in the following ways:

1. **Collaboration:** Learners collaborate with experts and peers from different parts of the planet through online platforms. Collaboration enhances their teamwork and communication skills (Mora et al., 2020).
2. **Creativity:** Online informal learning provides learners with a platform to explore their creativity through various activities, such as online gaming and video production (CostaSánchez & Guerrero-Pico, 2020).
3. **Critical thinking:** Online informal learning encourages learners to question and analyse information critically. It helps them develop critical thinking skills (Goodsett, 2020).
4. **Information literacy:** Learners acquire information literacy skills through online research and analysis. They learn how to evaluate and use information from various sources (Polizzi, 2020).
5. **Digital literacy:** Online informal learning exposes learners to various digital tools and technologies. The exposure helps them develop digital literacy skills, which are essential in the digital age (Kmecová, 2020).

The study revealed that OIL is an effective way of developing 21CS among secondary school learners. It highlights how OIL provides learners with a flexible, engaging, and meaningful way to acquire 21CS. Moreover, it emphasises the importance of integrating OIL into the formal education system to enhance the acquisition of these skills. Nygren et al. (2019), therefore, advocate that teachers and educational policymakers should embrace OIL as a way of preparing learners for the digital age.

7.2.2.1 How Can Online Informal Learning Facilitate Development of 21st Century Skills Through the Activity Theory Lens?

According to the analysis in Figure 7.1 of the study's six online activity system components, the "Subject" is secondary school students participating in online informal learning, the "Object" is acquiring 21CS through OIL, the "Tool" is the use of online tools, such as social media tools, to mediate the execution of the informal online activity, and the "Rules" are the guidelines and

conventions governing activities, the “Community” is the system’s social environment, which comprises learners, online groups, friends, peers, and relatives, the “Division of Labour” denotes the division of activities among learners and other stakeholders in the system, while the “Outcome” is the acquisition of 21CS, in particular transfer of learning, through OIL, critical thinking, communication, collaboration, and other 21CS.

Moreover, secondary school students use online tools outside of the classroom to learn more about a specific topic, communicate with friends, share their opinions, comment on those of their peers, or even learn more about what they have already learned in class. Participants also mentioned that they even let their peers use their online learning resources.

The 4CS, which stands for creativity, collaboration, critical thinking, and communication, was used to conceptualise the study’s research and findings (Scott, 2015). Since secondary school students frequently use online tools, the study first showed that various OIL aid in the development of technical skills. Furthermore, as secondary school students from all grades use online informal tools to stay up to date with new technologies and practise, these skills are said to be dynamic.

Secondary school learners who are the main agents of the Online Informal Activity system are responsible for using online tools in which they can acquire knowledge, select their sources of information, and work autonomously, as supported by some participants in the study. The study’s results align with those raised by Schmidt and Tawfik (2022) in their discussion of AT’s broader context and culture. Schmidt and Tawfik stress the significance of comprehending how learners use online tools to engage in meaning-making and advance their comprehension of the world around them within a social context. According to Soloway et al. (1994), this perspective contrasts with more conventional, instructor-centric methods of teaching and learning and underscores the significance of the learner (Subject) to the learning process.

In a similar vein, in addition to the subjects themselves, other subjects participate in the OIL process as well, including other students with comparable interests, friends and family, teachers, parents, facilitators, and users of online communities. According to Yamagata-Lynch (2010), from the perspective of AT, activities are created through the interaction between subjects and the real environment and are intentional, social, mediated, multi-levelled, and purposeful. The theory

explains the role of individuals in the intersection of tasks (activity) and group-level work (action). Using the available tools to perform a task, a person engages in goal-directed behaviours under norms and processes, according to the analysis presented in Chapter 6. The division of labour provides another way for the community to relate to the item. Numerous studies, including those by Yamagata-Lynch (2010) and Schmidt and Tawfik (2022), provide evidence for this position.

AT as an analytical lens shows how the Subjects (secondary school learners) use online tools within the Online Informal Activity system and social context to engage in Online Informal Learning. Students in secondary schools interact with Objects using tools to obtain desired results (Said et al., 2014). For example, Participant 7A iterated,

I use mainly YouTube, Twitter, Google, Facebook, Snapchat, and eBay when I go online at home.

Participants in grades 10-13 stated that they use different tools and online sites to learn things informally, for example, Facebook for sharing information, WhatsApp (photos, notes, songs, games), YouTube (for watching music and videos), self-discovery learning connected to schoolwork and also for additional knowledge, and to listen to music as a hobby. Participant 12E commented,

I use Google Classroom extensively, Zoom for group classes, WhatsApp for chatting, Google for searching for information both related to schoolwork and self-learning, YouTube to watch videos; I listen to music during my free time, Yahoo, WhatsApp, Facebook to watch photos, videos, Instagram to see photos, chat with friends. I also use WhatsApp and YouTube to check tutorials and videos about other things to understand better what we learned at school.

Participants mentioned using various services informally, such as Facebook for information sharing, WhatsApp for photos, notes, songs, and games, YouTube for music and videos, self-

discovery learning related to academic work and for additional knowledge and listening to music as a hobby.

The remarks supported Engestrom's (2001) claim that by transforming learning using informal online activities and AT, people can embrace the potential for extensive learning and skill development. Additionally, they show that secondary school students engage in informal online activities with little to no context for their own actions (Kuutti, 1996). However, humans grow in skills, personalities, and consciousness because of their actions, which also alter the social environment, resolve conflicts, create new cultural artefacts, and create novel ways of being and being oneself (Samino, Daniels & Gutierrez, 2009).

The study revealed that secondary school learners engage in various activities, either academic or non-academic, within their social and cultural context. These activities involve the use of tools and resources to achieve goals, and they are shaped by the individual's goals, motivations, and the social and cultural context in which they occur, as supported by the study of Lioutas et al. (2019).

As reinforced by different remarks from the participants, subjects of the online informal activity system also indicated that they are more comfortable and find it more flexible to learn informally utilising online resources than within the classroom settings:

I find a lot of things that I like, and I learn it the way I feel is easier for me. [Participant 11B]

Learning is easier and faster since we have all the information at our disposal online. [Participant 12C]

Yes, I learn about many things happening in my country, and I find it easier to read online newspapers to know what is happening around me instead of reading newspapers. [Participant 11D]

We can get information quickly. Apart from what the teacher taught us at school, we can work in groups, learn to draw different things by ourselves. [Participant 10E]

I use online tools to learn a lot of new words for my English and French and Yes, I use online tools for my projects to look for photos and more information as well as I learn better when I read more on the internet than in a book. [Participant 12A]

When we communicate with our friends and work in groups on WhatsApp, we can also give our views and tell what we think about WhatsApp. It is easier to describe our views and thoughts on different things. [Participant 11A]

I can learn whenever I want and on any topic. If I haven't understood a topic, I can still learn it by looking for notes on the internet. [Participant 11A]

These results support the findings of studies by Alexander (2006) and Thompson (2007) on learning flexibility and comfort with performing OIL. Many students have stated that online tools are flexible and simple to use, and they like getting used to new technology because they don't require a lot of technical knowledge (Camberlion, 2022). When it comes to general information, other learners are especially drawn to OIL tools and independent learning.

With increased online learning and remote work, it's critical to comprehend how people feel about how simple learning is and how comfortable they are using these resources. Numerous factors, according to research, influence people's comfort level when using online tools. First, people's comfort level is greatly influenced by how simple it is to use Internet tools. Users are more likely to adopt and accept online tools that are simple to use and intuitive. First, people's comfort level is greatly influenced by how simple it is to use Internet tools. Users are more likely to adopt and accept online tools that are simple to use and intuitive. For instance, Dutta et al. (2021) argue that users prefer using online tools that are easy to use and have clear navigation over those that are more complex and challenging to use.

Second, the ease of learning and comfort levels with online tools can be greatly impacted by the accessibility of online materials and support. Users are more likely to feel comfortable using online tools when they have access to helpful materials and can get assistance when needed. Support can come such as online help centres, user manuals, and tutorials, Sharma et al. (2020) maintain. Third, individuals' prior experience with online tools can also influence their comfort level. Those who have had more exposure to online tools tend to be more comfortable using them, while those who are less familiar with online tools may feel more apprehensive. The finding highlights the importance of providing adequate training and support for individuals who are new to using online tools (Rahmani et al., 2023).

The section concluded by highlighting how OIL offers students a flexible, interesting, and valuable method to learn 21CS. Several variables, such as the tool's usability, the accessibility to online help and resources, the users' prior experience, and the tool's design, affect how simple it is to learn how to use and how comfortable they feel using online tools. By being aware of these elements, designers and educators may produce online resources that are more efficient and more pleasant for secondary school students to use.

7.2.2.2 Applying and Following Rules.

A key component of the Online Informal Activity system, according to an analysis of the qualitative findings, was that secondary school students learned to apply and follow appropriate rules by using ethics, copyright, respect for others' privacy, appropriate language, respect for peers' emotions, and safe netiquette when sharing information.

These results are related to the AT's "Rules" component, which shows that secondary school students were aware of the need to follow the right rules when engaging in online informal learning. These guidelines are specifically utilised by secondary school students to encourage peer social interaction and, as a result, greater communication, and teamwork. Participants expressed both negative and positive views when applying proper netiquette during OIL like expressing their emotions and how they feel less stressed and relaxed when they are communicating through online tools. Many participants were more comfortable expressing their feelings with the use of emojis. Comments by Participants 8D, 7A, 9D and 12B support this finding,

I feel less shy to give my opinions on chat groups rather than in class. [Participant 8D]

I share interesting videos from YouTube with my friends. Do not forget smileys and emojis. I only use text, pictures, and notes. However, I am also scared that someone may copy my work or ideas and put it in their own work. [Participant 7A]

I can also type very quickly. And use emojis. I can communicate with my friends but by respecting their privacy at the same time. [Participant 9C]

I feel less stressed about communicating over WhatsApp and write my messages with funny, sad or any other emojis and I want to express my feelings. [Participant 9D]

I can express myself better in Creole, English or French...easier in Creole. With the emojis and so on. [Participant 12B]

Additionally, the participants encountered some detrimental barriers when they disobeyed OIL's rules. Lack of or excessive parental control, diversion, preference for formal education, OIL addiction, stress from connectivity issues, disregard for privacy, bullying through communication or group chat, health issues, inability to control the learning process, and confusion brought on by an abundance of data were among them. Parental control can be witnessed in the following comments:

My parents are trying to block me from YouTube to the pressure of studies. I am also trying to avoid any kind of distraction. [Participant 11A]

I have fun but learn a little at the same time. That's why my parents took my mobile away. [Participant 9C]

Participant 10A admitted to being easily distracted,

Sometimes we can control what we learn but other times we get easily distracted.

Some students experienced stress due to connectivity problems or picked up a lack of privacy. The finding was supported by the following comments:

When we chat, some friends do not know how to talk. They do not respect others.
[Participant 9D]

They also do not respect other people's privacy. Low connection problems. I am also sometimes addicted to the internet. We tend to spend too much time, hence neglecting other things. [Participant 13B]

I get stressed when I get connectivity problems. [Participant 11A]

We can easily get distracted and neglect our studies. Sometimes we do not get internet, or it is too slow. [Participant 11B]

A preference for formal learning and addiction to OIL was noted by other participants:

I got a lot of problems with my parents since I was spending too much time on the internet and mobile. So, we may get addicted to social media sites and games. [Participant 7B]

We can spend a lot of time surfing and learning nothing. [Participant 11D]

It takes time to look for things online. Then our schoolwork is neglected. [Participant 12A]

If we spend too much time on online tools, our school grades might be affected. [Participant 13A]

No, sometimes, I get more confused when I learn something online instead of at school. [Participant 8B]

I waste too much time on the net. [Participant 7C]

No, I prefer the help of my teacher to learn my subjects. [Participant 7E]

The research showed that secondary students might learn 21CS by utilising the technical elements found in the Tools component of the AT. A variety of communication channels or media, including text, audio, video, graphics, and interactive media, are made possible by these technical qualities. The tools component collaborates with other components in various AT sub-triangles to help secondary school students build their 21CS. The richness of data refers to the amount and quality of information conveyed through these channels, including the level of detail, complexity, and ambiguity. Handwritten communication may be less rich because it lacks these features and relies more on the reader's interpretation and context.

However, the richness of a medium also depends on the nature of the message and the task at hand. Some messages may be more suited for certain media than others, depending on factors such as urgency, complexity, and emotional tone. For instance, a quick text message may be more appropriate for a simple message that requires a prompt response, whereas a face-to-face meeting may be better for a sensitive or complex issue that requires detailed discussion and clarification (Wang Wang, 2022).

Moreover, new media forms that combine various rich and varied elements have emerged because of technological advancements and media convergence, including virtual reality, social media, and videoconferencing. These media may present one-of-a-kind chances for interaction and

cooperation, but they also present new difficulties and the need for fresh approaches to be used effectively (Baa Reis & Ashmore, 2022).

In conclusion, media variety and richness of data are important factors to consider when choosing and using communication channels for different purposes and contexts. By understanding the strengths and limitations of different media and adapting to new forms of technology and media convergence, secondary school learners can enhance their communication effectiveness and achieve their goals more efficiently.

7.2.2.3 Socialisation and Interaction with Peers within Non-School Settings.

According to the participants, online tools also enable secondary school learners to communicate or even socialise with other peers at their school or other schools after school time or even during the weekends as pointed out by some participants,

News is instantly available. We also share a lot of things of interest on the group, for example songs, notes, videos, news for example No school communique. [Participant 8B]

We can communicate with families and friends and work in groups even after school. [Participant 7A]

I also tell my views when I chat in groups. It improves my intelligence. When I tell my thoughts and views when I chat online. I chat a lot with my friends online when we do not have the time to talk at school. [Participant 12C]

When we play online games, then we play in groups to spend time together or when we share notes, then we do it in groups. [Participant 9B]

Yes, we are more comfortable to talk and express our views in online groups than in class. [Participant 11A]

Another conclusion was that the Division of Labour, another feature of the OIL activity system, is illustrated by working in groups, being a part of a community, and sharing information. It primarily relates to the functions, responsibilities, and power dynamics of the many subjects within the OIL system. The investigation's findings indicate that secondary school students typically learn more effectively in social groups than they do individually or even in the classroom. The finding is further illustrated by the following comments:

We work in groups and learn more among ourselves by sharing what we know and learn what we do not know. [Participant 7B]

When we communicate with our friends and work in groups on WhatsApp, we can also give our views and tell what we think. On WhatsApp, it is easier to describe our views and thoughts on different things. [Participant 9D]

When we work in groups, we get more ideas from our friends. We learn more how to do things quicker and share our ideas. [Participant 11B]

We can also work in groups, not only wait to work at school but also at home after school. [Participant 9A]

We can also work in groups for a project or to discuss something since at school we don't get time. [Participant 11B]

Many participants mentioned how they frequently collaborate in groups to complete a given project. When a certain school project needs to be completed, they frequently split the duties. Each group participant is then given a portion of completing ad hoc online at home, where they later combine and share what they have learned. Several comments support this finding:

It usually encourages me to go and find out more and more on the internet about different things when we get projects at school. We go and do research on the internet where we learn a lot of things. We usually divide the work, work on our own at home looking for information and solutions on the internet and share our ideas at school. [Participant 13A]

Learning online at home is one of the main things I do, especially when we get group projects in design and technology. Each one of us does a small part of the work. Then we merge it all together. Usually, there is a leader in the group all the time. [Participant 10A]

The findings show that students in secondary schools use Internet resources to pique their curiosity and study more and more. They are constantly interested in learning about the nation, the outside world, and even how to fix things and prepare food. The finding is expressed in the comments that follow:

I am more encouraged and curious to look for answers on the net and to communicate through Zoom since reading one thing always leads us to other interesting things. [Participant 10A]

I am always curious to learn new things and watch new videos on YouTube, Instagram, and Facebook ... laugh... When I watch one video, I always want to watch another one. [Participant 10B]

I always want to learn more and more things about mobile phone repair hacks and PC repair by watching on YouTube. [Participant 12C]

The results also indicate that socialisation and interaction with peers outside of school settings play a crucial role in shaping an individual's personality and behaviour. It also supports vital language and other cultural skills. Socialisation and interaction with peers outside of school settings is mentioned by several participants:

During my leisure time, I watch documentary films online to enrich my English or French. [Participant 10A]

I learn about things that are not usually talked about at school, for example, news around the world and discovering things. Online news on BBC news to learn about what is happening around the world. [Participant 13E]

I use online tools to learn a lot of new words for my English and French. I also use online tools for my projects to look for photos and more information. I learn better when I read more on the internet than in a book. [Participant 8B]

I usually learn English and French when I watch videos on YouTube. I prefer to watch videos on YouTube than to read to learn something. [Participant 10B]

If we want to improve our French, we need to watch and reach French stuffs online. To some extent, I know how to write the words and how to better talk in French. Also, for English. [Participant 10D]

It has helped me improve your oral skills and the way I write when I communicate both in terms of Creole, French or English. [Participant 12A]

There are also Google docs which I use for school such as English essay writing. Yes, and also French. [Participant 13B]

We can improve our general knowledge by reading things on the net. For example, I learned about historical events in other countries, their different cultures. [Participant 13E]

Learners can communicate with their peers in less formal settings outside of school, such as community groups, sports teams, and extracurricular activities, where they can build crucial relationships and social skills. Those learners who participate in extracurricular activities are more likely to gain leadership qualities, teamwork abilities, and a sense of responsibility, according to studies (Lorenz et al., 2020). Similarly, people who are a part of community organisations and athletic teams frequently have a strong feeling of social identification and belonging.

However, it is important to note that socialisation and interaction with peers outside of school settings can also have negative effects on an individual's development. For example, peer pressure and social comparison can lead to risky behaviours, such as substance abuse or delinquency. Additionally, exclusion and bullying within social groups can have detrimental effects on a learner's mental state and health (Alwaely et al., 2021). To promote positive socialisation and interaction with peers within non-school settings, it is important for parents and caregivers to encourage participation in activities that align with the individual's interests and values. Parents and caregivers should also educate their children about the importance of healthy relationships and guide how to handle peer pressure and bullying (Jose et al., 2021).

In conclusion, socialisation, and interaction with peers within non-school settings can have quite a significant effect on learner development. While these settings provide opportunities for positive social experiences, they can also have negative consequences. Therefore, it is important to promote positive socialisation and provide guidance and support to ensure healthy relationships and behaviours.

7.2.2.4 Learning for Fun.

Both qualitative and quantitative results show that secondary school learners find OIL as “another way of learning which is more fun while watching videos and learning at the same time than listening to the teacher in class.” The study found that learners use online tools and social media during their leisure time by reading for fun, while simultaneously learning new things and enriching their knowledge. As stated by Participant 11C,

I think learning online is part and parcel of our education since it is also important while having fun. Often, we have a discussion about a school topic on WhatsApp. We also chat to have fun.

A popular method of teaching that has received a lot of attention recently is learning for fun. The idea behind learning for enjoyment is that people are more likely to remember material if they actively participate in learning and find it entertaining. Studies repeatedly demonstrate that when learning is fun, people are more driven to study and are more likely to retain what they have learned (Yarberry & Sims, 2021). The reason for the phenomenon is that the brain is wired to release dopamine, a neurotransmitter associated with pleasure when we engage in activities we enjoy. Dopamine release aids in the strengthening of brain connections, which can facilitate information retention.

Furthermore, learning for pleasure may also encourage a passion for learning, which can inspire a lifetime interest in learning. People are more inclined to seek out new knowledge and keep learning throughout their lives when they are actively participating in the learning process. Learning for fun can take many forms, such as playing games, participating in hands-on activities, or exploring topics that interest individuals. For example, individuals may find it fun to learn about history by visiting historical sites, or they may enjoy learning about science by conducting experiments (Maiorca et al., 2021).

It has been demonstrated that learning for enjoyment has several advantages for people of all ages. Researchers in one study showed that those who engaged in learning activities for enjoyment, such as playing brain-training games, showed gains in their cognitive abilities, including memory, attention, and processing speed (Hisam et al., 2018). These improvements were particularly pronounced in older adults, suggesting that learning for fun may be an effective way to maintain cognitive function in ageing populations (Shaby et al., 2021). Learning for pleasure also aids in the development of crucial abilities like creativity, problem-solving, and critical thinking. When individuals engage in activities that are enjoyable and stimulating, the chances are higher that they will face challenges with a positive attitude and be more creative in finding solutions (Tang et al., 2020).

Moreover, learning for fun can assist individuals in developing social connections and a sense of community. Activities such as book clubs, discussion groups, and hobby clubs can provide opportunities for individuals to connect with others who share similar interests, which can be particularly important for individuals who may feel isolated or lonely (Matthee & Turpin, 2019). However, Alkhatib (2019) cautions that one challenge with learning for fun, however, is ensuring that individuals are still learning valuable and accurate information. While it is important for learning to be enjoyable, it is also essential that the information being learned is accurate and relevant. Therefore, it is important for educators and individuals to be mindful of the sources of information and the quality of the content being learned.

Overall, learning for fun can have numerous benefits for individuals of all ages, from improving cognitive function to developing important skills and social connections. By engaging secondary school learners in enjoyable and stimulating activities, learning for fun has the potential of being used in OIL as a complement to formal education and a critical avenue for lifelong learning.

7.2.2.5 Subject Engagement.

The analysis of the results also revealed that through OIL, secondary school learners are encouraged to go and find information on the internet about a variety of things that they did not understand when they got projects at school. Online tools such as video tutorials, websites, and online notes can help them to better understand general topics, subjects and course works. The view is supported by Participant 13A, who stated,

I have learned how to cook different food at home. Learning online at home has also encouraged me to complete my work from school, especially when we get projects in Design and Technology; News is instantly available. We also share a lot of things of interest in the group, for example, songs, notes, videos, news, for example, no school communicate.

Effective learning relies heavily on subject engagement. It is defined as the level of commitment and involvement that students have in their learning process. The study aimed to discover how

subject engagement affects student outcomes and academic achievement. The results revealed a link between learners' academic achievement and topic engagement. Higher grades and test scores were obtained by students who expressed greater degrees of interest in their studies. Additionally, learners who perceived engagement as important were more likely to engage in class and complete their assignments (Dunn & Kennedy, 2019).

The interviews with teachers revealed several strategies for promoting subject engagement, including:

1. Creating a supportive and inclusive classroom environment
2. Providing opportunities for active learning and learner-centred activities
3. Giving learners a feeling of ownership and power over their learning
4. Incorporating real-world examples and applications of subject material

The study's findings support the notion that subject engagement is crucial for learners to succeed. According to the findings, teachers can significantly influence student involvement by fostering a welcoming, inclusive environment and offering opportunities for active learning. Giving students a sense of control and ownership over their education is also crucial (Ibáñez et al., 2020).

Finally, it should be noted that student outcomes in secondary school and academic performance are both highly dependent on subject engagement. Teachers can encourage engagement by fostering an accepting and welcoming learning environment in the classroom, offering chances for active learning, and giving students a sense of control over their education. By encouraging engagement, teachers can assist secondary school students in achieving their academic objectives and creating a lifelong love of learning.

7.2.2.6 Development of Communication Skills Through OIL.

According to the findings of the interviews, secondary school students use online tools to communicate frequently. They prefer WhatsApp because it is easy to use and allows them to send pictures and emojis, and they use a variety of methods to talk to their friends and teachers. Through trial and error, they have discovered how to communicate with their friends more effectively by exchanging notes and other messages via WhatsApp and Instagram. The finding indicates that the

communication skills of secondary school learners are improved using OIL and through a variety of online tools. Participant 10A was enthusiastic about this method of communication,

I can communicate more with my friends by sending photos and videos. It is also quicker than phoning or talking at school since I get more time to chat.

The recent rise of online learning platforms provides people with access to an abundance of information and opportunities to learn new skills. One of the key skills that can be developed through OIL is communication. In the study, the researchers explored the effectiveness of OIL in developing communication skills.

1. **Access to diverse resources:** OIL gives users access to a wide variety of resources, including videos, articles, and discussion forums. The exposure to diverse types of content can help learners develop their communication skills by providing them with a variety of perspectives and modes of communication (Kumar and Nanda, 2022).
2. **Flexibility:** Online learning offers flexibility in scheduling and pacing, which allows learners to practice their communication skills in a comfortable and stress-free environment. As a result, it can lead to increased confidence and better communication outcomes (Kukulska-Hulme and Lee, 2019).
3. **Collaborative learning:** OIL also facilitates collaborative learning, which can help learners develop their communication skills by providing opportunities to practice communication in a group setting. Collaborative learning can also expose learners to different communication styles and help them develop their own style through feedback and reflection (Archambault et al., 2022).
4. **Tailored learning:** Online learning platforms can provide personalised learning experiences that are tailored to the learner's needs and preferences. Consequently, tailored learning can help learners develop their communication skills by providing targeted feedback and customised resources that address their specific areas of improvement (Hubbard, 2019).

In conclusion, OIL can be an effective way to help secondary school learners develop communication skills. Its flexibility, access to diverse resources, collaborative learning, and tailored learning opportunities make it a valuable tool for those seeking to improve their communication competencies. However, it is important to note that online learning should be used in conjunction with real-life communication experiences to ensure the development of well-rounded communication skills.

7.2.2.7 Development of Creativity through OIL.

Many participants agreed that using online tools to learn outside of school settings helps them in “doing their projects, FNT, design, to get different photos, to learn on their own how to build things by watching tutorials”. Their imagination is stimulated by this, especially while they are cooking, sketching, or working on projects. They both said that OIL platforms, including social media apps like Facebook and Instagram, helped them to be more creative. Several participants confirmed the results:

Yes, I have become more creative by looking for videos on how to draw and I learned how to draw things or build a house for my design project work. [Participant 13A]

Technology is better than when we do or learn something manually, like at school. Like if we are doing a project, we get a lot of creative and innovative ideas on Google and YouTube that help us to complete our project so that we can get more marks. [Participant 12A]

Creative in how we can look for a lot of things that interest us not related to our studies. [Participant 13B]

Yes, now I know how to cook a lot of food by looking at video channels on YouTube. I am interested in how to cook and decorate my plates. [Participant 13E]

But I learn a lot of informal things on YouTube by watching videos. It improves my creativity. Understanding is the key. [Participant 10B]

My football techniques have improved through YouTube and Instagram. [Participant 12A]

Lately, there has been a growing interest in using OIL environments to promote creativity. Informal learning refers to self-directed, non-formal learning that takes place outside of traditional classroom settings. OIL environments, such as online communities, social media platforms, and open educational resources, provide learners with opportunities to engage with diverse perspectives and develop their creativity in a more flexible and personalised manner (Cha & So, 2020).

The study's results indicate that OIL settings are beneficial for the growth of creativity. A variety of creative activities, such as content production, teamwork, and discovery, are made available to learners. They can engage with many communities while also having access to a wide range of resources, which can foster the growth of fresh viewpoints and ideas (Ndawonde, 2022). The use of OIL environments can also promote learner autonomy and self-directed learning, which are key factors in the development of creativity. Learners can pursue their interests and engage with topics that are relevant to their personal and professional goals, which can enhance their motivation and engagement (Morris, 2019). Furthermore, the study found that OIL environments can facilitate the development of emotional skills, which are crucial for creativity. Through online interactions, students may also hone their collaboration and communication abilities, which can enhance their ability to work effectively in teams and generate new ideas (Coll & Coll, 2019).

These results imply that OIL settings can foster the development of creativity. The utilisation of these environments can give secondary school students the chance to participate in a variety of creative activities, access many resources, and hone essential abilities for creativity. The precise mechanisms through which OIL settings might foster creativity and the variables that may affect these surroundings' efficacy in various contexts require further study.

7.2.2.8 Development of Critical Thinking Skills through OIL.

Many participants felt that using online tools to help them look for solutions on YouTube or Google helps OIL contribute to the development of their critical thinking skills. They are, therefore, equipped to handle a situation on their own. Additionally, they take their time to learn new things by reading online or watching tutorials that aid in their comprehension. Koruklioglu et al.'s 2022 study found that online tools or Web 2.0 tools had a positive impact on the participants' critical thinking skills.

A critical talent for success in both professional and personal life is critical thinking. The increasing use of OIL platforms has created an opportunity for individuals to develop their critical thinking skills. The study sought to determine how OIL affected the growth of critical-thinking abilities. Several studies have shown that OIL can significantly contribute to the development of critical thinking abilities. For example, research conducted by Wang and Liu (2018) found that online discussion forums can help learners develop their critical thinking skills. The study reported that learners who participated in online discussion forums were more likely to ask questions, analyse information, and evaluate arguments than those who did not.

Another study by Zhu and Zhang (2017) examined how OIL affected undergraduate students' critical thinking abilities. The study discovered that OIL could enhance critical thinking abilities in several domains, including creativity, problem-solving, and decision-making. According to a 2018 study by Van den Brink-Budgen, OIL may aid students in honing their critical thinking abilities by encouraging metacognition. The capacity for self-reflection on one's own learning and thought processes is referred to as metacognition. According to the study, students who participated in OIL were more inclined to reflect on their own learning and thought processes, which promoted the growth of critical thinking abilities.

In conclusion, the findings of various studies suggest that OIL can significantly contribute to the development of critical thinking skills. Online discussion forums, problem-based learning, and reflective activities are some of the effective approaches to promoting critical thinking skills development through online informal learning. As the use of OIL platforms continues to grow, it is essential to further explore how these platforms can be used to promote critical thinking skills development in secondary school learners.

7.2.2.9 Development of Collaboration Skills through OIL.

The analyses' findings showed that OIL might enable secondary school students to participate in learning activities that will not only enhance learning processes but also the general learning experience. The finding is corroborated by various comments, including:

We often work in groups on a project or to discuss something since at school we don't get time and when we work together, we do the work quicker and better. [Participant 7B]

I chat every day on WhatsApp to work in groups and share notes since when we share notes among ourselves; we help each other to understand better. [Participant 9C]

When I learn something together with my friends, it stays in my mind longer. [Participant 10E]

When we work in groups, we can understand better a topic. [Participant 10D]

Yes, we share a lot of notes, pictures, and videos online with our friends when we work in groups. This is a way to show that we are contributing to the project work a lot by sharing a lot of interesting things related to schoolwork and others as well. I use WhatsApp a lot to share pictures, videos, and notes. [Participant 11A]

The advancement of technology has changed how people study, communicate, and work together. OIL has gained popularity as a tool for honing collaborative abilities. The impact of OIL in fostering collaborative skills is investigated in the study. The study's findings suggest that OIL can be a helpful tool for encouraging collaboration and fostering teamwork. Participants said their ability to communicate, actively listen, negotiate, and resolve conflicts had improved. Online group activities, such as discussion forums, group assignments, and videoconferencing, facilitated collaboration and provided opportunities for participants to practice their skills (González-Lloret, 2020).

Moreover, the research results also showed that elements including the frequency of online learning participation, the calibre of online interactions, and the amount of support offered by the online community all had an impact on the development of collaborative abilities. OIL is a useful tool for honing collaborative abilities. The study's conclusions imply that online group interactions and activities give participants a chance to hone and strengthen their collaborative abilities. However, the quality of online interactions and the level of support provided by the online community are crucial elements that affect the development of collaboration skills (Onyema et al., 2019). Overall, the research findings highlight the potential of OIL as a means to develop collaboration skills and the importance of creating supportive and engaging online communities.

7.2.2.10 Development of social skills through OIL.

The analyses' findings led the researcher to conclude that OIL could enhance students' social abilities. OIL is gaining popularity and is a special chance for people to improve their social skills. Success in today's society depends on having strong social skills, and OIL may offer a secure and encouraging atmosphere for people to develop these abilities.

1. **Online Informal Learning can improve communication skills:** One study found that OIL can help individuals develop better communication skills, including active listening, empathy, and assertiveness. These skills are essential for building relationships and resolving conflicts (Yu et al., 2021).
2. **Online Informal Learning can improve social cognition:** Another study found that OIL can improve social cognition, which refers to the ability to understand and interpret social cues. Social cognition is crucial for developing and maintaining social relationships (Mehall, 2020).
3. **Online Informal Learning can improve teamwork skills:** A third study found that OIL can improve teamwork skills, including collaboration, cooperation, and leadership. These skills are important for success in both personal and professional contexts (Jurkovič, 2019).
4. **Online Informal Learning can increase social support:** A fourth study found that OIL may boost social support, which is the emotional and practical assistance that people get

from other people. Social support can help individuals cope with stress and improve their mental health (Peters & Romero, 2019).

5. **Online Informal Learning can promote social integration:** Finally, a fifth study found that OIL can promote social integration, which refers to the process of building and maintaining social networks. Social integration can help individuals feel a sense of belonging and improve their overall well-being (Holland, 2019).

Overall, the results of the research point to OIL as a potential tool for social skill development. OIL can help people flourish in both personal and professional environments by enhancing secondary school learners' communication abilities, social cognition, collaborative skills, social support, and social integration. It is critical to investigate OIL's potential for social skill development as it gains popularity.

7.2.2.11 Self-directed Learning / Flexibility in Learning

Participants of different grades were asked whether they use online tools to learn informally anywhere and anytime without the help of their teacher. Many participants stated that they can self-manage their time while learning online informally. They had the following to say:

We get easily and quickly the answers anytime and anywhere we want, even during school time or after school. [Participant 7C]

We can refer to our notes since we already have it on our online tool. [Participant 8B]

I can work on my own. I don't need to ask anyone. [Participant 10A]

Instead of waiting for school time to ask our teachers questions, we can do it during the day at home. [Participant 8A]

Even during recess, now I spend my time watching a video or reading something online by using mobile data on my smartphone. I also often do it on the bus while travelling. [Participant 9E]

There are many things that I learn to use by myself online by looking for the solutions on the internet. [Participant 10A]

From the comfort of our homes or outdoors, we can communicate better on WhatsApp or Instagram. [Participant 12A]

I usually learn without the help of anyone. I know that we need to learn by ourselves. [Participant 11B]

The finding corroborates Butarbutar et al.'s (2021) statement that the ability to operate new software automatically demonstrates the development of self-learning abilities. A similar opinion is held by Layton (2000) who iterates that computers and online tools have permanently altered secondary school learners' learning environments, temperaments, and ideas about work and play.

1. Self-directed learning is a process where people take charge of their own education, defining their own objectives, finding their own resources, and monitoring their own progress. It is a critical skill in today's rapidly changing world, where individuals must be able to adapt and learn quickly to keep up with new developments in their field (Geng et al., 2019).
2. Self-directed learning is associated with several outcomes, including improved academic performance, increased motivation, and greater confidence in one's abilities. It is also linked to better career prospects, as employers value individuals who can take initiative and learn on their own (Shafait et al., 2021).
3. Flexibility in learning is a vital component of self-directed learning. It refers to the capability to adapt to changing circumstances and adjust one's learning strategies

accordingly. This might include being able to switch between different learning modes (e.g., reading, watching videos, attending lectures), or adjusting one's schedule to accommodate other commitments (Tang et al., 2022).

4. One key advantage of flexibility in learning is that it allows individuals to tailor their learning experiences to their own needs and preferences. Tailoring their experiences can help to increase engagement and motivation, as individuals are more likely to be invested in learning that is relevant and meaningful to them (Briede, 2019).
5. Technology has significantly contributed to the availability of flexible, self-directed learning. Online courses, digital resources, and social media platforms have made it easier than ever for individuals to access information and connect with other learners around the world. Self-directed and flexible learning has opened up new opportunities for lifelong learning and professional development (Kim, 2021).

Overall, the ability to learn independently and adapt to changing circumstances is crucial for success in today's environment. Secondary school students can accomplish their objectives and maintain their competitive edge by taking charge of their own learning and being flexible in their approach.

7.2.2.12 Development of Information Literacy through OIL.

Participants were asked how much OIL could improve their knowledge and help them use information efficiently to complete a task. Many respondents indicated favourably that they have a lot of information:

It also boosts our general knowledge and, of course, our intellectual capabilities.
[Participant 7A]

We can also acquire a lot of knowledge through more research online. [Participant 7C]

Also, if we don't know something, for example, when we search on this specific topic, we find more concepts on this topic. [Participant 9A]

We can get all sorts of information. I learn how to draw things on my own. News is instantly available. [Participant 10D]

It helps us to complete our projects at school by looking for additional information and ideas. It gives us more details when we have something to do without the help of our teacher, on our own when I go on the internet. [Participant 11A]

The development of information literacy is critical in today's digital age, where access to information is abundant but not always reliable. OIL has emerged as a promising avenue for individuals to develop their information literacy skills outside of traditional educational settings. According to research, OIL can successfully encourage the growth of information literacy abilities. Participating in online activities like social media, blogging, and online forums might enhance information assessment and analytical skills, according to a study by Galvin and Greenhow (2020). Using online tutorials and guides can improve information-seeking and retrieval abilities, according to Chugh et al.'s (2021) study.

OIL can also aid in the development of crucial information literacy-related attitudes and behaviours. For instance, participating in online communities and collaborating with others can foster a sense of responsibility for one's own learning and an appreciation for diverse perspectives (Masanet et al., 2019). However, not all OIL activities are equally effective in promoting information literacy development. Research suggests that activities that involve active engagement and reflection, such as creating and sharing content, are more likely to result in meaningful learning outcomes (Marsh, 2019).

Given the exponential increase in the amount of information available, information literacy is a crucial skill in today's society. OIL offers access to a plethora of information and resources in a flexible, self-directed environment, making it a potent tool for fostering information literacy skills. According to studies, OIL can be useful for fostering information literacy in a range of situations.

For example, one study found that online discussion forums can help learners develop critical thinking skills and improve their ability to evaluate sources of information (Nascimbeni & Vosloo, 2019). Another study discovered that using social media can help develop information literacy skills by encouraging learners to engage with a variety of perspectives and sources of information (Goodsett, 2020).

The efficiency of OIL for enhancing information literacy skills is largely dependent on several important elements. These include the use of engaging and interactive materials, the declaration of specific learning objectives, and the accessibility of support and feedback. Additionally, according to Croucher et al. (2022) learners who are motivated and self-directed are more likely to succeed in honing their information literacy skills through OIL.

Overall, these research findings highlighted the potential of OIL as a valuable instrument for promoting the development of information literacy abilities. However, it is important to approach such learning opportunities critically and to be aware of the potential risks associated with online information sources. Ongoing research in this area can help to inform best practices for using OIL to support information literacy development.

7.2.2.13 Development of Digital/ Technological Literacy through OIL.

Digital literacy is seen as essential in the 21st century for individuals to successfully complete activities in their professional and personal lives, and it becomes much more crucial in online learning environments (Karagul et al., 2021). When conducting the analysis, secondary school students were asked if learning online outside of the classroom helped them develop and advance their technological or digital literacy. Their responses included:

We communicate better with our group friends. Hence, it improves our typing skills and the way we use our online devices. [Participant 7B]

Learning online has helped me to use my PC and mobile better. Now I can make better use of technology. [Participant 13C]

I also use online tools to learn animations and play computer games during my leisure time. Chat with friends. I can share photos with my friends on WhatsApp and Instagram. I also want to say how I learned how to make a digital thermometer on my own for my biology class. [Participant 13E]

The analysis's findings showed that when secondary school students perform OIL, their literacy improves. The finding is consistent with Ledgerwood's (2022) opinion that most secondary school learners have mastered several online Informal tools including blogs and Social Networking sites since they are daily or frequently engaged with them in their personal lives.

Technology and digital literacy are becoming essential aspects of contemporary life. OIL offers a flexible and accessible platform for people to improve their technological and digital literacy considering the growing dependency on technology and the Internet (Peimani & Kamalipour, 2021). OIL provides numerous benefits for individuals looking to develop their digital/technological literacy. First, it is accessible to anyone with an internet connection, regardless of their geographic location or educational background. Therefore, it is an inclusive learning platform, enabling individuals from diverse backgrounds to acquire new digital/technological skills (Alea et al., 2020; Lembani et al., 2020). Second, OIL is flexible, allowing learners to fit their learning around their existing commitments, such as extracurricular activities or family (Henry, 2020). Finally, the use of online resources, such as video tutorials and online forums, enables learners to access a wide range of information and expertise, making it easier to learn at their own pace (Ma and Liang, 2019).

OIL has its advantages, but there are also some drawbacks to take into account. First, a lack of organisation might make it challenging for students to maintain motivation and keep up with their

academic objectives (Rahiem, 2021). Second, there is a chance of receiving inaccurate information because internet sources might not always be trustworthy or accurate (Alkhatib, 2019). Finally, the absence of connection with instructors and classmates may restrict opportunities for collaboration and feedback, both of which are crucial for efficient learning (Rashid et al., 2019).

To maximise the benefits of OIL and overcome the challenges, there are some effective strategies that learners can adopt. First, setting clear learning goals and creating a structured learning plan can help learners stay motivated and focused. Second, using reputable online resources and seeking guidance from experts in the field can help learners avoid misinformation and develop a deeper understanding of the subject. Finally, engaging with online communities, such as forums or social media groups, can provide opportunities for feedback, collaboration, and networking with like-minded individuals (Faix and Fyn, 2020; Hennekam et al., 2020; Rahiem, 2021).

In conclusion, OIL has several advantages for secondary school students who want to improve their technological and digital literacy. To maximise their learning outcomes, students must know of the difficulties and use practical techniques. Learning new digital/technological skills, which are becoming more and more crucial in the contemporary world, is possible through this method.

7.2.2.14 Peer/ Emotional Support.

During the interview, participants were asked whether OIL could also contribute to improving or deepening the relationships among friends in a group or while communicating. They were also asked whether they get peer or emotional support from their friends when in need using online tools. Two participants iterated the following:

I usually chat with some of my teachers to discuss problems related to my study, of course.... They are always here to help me. [Participant 13C]

Most of the time, I get the help and advice of my friends when I do not understand something. [Participant 13E]

In OIL contexts, peer assistance was found to be a key element in fostering learning. Students who received peer assistance during online group projects reported higher levels of engagement and satisfaction with the learning experience than students who did not receive peer help, according to a study by Youde (2020). Peer assistance was found to improve students' social presence and sense of community, which aided in their learning and motivation.

Additionally, emotional support has also been identified as a critical component of successful OIL experiences. In a study by Deng & Benckendorff (2021), emotional support from peers was found to be positively related to learners' perceived learning outcomes, such as their understanding of course content and their ability to apply what they learned in real-world situations. Emotional support was also found to be associated with learners' satisfaction with the learning experience and their intention to continue participating in the online learning community.

However, it is important to note that the effectiveness of peer and emotional support in OIL may depend on various factors, such as the nature of the learning activities, the characteristics of the learners, and the design of the learning platform. For example, research conducted by Kim et al. (2020) found that the level of peer support received by learners was higher in a platform that provided features for communication and collaboration among learners, compared to a platform that only offered course materials for self-paced learning.

Overall, these findings suggest that peer and emotional support are important factors to consider while designing and implementing OIL environments. Providing chances for secondary school students' engagement, contentment, and academic performance in these contexts may all be improved by connecting with and supporting one another.

7.3 Why Does Online Informal Learning Influence Secondary School Learners' 21st Century Skills the way it Does?

A collection of abilities known as 21CS enables people to prosper in a technological environment that is always changing. For students, especially those in secondary schools, acquiring these abilities is essential as they get ready for their future careers and personal development. OIL (OIL) has become a well-liked method for secondary school students to gain these skills. First, OIL offers a flexible and individualised learning experience that is not always possible in regular classroom

settings. Flexibility allows learners to set their own pace and focus on their individual interests. In a study conducted by the National Research Council (2009), researchers found that informal learning environments, such as online communities, allow learners to develop a feeling of control and ownership over their learning experience. Ownership and control can lead to a more enthusiastic outlook on education and increased motivation to acquire 21CS (Jurkovič, 2019).

Second, learners acquire 21CS through OIL because of the availability of a considerable number of resources. One can access a plethora of resources through online learning environments, including videos, interactive simulations, and online communities. These resources offer learners the opportunity to explore topics in greater depth and to engage with a wider community of learners who share their interests. According to a study by the University of California, Berkeley, learners that engage in OIL are expected to be highly satisfied with their learning experience, and they are more likely to feel that they are gaining valuable skills (Mehrvarz et al., 2021).

Third, OIL provides learners with the chance to improve their problem-solving and critical thinking abilities. Students who participate in online communities are more curious and are more willing to look for solutions to challenges (Soltovets et al., 2019). A challenge-based approach to can lead to the development of critical thinking abilities, which are crucial for success in the workforce of the twenty-first century.

Fourth, OIL allows learners to develop crucial skills. Learners who engage in online communities are exposed to a diverse range of perspectives and opinions. Exposure can lead to the development of empathy and understanding of others. In addition, learners who engage in online communities develop important communication skills, such as the ability to collaborate with others and to provide and receive constructive feedback (Masanet et al., 2019).

Finally, secondary school learners acquire 21CS through OIL because of the flexibility and personalised approach to learning, the availability of a wide range of resources, the development of critical thinking and problem-solving skills, and the development of important social skills.

Learners must acquire these skills to succeed in their personal and professional lives as technology advances.

Buckingham (2003) contends that learning is not confined to traditional school settings, but can also take place at home, for leisure, and work. The perspective challenges the conventional notion that learning is solely an academic pursuit and highlights the importance of recognising the knowledge that young people acquire outside of formal educational environments. Often overlooked is the value of informal learning that takes place through digital platforms and peer communication (Pereira et al., 2019). However, the qualitative and quantitative research findings have indicated that OIL of secondary school learners can help in the acquisition of 21CS.

The results of the data analysis show that when secondary school learners engage themselves in the learning process, they acquire certain 21CS. It can be verified by comments analysed by various participants such as:

It usually encourages me to go and find out more and more on the internet about different things when we get projects at school. We go and make research on the internet where we learn a lot of things. We usually divide the work, work on our own at home looking for information and solutions on the internet and share our ideas at school. [Participant 13A]

Learning online at home is one of the main things I do, especially when we get group projects in Design and Technology. Each one of us does a small part of the work. Then we merge it all together. Usually, there is a leader in the group all the time. [Participant 10A]

I use online tools for my projects to look for photos and more information. My friends in my group also look for the same. Each one of us looks for a particular topic, then we put them together for our project. [Participant 8B]

In agreement, Mehdinezhad (2011) highlighted that using technology as a tool to learn results in “high levels of engagement in learning, strong connections to the material, and the development of social, technical, and communication skills in students”. The findings also provide support for the acquisition of technical skills. The finding is in line with research by Alsuwida (2022), which found that 21CS was significantly and favourably affected by online tools.

According to a study by Korukluoğlu et al. (2022), Web 2.0 tool use was associated with a significant improvement in critical thinking skills among participants. Similarly, Zain et al. (2022) reported that integrating Web 2.0 tools into teaching resulted in enhanced high-level thinking skills, which are essential 21CS. These findings suggest that the use of Web 2.0 tools can be a valuable pedagogical strategy for promoting critical thinking.

Jose's 2021 study concluded that participation in communication, cooperation, and creativity activities carried out through Web 2.0 tools can gain participants' curiosity, patience, harmony, and sociocultural awareness. Per Artiningsih and Nurohman (2019), the use of Web 2.0 technologies led to a notable improvement in secondary school students' research skills, which is one of the essential 21CS. Similar findings were made by Frisch et al. (2013) who found that employing Web 2.0 tools improved learners' critical thinking abilities, another crucial 21CS. These results are supported by further research in the literature, such as Bannister (2008), Tucker (2014), and Efe et al. (2022).

7.3.1 Activity Theory perspective

Research Question 3 was addressed through the lens of the AT and Fenwick and Tennant's (2004) classification of adult learning. Although Fenwick and Tennant's (2004) classification of adult learning are mainly used for research in adults, it was adapted to that of secondary learners' learning for this research together with AT as a conceptual framework to determine why OIL influences 21CS of secondary school learners.

The findings from the analysis of the interview data gathered in the study have indicated results similar to adults. However, the researcher believes that secondary school learners learn more in diverse and flexible settings (Park et al., 2011). Consequently, they are more prone to acquire 21CS while learning informally through online tools since they tend to plan and conduct learning without any direct reliance on their teacher or instructors or just gain learning as serendipity (Marsick and Watkins, 2001, Park et al., 2011). Participants 12A and 11B attested to this finding,

I use online tools to learn a lot of new words for my English and French and yes; I use online tools for my projects to look for photos and more information as well as I learn better when I read more on the internet than in a book. [Participant 12A]

The different multimedia effects make learning more interesting, and it encourages for learning more. [Participant 11B]

According to Heo and Lee (2013), an online informal activity system is made up of several components, and the connections between these components are intricate. Engeström's (1987) AT can be used as a framework to examine the data, and the researcher believes that an OIL space is an activity system that operates based on the theory. In this system, secondary school learners gain knowledge through various activity systems. AT is a useful tool for understanding learning processes which arise from specific actions taken by learners in a particular context. These actions ultimately lead to the learners' enhanced knowledge and attitudes. Figure 7.2 aptly summarises how secondary school learners used online informal activity systems to acquire 21CS as outcomes of their learning.

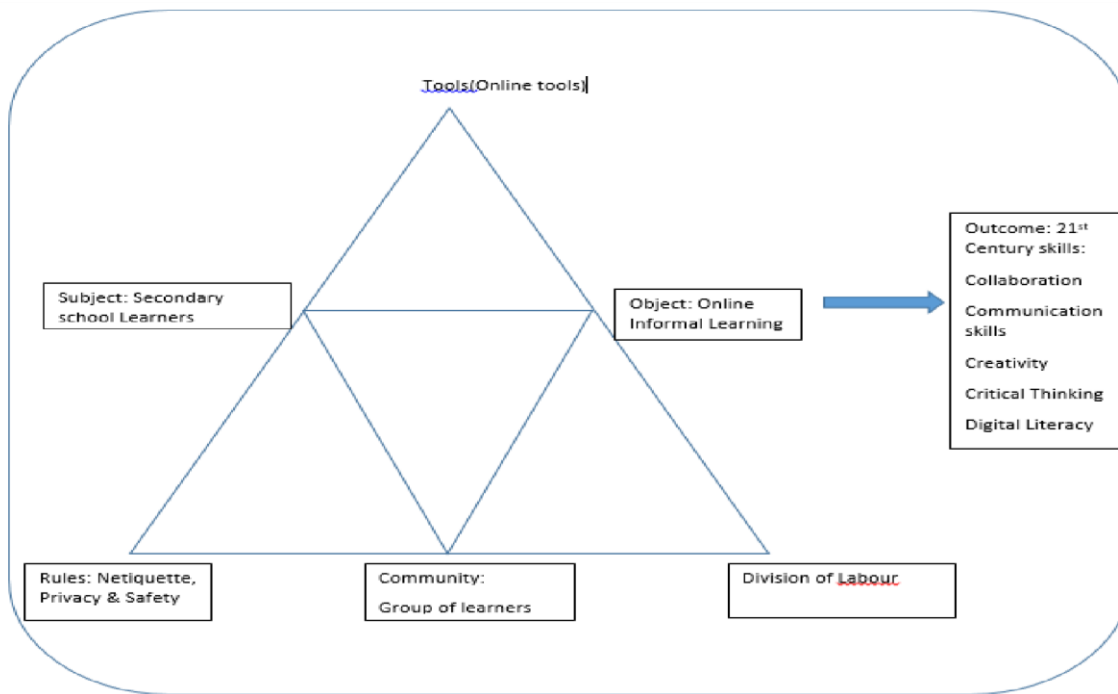


Figure 7.2

How Secondary School Learners Use OIL Systems to Acquire 21CS

The study's results corroborate prior studies showing how adults might be classified as learners. According to the results, adult learning can be viewed from four different perspectives: (a) learning as the acquisition of knowledge and/or competencies; (b) learning as reflection and the construction of meaning; (c) learning as practice-based activities of particular communities; and (d) learning as an embodied co-emergent process (Fenwick & Tennant, 2004).

The dimensions of the following classification of secondary school learners' learning in Figure 7.3 were adapted from Fenwick and Tennant's three dimensions of adult informal learning activities using OIL tools.

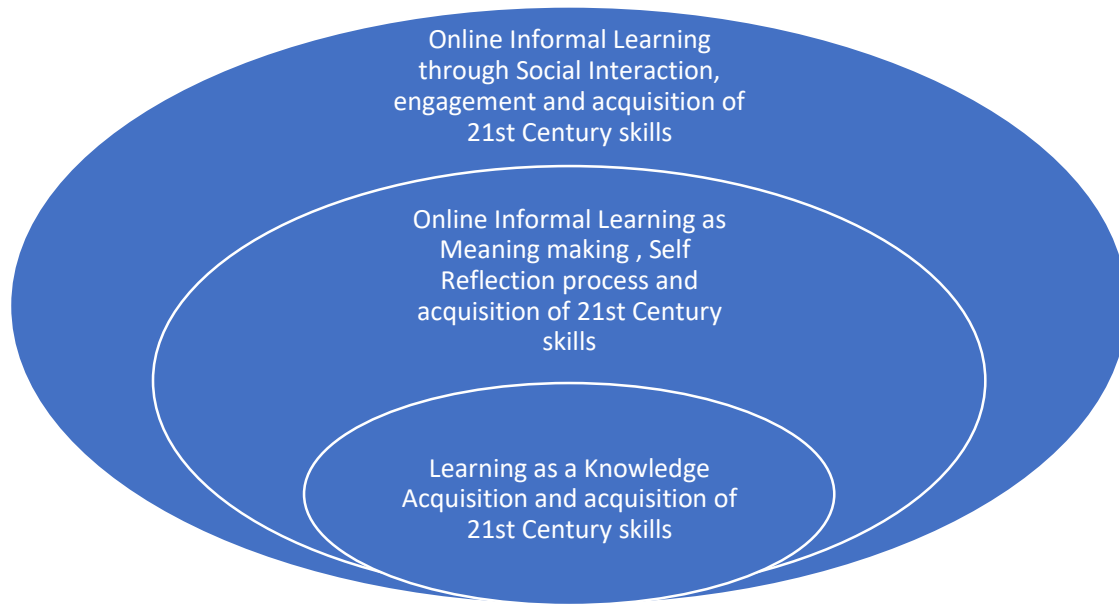


Figure 7.3

Three Dimensions of Adult Formal Learning (Adapted from Fenwick & Tennant, 2004)

Furthermore, the results support the notion that secondary school students can learn and gain knowledge, skills, or competencies in the first dimension of the learning process, much like adults. In OIL activities, secondary school students, according to Heo and Lee (2013), engage in distinct processes that result in a variety of outcomes, including knowledge acquisition, experience reflection, identity formation through indulgence, and change that affects both students and the system. These results are consistent with those of the current study (Park, Heo, & Lee, 2011).

Fenwick and Tennant's (2004) classification offers a perspective on learning as an acquisition process. According to Fenwick and Tennant's view, high school learners can access knowledge, skills, and strategies for addressing advancement in various realms, including educational, occupational, and routine tasks. Through this process, learners can gain expertise in these areas. While the approach shares similarities with traditional cognitive and intelligence theories, it places greater emphasis on learning context and how experiences contributed to facilitating learning for secondary school learners, who are comparable to adults (Heo & Lee, 2013).

Additionally, the study reveals that learners in this age group often seek out and obtain data and awareness, indicating a more passive role in their informal online erudition processes within the activity system. In the literature reviewed, it was stated that even though it was not designed specifically for educational purposes, Web 2.0 technologies, such as social networking, wikis, among others, have received intense and growing attention from educational researchers over the last two decades (Angelaina & Jimoyiannis, 2012; Escobar-Rodriguez et al., 2014, Sonmez & Cakir, 2021). They are advantageous to educators because they provide many opportunities for content and resource sharing, self-directed and collaborative learning, as well as ubiquitous and lifelong learning (Angelaina & Jimoyiannis (2012); Gyamfi, 2017). Khalid (2010) also maintains that online informal technologies (podcasts, blogs, and wikis) would enhance learners' creativity and innovation in their academic growth, encourage reactions, reflections and ideas of learners and even adopt and incorporate these in their formal education.

The results from the data analysis are in line with that Fenwick and Tennant's (2004) assertion that learning becomes even deeper by secondary school learners when it is taken as a means of reflecting and when meaning is constructed on what has been learned informally through online tools. Individuals can engage in reflective learning by analysing experiences of one's own, and others, either with reference to the content (i.e., what occurred) or the procedure (i.e., how it happened). Reflective learning can result in personal transformation (Mezirow, 1991) or collective social awareness and action, known as praxis (Freire, 1970). According to Fenwick and Tennant's (2004) learning classification, it typically occurs in the second dimension, where secondary school students actively participate in the processing and assimilation of knowledge by giving it meaning and considering its importance. At this stage, they can recognise the 21CS mentioned.

Wenger (1998) introduces the idea of communities of practice, a perspective on practice-based learning that focuses on specific groups. Learners may exchange, negotiate, and produce information relevant to their own practice by working together with people who have different experiences, knowledge, and skills. According to Fenwick and Tennant, learning and doing must be combined to fully participate in the CoP (2004). The idea that learning is a co-emergent process also undermines the usual emphasis on people and highlights an ecological viewpoint. During the learning process, it investigates the simultaneous co-emergence, interaction, and change of

cognition, identities, and the environment. However, it contends that people cannot be separated from the group, learners cannot be separated from context, and the subject cannot be separated from the object, the method departs from the first three viewpoints (Fenwick & Tennant, 2004). The meaning of these dimensions implies a range of engagement in informal learning processes, from narrow to more comprehensive concepts of learning.

The utilisation of OIL settings, per the finding of the study, gives secondary school students the chance to participate in social activities and interactions at many levels, enabling them to experience multiple facets of learning as self-regulated and self-directed learners. The researcher believes that, similar to adults, secondary school learners can learn through online informal settings, by engaging in individual activities such as self-expression and self-reflection (Jin et al., 2019). Al-Sabaawi et al. (2021) contend that “These two web-based spaces produce different interactive processes and outcomes, depending on the roles and degrees of engagement of learners”. The study defines certain roles in both web-based environments and presents a spectrum of levels of participation, from passive to active and from interpersonal to group. By connecting too many aspects of learning activities, such as acquisition, reflection, and community-based learning, learners may become more engaged and have more diversified learning experiences. Therefore, incorporating more interactive ways of using Web 2.0 can not only provide a more diverse but also a better-quality learning experience.

Learners must possess a variety of abilities, including critical thinking, cooperation, communication, creativity, and digital literacy, for efficient use of technology in the 21st century. OIL has evolved as a well-liked and successful method for secondary school students to gain 21CS, even though regular classroom learning is essential in developing these abilities. Learning is an action that happens in a social and cultural setting, according to AT. Individuals are motivated to learn when they are engaged in an activity that is meaningful to them, and they can interact with others who share similar goals and interests (Heidari et al., 2021; Temban et al., 2021). In OIL, learners engage in activities that are relevant to their interests and goals, and they have access to a network of peers and experts who can support and challenge their learning.

According to the research, there are several methods that learners might acquire 21CS through OIL. For instance, by participating in problem-solving activities and discussing complex topics with others, learners can strengthen their critical thinking abilities. Through group projects and conversations, where students cooperate to accomplish a common goal, collaboration is developed. Online debates and discussions help students develop their communication skills by teaching them how to articulate their thoughts politely and clearly. The examination of various media and instruments fosters creativity by enabling students to express themselves in fresh and original ways. Finally, digital literacy is developed using technology to support and enhance learning, as well as through the development of online safety and responsible use of technology (Baucum, 2022; Jin et al., 2019; Peters & Romero, 2019; Yan & Fan, 2022). In conclusion, secondary school learners acquire 21CS through OIL because it provides them with meaningful activities that are relevant to their goals and interests. Through the lens of AT, it is clear that learning is a social and cultural activity that is influenced by the context in which it occurs.

Furthermore, the research suggests that OIL also gives students more flexibility and control over their educational experiences. Traditional classroom environments frequently place limitations on time, space, and the curriculum. OIL, on the other hand, gives students more flexibility in terms of when, where, and how they learn. As a result, students may be more motivated and engaged because they feel more in control of their educational experiences (Adnan & Anwar, 2020; Lo & Hew, 2020; Vallée et al., 2020). Moreover, OIL can assist students in acquiring the self-control necessary for success in higher education and beyond. However, one can keep an eye on their selfregulation, set a goal for it, and modify their learning strategies as necessary. OIL enables students to take more charge of their own education, which can aid in the long-term development of these competencies (Bączek et al., 2021; Tang et al., 2020).

Technology's importance in OIL cannot be disregarded either. Technology gives students access to a wide variety of tools and resources that might help them learn. To better understand complex subjects, for instance, students can access educational videos, simulations, and games through online platforms (Alam, 2022). A sense of community that can improve learning experiences can be created via social media platforms, which can also help learners communicate and work together (Awidi et al., 2019; Ghounane, 2020).

However, it is important to note that not all OIL experiences are created equal. Research has highlighted the importance of quality design and pedagogy in online learning environments. Effective online learning environments need to be designed with the learner in mind, taking into consideration their goals, interests, and prior knowledge. Pedagogical approaches such as projectbased learning, problem-based learning, and inquiry-based learning have all been found to be effective in OIL environments (Herodotou et al., 2019; Wong et al., 2019).

In conclusion, OIL offers secondary school students a flexible, interesting, and worthwhile method to learn 21CS. To assist the development of 21CS, it is crucial to adopt effective pedagogical strategies and to make sure that OIL environments are created with learners in mind.

7.4 SYNTHESIS

The chapter connected the conceptualisation of 21st century skills, and the behaviour demonstrated by the learner is critical for understanding these skills and how they can be elicited and enhanced. The data is invaluable in understanding how Web 2.0 resources and interactive mentoring programs can help learners build 21CS. Overall, the results of the study suggest that OIL has the potential to complement formal education and serve as an important avenue for lifelong learning. Future research could explore the experiences and outcomes of OIL across different populations and settings and investigate strategies for supporting and enhancing the quality of informal learning experiences in online environments. Furthermore, derived from the findings of the study, an Online Informal Learning conceptual framework for secondary school learners can be developed to promote the support of their 21st century skills. This will be discussed in the final chapter.

CHAPTER 8

IMPLICATIONS, RECOMMENDATIONS, AND FUTURE DIRECTIONS

8.1 Introduction

Chapter 7 presented a discussion of the findings. The study aimed to explore how Online Informal Learning (OIL) can assist learners in developing their 21st century skills (21CS) using online tools outside of the classroom through informal learning. A sequential-explanatory mixed-method research approach was selected for the study. In this chapter (8), findings are summarised, and the limitations and implications of the study are outlined. Further, the present chapter applies the theoretical model for developing 21CS through OIL using online tools. In sum, recommendations and suggestions for future research based on the findings of the study are provided.

8.2 Overview of the Research Study

The study aimed to explore how Online Informal Learning can assist learners in developing their 21st Century Skills using online tools outside of the classroom through Informal Online Learning. The following questions were answered by analysing the generated data:

RQ1: What forms of Online Informal Learning exist among secondary school learners?

RQ2: How does Online Informal Learning influence secondary school learners' 21st century skills?

RQ3: Why does Online Informal Learning influence secondary school learners' 21st century skills the way it does?

To attend to the research questions, the thesis layout was structured as follows:

Chapter 1 outlined the conceptual basis in terms of what the researcher had investigated, including the research questions and the basic research design. It explained the significance of the study by describing how the study differed from existing studies. The chapter also included the background of the study, the research statement, the research questions, and the implications of the study.

Chapter 2 focused on reviewing the literature on the two phenomena: Online Informal Learning, and 21st century skills. The key purpose of the chapter was to identify the gaps within the current literature concerning the two phenomena, and then link them to the present study.

Chapter 3 justified the use of the theoretical framework used for the research and confirmed its interconnectedness and compatibility with the study. It was then used to analyse the data which was presented in subsequent chapters.

Chapter 4 discussed the research method, the research design, the research methodology, the setting, and research questions, and the data collection processes.

Chapter 5 presented the quantitative study findings obtained via the mixed-methods approach, which included utilising questionnaires, semi-structured interviews, and focus group discussions. *Chapter 6* analysed the qualitative data of the study, which was mainly obtained through conducting semi-structured and focus group interviews. The results were then combined with the quantitative results to align with the research objectives.

Chapter 7 of the study discussed the findings which assisted the researcher in addressing the research questions that guided the study.

8.3 Implications of the Study

There were several implications for Informal Online Learning and the acquisition of 21st century skills for secondary school learners that are unpacked in this section. These implications are addressed according to each research question:

8.3.1 Research Question 1: What forms of Online Informal Learning (OIL) occur among Secondary School Learners through utilising Online Tools?

The study applied the lens of AT to investigate the forms of Online Informal Learning (OIL) that occur among secondary school learners when they engage with online tools. The results of the study indicated that most secondary school learners were acquainted with online tools daily, rather than on a weekly or monthly basis by engaging with video/audio clips, online discussion groups, Instant chat, Internet websites, Online games, and YouTube.

Furthermore, the study provided incisive insight into Social Networking Sites (SNSs). It was determined that respondents were most familiar with Online Discussion groups through WhatsApp, YouTube, and Instagram. Several online tools were accessed for informal learning, while other tools were utilised for both formal and informal learning. As secondary school learners adapted to new learning environments, social networking tools were used to make new friends and share school notes. It implied that the social aspect of group activities in OIL became an integral part of the learner's experience.

Moreover, the study demonstrated that there was a variation in using online tools for online informal learning across different grades (7-13). Younger secondary school learners used online tools mainly for informal learning to share information, photos, songs, and games, whereas older secondary school learners used them mainly to share information but also to compensate for formal learning. Most secondary school learners stated that OIL had become an integral part of their daily lives since whatever was being learned in their formal settings was not sufficient for them to complete their learning. Also, it emerged that older learners used OIL more formally.

Participants in Grades 10-13 stated that they used different online sites to assist them with self-discovery learning, which applied to schoolwork, to gain additional knowledge, and to listen to music as a hobby. The following online tools were accessed for knowledge acquisition and recreation:

- Google Classroom was used extensively for formal learning;
- Zoom for group classes;
- WhatsApp for chatting;
- Google for information searches related to schoolwork and self-learning;
- YouTube to watch videos, and listen to music during free time;
- Yahoo, WhatsApp, Facebook, and Instagram to look at photos and videos;
- Chat was used to communicate with friends; and
- WhatsApp and YouTube to watch tutorials and videos about subject topics to supplement previous knowledge.

Both the quantitative and qualitative analysis results shown in Chapter 7 concluded that utilising internet resources benefited students' individual study, group work tasks, development of active

and self-regulated study techniques, and acquisition of 21CS. Similar findings are supported by Venkatesh, Croteau & Rabah (2014) in a study on understanding learners' perceptions regarding the effectiveness of information and communication technology (ICT) use. The quantitative results revealed that secondary school learners used different OIL tools for sharing information, interpersonal communication, fun, personal interest, hobbies, developing self-identity, observing other people's lives, maintaining social relationships, self-expression, and self-reflection, and developing expertise.

Internet environments not only provide learners with the opportunity to gain new knowledge but also enable them to express opinions and share knowledge. The OIL activities helped learners learn how to collaborate, create digital content, reflect on their thoughts, extend the time space of educational dialogue, and promote trust between learners and teachers. The mixed-method analysis reflected that most secondary school learners used online technologies for OIL and academics through online platforms.

The analysis phase of the study also revealed that online tools used by secondary school learners were mainly for informal learning outside school settings or simply to complement what they had learned at school. Participants in Grades 10-13 stated that they used different online sites for informal learning; for example, Facebook for sharing information. Additionally, it emerged that secondary school learners were more comfortable when learning at home. Participants indicated that they preferred to self-learn to use online tools, especially when it concerned the acquisition of general knowledge. Some participants prioritised this as being critical for gaining a deeper understanding of specific school subjects.

Similar to the findings of Yang et al. (2011) in a study on the Development of a Content Analysis Model for Assessing Students' Cognitive Learning in Asynchronous Online Discussions, regarding the type of online learning accessed by secondary school learners using OIL, it was evident that they acquired knowledge through cognitive learning by developing a sense of reasoning, in addition to powers of intuition. It was also found that secondary school students who engaged with multiple forms of content using different online tools could increase their cognitive potential, which included critical-thinking skills. Similar results were supported in a study conducted by Alaraj (2012). Also, since Web 2.0 tools facilitate communication, cooperation and knowledge exchange, rapid communication growth and development are stimulated. The

implication of this finding is that Web 2.0 resources in OIL can be used interactively by employing multiple forms of content of different OIL tools to elicit and enhance 21CS.

Other forms of OIL, like self-directed learning, socialisation, and incidental learning (self-discovery) were also evident. Previous research by Schugurensky (2000) supports the mapping of informal learning by distinguishing three basic forms of learning and highlighting intentionality and awareness as criteria to discriminate between them and providing additional evidence. In the diagram, socialisation is at one end of the informal learning spectrum and self-directed learning is at the other, with accidental learning somewhere in the middle. The results from the study primarily revealed that secondary school learners perform self-directed OIL when individuals learn consciously or unconsciously, by themselves or in a group, without the help of a teacher, instructor, or facilitator. They study officially but purposefully because they are already motivated to learn something before the learning process even starts, and they are cognisant of what they have learned.

Further, other secondary school students engaged in incidental online informal learning when they used online tools to obtain learning experiences that happened without the learner intending to learn anything from it beforehand, but after the experience, they realised that some learning had happened as also supported by Schugurensky (2000). He states that not only do learners have no *a priori* intention of acquiring them, but they are also not aware that they learned something (Schugurensky, 2000). Thus, accidental OIL appeared to be unintentional, but conscious. The finding was supported by some participants who stated that they preferred to learn about events happening in the country online rather than reading the newspaper. They also learn many new words in English and French. They learn how to cook, listen to music, watch YouTube, check tutorials about different subjects, and watch movies.

Socialisation was one of the primary types of OIL where secondary school learners could develop 21CS when learning through different online tools. When performing OIL, socialisation, also known as tacit learning, refers to the internalisation of values, attitudes, practises, and skills that take place during daily living. For the study, this type of informal learning was mainly called Online Informal Socialisation (OIS) or Online Informal Tacit Learning (OITL). All the forms of OIL support the theory that they can result in the acquisition of new knowledge or skills. The results from the study, therefore, provided a deeper understanding that the different online tools provided different forms of learning and opportunities for learning.

Through the communicative interaction between different secondary school learners, online informal socialisation occurred. The learners also developed personal familiarity, enhanced communication, and applied problem-solving (critical thinking) skills. These findings are supported by other studies like Gupta & Govindarajan (2000) and Hangfield (2009). These skills comprise two of the four Cs (4Cs) of 21CS that were identified in Section 2.3: creativity and critical thinking (problem-solving); and communication and collaboration. These skills proved to be beneficial for secondary school learners as they could use them for their personal development, and their future endeavours.

The awareness of learners' unconscious and unintentional learning experiences may occur immediately or many years later. The process of retrospective recognition can come from within or from outside. The results also indicate that informal learning, such as OIL, that uses websites and online tools, is beneficial to learners as stated by Schugurensky (2000). Some previous studies confirm the results of the research by stating that online technologies, such as watching video clips on YouTube, foster communication, collaboration, sharing of knowledge, and discourse analysis. Therefore, it was concluded that through different forms of OIL and the use of several online tools, 21CS like communication, critical thinking and collaboration, can be developed in secondary school learners.

From a theoretical perspective, the results of both the quantitative and qualitative analyses showed that different forms of OIL occur in an Online Informal Activity (OIA) system. To explore the power of an Online Informal Activity system, all the vertices of the AT were analysed incisively to determine the different forms of OIL that facilitate learning among secondary school learners using online tools. The results of the study also found that all the six elements of the AT as stated by Heo and Lee (2011) in Section 6.3.2.1 are interconnected and work together as a complex system to facilitate the OIL process, which helps in the development of 21CS. The findings of the study supported the data obtained in similar studies conducted by Heo and Lee (2013) and Schugurensky (2000). It was confirmed that the use of online tools by secondary school learners is “a collaborative medium that allows users to communicate, work together and share and publish their ideas and thoughts” (Rollett et al., 2007, pp. 97-98; Heo et al., 2013).

In addition, the results of the study provided support for various relevant existing literature sources by proving that different sub-online informal activity triangles work together to help secondary school learners learn informally through online tools. Hence, different sub-activity triangles were

analysed in depth. One of the unique affordances of AT is that it may be “used as a framework for understanding how the different components of the activity impacted each other” (Doubleday & Wille, 2014, p. 367).

For different forms of individual OIL to occur, the study found that the sub-triangle (Subject-toolsObject) shows the systemic relations between a secondary school learner and his/her online informal learning environment as stated in a similar study by Heo & Lee (2013). The Subjects, who are the main agents of the OIL, are responsible for activating the OIL environment through which they acquire knowledge and work autonomously and enact self-directed or incidental, informal learning. Tools as another element of the OIL activity are used by subjects to interact with objects for different forms of learning to occur. One of the most crucial elements of the subtriangle of individual OIL to occur is the object. The Object element in the study is the physical or symbolic move to learn something informally using online tools. The study also revealed that the moves could be driven by curiosity, intentional learning, unintentional learning, learning for fun, or engaging in formal subjects at school.

Moreover, the study also revealed that different forms of learning occur when secondary school learners learn in groups. Here, the study supported the findings of Heo and Lee (2013) by revealing the Sub-triangle (Subject-Object-Community). Secondary school learners (subjects) who usually have the same interests and have common objects work in groups or as an online community to learn online informally. The objectives here are mainly to communicate or even socialise with other subjects outside the school setting. As a result, OIS or OITL occur in a setting where several secondary school learners learn informally using different online tools by interacting with each other to communicate and acquire knowledge informally. The results of the study also found that secondary school learners learn better within social groups, rather than individually.

However, for the different forms of OIL to occur, two more elements of the Activity System have to come into play Division of Labour and Rules. The results of the study revealed that each subject in the Activity System has a role to play in the OIL system. They can participate in the OIL process either as readers or online viewers or by expressing reactions, writing/posting messages, or sharing information with other peers in the community. According to Heo and Lee (2013), secondary school learners have three different roles to play in terms of their patterns of behaviours; namely, Knowledge Creators (Writers), Information Organisers (Collectors), and Information Seekers (Readers).

The finding is in line with Kutti's (1996) view that Objects and Communities are interconnected through the division of labour. The results of the study further support Heo and Lee's (2013) findings by confirming that secondary school learners' roles, tasks, and power relationships in the OIA system can also be categorised according to three objectives: Self-reflectors (Presenter), Interpersonal Communicators (Communicator), and Lurkers (Observer).

Furthermore, the results of the study confirm that, for OIL to occur, appropriate rules must be followed, which is one of the elements of the Activity System, without which many conflicts may occur in an online Informal Learning Activity System. Therefore, the researcher discovered that norms, conventions, and values (Kain & Wardle, 2002) such as ethics, use of copyright, respecting others' privacy, use of appropriate language, respect for other peers' emotions, and etiquette are prerequisites. However, the improper use of follow-up of rules in the system may result in negativity, conflicts, distractions, lack of (or excess) parental control, addiction to OIL, stress due to connectivity problems, disrespect for privacy, and bullying through chats.

8.3.2 Research Question 2: How do Secondary School Learners Acquire 21st Century Skills through Online Informal Learning?

The pedagogical approaches that are effective in OIL environments need to be identified for 21CS to be acquired. The analysis and results of the study were framed around the 4Cs conceptualisation of the 21CS (Scott, 2015). Firstly, the study revealed that different forms of OIL promote the development of secondary school learners' technical skills since they are constantly using online tools. These skills are said to be dynamic because using online informal tools secondary school learners across all grades make a continual effort to keep abreast of new technologies and practices.

The results of the study confirm that the use of online technologies to perform different online tasks contributes to the 21CS of secondary school learners. These learners who are the main agents of the OIA system are responsible for accessing online tools to acquire knowledge, select sources of information, and work autonomously.

Similarly, other subjects such as other learners of common interests, friends and relatives, teachers, parents, facilitators, and members of the online community also contribute to the OIL process concurrently with the subjects. It emphasises how tasks (activities) intersect with group-level work (action) as they relate to individuals and their roles. Through established rules and processes, learners engage in goal-directed behaviours while completing a given task. The AT as an analytical

lens demonstrates how the Subjects (secondary school learners) use online tools within the OIA system and social context to engage in OIL.

Secondary school learners use tools to interact with Objects to achieve desired outcomes (Said et al., 2014). These tools are used to learn informally or outside the school setting. Throughout the world, human beings develop skills, personalities, and consciousness through OIA, thereby transforming social conditions, resolving contradictions, creating new cultural artefacts, and engendering new forms of life and self (Samino, Daniels & Gutierrez, 2009).

Subjects of the OIA system also revealed that they are comfortable in a flexible environment by informally using online tools rather than within school settings. Consequently, many learners reported that using online tools does not require a high level of technical skills, and they enjoy adapting to new technology (Camberlion, 2022). Others are in favour of accessing OIL tools and learning on their own, especially when it concerns general knowledge, which some participants stated is very beneficial for their subject-general paper, which is based on evaluating learners' general knowledge.

Moreover, the analysis revealed that the participants are more comfortable learning by themselves as opposed to the traditional methods of formal learning or structured ways of learning at school. Further, it emerged that many participants prefer OIL since they obtain a wider range of textual, audio, and video information through a variety of online tools. Another key element of the OIA system is to apply and follow appropriate rules through ethical principles, use of copyright, respect for others' privacy, use of proper language, respect for peers' emotions, and the use of netiquette when sharing information. Participants expressed both negative and positive views when applying proper netiquette during OIL – they are less stressed when they are communicating through online tools.

The researcher also discovered that a few negative factors were stated by participants of the study, especially when they did not abide by the rules in OIA. Some barriers encountered by learners during OIL include a lack (or excessive) parental control, distraction, preference for formal learning, addiction to OIL, stress due to connectivity problems, disrespect for privacy, bullying through communication or group chats, health problems, failure to manage the way of learning, and confusion due to data abundance.

Online tools also enable secondary school learners to communicate or even socialise with peers at their school or other schools, either after school, during breaks or over the weekend. The results of the analysis indicate that working in groups or being part of a community, and sharing information illustrate another aspect of the Online Informal Learning activity system, which is the Division of Labour. It is mainly linked to roles, tasks, and power relationships of the different subjects in the OIL system. The results show that secondary school learners tend to learn better within social groups rather than individually.

Many participants articulated that they usually work in groups for a specific project where they share responsibilities. Each member of the group is then assigned part of the work to do informally online at home, after which they combine and share what they have learned. The analysis of the results also unearthed that secondary school learners use online tools to learn more and more, as they are triggered by curiosity. They are eager to know what is happening in the country and the outside world, or even to learn how to repair machines or cook food.

Both qualitative and quantitative results show that secondary school learners consider OIL as a fun alternative way of learning compared to listening to the teacher in class. They can watch videos and learn at the same time. Some participants stated that they use online tools and social media during their leisure time by reading for fun, while at the same time learning new aspects to enrich their knowledge. Through OIL, secondary school learners are encouraged to research information on the internet on different subjects that they do not understand when they get projects at school. Online tools such as video tutorials, websites and online notes can help them understand general topics, subjects and coursework better.

The results from the interviews have demonstrated that secondary school learners communicate extensively when they use online tools. They communicate with their friends and teachers using several methods, either through text or emojis or through a voice message. They prefer to communicate using WhatsApp because they can easily type and send pictures. In this manner, they have learned how to communicate better with their friends by sharing notes and other information through WhatsApp or Instagram on their own through trial and error. These findings indicate that the communication skills of secondary learners are improved using online informal learning and through a variety of online tools.

Many participants agreed that using online tools to learn outside school settings helps them to do their projects, FNT, design, get different photos and/or learn on their own how to build things by watching tutorials. Using online tools outside school settings activates their creativity, especially when cooking, drawing, or tackling project-based assignments. They had similar views about their creativity being stimulated by accessing OIL platforms, including social media apps (such as Facebook and Instagram).

Several participants articulated that OIL contributed to the development of their critical-thinking skills, especially when they look for solutions via YouTube or Google. In the process, they learn how to solve problems independently. They are not pressured for time to acquire knowledge by reading on the internet or watching tutorials which help them to understand the world better.

Importantly, the results of the analysis revealed that OIL allows secondary school learners to engage, interact and collaborate in the process of learning tasks that enhance the acquisition of knowledge and the overall learning experience. Participants in different grades were asked whether they use online tools to learn informally anywhere and anytime without the help of their teacher - many participants stated that they can self-manage their time while learning informally online.

It is widely recognised that Digital Literacy, which has increased in importance in online learning environments, is a necessity in the 21st century for successful professional and personal development (Karagul et al., 2021). During the interviews, secondary school learners were asked whether learning online outside the school setting develops and improves their digital literacy. The results of the study confirmed that there is a noticeable improvement in secondary school learners' literacy when they engage in OIL. The finding is corroborated by Aramide (2022) who maintains that there is a positive correlation between secondary school learners' digital and media literacy and information-sharing when online informal tools are used. Mega et al. (2022) also support the study's results by confirming that most secondary school learners have mastered several online informal tools including social media tools since they are frequently engaged with them in their personal lives (Ledgerwood, 2022).

8.3.3 Research Question 3: Why Do Secondary School Learners Acquire 21st Century Skills Through Online Informal Learning the Way They Do?

The results of the qualitative and quantitative analyses indicate that secondary school learners can acquire skills that are necessary for 21st century success through OIL. This part of the chapter provided reasons for secondary school learners to acquire 21CS through OIL. According to Mehdinezhad (2011), learners will develop social, technical and communication skills when they use technology as a learning tool. The finding is consistent with those of various studies (Abdulrahaman, 2020; Haleem et al., 2022) in which technology was used as a learning tool. The findings also reveal that technical skills are acquired since participants use different multimedia techniques to make learning interesting, which encourages more learning. It also improves learners' communication skills when there is a sharing of videos and pictures (among others) which requires them to type and utilise appropriate language.

Researchers believe that secondary school learners learn more in diverse and flexible settings (Park et al., 2011) which is consistent with the study's results (based on an analysis of interview data collected in the study). Hence, they are more prone to acquire 21CS while learning informally through online tools. Instead of directly relying on their teachers or instructors to plan or conduct their learning, they tend to experience learning through serendipity (Marsick & Watkins, 2001; Park et al., 2011).

Engeström (1987) asserts that a researcher using AT as a lens for analysing data in an online informal learning space utilises the typical components and features of an OIA system to facilitate learning involving the division of labour, objects, subjects, and outcomes. Through OIL processes, secondary school learners acquire knowledge in a variety of ways. Because of particular actions taken by learners in a particular context, the AT is a useful way to explain the learning processes that result in expanded knowledge, skills, and attitudes as an outcome.

The findings of the research strengthen the idea that like adults, secondary school learners can also learn and acquire knowledge, skills, or competencies in the first dimension of Fenwick and Tennant's (2004) classification of the learning process. A secondary school learner can acquire knowledge, skills, and competencies in particular domains such as academic, work-related, and everyday activities, based on the first perspective of Fenwick and Tennant's classification, which is learning as an acquisition process. A significant implication of this activity is that there are opportunities to gain new expertise in various areas. Additionally, secondary school learners in the activity system seek and acquire knowledge and information from others, implying that they play a passive role regarding informal learning online. By engaging in these activities, learners are not

merely passively absorbing knowledge and information but actively participating in the acquisition of expertise in new fields.

The results extracted from the data analysis are also in line with Fenwick and Tennant's assertion that learning becomes even deeper for secondary school learners when it is regarded as a means of reflecting, and when meaning is constructed on what has been learned informally through online tools. Learning can be enhanced by reflecting on the content (what happened?) and the process (how did it happen?). Individual transformation is often achieved through this type of learning (Mezirow, 1991), and sometimes it is achieved through group-based social awareness and action (Freire, 1970). In secondary schools, learners are more active in dealing with and accepting knowledge by making meaning for themselves and reflecting on that meaning. It falls into the second dimension of Fenwick and Tennant's (2004) classification of learning, which is *learning as a reflection process* where several 21CS are developed during this stage.

In addition, learning as a practice-based activity in a particular community presents the concept of communities of practice (Wenger, 1998). By communicating and collaborating with others with various levels of experience, knowledge and expertise, members of a Community of Practice (CoP) can share, negotiate, and create knowledge about their own practice. To become a full participant in the CoP, learning must be enacted according to best practice (Fenwick & Tennant, 2004).

The lens of learning embodied as a co-emergent process challenges the notion that learners are separated from context by people-centred notions. Fenwick and Tennant (2004) explore how the learning process interconnects with cognition, identities, and environment simultaneously, which espouses the ecological view. Individuals, learners, and contexts should not be separated from each other (Fenwick & Tennant, 2004); hence, this view is different from the first three. Furthermore, these dimensions also signify a range of engagement in informal learning processes, ranging from narrow to more extended concepts.

The findings of the study emphasise that learners can interact at various levels and participate in social online informal learning environments to experience a variety of learning dimensions based on their own purposes. The implication is that secondary school learners can also benefit from learning online in informal settings, as can adults. In these two web-based spaces, learners can

perform individual-level activities (self-expression and self-reflection) that can lead to various levels of interaction and value.

The degree of engagement in these online informal activities varies based on the roles that each participant plays. The study's results indicate that certain patterns of behaviour play specific roles in both web-based environments. In terms of engagement, it encompasses a spectrum ranging from passive to active engagement, as well as individual to interpersonal interaction. When one is engaged in learning activities, one will gain a greater diversity of learning experiences, such as learning as acquisition, reflection, and community-based learning. The study concluded that the use of Web 2.0 in more interactive ways may result in a more diverse learning environment, which leads to a higher quality of education.

8.4 Limitations

The findings of research studies are restricted in terms of how they can be applied in the real world. The context, nature, and scope of the sample of the study were major limitations. I, as the researcher, recruited secondary school learner participants from a state college where I worked as a teacher. The research, therefore, can only be applied in this context. The implication is that the results of the study cannot be generalised to learners in other contexts who were not sampled as it may not be relevant to learners who do not have access to internet online learning.

8.5 Contribution of the Research

Prior to the study, the existing literature on how OIL can assist individuals in developing their 21CS using online tools was based on adult populations. Similar studies in other nations can be conducted to help researchers understand how OIL can be used to help secondary school learners develop 21CS. Importantly, the research provided valuable advances to expand the research design. Most research on OIL has been qualitative; hence, a mixed-method explanatory sequential research process study adds a deeper perspective of OIL as it offers quantitative explanations. While the research design for the study was based on predetermined design principles, the subsequent framework that was used was new to the field as no other frameworks exist on how OIL can assist secondary school learners in developing 21CS.

8.5.1 Theoretical contribution

The study contributed to the body of knowledge in several ways. First, it provided valuable insights into the potential of OIL to complement formal education and promote critical thinking for lifelong learning. The research investigated how learners can acquire 21CS through OIL, which includes critical thinking, collaboration, communication, creativity, and digital literacy. In addition, it highlighted how OIL provided learners with a flexible, engaging, and meaningful way to acquire 21CS.

Moreover, the research contributed to the body of knowledge by identifying the pedagogical approaches that are effective in OIL environments. The study identifies inquiry-based learning, project-based learning, and problem-based learning as effective approaches to support the development of 21CS in OIL environments. The finding was significant since it provided educators and policymakers with guidance on how to design effective OIL environments that support the acquisition of 21CS.

The research provided critical insights into the challenges associated with OIL. The study cautions us against misinformation regarding online resources while emphasising the importance of critical evaluation by learners to ensure the quality of online resources. Additionally, the research addressed the lack of formal recognition of learning outcomes in OIL environments, which could hinder the learners' motivation to engage in online learning activities. The research also suggests strategies for recognising learning achievements to overcome this challenge.

Further, the findings of the study help to understand how OIL assists secondary school learners in similar contexts across the world. The research can contribute to enhancing OIL systems to facilitate the development of 21CS in secondary school learners. As a result, it makes a valuable contribution to existing OIL and 21CS frameworks. The data revealed that learners' use of OIL positively developed 21CS. According to the study's findings, Web 2.0 resources in OIL can be used interactively by employing multiple forms of content of different OIL tools to elicit and enhance 21CS. During this process, secondary school learners can acquire knowledge, skills, and competencies in particular domains such as academic, work-related, and everyday activities, based on the first dimension of Fenwick and Tennant's (2004) classification of learning as Knowledge Acquisition to facilitate 21st century skills.

Currently, no study has applied Fenwick and Tennant's framework (2004) regarding secondary school learners. The study has mainly used this framework to analyse how and why secondary school learners acquire 21st century skills through Online Informal Learning. The researcher therefore proposed a model to determine how secondary school learners can acquire 21st century skills via effective coordination of the six components of the Activity Theory (AT), and through the three dimensions of the Fenwick and Tennant (2004) framework.

8.6 Proposed Theoretical Model

Engeström (1987) depicts a triangular structure of an activity system with six components: Subject, Object, Tools, Community, Division of Labour, and Rules. The study used the AT as an assessment tool to demonstrate that these six elements are connected to each other and work together as a complex system to develop the Online Informal Learning process to assist in the development of 21st Century Skills. Importantly, the study analysed Informal Activity Systems of secondary school learners to examine how the six components of the AT interact collaboratively in different sub-triangles to develop their Online Informal Learning to achieve the task's objective.

As explained in Chapter 7- research questions 1 and 2, the six components of the Online Informal Activity system should be combined to give the learner an enhanced Online Informal Learning experience which results in the acquisition of 21CS. The research confirms that the combination of different components and different sub-triangles in the Online Informal Activity system makes a difference since any component working on its own negatively influences the Online Informal Learning process. However, to analyse how and why the Online Informal learning process results in the acquisition of 21CS, the researcher proposed a model which combined the Fenwick and Tennant (2004) model with the present conceptual framework which examined how and why secondary school learners acquire 21CS through OIL. The process can be diagrammatically seen in Figure 8.1.

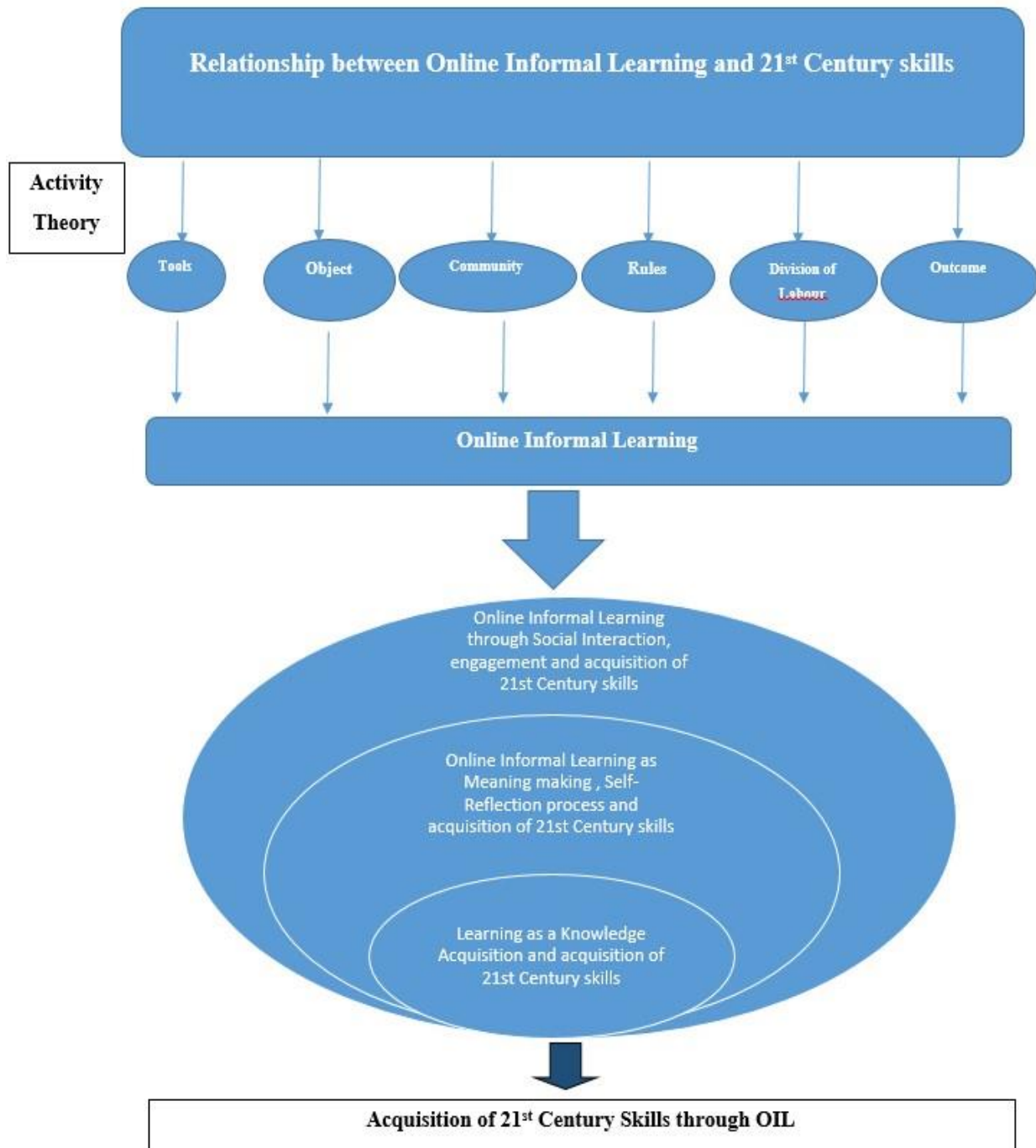


Figure 8.1

Proposed Framework for the Development of 21st Century Skills through Online Informal Learning (Engeström, 1987; Fenwick & Tennant, 2004)

8.7 Recommendations and Future Directions

Considering the limited sample context and nature of the study, the following recommendations were suggested regarding 21CS development through Online Informal Learning:

Future research should consider diversifying the sample to include learners from a broad range of schools, colleges, and academic settings to increase generalisability. It is important for future investigations to assess how Online Informal Learning (OIL) impacts 21CS development across diverse populations. They may include learners from various socioeconomic backgrounds, genders, ethnicities, and educational levels. Moreover, a variety of educational settings, including private schools, international schools, and vocational schools, may be used for future studies to gain a more comprehensive understanding of how informal online learning impacts 21CS acquisition. Different educational contexts could be explored to determine the effectiveness of online informal learning.

To examine potential gender differences in 21CS development through OIL, a mixed-gender sample could be included in future research. Both male and female learners would acquire 21CS through online informal learning if nuances related to gender are identified. Additionally, a longitudinal study could be conducted to track the progression of learners' 21CS acquisition over time, given the dynamic and evolving nature of OIL. The OIL can help determine the long-term sustainability of skills acquired while providing insight into long-term effects on skills development.

Furthermore, to obtain in-depth insights into learners' experiences with OIL and its contribution to the acquisition of 21st-century skills, future research should include qualitative techniques such as interviews, focus groups, and questionnaires with open-ended survey questions. Thus, we will gain a more comprehensive understanding of the phenomenon, as well as learn about learners' perceptions, motivations, and challenges regarding the acquisition of 21CS skills through OIL. As the current study examined a particular form of informal online learning, future research could examine the impact of these platforms and resources on 21CS development pertaining to a variety of online platforms and resources, social media, online forums, and virtual communities. In this way, learners' informal learning online can be better understood, while the impact it has on learners' skill development can be assessed.

A future study should examine other factors that influence the process; these include learners' background knowledge, motivation, self-regulation, and access to technology. To gain a better understanding of how online informal learning contributes to 21CS acquisition, it may be beneficial to examine the interaction between these factors which may help to identify potential mediators or moderators in the process.

Researchers could also provide practical recommendations based on the findings of the study to educators, policymakers, and stakeholders in education to promote the integration of OIL into formal education. The objective is to optimise 21CS acquisition through OIL to enhance the development of curricula, instructional strategies, and technology integration.

In sum, because of limitations pertaining to the sample context and nature of the study, future research may involve diversifying the sample; expanding the research setting; including a mixed-gender sample; considering longitudinal studies; incorporating qualitative measures; and exploring different types of online informal learning, while providing practical suggestions for stakeholders including educators and policymakers. Research that addresses these criteria can help to improve knowledge of 21CS acquisition through online informal learning, which can help to design successful educational practices in the digital era.

8.8 Conclusion to the Study

The potential of OIL as a beneficial source of information and skill acquisition for people outside of conventional educational settings is highlighted by the study. According to the findings, OIL platforms provide a wide variety of tools and opportunities for self-directed learning, including user-generated information, discussion forums, and online communities of practice. Participants in the study stated that their participation in online informal learning allowed them to pick up new skills, broaden their knowledge, and even discover new interests. However, there are potential problems with online informal learning, including misinformation and lack of recognition of learning results. It is important for individuals to evaluate the quality of online resources critically and seek out opportunities for credentialing or recognition of their learning achievements.

The study was conducted by utilising Online Informal Learning as a source to determine how and why learners developed online 21CS. According to the study's findings, learners acquire these skills through online informal learning, An Activity Lens and Fenwick and Tennant's classification of adult learning was adopted to frame a model for acquiring 21CS through Online

Informal Learning. To develop 21CS and to understand the impact of such approaches on learner achievement, the model was applied to study how activities and informal learning can be utilised for the development of 21CS. The Activity Lens and Fenwick and Tennant's classification of adult learning allowed for a more precise analysis of the different activities that can be conducted to develop the skills. Moreover, AT allowed for a better understanding of how different activities can be used to develop the skills, as well as how informal learning can be utilised to help in the development of these skills. The model proposed in the study provided a framework for future research in this area regarding the use of online informal tools as a foundation to promote learning.

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APPENDICES

Appendix 1: Questionnaire for Secondary School Learners

Student Questionnaire

The purpose of this questionnaire is to gather details regarding the use of Online tools that secondary school students' use for Online Informal Learning. I would be very grateful if you could complete this questionnaire by ticking the boxes corresponding to your answer or entering an appropriate response when indicated. Your participation is entirely voluntary, and responses are confidential.

I would also like to identify potential participants for future focus groups and interviews. There is a section at the end of this questionnaire where you can enter your email address so that I can contact you if you would take part.

Section A – Personal Details

1. What is your gender?

Female

☐

Male

☐

2. How old are you? (Please tick your age in the box)

Your age group: ☐ 11-12 ☐ 13 ☐ 14-15 ☐ 16-17 ☐ 18 and above-

3. In which grade are you? (Please tick your grade in the box)

Grade 7	<input type="checkbox"/>
Grade 8	<input type="checkbox"/>
Grade 9	<input type="checkbox"/>
Grade 10	<input type="checkbox"/>
Grade 11	<input type="checkbox"/>
Grade 12	<input type="checkbox"/>
Grade 13	<input type="checkbox"/>

4. Do you currently have Internet access in your place of residence?

Yes ☐ No ☐

5. Do you currently use Online tools when you have access to the Internet?

Yes ☐ No ☐

6. Which of the following do you own and use regularly to access online tools? (Please tick as many as apply)

Mobile Phone	
Personal Computer (e.g. PC)	
Tablets	
Laptop computer	
Other(s) (please give details)	

Section B – Student experiences and Perceptions of Use of Online Tools for Online Informal Learning

This section concerns your personal experiences of the use of Online Tools as a means of Online Informal Learning.

7. Please indicate which Online tools you use outside school and the extent to which you use them:

	Almost Never	Weekly	Monthly	Never
Online Discussion Groups				
Internet Websites				
Wikipedia				
Facebook				
YouTube				
Blogs				

Google/ Google Scholar				
Message boards				
Online games				
Video/ audio clips				
Instant chat				
Twitter/ Snapchat/ Instagram				
Others-_____				

8. Please indicate which online tools you use to help you with your studies or to learn something informally and when.

	daily	weekly	monthly	never
Weblog or Blog				
Message Boards				
Video/audio clips				
Internet Websites				
MP3 player				
Wikipedia				
Simulations, games				
Text Messaging				
YouTube				
Google/Google Scholar				
Other(s) (please give details)				

9. Please indicate what are the reasons for using online tools

Reasons	Yes		No
Sharing information			
Personal interest or hobby			
Self-expression and self-reflection			
Maintaining social relationships			
Developing expertise			
For fun			
Interpersonal communication			
Developing self-identity			

Observing others' lives			
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C– Acquisition of 21st Century skills through Online Informal Learning tools

This section is about your use of Online Informal Learning tools to acquire 21st Century skills.

B. Critical thinking Skills

10. How often are you encouraged to think critically by using online informal learning tools when you do the things described below? (Please tick where appropriate)

	Almost never	A few times during the year	1-3 times per month	1-3 times per week	Almost daily
Compare information from different sources before completing a task or an assignment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Draw conclusion based on analysis of numbers, facts or relevant information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Summarise or create your interpretation of what you have read or were being taught	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Analyze competing arguments, perspectives or solutions to the problem	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop a persuasive argument based on	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Almost never	A few times during the year	1-3 times per month	1-3 times per week	Almost daily
supportive evidence or reasoning					
Try to solve complex problems or					
answer questions that have no single correct solution or answer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

11. In which online tools do you use critical thinking skills most? (Please tick where appropriate)

- ☐ Blog
- ☐ Chat
- ☐ You Tube
- ☐ Message Boards
- ☐ Google Scholar
- ☐ Other (please specify)

Collaborative Skills

12. How often do you collaborate with your peers when you do the following things described below using Online Informal Learning tools?

	Almost never	A few times during the year	1-3 times per month	1-3 times per week	Almost daily
Work in pairs or small groups to complete a task together	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work with other students to understand a chapter at school through online tool	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Do assignments using contributions from each student in a group	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Present your group work to other people online or in a chat group.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Work as a team to solve a problem.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. In which online tools do you use critical thinking skills most?

- ☐ Blog
- ☐ Chat
- ☐ You Tube
- ☐ Message Boards
- ☐ Google Scholar
- ☐ Other (please specify)

Communication Skills

14. How often are you encouraged to communicate with your friends when using Online Informal Learning tools?

	Almost never	A few times during the year	1-3 times per month	1-3 times per week	Almost daily
Convey your ideas using online media other than a written paper.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Prepare and submit your work online to the teacher or others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. In which online tools do you use communication skills most?

- ☐ Blog
- ☐ Chat
- ☐ You Tube
- ☐ Message Boards
- ☐ Google Scholar
- ☐ Other (please specify)

Creativity

16. How often were you encouraged to use creativity and innovation when using online tools?

	Almost never	A few times during the year	1-3 times per month	1-3 times per week	Almost daily
Use idea creation techniques such as brainstorming or concept mapping	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Generate your ideas about how to confront a problem or question	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Test out different ideas and work to improve them	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Invent a solution to complex, open-ended question or problem	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. In which online tools do you use creativity most?

☐ Blog
☐ Chat
☐ You Tube
☐ Message Boards
☐ Google Scholar
☐ Other (please specify)

Section E – Further Participation In the Study

Please tick the box below and enter your email address if you are interested in contributing further to the study by participating in a focus group and/or interview about your use of Online tools for Online Informal Learning.

Yes, I am interested in taking part in a focus group discussion:

☐

Please enter your email address (clearly, using block capitals)

below:

Thank you for taking the time to complete this questionnaire.

Appendix 2: Semi Structured Interview Guide for Secondary School Learners

Demographic Information:

School: _____

Gender: Female [☐] Male [☐]

Age category: Below 30 [☐] 31- 40 [☐] 41-50 [☐] 51-60 [☐] 61 and above [☐]

Research questions

1. How does Online Informal Learning influence secondary school learners' 21st century skills?
2. Why does Online Informal Learning influence secondary school learners' 21st century skills the way it does?

Dear Participant [student name]

Thank you for agreeing to be part of this research project. I just wanted to remind you that I will be recording this information on audio.

I have a number of questions I would like to ask you about your experiences when you make use of online tools and then some specific questions related to informal learning through online tools and how it influences your 21st century skills.

1. What subjects do you study at school?
2. How do you (if at all) use online tools to learn more about your subjects outside school?
3. How do you (if at all) use online tools to communicate and chat with your friends?
4. What online-tools do you use when you go on the internet?
5. Why do you choose these, what influences your decision?
6. How do Online tools help you in learning informally?
7. What do you learn from these Online tools that you don't learn at school?

8. Do you use the Online tools in groups or individually?
9. Why do you use Online tools in groups or individually?
10. Can you give some positive experiences when you use online tools in groups?
11. Can you give some positive experiences when you use online tools in individually?
12. Can you give some negative experiences when you use online tools in groups?
13. Can you give some negative experiences when you use online tools in individually?

Online Informal Learning perspectives/ 21 st Century skills	Tentative Questions
Learning as an acquisition process	1. How does OIL be useful in acquiring various kinds of knowledge and information?
	2. How does OIL help you develop your own expertise in some academic or general subjects?
	3. How does OIL help you engage more actively in your fields of interests?
Learning as a reflection process	4. How does OIL help you experience moments that transforms your old views to a new one?
	5. How does OIL provide you opportunities to grow by looking back on your own thoughts, views and experiences?
	6. How does OIL be useful to describe and/or express your thoughts and views?
	7. How does OIL help your gain new awareness and set up plans on the basis of it?
Learning as a practice-based community process	8. How does OIL be useful to build up some social networks around you?
	9. How does OIL help you realize the influence of other bloggers on you?
	10. How does OIL help you realize the importance of it as a collective activity in a community?

Learning as an embodied co-emergent process	11. How does OIL make you communicate with the world and how influences every area of your life?
	12. Can OIL help you create new knowledge, and I can share this with others as an expert?

Appendix 3: Focus Group Interview Schedule

Demographic Information:

School: _____

Gender: Female [] Male []

Group No:

Age category: Below 30 [] 31- 40 [] 41-50 [] 51-60 [] 61 and above []

Research questions

1. How does Online Informal Learning influence secondary school learners' 21st century skills?
2. Why does Online Informal Learning influence secondary school learners' 21st century skills the way it does?

Dear Participants

Thank you for agreeing to be part of this research project. I just wanted to remind you that I will be recording this information on audio.

I have a number of questions I would like to ask you about your experiences when you make use of online tools and then some specific questions related to informal learning through online tools and how it influences your 21st century skills.

Tentative questions:

1. What online-tools do you use when you go on the internet?
2. What do you learn from these Online tools that you don't learn at school?
3. Do you use the Online tools in groups or individually?
4. Describe the things you enjoy doing with online tools and the web each week.
5. Do you learn informally through online tools?
6. What do you learn informally from Online tools?

7. How important is the web for your social life, do you use it to keep in touch with your friends? What gadgets/devices/things do you use the most, is there anything you couldn't live without? How much time on average do you spend online each week? Is there anything that bothers you about being online?
8. Do you socialise online? Do you 'contribute' online in the form of pictures, video, blogs, etc.?
9. Think of the ways you have used online tools and the web for your own learning. Describe a typical week. We are looking at interviewees' use of online tools for study. We hope they will start to introduce online informal learning, self-directed study, peer to peer learning, etc. We anticipate they will (or may not) mention Facebook, Whatsapp, you tube, etc.

[PROBES: How do you keep track of things? What systems for learning online do you have? Can you give us any examples of when you've asked your friends for help on assignments/homework online? What kind of online resources have you found that help you with your studies? How did you find them? What other gadgets or devices do you use for your studies?]

10. How do you think Online tools can help you learn informally?
11. Why do you think Online tools can help you learn informally?

Thank you for answering these questions.

Appendix 4: Participant Consent Forms

Participant Consent Form

Research Topic: Online Informal Learning and 21st century skills among Secondary school learners: A Mauritian Narrative

I, _____ understand the contents of this document and consent to participate in the study by Bharatee Pentiah on **Online Informal Learning and 21st century skills among Secondary school learners: A Mauritian Narrative**

I understand that:

- My participation may involve interviews and other data generation methods as explained in the information letter.
- I may be asked to answer questions of a personal nature, but I can choose not to answer questions about aspects of my life which I am not willing to disclose.
- I am invited to voice to the researcher any concerns I have about my participation in the study, or consequences I may experience because of my participation and to have these addressed to my satisfaction.
- I am free to withdraw from the study, however I commit myself to full participation unless some unusual circumstances occur, or I have concerns about my participation which I did not originally anticipate.
- The report on the project may contain information about my personal experiences, attitudes and behaviours, but that the report will be designed in such a way that it will not be possible for me to be identified by the general reader.

I provide consent,

For interviews that I participate in to be audio recorded
your response)

YES / NO (Please circle

Signature of Participant

Date

Yours sincerely,

Mrs Bharatee Pentiah

Contact Details:

Mrs Bharatee Pentiah

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Tel No: (230) 401 6555

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Participant Consent Form for audio recording of Semi- Structured Interviews

Research Topic: Online Informal Learning and 21st century skills among Secondary school learners: A Mauritian Narrative

Should you agree to participate in this study please read the statements below and if you agree to them, please sign the consent form.

- I have read and understood the participant information sheet.
- I understand what the research is about, and what the results will be used for.
- I understand that what the researcher finds out in this study may be shared with others but that my name will not be given to anyone in any written material developed.
- I am fully aware of what I will have to do, and of any risks and benefits of the study.
- I know that I am choosing to take part in the study and that I can stop taking part in the study at any stage without giving any reason to the researchers.

This study involves audio recording of the interviews. Please tick the appropriate box

- I am aware that the focus groups will be audio recorded and I agree to this. However, should I feel uncomfortable I can ask that the recording equipment be switched off. I know that I can ask for a summary of the interview, which will not include anybody's name. I understand what will happen to the recordings once the study is finished.

☐

- I do not agree to my child being audio/video recorded in this study.

☐

I agree to the statements above and I consent to taking part in this research study.

Signature of Participant

Date

Yours sincerely,

Mrs Bharatee Pentiah

Contact Details:

Mrs Bharatee Pentiah	MIE Supervisor: Dr Ajay HSSREC Research Office:
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Participant Consent Form for audio recording of Focus Group Interviews

Research Topic: Online Informal Learning and 21st century skills among Secondary school learners: A Mauritian Narrative

Should you agree to participate in this study please read the statements below and if you agree to them, please sign the consent form.

- I have read and understood the participant information sheet.
- I understand what the project is about, and what the results will be used for.
- I understand that what the researcher finds out in this study may be shared with others but that my name will not be given to anyone in any written material developed.
- I am fully aware of what I will have to do, and of any risks and benefits of the study.
- I know that I am choosing to take part in the study and that I can stop taking part in the study at any stage without giving any reason to the researchers.

This study involves audio recording of the interviews. Please tick the appropriate box

- I am aware that the focus groups will be audio recorded and I agree to this. However, should I feel uncomfortable I can ask that the recording equipment be switched off. I know that I can ask for a summary of the interview, which will not include anybody's name. I understand what will happen to the recordings once the study is finished. ☐
- I do not agree to my child being audio/video recorded in this study. ☐

I agree to the statements above and I consent to taking part in this research study.

Signature of Participant

Date

Yours sincerely,

Mrs Bharatee Pentiah

Contact Details:

Mrs Bharatee Pentiah	MIE Supervisor: Dr Ajay HSSREC Research Office:
Tel No: 5925 5672	Ramphul Mariette Snyman
Email: bpentiah@gmail.com	Mauritius Institute of HSSREC Administrator
	Education Tel: +27 31 260 8350
	Mathematics Education Email: snymanm@ukzn.ac.za
	Department
	Tel No: (230) 401 6555
	Email: a.ramful@mieonline.org

Appendix 5: Gatekeeper's Permission Letter

Gatekeepers Permission Letter

Date: 25/02/2019

To: Senior Chief Executive

Ministry of Education and Human Resources, Tertiary Education and Scientific Research

MITD House

Pont Fer, Phoenix

Dear Sir,

Request for Permission to Conduct PhD Research in State Secondary Schools

I, Bharatee Pentiah, am reading for a PhD with Specialisation in Education at the University of KwaZulu-Natal/ Mauritius Institute of Education and I am conducting research on Online Informal Learning and 21st Century Skills among secondary school students.

The proposed title of my study is:

Online Informal Learning and 21st century skills among Secondary school learners: A Mauritian Narrative

I intend to invite secondary students from Grades 7 to 13 (age groups 11 to 18) in State Secondary Schools as participants in this study. The purpose of my study is firstly, to explore the 21st century skills that secondary school students acquire through Online Informal Learning. Secondly, I wish to understand critically how and why online informal learning contributes to secondary school

learners' 21st century skills the way they do. The insights from this study will contribute theoretically to existing research in Online Informal Learning and development of 21st Century skills in Secondary education which is one of the main goals mentioned in the NYCBE reform.

I hereby apply for permission to undertake this research inviting participation of students from State Secondary schools.

The information gathered in this study will be treated with utmost confidentiality. The names of the participants from the school and the name of the school will not be disclosed. Participation in this study is completely voluntary and participants will withdraw from the study.

Yours sincerely,

Mrs Bharatee Pentiah

Contact Details:

Mrs Bharatee Pentiah

Tel No: 59255672

Email: bpentiah@gmail.com

____25/02/2019____

Date

MIE Supervisor: Dr Ajay Ramphul

Mathematics Education Department

Mauritius Institute of Education

(230) 4016555

Appendix 6: Reply and Approval Letter from Gatekeepers



REPUBLIC OF MAURITIUS
MINISTRY OF EDUCATION AND HUMAN RESOURCES, TERTIARY EDUCATION
AND SCIENTIFIC RESEARCH

ME/305/3T₁₆

29 March 2019

Mrs Bharatee Pentiah
Kalimaye Road
Providence
Quartier Militaire

Dear Madam


Subject: Request for permission to conduct PhD research in secondary schools

Please refer to your correspondence dated 25 February 2019 on the above subject.

2. This is to inform you that permission has been granted to you to collect data from Quartier Militaire State Secondary School and Shrimati Indira Gandhi State Secondary School subject to the following:

- i). Informed consent of parents of the sampled students would have to be sought and obtained before you proceed with the collection of data;
 - ii). Anonymity of participants and confidentiality of data would have to be maintained; and
 - iii). At no point should the smooth running of classes be disturbed by the research exercise.
3. We advise that you liaise with the Rector of the school to make all necessary prior arrangements.
4. You will have to submit a copy of your findings to the Ministry upon completing the study.

Yours faithfully,


C. Surajbali-Bissoonaath (Mrs)
for Acting Senior Chief Executive

Cc: Director, Zone 2 ✓

MITD House, Phoenix 73544 - MAURITIUS
Tel. No: 601 3458 Fax No: (230) 697 5305
E-mail: moe-secedu@govmu.org

Appendix 7: UKZN Ethical Clearance



09 December 2019

Mrs Bharatee Pentiah (218046886)
School of Education
Edgewood Campus

Dear Mrs Pentiah,

Protocol reference number: HSS/0587/019D

Project title: Online informal learning and 21st Century skills among secondary school learners: A Mauritian narrative

Approval Notification – Expedited Application

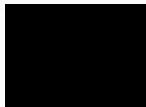
This letter serves to notify you that your application received on 31 May 2019 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

This approval is valid for one year until 09 December 2020.

To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

Yours sincerely,



Professor Urmilla Bob
University Dean of Research

/ms

Humanities & Social Sciences Research Ethics Committee
Dr Rosemary Sibanda (Chair)
UKZN Research Ethics Office Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Website: <http://research.ukzn.ac.za/Research-Ethics/>

Founding Campuses:  Edgewood  Howard College  Medical School  Pietermaritzburg  Westville

INSPIRING GREATNESS

Appendix 8: Editing Certificate

<p>18 Languedoc Street Baywater Bloemfontein 9301 Cell: 0631899752 elgine@elgine.com</p>		<p>PROFESSIONAL LANGUAGE EDITING SERVICES</p> <p>STRIVING FOR EXCELLENCE</p>
<p>BA- English major; BA Hons. Integrated Organisational Communication; PGCE Certificate; TESOL Cert; UCT Cert. in Copy-Editing; UFS Advanced Cert. in Labour Law</p>		
<p>SPECIALISING IN THE LANGUAGE EDITING OF THESES, DISSERTATIONS, JOURNAL ARTICLES, PROPOSALS, POLICIES AND PUBLICATIONS.</p>		
<p><u>CERTIFICATE FOR LANGUAGE EDITING: PHD</u></p>		
<p>Online Informal Learning and 21st Century Skills Among Secondary School Students: The Mauritian Context</p>		
<p>Bharatee Pentiah</p>		
<p>STUDENT NUMBER: 218046886</p>		
<p>UNIVERSITY OF KWAZULU-NATAL</p>		
<p><u>TO WHOM IT MAY CONCERN</u></p>		
<p>This certificate confirms that the above-mentioned student submitted her PhD language -editing, which included correcting in-text citations and formatting. This document was edited and returned to the student for revision as per suggestions from the supervisors. I make no claims of accuracy on the research content. The text, as edited by me, is grammatically correct. After completion of the language editing, any changes made the student is not the responsibility of the editor.</p>		
	<p>ID:7702020249086</p>	<p>DATE: 27/06/2023</p>
<p>THANK YOU FOR YOUR SUPPORT</p>		

Appendix 9: Turnitin Originality Report

ORIGINALITY REPORT			
8%	8%	3%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS
PRIMARY SOURCES			
1	www.ds.unipi.gr Internet Source	1%	
2	researchspace.ukzn.ac.za Internet Source	<1%	
3	Submitted to University of KwaZulu-Natal Student Paper	<1%	
4	www.coursehero.com Internet Source	<1%	
5	hdl.handle.net Internet Source	<1%	
6	uir.unisa.ac.za Internet Source	<1%	
7	Submitted to Polytechnic University of the Philippines - Sta. Mesa Student Paper	<1%	
8	vital.seals.ac.za:8080 Internet Source	<1%	
9	ukzn-dspace.ukzn.ac.za Internet Source	<1%	
Exclude quotes On			
Exclude bibliography On			
Exclude matches		< 15 words	

