

The use of digital educational technology affordances to develop 21st-century skills in online learning

by

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## Declaration

I declare that this dissertation, which I hereby submit for the degree Magister Education at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution. I further declare that a comprehensive list of references in this research report contains all sources cited or quoted.



.....

René Leus

6 November 2022

## Dedication

I dedicate this research to all the people who have supported me during this journey. Without your support, understanding, and motivation, I would not have reached this milestone.

## Acknowledgements

I would like to express my sincere gratitude for the following:

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## Abstract

Literature has shown that there is a shortage of graduates with the necessary 21st-century skills to fill current workplace requirements, causing a gap in the market contributing to low employability rates. Although higher education institutions have been making efforts to develop policies to include these 21st-century skills within curricula, developing 21st-century skills, such as communication, collaboration, and critical thinking, in a fully online learning environment comes with several challenges. This study used a qualitative case study approach to gather data from ten educators through online questionnaires, document analysis, and interviews. The purpose of this study was to determine what practices current educators were using as well as how they were using digital educational technology (DET) to develop 21st-century skills in their fully online learning modules. Guided by the Partnership for 21st-century (P21) Framework, the results revealed that educators were using several affordances of DET to develop 21st-century skills in their online learning modules; however, these skills were being developed to varying extents. The most popular affordances of DET included feedback and linked representations which encouraged learners to develop critical thinking skills. Some affordances of DET could be used to target the development of a specific 21st-century skill, whereas other could be used to develop skills concurrently. Although the use of DET could result in the fortuitous development of 21st-century skills, it is recommended that educators know what these skills are and receive the necessary training to learn how DET can be used to develop 21st-century skills to their full extent.

Keywords: Digital educational technology, 21st-century skills, online learning

## Ethical clearance certificate



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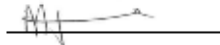
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My editing was restricted to language and in-text referencing. It remains the responsibility of the candidate to make the recommended changes.

No view is expressed regarding the subject-specific contents of the document.

Dr Fran Greyling  
D Ed. Computer-Based Education  
SA Writers College: Copy-editing and Proofreading

4 December 2022

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## List of Abbreviations

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Abbreviation	Definition
DET	Digital Educational Technology
RSQ	Research Sub-Question
SAQA	South African Qualifications Authority
HEQF	Higher Education Qualifications Framework
4Cs	Communication, Collaboration, Critical thinking and Creativity skills
NQF	National Qualifications Framework
SETA	Sector Education and Training Authority
SACE	South African Council for Educators
ECSA	Engineering Council of South Africa
SANC	South African Nursing Council
WHO	World Health Organisation
LMS	Learning Management System
NASEM	National Academies of Sciences, Engineering and Medicine
P21	Partnership for 21st-century

## Chapter 1: Introduction

### 1.1 Introduction

During the past few years, participation in online learning has grown exponentially (Mani, 2020; Rungta, 2022). Bouchrika (2022) and Mani (2020) are of the opinion that the e-learning industry will be reaching a value worth at least \$336.98 billion by 2026, whilst Rungta (2022) predicts a 200% increase in the online learning industry between 2020 and 2025. As online learning grows, many questions arise, such as what technology can be used, what its affordances are, and what skills are developed through online programmes (Arghode, Brieger, & McLean, 2017; Dhawan, 2020).

There is also a concern among employers that graduates lack the necessary skills to be successful in the workplace (Care, Vista, & Kim, 2020; Rios, Ling, Pug, Becker, & Bacall, 2020; Van Dam, 2017). In the 21st century certain skill sets are needed for individuals to thrive in the workplace; some of these skills include critical thinking, creativity, communication, collaboration, and flexibility (World Economic Forum, 2020a). This research study looked into these 21st-century skills – which have become a necessity – in more detail, and it investigated the affordances of DET that can be used to develop these skills.

In this chapter more background information regarding the research topic, the purpose of the research, and the research questions are shared. The chapter ends with a summary of the research methodology as well as the trustworthiness and ethical considerations of the study.

### 1.2 Background

According to research done by the World Economic Forum (2016, 2020a) and Van Laar, Van Deursen, Van Dijk & De Haan (2017), employers are nowadays giving preference to candidates who have 21st-century skills in addition to job-specific skills. These much sought-

after 21st-century skills include emotional intelligence, communication, creativity, critical thinking, collaboration, and digital literacy skills (Van Laar et al., 2017; Voogt & Roblin, 2012; World Economic Forum, 2016, 2020a).

Schools often neglect the development of above-mentioned skills within the curriculum and instructional practices even though it is included in educational policies (Care et al., 2020). According to Mabaso (2017), some efforts have been made to implement 21st-century skills within the curriculum, but doubts remain whether the teachers have the pedagogical knowledge and resources required to develop 21st-century skills. This inattention to developing and prioritising 21st-century skills will have an influence on students when they enter the workforce or higher education (Care et al., 2020). Moreover, Voogt et al. (2013) identified three issues regarding the implantation of 21st-century skills in schools: the training and responsibilities of teachers, the lack of collaboration between different parties, such as educators and employers, and, most importantly, the placement of 21st-century skills within pedagogies and the curriculum.

As a major contributor to the development of future skilled employees, higher education institutions have an obligation to identify the skills graduates require for the workplace (Ali & Jalal, 2018; Veldsman, 2019). It is essential that higher education institutions prioritise these skills within their teaching and learning processes to prepare graduates to succeed in the workplace (Ahmad, 2013). In addition to the existing gap in education systems, higher education has also experienced huge growth in the area of online learning (Dhawan, 2020; Diaz-Infante et al., 2022) which comes with its own challenges, such as linking educational practices with digital technology and incorporating the development of 21st-century skills (Parker, Maor, & Herrington, 2013). To address the challenges of online learning, education curricula and pedagogies should be responsive to the needs of the workplace and should be

incorporating 21st-century skills in instructional practices (Amin, 2019; Battelle for Kids, 2019; South African Qualifications Authority, 2011).

### **1.3 Problem Statement**

Research has shown that there is a lack of opportunity for students in higher education to develop 21st-century skills (Beamish, 2019; Joynes, Rossignoli, & Amonoo-Kuofi, 2019). Prospective graduate employees are looking for 21st-century skills on top of job-specific skills (World Economic Forum, 2016; Kereluik, Mishra, Fahnoe, & Terry, 2013). One resulting major problem is that a gap exists between the skills development that is taking place at higher education institutions and the skills required by the 21st-century workplace. Research has found that this gap is contributing to the low employability rate that graduates are currently facing when entering the workforce (Teng, Ma, Pahlevansharif, & Turner, 2019; Van Dam, 2017).

In addition, fully online learning is becoming more prominent, and this phenomenon is impacting the rapid growth of using DET for educational purposes (Bhowmik & Dipak Bhattacharya, 2021; Li & Lalani, 2020; Martin, Budhrani, Kumar, & Ritzhaupt, 2019). Universities are moving modules online for various reasons, such as to improve student interaction, to create a flexible learning environment, and to provide a more cost-effective opportunity for learning (Shanthi & Jayapaul, 2020). However, to develop 21st-century skills, such as communication, collaboration, and emotional intelligence can be problematic in a fully online learning setting (Gillett-Swan, 2017; Davey, Elliott, & Bora, 2019). Therefore, for educators in higher education institutions to develop these workplace-required 21st-century skills is becoming more problematic in online learning environments. The problematic development of 21st-century skills in online environments in higher education may further contribute to low employability rates and a lack of competent and successful graduates for future employers.



#### **1.4 Rationale and Purpose of the Study**

As mentioned before, a gap exists between the skills that graduates acquire and the skills that are expected from employers in the workplace (Teng et al., 2019; Van Dam, 2017). This gap causes, amongst others, low employability rates, as graduates struggle to gain employment even though they have the necessary job-specific skills. The lack of developing and prioritising 21st-century skills in school and education is contributing to the issue of graduates not being prepared for the workplace (Care, et al., 2020). Additionally, the education sector, especially higher education, has seen significant expansion in online learning (Dhawan, 2020; Diaz-Infante et al., 2022), which presents its own difficulties, such as integrating technology into teaching methods and fostering 21st-century skills (Parker, Maor, & Herrington, 2013). This exacerbates the already existing disparities in education systems, particularly in higher education, and that graduates are not acquiring the necessary skills to be successful in the 21st-century workplace.

Therefore, the purpose of this study was to investigate what affordances of DET support the development of the much sought-after 21st-century skills that the workplace requires. The researcher was also interested to find out whether, and to what extent, 21st-century skills are being developed in fully online learning modules at higher education institutions. In addition, the researcher performed a literature review about 21st-century skills, and how these skills can be incorporated into online learning, as well as the uses of affordances of DET for developing 21st-century skills were also examined.

Lastly, the aim was to contribute to the body of knowledge to provide in-depth insights to other educators on how DET can be used to develop 21st-century skills in online learning. Therefore, the findings of this study may be useful to educators who are developing and/or teaching online learning content to adult learners at higher education institutions and who would like to improve the development of 21st-century skills in their online modules.

## 1.5 Research Questions

The main research question for this study is: How can digital educational technology be used to develop 21st-century skills in fully online learning?

The research sub-questions (RSQ) for this study are:

1. What affordances of DET support the development of 21st-century skills in fully online learning?
2. To what extent do current fully online modules make provision for the development of 21st-century skills?

## 1.6 Key Theoretical Concepts

Since various terms and concepts can be used interchangeably, but with a different meaning, it is necessary to provide clarity regarding the key theoretical concepts that were used in this study. Table 1.1 outlines the key concepts applicable to this study.

**Table 1.1**

*Key concepts used in this study*

<b>Concept</b>	<b>Description applicable to this study</b>
Educators	Educators are individuals who teach others or are specialist in the educational field (Indeed, 2022). In this study, educators refer to any person who teaches fully online modules at a higher education institution, or who designs fully online modules for a higher education institution.
Fully online learning	The term online learning refers to learning and teaching using the Internet only (Martin et al., 2019). In this study, fully online learning means that the entire learning process takes place online and there is no in-person contact. Throughout this study the terms fully online learning and online learning will be used interchangeably.

Concept	Description applicable to this study
Fully online modules	In this study, fully online modules are modules that are offered fully online. This means that all the contents, resources, and teaching are offered online only (Martin et al., 2019).
Digital educational technology	In general, and in this study, digital educational technology (DET) refers to applications, digital tools, and resources, such as videos, learning management systems, and social media platforms, that can be used for educational purposes (Jones, 2019; Liu, 2013; State Government of Victoria, 2019).
21st-century skills	The set of skills that are used to describe the skills that individuals will require to be successful in the workplace, in this century and for the future to come, are referred to as 21st-century skills (Ornellas, Falkner, & Erdman Stålbrandt, 2019; Voogt et al., 2013; World Economic Forum, 2016, 2020a). There are several skills that can be classified as 21st-century skills, such as critical thinking, self-management, problem-solving, flexibility, and creativity (Chalkiadaki, 2018; World Economic Forum, 2016, 2020b). In this study, this concept is used similarly but the focus is on the 4Cs of 21st-century skills, namely critical thinking, communication, collaboration, and creativity.

## 1.7 Research Design and Approach

In this study, the interest was in the authentic experience of the educators in their environment of online learning, while they reflect on how they incorporate the development of 21st-century skills in their online modules. Therefore, the researcher was guided by an interpretive research paradigm (Günbayi & Sorm, 2018). A qualitative case study (Baxter & Jack, 2008; Tiley, 2017; Yin, 2009) was undertaken to explore the in-depth opinions and

experiences of online educators on how DET can be applied to develop 21st-century skills in fully online learning in higher education. This study was guided by the P21 Framework (Battelle for Kids, 2019; Partnership for 21st Century Skills, 2009) which focuses on the 21st-century skills that students acquire to succeed in the modern workplace. The P21 Framework is structured in four support systems that enable educators to incorporate 21st-century skills within their teaching pedagogies and curricula.

The participants for this study were selected based on a combination of purposive sampling, convenience sampling and voluntary sampling. The research instruments for this study consisted of an online questionnaire, document analysis of various documents of the participants' online modules, and semi-structured interviews. A thematic analysis of the qualitative data was performed. A summary of the study's research design can be seen in Table 1.2, while a full explanation is provided in Chapter 3.

**Table 1.2**

*Summary of the research design of the study*

<b>Research Sub-questions</b>	<b>Source of data</b>	<b>Data collection instruments</b>	<b>Number of sources</b>
RSQ1	<ul style="list-style-type: none"> <li>• Online modules</li> <li>• Educators at a higher education institution</li> </ul>	<ul style="list-style-type: none"> <li>• Document analysis</li> <li>• Online questionnaire</li> </ul>	<ul style="list-style-type: none"> <li>• 18 modules</li> <li>• 11 participants</li> </ul>
RSQ2	<ul style="list-style-type: none"> <li>• Educators at a higher education institution</li> </ul>	<ul style="list-style-type: none"> <li>• Online questionnaire</li> <li>• Sem-structured interviews</li> </ul>	<ul style="list-style-type: none"> <li>• 11 participants</li> <li>• 5 participants</li> </ul>

## **1.8 Trustworthiness**

In order to maintain the trustworthiness of the research findings of this study, the researcher paid close attention to the four criteria recommended by Guba and Lincoln (1994): credibility, dependability, confirmability, and transferability, as. The details of how each of these trustworthiness criteria was attended to in this study are discussed in Chapter 3.

## **1.9 Limitations of the Study**

A limitation of this study is that the sample size was small since the researcher had access to one higher education institution only. Another limitation may be that this study investigated fully online modules only and not fully online programmes in totality. As such, there is a possibility that 21st-century skills may be incorporated in more detail in other modules or face-to-face modules of programmes at this institution.

## **1.10 Ethical Considerations**

In this research, ethical clearance had been obtained from one higher education institution before any data were collected for the study. The researcher complied with the institution's requirements by ensuring the participants voluntarily agreed and gave informed consent to participate in this study. Furthermore, the anonymity of the participants was assured by treating all the information confidentially. At no time were the participants mentioned by name or allowed to be identified in any manner or means whatsoever in the research report.

All the secured data files and findings were stored on a cloud-based drive that was secured with its own distinct password and was updated regularly. Only the researcher, supervisor, and co-supervisor had access to the drive to ensure the security and confidentiality of the information. The University of Pretoria requires research data to be

stored for a minimum of ten years (University of Pretoria, 2007). In this research study, the data and findings will be stored for 15 years from the collection date.

### **1.11 Summary**

In this chapter, the background of this study was discussed in terms of the importance of 21st-century skills, what these skills entail, and the role of higher education institutions in developing these skills. The chapter further looked at the problem statement, aims, purpose, and the research questions of this study. The main focus of this study was on how educators used DET to incorporate 21st-century skills within their fully online learning environments.

Finally, the research study's methodology, methods to ensure the study's trustworthiness, and the limitations of this study were summarised. The following chapter presents a literature review of what 21st-century skills entail, 21st-century skills in the workplace and education as well as the role of online learning and EDT in relation to the development of 21st-century skills. The study's theoretical framework is also unpacked.

## Chapter 2: Literature Review

### 2.1 Introduction

In this chapter, the focus is on what previous research found in relation to the skill sets needed to thrive in today's workplace and how higher education is currently accommodating the development of these skills in fully online modules. The research question and sub-questions led to the examination of existing literature in relation to this study. The first research sub-question focuses on the affordances of DET that could potentially contribute to the development of 21st-century skills and was used to direct the focus of the literature review to the challenges, methods, and attempts that have been identified and implemented for the development of 21st-century skills in fully online modules. The second sub-question guided the literature review to identify what digital educational technologies facilitate the development of 21st-century skills. The chapter concludes with a description of the theoretical framework that guided this study.

### 2.2 21st-century skills

According to the European Education and Culture Executive Agency (2014), employability refers to whether graduates can secure employment or become self-employed as well as navigate successfully within the labour market to maintain employment. There are many terms used to describe the employability skills that are required for individuals to succeed in a work environment. Most higher education institutions refer to these skills as graduate attributes (Oraison, Konjarski, & Howe, 2019). Other popular terms are soft skills and transferable skills, whereas the most popular term is 21st-century skills (Ornellas et al., 2019; Voogt et al., 2013). In this study, the term 21st-century skills refer to the skills required for graduates to be successful in the modern-day workplace. Considering the definition of the term 21st-century skills, the focus now shifts to the role that these skills play in the workplace and in education, respectively.

### **2.2.1 21st-Century Skills in the Workplace**

The Fourth Industrial Revolution started when technologies called cyber-physical systems became more prominent and were integrated with the Internet and people (Van Dam, 2017). The Fourth Industrial Revolution includes technologies implemented in the physical, digital, and biological spheres of today's society (Aziz Hussin, 2018). These new technologies have been referred to as being disruptive since they cause a disruption in the economy and reorder the way businesses and people are doing things (World Economic Forum, 2016). The changes brought along by the Fourth Industrial Revolution have caused some fears in terms of job loss due to the automation of certain job tasks and activities (Hirschi, 2018). Hirschi (2018), however, also proposes that there is the possibility that new jobs can be created. For example, in businesses, certain jobs may be replaced with new technologies in the near future, while others might be outsourced, or positions may be adjusted to adapt to these new technologies (Van Dam, 2017).

Jobs that are easy to automate are mostly middle-skilled positions, such as those of administrators and operators of machinery (Levy, 2018). In contrast, high-skilled and low-skilled jobs are harder to automate since these job tasks, such as solving problems, socialising, and caretaking, still require some human interaction (Hirschi, 2018).

The possible loss of jobs due to the changes of the Fourth Industrial Revolution has placed immense pressure on employees to attain the necessary skills to adapt to ever-changing environments. Similarly, the possibility that new jobs can be created in new industries can also put pressure on future employees to have the required skills for that new job industry (Pinzone, Fantini, Perini, Gafavaglia, & Miragliotta, 2017). It is clear that the disruptions caused by the Fourth Industrial Revolution are affecting the skill sets needed in workplaces, especially skills to adapt to the fast pace and changing environment (Rios et al., 2020; World Economic Forum, 2016).



Research indicates that the employability skills that will be required in the Fourth Industrial Revolution will transform the workplace from a technical to a more social environment (Teng, Ma & Pahlevansharif, 2019). This transfer from a technical to a more social setting does not indicate that digital skills are not considered necessary but that employable individuals will require a broad spectrum of skills ranging from social to technical skills (Teng et al., 2019). The Future of Jobs Report (2016) has surveyed over 13 million employees across the globe to predict the skill sets needed to thrive in today's workplace (World Economic Forum, 2016). According to the report, by the time students graduate, 50 percent of the subject knowledge gained during their first year of study will be outdated. Additionally, the findings indicate that employers are looking beyond job-specific skills to interpersonal skills that classify how an individual interacts with other employees and their workplace (Aarts & Kunn, 2019; Stewart, Wall, & Marciniac, 2016; World Economic Forum, 2016).

According to Suleman (2016), there is no single method to determine the set of skills that makes graduates more employable, since employers' perceptions play a role in determining the skills required for graduates. Additionally, Suleman (2016) argues that most of these skills are not easy to measure but that the skills identified by research thus far contribute to reducing the gap between graduates' skills and the skills required by the workforce for employability. The skill that is most in demand in the workforce for employability falls under the umbrella term relational skills, such as communication and collaboration (Dimitriadis & Koning, 2020; Thi Quynh Lan, 2018). The World Economic Forum (2020b) has, furthermore, identified their top 10 skills for 2025 in the workplace. Figure 2.1 shows these top skills which include complex problem-solving, critical thinking, self-management, and creativity.

**Figure 2.1**

*Top 10 skills for 2025 (World Economic Forum, 2020b)*



Research done by Kyllonen (2012), and Lai and Viering (2012) found that there are common themes amongst the different kinds of expertise that are identified as 21st-century skills. Certain skills are repeated and overlap in different frameworks (Chalkiadaki, 2018). The majority of frameworks for 21st-century skills include the following skills: critical thinking, problem-solving, creativity, communication, collaboration, and digital literacy skills (Caena & Redecker, 2019; Care et al., 2018; Kereluik et al., 2013).

Critical thinking and problem-solving are 21st-century skills that depend on effective communication skills to understand a situation in its entirety. Critical thinking skills are required to analyse data while solving problems (Rios et al., 2020). Problem-solving

describes the process of analysing and evaluating different concepts or scenarios in order to determine possible solutions to problems (Leite, 2020). Both problem-solving and creativity skills are highly required competencies. Creativity refers to an individual's ability to think creatively and interpret complex information in order to generate new opportunities and possibilities (Dong, Bartol, Zhang, & Li, 2017). Other required skills, such as collaboration and communication skills, are also important for competing in the global job market. Effective communication skills are needed for collaborating with others to achieve successful outcomes as a team and to manage conflicts (Chalkiadaki, 2018; Jacobson-Lundeberg, 2016). Lastly, digital literacy skills – the ability to access and communicate information via digital technology – are seen as the most prominent area of research for many educators and researchers when it comes to researching 21st-century skills (Chalkiadaki, 2018; Komalasari, 2021; Silvhiany et al., 2021). According to Chalkiadaki (2018), digital literacy skills are such a predominant area of research because the 21st-century period is about the advancement of technologies, innovation, and globalisation.

Joynes et al. (2019) found that most of the above-mentioned skills will be among the essential skills needed in the workplace by the year 2030. The World Economic Forum (2020a), furthermore, indicates that workers with 21st-century skills are in high demand and will remain in high demand for the years to come. The education system can contribute to reducing the skills gap in the labour market by better preparing graduates for the Fourth Industrial Revolution workplace (Teng et al., 2019) by using the affordances of DET to develop 21st-century skills.

## **2.2.2 21st-Century skills in Education**

Education prepares students for the workplace whether they enter the workplace from high school, college, or university (Department of Basic Education South Africa, 2019). The Department of Basic Education in South Africa and several statutory bodies are cognisant of

21st-century skills and have attempted to put many measures in place to incorporate these skills and subsequently meet workplace needs (Department of Basic Education South Africa, 2019). The 2030 Agenda for Sustainable Development of the United Nations (2015) set out goals and targets to develop and strengthen global systems to be more sustainable and accessible to all. The Sustainable Development Goals (United Nations, 2015, p. 19) include under Goal 4 the following: “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”. Target 4.7 of the Agenda (United Nations, 2015) specifically indicates that this goal is to provide all students with the necessary skills and knowledge they need to develop and sustain healthy lifestyles and global citizenship. The target is further extended to ensure: “(i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in: (a) national education policies, (b) curricula, (c) teacher education and (d) student assessment” (United Nations, 2017, p. 8).

In addition to the Sustainable Development Goals (United Nations, 2015), the South African Qualifications Authority (SAQA) identified specific critical cross-field outcomes that include solving problems, systems thinking, working with others, using technology, self-management, and using information and effective communication (Carmichael & Stacey, 2006; Isaacs, 2000). These critical cross-field outcomes closely relate to 21st-century skills. Critical cross-field outcomes define the qualities that should be developed in students irrespective of the specific subject matter or content that they are learning (South African Qualifications Authority, 2000). These outcomes should be followed by educators and curriculum developers in order to develop life-long learning capacities (South African Qualifications Authority, 1997). SAQA is also responsible for registering qualifications when they meet the relevant criteria set out in the National Qualifications Framework (NQF) Act (South African Qualifications Authority, 2014). The Higher Education Qualifications Framework (HEQF) further provides information on how higher education qualifications are

incorporated into the NQF and aims to standardise all higher education qualifications in South Africa in terms of their characteristics and purposes Africa (DoE, SAQA, & CHE, 2008).

The Sector Education and Training Authority (SETA) is responsible for identifying the skills required in the industry and for the development of these skills (SETA, 2015). According to SETA, some of the essential skills that are needed in South Africa include evaluation, leadership and management, planning, ethics, communication, and interpersonal skills, personal development, IT skills, and community engagement (Local Government Sector Education and Training Authority, 2018). Again, these skills correlate with the top 21st-century skills (World Economic Forum, 2020b).

Ensuring graduates from the education system acquire the skills as set out above, professional bodies regulate registered professionals to verify they have the necessary skills and are competent for the profession (Dowelani & Dowelani, 2020). According to Naidoo and Rajcoomar (2020, p. 2), “professional bodies are now considered part of the strategic learning and skilling infrastructure of South Africa”. In South Africa, there are several professional bodies that monitor the practice of certain professions, such as the South African Council for Education (SACE), the Engineering Council of South Africa (ECSA), and the South African Nursing Council (SANC).

According to SACE (2018), the following are some of the skills identified as professional teaching standards and are necessary for the professional teaching practice: collaboration, social responsibility, subject matter knowledge, thoughtful decision making, and monitoring and assessing learning. ECSA, however, places emphasis on problem-solving as a high-priority skill needed for the profession (Engineering Council of South Africa, 2018). Other competencies in highlighted by ECSA are social responsibility and specialist knowledge in

the subject matter of engineering. The Legal Practitioners Council only mentions job-specific skills in the form of a qualification (Legal Practice Council, 2019), whereas SANC lists the following competencies besides job-specific skills: collaboration, leadership and management, problem-solving, communication, and social responsibility (South African Nursing Council, 2018). The Health Professions Council of South Africa has the main competencies of ethical practice in terms of social responsibility and professional development (Health Professions Council of South Africa, 2016), and the South African Veterinary Council's competencies include communication, professional and ethical practice, continued professional development and specialist knowledge in the subject matter of veterinary science (South African Veterinary Council's, 2019). Yet again, it is clear that the skills required by most professional bodies closely relate to 21st-century skills (World Economic Forum, 2020b).

Higher educational institutions contribute greatly to the development of future skilled employees for the workplace and, therefore, have an obligation to determine the skills graduates need (Ali & Jalal, 2018; Veldsman, 2019). Although 21st-century skills development is often included in educational planning policies, it is not necessarily prioritised within the curriculum development processes and pedagogies (Care et al., 2020). In spite of all the suggestions by the authorities, advisory committees, and professional bodies, research findings indicate that there is a disparity between the skills graduates possess and the skills that employers require (Sulaiman & Ismail, 2020; Thirunavukarasu et al., 2020). This gap contributes to issues in the labour market due to the quality of the qualifications according to international standards (Suarta, Suwintana, Dudhana, & Hariyanti, 2017). Similarly, the research of Binsaeed, Unnisa, and Rizvi (2017), found that the major demand in the international and national markets are the skills required to perform in the workplace, such as 21st-century skills. The reason for this

high demand is that higher education is finding it difficult to develop these skills that are required by the workforce (Binsaeed et al., 2017).

Furthermore, it is worth noting that 21st-century skills are not usually incorporated into the curriculum and instructional practices in schools (The Eduvation Network, 2020).

Governments and leaders of countries such as Asia, China, and Malaysia have noted the importance of integrating employability skills within education and encouraged educational institutions to implement these skills within their policies and curricula (Teng et al., 2019; Zaharim, Ahmad, Yusoff, Omar, & Basri, 2012). However, it is questionable whether all schools have access to the necessary resources and if educators have the pedagogical knowledge to develop these skills (Sulaiman & Ismail, 2020). Additionally, it has also been found that most educators are still implementing traditional teaching practices and are not adapting their practices to attend to the skills gap in the current labour market (Teng et al., 2019). This failure to develop 21st-century skills will have an influence on students when they enter the workforce or higher education (Care et al., 2020).

Sam and Soong (2019), identified some issues in regard to implementing 21st-century skills in higher education: the lack of knowledge, skills, and training of educators, the lack of collaboration between educators, the lack of support, and, most importantly, the placement of 21st-century skills within the curriculum and pedagogies. While most frameworks address these issues, all use different approaches for integrating 21st-century skills. However, the overall recommendation is to integrate these skills across the curriculum Voogt & Roblin, 2012). To include these skills in the curriculum, higher education institutions must find a way to prioritise the 21st-century skills within their teaching and learning practices, so that they can deliver graduates that can function successfully in their prospective job placements (Ahmad, 2013). A possible solution for higher education institutions to implement the

development of 21st-century skills might be online learning (Edirisingha & Ehlers, 2020; Riegel & Kozen, 2016; Thaha Abdullateef, 2021).

### **2.3 Online Learning**

The online learning industry has shown tremendous growth over the years with a 900% increase since 2000 and is estimated to reach an industry value worth \$398 billion by 2026 (Mani, 2020). The growth of the online learning industry further spiked in 2020 as a result of the Coronavirus disease when the World Health Organisation (WHO) declared it a world pandemic. The declaration of the COVID-19 pandemic brought about change across the world and in every aspect of individuals' lives to prevent the spread of the Coronavirus (Adnan & Anwar, 2020). Educational institutions had to apply restrictions and eventually had to shut down in order to prevent the transmission of the Coronavirus disease. Most educational institutions had to adapt their teaching practices to fully online learning environments to continue the learning process for students (Dhawan, 2020). During the shift from traditional teaching to online teaching, emphasis was placed on the barriers and challenges of online learning and that interventions are still required.

Online learning can be defined as using the Internet for the entire learning process which includes getting access to content, learning activities, instruction, and interacting with peers and academics during their learning process (Martin et al., 2019). Learning online has many benefits for the learner, such as lower costs (for travel and/or accommodation), more flexibility, more diversity, and more instructional designed content than face-to-face learning would normally offer (Shanthi & Jayapaul, 2020). Online learning provides opportunities where students have the option of choosing the most cost-effective online course or degree (Shanthi & Jayapaul, 2020). It can be argued that studying online lowers the cost of study since it reduces the cost of acquiring residence close to an educational institution, traveling costs, and other aspects that would normally require cost whilst studying on campus at a



higher education institution (Solangi et al., 2018). As a result of online learning's flexibility, students can learn at their own pace and study while working remotely. According to online learning statistics, more than 50% of Internet users find online learning to be more convenient and better suited for their lifestyle since they can plan it around their schedules (Mani, 2020). Online learning provides learning opportunities for students from a diverse range of backgrounds since there are no geographical limits, and it offers a space for students to exchange their different cultural perspectives (Bozkurt, Yazici, & Aydin, 2017).

In online learning, the teacher now play the role of a facilitator and extends to a more student-centred approach. In contrast to a teacher-centred approach, an online student-centred approach requires facilitators to engage with students online, offer support to students in various aspects such as technical and time management support, create an online presence with constant communication, and encourage engagement and interaction to only name a few (Martin et al., 2019; Solangi et al., 2018). Therefore, instructional strategies and pedagogical approaches specifically for online learning are needed when creating content and activities for online courses (Arghode et al., 2017). Designing interactive and fun instructional activities can motivate students to become more engaged and interested in their learning (Senthamarai, 2018). Online learning content can also include several modes of representation such as audio, video, and text that not just brings in a human factor and engagement (Stone, 2019), but also fosters an environment of inclusion (Boothe, Lohmann, & Donnell, 2018).

### **2.3.1 Challenges in the online learning environments**

Although online learning has many benefits there are also major challenges with online learning environments (Gilbert, 2015; Xhaferi & Xhaferi, 2020). Students find the lack of interaction and communication in an online learning environment especially challenging (Azmat & Ahmad, 2022). This can include anything from the lack of communication between

instructors and students, not knowing how to use the technologies appropriately, and not having enough time to practice in a safe environment (Tareen & Haand, 2020). Online learning can result in students feeling isolated, and this feeling of isolation hinders the students learning process. Furthermore, isolation in online learning is two-fold since the student can feel alone in their physical learning environment, and they can feel alone in their learning experience (Arulsevarani & Kirubakaran, 2013; Vandenberg & Magnuson, 2021).

Other problems in online learning environments are based on the assumption that students have the skills to use the technology and have the data bandwidth available to collaborate online (Mpungose & Khoza, 2021). Some of the reasons why students might find collaborative activities challenging could be personal; they are anxious or uncomfortable with using the technology (Gillett-Swan, 2017; Vandenberg & Magnuson, 2021). Students may also be unfamiliar with the technologies involved in completing collaborative activities (Gillett-Swan, 2017; Mpungose & Khoza, 2021). Online collaboration activities must initially be facilitated by the instructor to provide support, and students can, over time, develop the skills required for participation. According to Hussin, Harun, and Shukor (2019), developing critical thinking and problem-solving skills in an online learning environment will require some form of social interaction. Social interaction encourages students to discuss problems and raise questions in order to solve the problem whilst they are developing their critical thinking skills (Hussin et al., 2019). Working in teams on projects and being able to communicate online, as well as solving problems, further supports the development of creativity skills among students (Seechaliao, 2017).

Students must communicate and collaborate in an online environment by using discussion forums or chat features to develop critical thinking (Hussin et al., 2019). Moreover, online environments that support critical thinking and collaborative problem-solving could also promote the development of creativity (Seechaliao, 2017). However, it is

important that educators have the necessary tools and knowledge to create an online environment that is conducive to the development of 21st-century skills (Bhuana & Apriliyanti, 2021; Uerz, Volman, & Kral, 2018). As Pei and Wu (2019) states the ineffective design and arrangement of multimedia materials in online courses are one of the many factors contributing to ineffective learning. Some educators have the perception that if they merely integrate or use digital tools within their teaching practices it will aid effective learning (Torres Martin et al., 2021). As Ali (2020) states one of the many shortcomings in online learning and with the use of digital tools are educators not having enough time for lesson planning and/or the support for effective curriculum design. However, if digital tools are used appropriately to create an online curriculum it can be highly effective in allowing students to acquire subject knowledge and acquire 21st-century skills needed future workplace success (Fitzgerald, Jones, Kucirkova, & Scanlon, 2018; World Economic Forum, 2016, 2020a). These tools are called digital educational technology (Jones, 2019).

## **2.4 Digital Educational Technology**

According to several resources, educational technology can contribute to the development of 21st-century skills (International Society for Technology in Education, 2007; Latorre-Coscolluela et al., 2021). Educational technology can be defined as putting teaching and learning into practice by integrating technology within traditional teaching practices (Liu, 2013). According to Liu (2013) the categories of educational technology include digital, network, intelligent, and multimedia technology. DET can be defined as applications, digital or computerised tools, and resources that can be used for educational purposes (Jones, 2019; State Government of Victoria, 2019). There are many different types of DET, such as learning management systems, social media, gamification, artificial intelligence, multimedia technology, and collaborative technology (Bui, 2020; Pinto & Leite, 2020).

DET plays an integral role to support online learning in higher education institutions (Bates, 2018). Martin, Polly, Coles, & Wang (2020) synthesised the literature on DET that is commonly used in higher education. The authors subsequently identified three categories for DET in higher education: learning management systems (LMS), collaborative technology, and audio and video technology. These three categories will also form part of the focus of this research.

### **Learning management system technology**

LMS technology provides students with access to course content online and allows educators to monitor the performance and engagement of their students in online learning (Yildiz, Tezer, & Uzunboylu, 2018). Some of the many benefits of LMS technology are that it makes learning more flexible and allow students to be independent and productive in their learning due to the online availability of all learning materials that can be accessed at any time (Simanullang & Rajagukguk, 2020; Zheng, Wang, Doll, Deng, & Williams, 2018). Some examples of LMSs are Moodle, Blackboard, Canvas, and Google Classroom (Pappas, 2020; Trustradius, 2021). Furthermore, LMS software extends to making assessment tools available to assess students' performance and understanding (Khairil & Mokshein, 2018). Online assessment offers several advantages such as automatic marking, immediate feedback, discussion opportunities, time saving, and even enhanced motivation of students (Khairil & Mokshein, 2018; Lin, 2018).

### **Collaborative technology**

Another category of DET is collaborative technology that can be referred to as the tools that support collaboration (and communication) among students as well as the coordination of online learning tasks (Hsu & Shiue, 2017; Schwendimann et al., 2018). Collaborative technology is further divided into categories such as social media, networking, discussion forums, wikis, and cloud-based technology (Consolidated Technologies Inc., 2019; De

Vreede, Antunes, Vassileva, Gerosa, & Wu, 2016). The benefits of using collaborative technology tools are that it fosters a support system for online learning to help students gain new perspectives, it increases student engagement, and students can develop collaboration and problem-solving skills (Hsu & Shiue, 2017; Pandey, 2017). Examples of such tools are Adobe Connect, Google Drive, Google Hangouts, Microsoft Teams, Padlet, Zoom, and Skype (Kumar, 2021; Mallon & Bernsten, 2015; Martino, 2019).

### **Audio and video technology**

Audio and video technology are used to present course content in a more stimulating manner and to improve the understanding and retention of content (Sejdiu, 2017). Learning with these educational technologies improves students' understanding of complex concepts and captures their attention (Nsirim & Omehia, 2021). Examples of audio and visual technology are digital videos, graphics, animations, and audio clips (Park, Kim, Cho, & Han; 2019; Sejdiu, 2017).

It is clear that there are various types of DET available that support online learning. For example, an LMS system is primarily designed to host content but also includes collaboration functions like video conferencing and discussion forums as well as the ability to embed videos, graphics, and audio. In addition, this study also looked at DET and its specific affordances that support the development of 21st-century skills in online learning.

### **2.5 Affordances of Digital Educational Technology**

Affordances can be defined as the characteristics of DET that allow for certain practices in online learning (Hoven, 2007; Ng, 2015). Affordances not only refer to the capabilities that DET has to offer, but also to the limitations of these technologies (Al-Maawali, 2020). Ng (2015) categorises the affordances of DET according to the purpose that the technology fulfils: learning, research, communication, collaboration and sharing, content creation and

presentation, and assessment. The National Academies of Sciences, Engineering, and Medicine (NASEM) (2018) of the United States identified the following affordances for educational technology: interactivity, adaptivity, feedback, choice, nonlinear access, linked presentations, open-ended learner input, and communication. According to NASEM, these affordances particularly support deep learning, which is needed to develop the foundations for literacy, numeracy, and 21st-century skills (National Academies of Sciences, Engineering & Medicine, 2018). Since the affordances identified by NASEM support the development of 21st-century skills, for the purpose of this research, these affordances are discussed in more detail.

### **Interactivity**

Interactivity allows students to engage and interact with their learning content by using a DET tool. The technology tool can also be set up to provide a response back to the student based on their interaction or inputs (Beauchamp & Kennewell, 2010; Lippert, Gatewood, Cai, & Graesser, 2019). DET tools can further support the student's individual interaction with learning content and their interaction with other participants within a group setting (Beauchamp & Kennewell, 2010). The more opportunities students are provided to interact with the content and with peers and educators, the better the students' learning experience (Smith & Winking-Diaz, 2004; Weber & Ahn, 2021). The interaction between a student and peers could create opportunities to also develop the 21st-century skills of collaboration and communication (Hussin et al., 2019). Individual student interaction with the learning content can develop 21st-century skills, such as problem-solving and critical thinking (Krusche & Seitz, 2019). In light of the above, it can be argued that some 21st-century skills are inherent in online learning. As an example, students need to be interactive by communicating and collaborating in order to develop critical thinking skills (Hussin et al., 2019). Furthermore, a

systematic review done by Yalcinalp and Avci (2019) revealed that the affordance of interactivity of several different DET did have a positive impact on developing students' creativity.

### **Adaptivity**

Adaptivity is where a DET affords for the student to have a personalised learning experience based on their behaviour and certain characteristics (Lippert et al., 2019). The affordance of adaptability can also be defined as the capability of DET to adjust to the notion of branching (Bajaj & Sharma, 2018). For example, the DET allows the educator to set up different learning paths for students, and based on the inputs of students, the DET will direct students to a specific learning path. Personalised learning experiences can offer students the opportunity to share their knowledge and ideas which can develop their collaboration skills (Fitzgerald et al., 2018; Han & Ellis, 2020). Additionally, since adaptivity prompts learners to make decisions and/or solve problems, it does develop learners' critical thinking skills (Liu, McKelroy, Coliss, & Carrigan, 2017). These skills, critical thinking and collaboration, form part of the acquisition of 21st-century skills that is made possible through the adaptability of the DET.

### **Feedback**

Feedback is the affordance of DET that affords students to get feedback regarding their performance with the focus on what the students can do to improve on a particular task (Winstone & Boud, 2019). Feedback allows the students to develop their critical thinking skills by critically analysing the feedback they receive and making improvements based on the feedback (Colthorpe, Chen, & Zimbardi, 2014; Hayes & Devitt, 2008). Feedback can also improve students' collaborative skills by providing opportunities for students to do peer reviews (Carless & Boud, 2018). Therefore, the 21st-century skills of collaboration and critical-thinking can be developed through a DET with the affordance that provides feedback.

## **Choice**

DET with the affordance of choice provides students with different options for choosing what content they want to learn, how they want to learn it, and how they want to complete content, such as assignments and quizzes (McDowell, Schmittzehe, Duerden, Cernusca, Collier, & Woelk, 2019). Allowing students the option of choice in their learning encourages a personalised learning experience, which also corresponds to the affordance of adaptivity. Providing students, the option of choice in their learning develops self-determination, which includes the 21st-century skills of problem-solving and decision making (Wilkinson, 2020). According to the P21 Framework definitions of 21st-century skills, problem-solving and decision making further encourage critical thinking skills (Partnership for 21st Century Skills, 2009). If instructors allow students different choices in their learning path, students can fast track through some content resulting in educators reducing lecturing time on certain learning content. This gives students more opportunities to actively engage in learning by collaborating with their peers and instructors (McDowell et al., 2019). Therefore, the choice affordance of DET supports the development of problem-solving, decision making, critical thinking, and collaboration (Partnership for 21st Century Skills, 2009; Wilkinson, 2020).

## **Nonlinear access**

Nonlinear access is an affordance of a DET that provides students the choice of selecting the order in which they complete the learning content (Burrage & Pelton, 2005; Lippert et al., 2019). Therefore, the affordance of nonlinear access also corresponds with the affordances of choice and adaptivity which contributes to a personal learning experience for students. According to Lee, Chow, Button, and Tan (2017), a nonlinear approach to learning encourages students to do problem-solving since the student adopts the role of facilitator in the sense that they have fewer guided instructions for learning. Lee et al. (2017) believe that



this approach further encourages students to develop the 21st-century skills of communication, collaboration, and critical thinking skills.

### **Linked representations**

The affordance of DET which provides different representations of content, through media or pedagogical strategies, is referred to as linked representations (Lippert et al., 2019). Research on immersive virtual educational technology indicated that this technology can be used as a tool for developing problem-solving skills which is described under 21st-century skills and encourages critical thinking skills (Araiza-Alba, Keane, Chen, & Kaufman, 2021; Partnership for 21st Century Skills, 2009). Abdurrahman, Setyaningsih, and Jalmo (2019), conducted a study regarding the use of multiple representation-based worksheets to encourage educators to present topics in a verbal, visual, or table format simultaneously. This encouraged students to get a different perspective and to critically think about the content. The findings of this study indicated that using the design of multiple representations can support and enhance the development of critical thinking skills (Abdurrahman, Setyaningsih, & Jalmo, 2019).

### **Open-ended learner input**

Open-ended learner input is an affordance of DET that allows students to express their learning and provide input through different means, such as pictures, drawings, and other types of communication (National Academies of Sciences, Engineering & Medicine, 2018). According to research, students can develop their creative and critical thinking skills with open-ended questions and then use this way of thinking to solve problems in several different ways (Kurniawan, Putri, & Hartono, 2018; Romli, Abdurrahman, & Riyadi, 2018).

### **Communication**

DET with the affordance of communication enables students to communicate with peers,

educators, and other academics through their learning journey. Through communication, educators are able to engage with students to expand their knowledge and create opportunities to develop their skills (Wahyuni, 2018). When students can communicate effectively it increases their confidence and motivation which supports the students to further develop 21st-century skills, such as communication, problem-solving, critical thinking, creativity, and collaboration (Raba, 2017).

Table 2.1 summarises the above-mentioned discussion of previous research in terms of DET affordances and the development of 21<sup>st</sup>-century skills (Abdurrahman et al., 2019; Fitzgerald et al., 2018; Hussin et al., 2019; Lee et al., 2017; M. Liu et al., 2017; Raba, 2017; Wilkinson, 2020; Yalcinalp & Avci, 2019). Note that one affordance can develop more than one 21st-century skill confirming the intertwined nature of these skills.

**Table 2.1**

*A summary of the literature for DET affordances that encourage development of 21st-century skills*

	<b>Communication</b>	<b>Collaboration</b>	<b>Creativity</b>	<b>Critical thinking</b>	<b>Problem solving</b>	<b>Decision making</b>
<b>Interactivity</b>	X	X		X	X	
<b>Adaptivity</b>	X	X	X			
<b>Feedback</b>		X		X		
<b>Choice</b>		X		X	X	X
<b>Nonlinear access</b>	X	X		X	X	
<b>Linked representations</b>				X	X	
<b>Open-ended learner input</b>			X	X	X	
<b>Communication</b>	X	X	X	X	X	

The above summary of the literature makes it clear that DET has the possibility of creating opportunities for the development of specific 21st-century skills in online learning. To determine how DET can be used in teaching practices for developing 21st-century skills, the P21 Framework was chosen as a theoretical framework.

## **2.6 Theoretical Framework**

An important component of a research study is the theoretical framework since the framework identifies existing knowledge and observations relevant to the research and provides a foundation of knowledge for the research (Grant & Osanloo, 2014). The theoretical framework outlines how a researcher plans to do their research, defines the criteria for applying theory, and provides definitions of concepts about the topic (Adom, Hussein, & Agyem, 2018). Several theoretical frameworks have been developed to help educators to integrate 21st-century skills within their instructional practices. Some of these frameworks include the Assessment and Teaching of 21st-century skills framework (Griffin, McGaw, & Care, 2012), P21 framework (Battelle for Kids, 2019), and EnGauge (Afandi, Sajidan, Akhyar, & Suryani, 2019). Of these, the P21 Framework is the most researched 21st-century skills framework and considers the most important 21st-century skills, including communication, collaboration, critical thinking and creativity, also known as the 4Cs (Voogt & Roblin, 2012). The P21 Framework, which was developed by the Partnership for 21st-century learning, considers support strategies that can assist educators and students to reach the 21st-century graduate requirements (Voogt & Roblin, 2012; Winfield, 2021). Therefore, the P21 Framework is chosen as the theoretical framework for this study.

The P21 Framework considers that the 21st-century individual will need to learn a wide set of skills such as key subject skills, life and career skills, social skills, and technology skills together

with the 4Cs: communication, collaboration, creativity, and critical thinking (Partnership for 21st Century Skills, 2009). The framework provides educators with a model to integrate these skills into their teaching pedagogies and the curriculum whilst providing students the expertise and skills needed to succeed in the workplace (Battelle for Kids, 2019). Figure 2.2 illustrates how the P21 Framework has been divided into four domains of 21st-century skills.

**Figure 2.2**

*P21 Framework (Battelle for Kids, 2019)*



The first domain, in the upper left part of the figure, covers life and career skills. Life and career skills consist of the following elements (Battelle for Kids, 2019):

- Initiative and self-direction;
- Productivity and accountability;
- Flexibility and adaptability;
- Social and cross-cultural skills; and
- Leadership and responsibility skills.

As this study was done at a South African university, the P21 Framework was contextualised to the South African context where education is split up between basic education (primary and secondary) and higher education (Department of Basic Education of South Africa, 2021). Secondary schools in South Africa have a strong emphasis on skills that relates to these life and career skills and even added a subject, referred to as Life Orientation, to the National Curriculum Statement for Grades 10 to 12 (Department of Basic Education South Africa, 2003).

The second domain, in the middle of Figure 2.2, contains the key subjects or 3Rs that stands for reading, writing, and arithmetic (Chu, 2014). In the South African context, primary schools have a strong focus on teaching children the 3Rs by incorporating literacy, numeracy, and life skills within their learning programmes because it forms the foundation of learning in the rest of their school years (Department of Basic Education South Africa, 2002, 2011).

Additionally, the third domain, in the upper right, refers to the literacy skills of information, media, and technology. There is a strong emphasis throughout the school years to incorporate the literacy skills of information and media (Department of Basic Education South Africa, 2002, 2010). More specifically, many higher education institutions either embed these literacy skills throughout the curriculum of first-year students or provide free short courses to students (North-West University, 2022; University of Cape Town, 2022; University of Johannesburg, 2021; University of Stellenbosch, 2022). Additionally, other higher education institutions list these skills as a requirement for admission to study or include it as a compulsory or fundamental subject for specific degrees (University of Pretoria, 2022; University of Stellenbosch, 2022; University of the Free State, 2021).

Finally, the fourth domain, in the upper part of the figure, contains the 4Cs of communication, collaboration, critical thinking, and creativity. Although the 4Cs of education are relevant for all phases of schooling (basic and higher education), these skills have been identified as the most sought-after 21st-century skills by the corporate world (Winfield, 2021; World Economic Forum, 2020b) and need to be developed to prepare students for the workplace. Therefore, the fourth domain, specifically in the online higher education context, is the focus of this study.

As part of the 4Cs, communication refers to the ability to convey ideas, information, and opinions successfully (Afandi et al., 2019), while collaboration is the ability to communicate and work effectively with others to reach a goal (Bedir, 2019). Both communication and collaboration play a role in the development of critical thinking (Hussin et al., 2019). Critical thinking can be described as the capability to evaluate, analyse, interpret, and reason to comprehend and solve problems or to make decisions (Brown, 2018). Since creativity is the ability to be innovative, create new ideas, and solve problems (Walia, 2019), communication and critical thinking also play a role to develop this skill (Yalcinalp & Avci, 2019). These 4Cs (communication, collaboration, critical thinking, creativity) are the most identified skills across frameworks for 21st-century skills (Kereluik et al., 2013). The 4Cs are also the most sought-after skills in the Fourth Industrial Revolution workplace and will be the most common skills that individuals will need to be successful in the 21<sup>st</sup>-century (Kurniawan et al., 2019; Winfield, 2021; World Economic Forum, 2020a). Furthermore, the review of the literature also indicates that the 4Cs are the skills that present the most challenges within online learning environments.

It is necessary to acknowledge that the skills covered in the remaining three domains are also important and might play a role in this study especially when analysing the curriculum documents of online modules since many activities, for example, group activities, also indirectly

cover skills such as leadership and critical thinking skills (Martin & Bolliger, 2018). However, in this research, the emphasis is only on the 4Cs to keep the focus of the study on how DET can be used to develop 21st-century skills in online learning in higher education.

The final component of the P21 Framework is the four support systems (as shown in the bottom row of Figure 2.2). These support systems include standards and assessments, curriculum and instruction, professional development, and learning environments. In order to successfully produce 21st-century outcomes for graduates, all four support systems should be aligned. As standards and assessments are established, it has a direct impact on the design of the curriculum and instructions as well as the design of the learning environment. Furthermore, to successfully create and design these three support systems, as mentioned above, educators need the right skills and knowledge which can be provided through professional development. The standards require educators to incorporate the 21st-century skills within core subjects by building an understanding of these matters and ensuring students are engaged (Battelle for Kids, 2019). In addition, the assessments system covers the formative and summative assessments that should be implemented, as well as the use of technology tools for assessment, to determine students' competency in terms of 21st-century skills (Partnership for 21st Century Skills & American Association of Colleges for Teacher Education, 2010). Similarly, the curriculum and instruction system requires the application of 21st-century skills within key subject areas through the use of technology, inquiry-, and problem-based approaches (Battelle for Kids, 2019). Furthermore, the professional development system is crucial for teachers to be able to teach the curriculum and assess students correctly. Therefore, the professional development system focuses on supporting teachers to use different technology tools and teaching strategies so that they can integrate 21st-century skills within their teaching practices (Handayani, 2017). The last support system that covers learning environments refers to the



physical environment and technological infrastructure that should be in place (Partnership for 21st Century Skills & AACTE, 2010). In order to make all these 21st-century skills development and support systems possible, the learning environment needs to be conducive to learning. In an online learning environment, the LMS needs to be set up and maintained so that the teaching and learning of 21st-century skills are supported in online learning.

The four support systems were used to identify the main aspects of the online modules to be focused on in this study. In other words, it assisted the researcher to identify how educators are developing 21st-century skills within the curriculum, instruction, and assessments of their online module/s. These systems also assisted in determining why educators might not be integrating 21st-century skills within their online module/s. Finally, the systems also assisted in determining how educators can be supported to incorporate the development of 21st-century skills within their online module/s.

Not only did the P21 Framework guide the methodology of the study, but it also provided insight into the findings by relating the findings to the framework recommendations on how DET can be incorporated into teaching practices, specifically to develop 21st-century skills within online modules.

## **2.7 Summary**

In the review of the literature, it was found that many terms are used to describe the skills that make graduates more employable and that assist them in being successful in the 21st-century workplace. The most popular term used to describe these skills are 21st-century skills (Voogt, Erstad, Dede, & Mishra, 2013). Although many discrepancies exist about what exactly

these 21st-century skills are, critical thinking, problem-solving, creativity, communication, collaboration, and digital literacy skills are constantly mentioned across frameworks (Kereluik et al., 2013).

Despite efforts by the Department of Basic Education of South Africa (2019) to incorporate 21st-century skills within their planning, the demand for individuals with 21st-century skills and the lack of education systems successfully integrating these 21st-century skills within their practices, have resulted in a major skills gap in the labour market (Sulaiman & Ismail, 2020; Thirunavukarasu et al., 2020). A possible resolution for incorporating 21st-century skills within higher education teaching and learning practices might be online learning (Parker et al., 2013; Uerz et al., 2018).

While the rapid growth of the online learning industry revealed many challenges, especially with the development of 21st-century skills within online learning environments (Gillett-Swan, 2017), DET has been used by many institutions over the years as support tools for online learning (Bates, 2018). Different types of DET offer different functionalities and support for online teaching and learning. The analysis of the literature suggested that certain affordances of DET provide for the development of 21st-century skills within online learning environments. In terms of collaborative technology and interactivity, research shows promising results that DET with certain affordances might support the development of 21st-century skills within an online learning environment.

There are several theoretical frameworks that can be used to incorporate the development of 21st-century skills within teaching and learning practices (Afandi et al., 2019; Battelle for Kids, 2019; Griffin et al., 2012). The most researched framework was identified as the P21 Framework (Voogt & Roblin, 2012) to guide this study.

Next, the research methodology, which was used to determine to what extent educators in current fully online modules make provision for the development of 21st-century skills, is described. Additionally, the study also explored whether educators made provision for the development of 21st-century skills by using the affordances of DET that support the development of these skills. Finally, it was considered how these affordances of DET can be used to develop 21st-century skills in fully online learning. The research methodology includes the description of the design, sampling methods, and the collection and analyses of data which is discussed in detail in the next chapter.

## Chapter 3: Research Methodology

### 3.1 Introduction

In this chapter, the research paradigm and the research design that were used in this qualitative case study are discussed. The qualitative case study approach allowed for a deeper understanding of educators' experiences whilst using DET for developing 21st-century skills in fully online courses. This provided a way to develop theory from the data in order to understand what affordances of DET support the development of these skills and to what extent current fully online modules make provision for the development of 21st-century skills. The relevance of a case study and an interpretive approach is discussed in detail in this chapter. The research design, including the methodology, research participants, instruments, data collection, data analysis method, limitations, and ethical concerns also forms part of the discussion in this chapter.

To respond to the main research question, this study explored what affordances of DET support the development of 21st-century skills in fully online learning. The study also focused on the extent to which educators were making provision for the development of 21st-century skills in current fully online modules. Both questions were used to discover how DET can be used to develop 21st-century skills in fully online learning.

### 3.2 Research Paradigm

The research paradigm refers to a researcher's worldview and how it influences their decision making (Kamal, 2019). According to Guba (1990), a paradigm can also be defined as a system of beliefs that directs behaviour. In the context of a research study, a research paradigm reflects how the researcher's views and beliefs guide their interpretation of, and decision making in, the research study. Therefore, the research paradigm is essential for understanding a study.

There are various paradigms and most differ in terms of what the researcher assumes as the reality of a phenomenon and how they come to know and understand the phenomenon (Shah et al., 2019).

Positivism, for example, refers to the belief that phenomena can be accurately explained, controlled, and foreseen by following methodical observations and scientific methods (Shah et al., 2019). A positivist researcher uses an objective approach and, therefore, does not interact with participants or rely on the participants' experiences and values (Park, Konge, & Artino, 2020). Alternatively, pragmatism supports using different research methods together (Maarouf, 2019). With the pragmatic paradigm, a researcher can consider both the objective and methodical approach when interpreting the data of a research study (Kaushik & Walsh, 2019). Contrary to the objective approach of the positivist, critical theory approach to research, where historical beliefs are formed, is more subjective, and a researcher can then consider the participants' notions about ideology as well as the subject that is being studied (Ryan, 2018). Critical theory aims to help individuals critically reflect and understand their social settings to encourage interventions or change in their society (Nazri, Wong, Khin, & Teng, 2019).

Since the researcher in this study was more interested in the subjective experiences of educators regarding developing 21st-century skills in fully online modules, an interpretivist approach was chosen. In an interpretive paradigm, a researcher holds the premise that a single scenario can have multiple interpretations and is shaped by human experiences whilst in a social environment (Günbayi & Sorm, 2018). This approach encompasses the various practices, perspectives, and experiences of individuals in social settings (Rahman, 2016). Alharahsheh and Pius (2020) describe interpretivism as considering the variables and factors in context, such

as considering the circumstances, time, and cultures when interpreting the data. Since the interpretivism approach is subjective in nature, it is mostly applied in qualitative research (Günbayi & Sorm, 2018). It is also important to note that the interpretive paradigm assumes that the reality of the experience, behaviour, perspectives, and practices of individuals are different. Therefore, the interpretation of the data is less inclined to be generalisable (Alharahsheh & Pius, 2020). Furthermore, the role of an interpretivist researcher is to reconstruct the data gathered about a particular subject and then formulate a theory about the subject matter in order to contribute to the body of research (Junjie & Yingxin, 2022).

In this study, the researcher was interested in the authentic experience of the educators in their fully online learning environment as well as their pedagogical approaches for incorporating 21st-century skills within their online modules. The participants completed a questionnaire and were interviewed to get the full context and understanding of their practices in their online modules. Through this interaction, an in-depth understanding was gained in terms of the participants' pedagogy, experiences, and the DET that was used to develop 21st-century skills. Furthermore, the data generated by the questionnaire, interviews, and a document analysis of the online modules were gathered and interpreted to provide the full context on how DET could possibly be used to develop 21st-century skills in online learning. Since the interpretive paradigm also focuses on the whole authentic experience in an environment and explores peoples' in-depth experiences to formulate a theory about a subject matter, the interpretivism approach was the best paradigm to guide this study.

### **3.3 Research Methodology**

Research methodology is the systematic processes and methods that are used to solve the research problem (Håkansson, 2013). It is important to not only know the different research

methods, but also the relevance of each method and why we use the chosen research methods, and not others, for a research study (Kothari, 2004). The research design determines the structure of the research and outlines how to logically collect, measure, and analyse the data for the research (Akhtar, 2016). The aim of the research design is to ensure the relevant data are identified to address the research problem, and the correct strategies are used to collect, analyse, and interpret the data (Coe, Waring, Hedges, & Ashley, 2021). Depending on the type of research being conducted, the research design can be mixed, quantitative, or qualitative.

Mixed method research is a research approach where quantitative and qualitative methods are used in one research study. Combining these two methods can, for example, improve the validity and credibility of the research study whilst including different perspectives regarding the research problem (Denton, 2022; Noble & Heale, 2019). Quantitative research can be described as collecting numerical data based on social situations or large population groups (Tuli, 2010). Even though this study contains some quantitative elements, such as the questionnaire which could be statistically analysed, it does not follow a quantitative research method. In quantitative research, the data does not capture the behaviour, experiences, and feelings of participants (Queirós, Faria, & Almeida, 2017), as is the case in this study. Since the researcher was interested in the experiences and practices of the participants with regard to the development of 21st-century skills within their online modules and wanted to determine why participants incorporated certain practices and DET, this study is qualitative in nature.

Qualitative research is a research approach to determine more in-depth the opinions, perspectives, and ideas of participants (Tiley, 2017). This type of research is subjective by nature and provides an in-depth understanding of a situation or concept through the researcher's own observations (Habib, 2021). This approach takes place in a natural

environment and is used to develop new ideas to address the research problem. The data analysis of qualitative research can become difficult to interpret since the data cannot be quantified and it can also become very time consuming due to the data's subjective nature (Queirós et al., 2017). However, the data collection process of a qualitative method provides opportunities for a researcher to interact with the participants directly, which means the data is more subjective and detailed than data generated through other methods, such as questionnaires in quantitative research (Rahman, 2016). Furthermore, it is worth noting that qualitative research does not necessarily provide numerical data as in quantitative research and, therefore, the data is not analysed statistically, but rather systematically to uncover hidden themes, trends, and relationships (Sukamolson, 2007). This means that qualitative data can link information and provide deeper insights into the research topic. In this study, the researcher aimed to determine the opinions and experiences of educators in their natural online environments. The researcher also wanted to discover the trends and themes of the affordances of the DET the educators were using to develop 21st-century skills, which gave the researcher in-depth insight and understanding of the research. Therefore, qualitative research was chosen as the most appropriate design for this study.

There are several types of qualitative research designs namely ethnography, action research, phenomenological research, narrative research, grounded theory, and case study research (Merriam & Grenier, 2019; Saldana, 2011). One of the most cited reasons for using case studies is that a researcher aims to answer “how” or “why” questions in their research (Baxter & Jack, 2008). In this study, the researcher aimed to answer the main research question: “How can digital educational technology be used to develop 21st-century skills in fully online learning?”. Throughout the study, the researcher further aimed to explain why educators were using the affordances of DET to develop 21st-century skills and/or why educators were



perhaps not incorporating the development of 21st-century skills. Thus, the case study approach was chosen as the best qualitative method for this study. In addition, the researcher adopted a case study approach since this method aims to gather in-depth and detailed research data on a subject (Schoch, 2020; Thomas, 2021). Moreover, case studies focus on one event in a real-life context and a researcher can study an individual, an organisation, a place, or even time to examine the subject within a real-life scenario (Tellis, 1997; Thomas, 2021). Through case study research, the researcher was able to interview lecturers, observe online assessment platforms, and analyse institutional documentation, where possible, in a real-life online learning environment. It is also worth noting that this is a cross-sectional case study since data was collected at a specific point in time from one higher education institution (Melnikovas, 2018).

Since a case study method was adopted, the researcher clearly defined the research problem and research questions before attempting the case study so that they had clarity and focus regarding the subject under study (Pinheiro, 2021). When using a case study method, the researcher can analyse data through a process called coding where they identify potential themes in data (Creswell & Poth, 2018). These themes can then be used to make comparisons, to link the findings to the research questions (Atkinson, 2002; Baškarada, 2014; Creswell & Poth, 2018). Thus, the researcher could compare the experiences of the educators for similarities and differences. This comparison assisted the researcher to determine what affordances of DET supported the development of 21st-century skills. The comparison further assisted the researcher to determine to what extent educators were making provision for the development of 21st-century skills in their fully online courses. This qualitative research method allowed the researcher to get descriptive information about the subject whilst gathering a variety of perspectives from a diverse group of educators in their real-life online learning environments (Thomas, 2021).

### 3.4 Research Participants

There are two main types of sampling methods: probability sampling and non-probability sampling (Bhardwaj, 2019). In this study, the participants were identified through non-probability sampling since the researcher used subjective reasoning to select the sample and did not choose the participants at random (Stratton, 2021). The participants were identified through three different types of non-probability sampling methods, namely purposive, convenience and voluntary sampling (Murairwa, 2015). Firstly, purposive sampling was used to refine the selection of participants for this study. This method assisted the researcher to select participants based on certain characteristics of the participant (Etikan, Musa, & Alkassim, 2016). For this study, the population was identified based on whether they were an educator from a traditional higher education institution and/or if they had experience in designing and/or facilitating of fully online modules. Secondly, the educators who met the characteristics and were available to participate in this study were selected as participants this is referred to as convenience sampling. Convenience sampling is a sampling method used frequently in qualitative research because it collects samples based on who is most conveniently available (Moser & Korstjens, 2018). Lastly, voluntary sampling was used which is based on whether the participants willingly and voluntarily agreed to participate in this study (Mills & Gay, 2016). In conclusion, the participants for this study was chosen based on whether they were educators who met the characteristics as mentioned above, who were available to participate, and voluntarily agreed to participate in this study.

Similar qualitative case studies were conducted using sample sizes ranging between nine to 10 participants (Austin, 2020; Brown, 2022). Therefore, the aim of this research study was to get feedback from at least 10 participants from a higher education institution through a

questionnaire and gathering their curriculum documents and resources. The final number of participants for this study was 11 educators, all from one public higher education institution in South Africa, and all facilitating fully online modules. Eight of the participants were female and three were male.

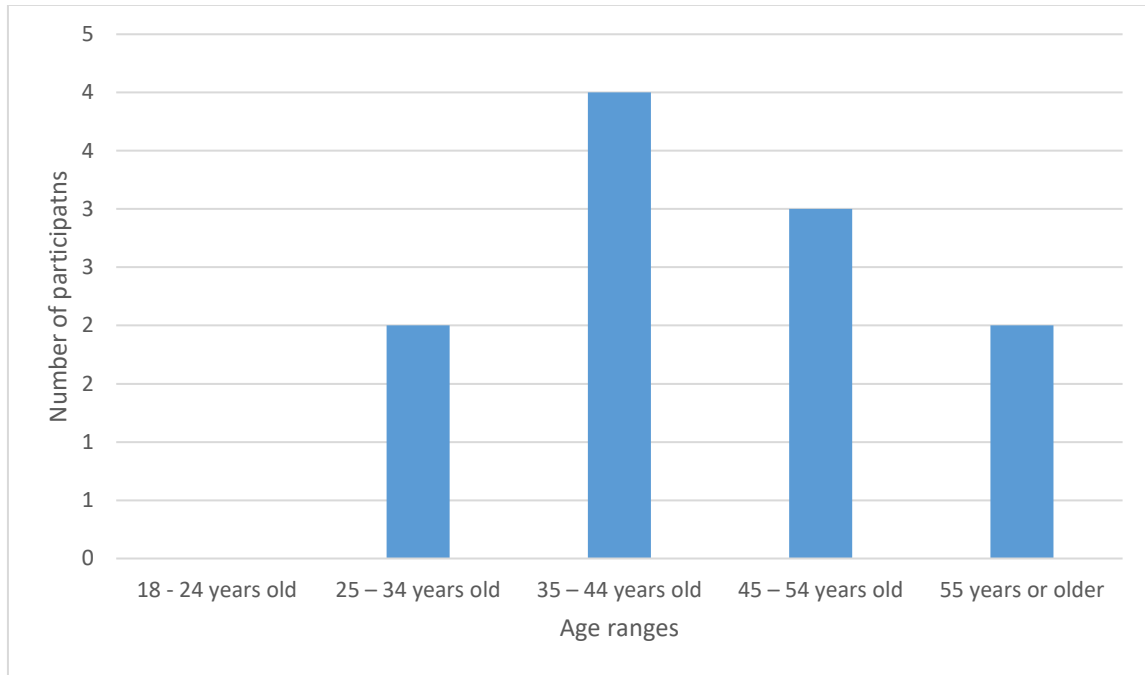
All 11 participants completed the questionnaire and allowed access to their online modules (including curriculum documents and resources). Their inclusion in the study was based upon whether the consent letters were signed and if the questionnaires were completed in full. Only five of the participants explicitly gave consent to participate in follow-up interviews. Therefore, in total five participants were interviewed, after the questionnaire and document analysis had been conducted, to gain more in-depth information regarding the research.

### **3.1.1 *Participants' profile information***

While this study does not focus on gender differences, eight of the participants were female and three were male. This is in contrast with the typical gender profile of male academics in higher education institutions in South Africa (Breetzke & Hedding, 2018; Department of Higher Education and Training, 2019). The participants were asked to choose the range in which their age falls. Figure 3.1 shows the participants' age ranges and the number of participants that fall within a particular age range.

**Figure 3.1**

*Participants' age ranges*



Nearly half of the participants in this study were between 25 and 44 years of age. People who were born after 1980 are referred to as digital natives (Stegehuis & Bondarouk, 2021). Hence, most participants in this study are falling into the digital natives category. This means nearly half of the participants grew up in the age where the Internet and digital technologies were predominant and are therefore accustomed to working with digital technology in their everyday lives. This partially corresponds with the typical age range of academics in higher education in South Africa which is usually between 35 to 54 years (Breetzke & Hedding, 2018). However, it is in contrast with the research trajectory that indicates an aging trend for academics in South Africa (Breetzke & Hedding, 2018). This means the predicted trend indicated that the most likely age profile of future academics in South Africa would lean more towards digital immigrants. Digital immigrants are people who were born before the year 1980 and grew up without the Internet and digital technologies (Stegehuis & Bondarouk, 2021).

It is also interesting to note that none of the participants were younger than 25 years of age. This corresponds to the research findings that indicate there will be a decrease of academics that are under the age of 25 years over the coming years (Breetzke & Hedding, 2018). One reason why none of the participants were younger than 25 could be that to become a lecturer at the higher education institution of this study you need at least a master's degree (University of Pretoria, 2023). Achieving a master's degree requires a person to complete a bachelor's degree of at least four years. After that, the person can begin with a master's degree, which usually takes two years to complete (Kereluik et al., 2013). In other words, after graduating from secondary school at the age of 18 years, a person will still have to study for six years before they can become a lecturer at a higher education institution. This would imply that individuals can usually only become lecturers at a higher education institution from the age of 24 years and onwards.

While all the participants had master's degrees, nine of the participants also obtained their doctorate degrees. This corresponds with the point made in the previous paragraph that lecturers need at least a master's degree to teach at higher education institutions. By being required to have at least a master's degree to become a lecturer, it can probably be assumed that all the lecturers had well-established theoretical knowledge and skills in their subject area. Moreover, these lecturers would have obtained at least the following skills by achieving their master's degree: research, problem-solving, critical thinking, communication, and self-direction (Council on Higher Education, 2013). These skills relate to the 21st-century skills that students need to master in order to be successful in their future work environment (World Economic Forum, 2020b). The researcher was specifically interested to see how the participants used their acquired skills to teach and to assist their students with developing 21st-century skills.

Eight of the 11 participants had more than 15 years of teaching experience, with the highest being 40 years of experience. On the other hand, the lowest number of years of experience was two years. This indicates that most participants facilitating these online module/s have been in the education industry for more than 15 years, and at some stage, they had to make changes to shift from traditional classroom teaching methods to online learning methods to adapt to current trends. Furthermore, the participants had several years of experience in education, therefore the subject area and curriculum were not regarded as a hurdle when they had to transition to online learning, but the new pedagogical practices for shifting to fully online courses might have been.

### **3.5 Data Collection**

Choosing the right data collection techniques is very important as it allows the researcher to gather appropriate data for the subject of the research study (Paradis, O'Brien, Nimmon, Bandiera, & Martinmianakis, 2016). The collection of data should be carried out methodically in order to gather reliable and accurate data that will address the research questions of the study (Elmusharaf, 2013; Palinkas et al., 2015). There are various qualitative data collection methods, such as interviews, observations, focus group discussions, questionnaires, and document analysis (Barrett & Twycross, 2018; Flick, 2013). In this case study, the data was collected through a questionnaire, document analysis, and interviews. Data triangulation is the term used to describe when a research study uses several different data collection sources and methods in a study (Moser & Korstjens, 2018). In this study data triangulation was evident by combining three data collection methods to gather in-depth data from different perspectives from the participants which enhances the credibility and dependability of the findings (Baxter & Jack, 2008).

Each participant that participated in this case study was given an alphanumeric coded number (e.g., P1) and to that coded number either a 'Q' was added to indicate they participated in the questionnaire and/or an 'I' was added to indicate they participated in an interview. For example, P1Q meant a participant who completed the questionnaire and P1I indicated the same participant participated in the interview. For the document analysis a coded number 'D' was used together with an 'M' and an alphanumeric coded number (e.g., DM1) to represent each online module that was analysed. For example, DM1 referred to the document analysis of Module 1. These coding profiles are discussed in more detail in the sections that follow.

### **3.5.1 Questionnaire**

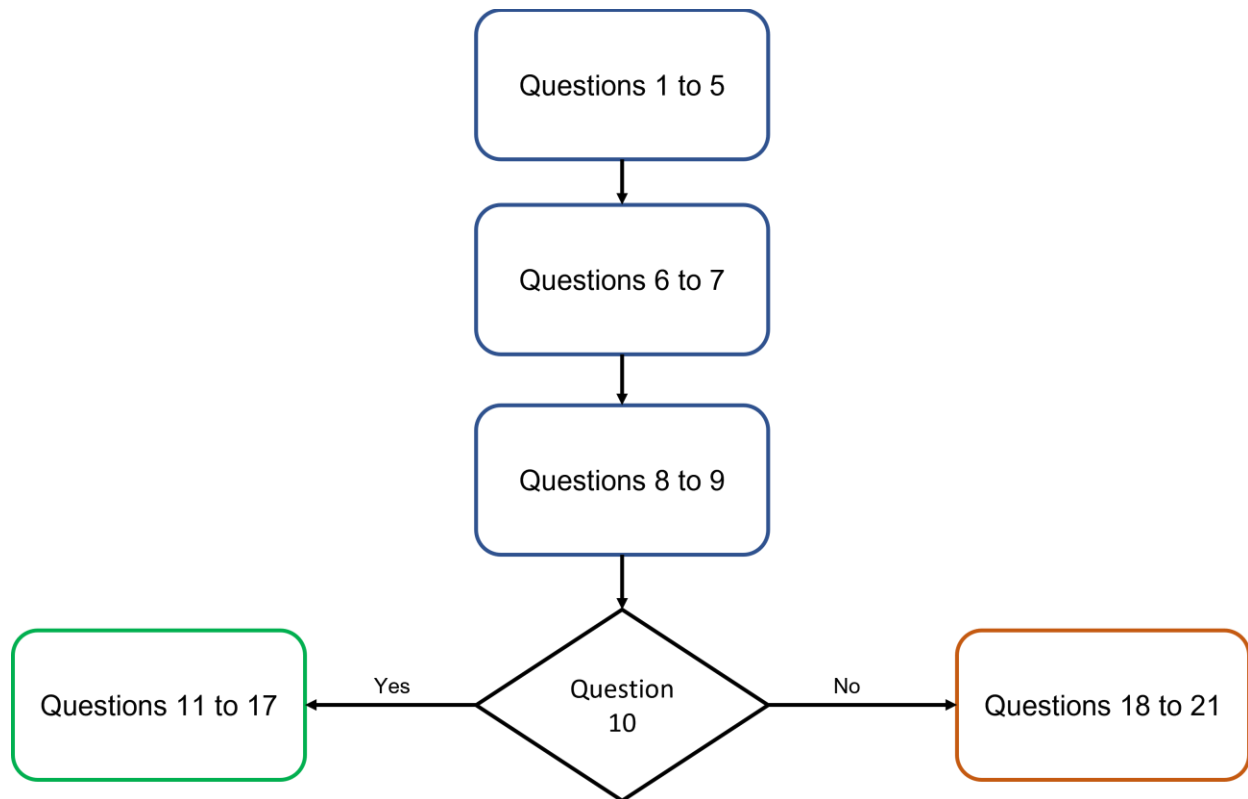
The main research instrument used in this study is an online questionnaire (see [Appendix A](#)). A questionnaire, otherwise known as a survey, is a tool used to gather information based on a range of aspects to gain insight into individuals' perceptions regarding the subject of research (Lally & Valentine-French, 2019). Questionnaires can be administered in different ways, such as over a telephone call, mailing the questionnaire through the post or via email, visiting participants in person, or completing the questionnaire online through an access link (Qualtrics, 2018). According to Sincero (2012), an online questionnaire is a type of survey used to gather data from participants through the process of completing a questionnaire over the Internet. In this study, the questionnaire was created on the Qualtrics online platform, and the link was distributed to the participants via email. The aim was to determine if the educators made provision for developing 21st-century skills in their fully online modules, and if they did make provision, what technologies they were using at the time to develop these skills.

The questionnaire consisted of multiple-choice, multiple-option, and closed and open-ended questions. The first five questions were included to gather demographic information about the

participants. Questions six and seven were used to gather information regarding the participants' online module/s in terms of the subject matter and degree level that the module/s contribute to. Questions eight and nine gathered information about the educators' perspective on the nature of a 21st-century skill as well as the importance thereof. Question 10 was a branching question to determine if the educator was incorporating 21st-century skills in their online module/s. If they chose "Yes", they were incorporating these skills in their online module/s, they had to continue with the rest of the questions up until question 17. However, if the educator chose "No", they were not incorporating 21st-century skills, they only completed questions 18 to 21. A visual representation of the branching of questions can be seen in Figure 3.2.

**Figure 3.2**

*Branching of questions*





Questions 11 to 15 gathered information regarding the 21st-century skills the educators were incorporating within their online module/s, such as what skills, and their strategies for assessing these skills. Questions 16 and 17 gathered information regarding the DET that the educators were using to develop 21st-century skills, such as the type of technologies and their affordances. Questions 18 to 21 gathered information about reasons the educator/s were not incorporating 21st-century skills. The purpose of these questions was to determine if the educator/s needed certain support or had a certain perception about the development of 21st-century skills within their online module/s.

The data from the questionnaire were exported from the Qualtrics application to an Excel spreadsheet. Each participant was then given an alphanumeric coded number (e.g., P1) and unto that code number a 'Q' was added to indicate they participated in the questionnaire (e.g., P1Q) to ensure the confidentiality of the information collected. The coding profile is summarised in Table 3.1.

**Table 3.1**

*Coding profile of participants that completed the questionnaire*

<b>Participants (educators) code</b>	<b>Gender</b>
P1Q	Male
P2Q	Female
P3Q	Female
P4Q	Female
P5Q	Female
P6Q	Female

Participants (educators) code	Gender
P7Q	Female
P8Q	Female
P9Q	Female
P10Q	Male
P11Q	Male

### 3.5.2 Document Analysis

The second research instrument used in this study was a document analysis; a process that was followed by reviewing the curriculum documents and resources in the participants' online modules. Document analysis is the method where documents are reviewed and interpreted to gain a deeper understanding and knowledge about a research topic (Owen, 2014). There are many types of documents that can be reviewed, such as minutes of meetings, files, manuals, books, journals, policies, reports, and curriculum documents (Bowen, 2009). In this study, the curriculum documents and resources that were analysed included learner activities (quizzes, assignments, and readings), student manuals, assessments, lesson plans, presentations, multimedia materials, and digital technology.

After having obtained consent from participants to gain access to their modules and collecting the online module information from the questionnaire, the document analysis could begin. The document analysis was given a coded number 'D', then each online module was given an alphanumeric coded number (e.g., M1), to ensure the confidentiality of the information collected. The document analysis code (D) and the online module codes (e.g., M1) were added together to generate a final code for each online module's documents that were analysed (e.g., DM1). The final codes and more details about each module are outlined in Table 3.2.

**Table 3.2**
*Online module codes and information*

<b>Online module code</b>	<b>Degree levels or other modes of offering</b>	<b>Period of offering</b>	<b>Subject matter</b>
DM1	Bachelors	Semester	Accounting
DM2	Master's	Semester	Financial management
DM3	Master's	Year	Financial management
DM4	Master's	Year	Financial management
DM5	Bachelors	Year	Accounting
DM6	Bachelor Honours and Postgraduate diploma	Year	Research methodology
DM7	Bachelor Honours and Postgraduate diploma	Year	Research methodology
DM8	Doctoral	Year	Research methodology
DM9	Bachelors	Year	Human resource management

<b>Online module code</b>	<b>Degree levels or other modes of offering</b>	<b>Period of offering</b>	<b>Subject matter</b>
DM10	Postgraduate diploma	Short course	Public health
DM11	Postgraduate diploma	Short course	Biostatistics
DM12	Bachelors	Short course	Biostatistics
DM13	Bachelors	Year	Public health
DM14	Bachelors	Year	Biostatistics
DM15	Bachelors	Year	Research methodology
DM16	Bachelors	Semester	Business management
DM17	Bachelors	Semester	Business management
DM18	Postgraduate diploma	Short course	Research methodology

It is important to note that the aim was not to differentiate between different degree levels, course offering and subject matter but to focus on the content and teaching practices of these online modules. Access to the online modules on the learning management system of the higher education institution was granted in order for the researcher to collect all the necessary resources. All the curriculum documents and resources that could be downloaded were gathered and saved in the cloud-storage drive. Other components that could not be downloaded

included discussion groups and online assessments. These resources were observed, and relevant details were noted down by the researcher and saved on the cloud-storage drive.

Overall, document analysis was used to gain a better understanding of the curriculum resources and affordances of DET that the participants were using. The results of the document analysis were then aligned with the P21 Framework. The aim was to determine to what extent the fully online modules were making provision for the development of 21st-century skills at the time and what affordances of DET support the development of 21st-century skills.

### **3.5.3 Interviews**

The third research instrument used in this study is interviews. The original plan was to conduct a focus group discussion and/or interviews. The aim of conducting a focus group was to identify the DET participants were using to develop 21st-century skills and how they were using these technologies in their practices. However, the questionnaire and document analysis provided enough feedback and results and continuing with the focus group would have been redundant. Therefore, a decision was made to continue with the interviews only.

Interviews are used to gather more direct information from participants and to gather the participants' insights on certain situations (Tellis, 1997). There are many ways interviews can be conducted such as in person, on the telephone, or through Internet voice or video calls (Barrett & Twycross, 2018; Moser & Korstjens, 2018). There are different types of interviews that can be used, such as structured interviews, least-structured interviews and semi-structured interviews.. Tellis (1997) points out that structured interviews uses only a set of questions that was pre-developed and asked to all participants in the same order. The second approach, least-structured interviews, the interviewer only identifies a few topics to discuss with participants and

is conversed in a casual setting (Stofer, 2019). Lastly, the semi-structured approach is the most used in qualitative research (Barrett & Twycross, 2018). A semi-structured approach allows the researcher to gather information based on key areas of the study whilst giving the participants the opportunity to bring their own viewpoints (Rahman, 2016). Therefore, in this study semi-structured interviews were chosen as the type of interviews to be conducted after the questionnaire and document analysis. The researcher pre-developed a few guiding questions for the interviews (see [Appendix C](#)). However, the researcher also allowed the participants to give their own feedback and perspective on 21st-century skills and using DET to develop these skills in fully online learning.

In the questionnaire the participants' were explicitly asked to give consent if they want to participate in a follow-up interview. Only five of the participants who voluntary agreed were invited and participated in a follow-up interview. The same coding number was used (e.g., P1) but an 'I' was added to indicate that these participants participated in an interview as well (e.g., P1I). The profile of the interviewed participants is shown in Table 3.3.

**Table 3.3**

*Coding profile of participants that participated in the interviews*

<b>Participant code</b>	<b>Gender</b>
P6I	Female
P7I	Female
P8I	Female
P9I	Female
P11I	Male

Although there are many ways to conduct interviews, due to the restrictions of the COVID-19 pandemic, a decision was made to conduct interviews via online video calls. Therefore, the

interviews took place over a Zoom video call and were approximately 30 minutes long. The participants were asked for consent to record their interviews for data analysis purposes.

The interview process gave the researcher an opportunity to collect more in-depth information about the participants' perspectives and their pedagogies for developing 21st-century skills in an online learning environment. The interview results confirmed some of the findings in the questionnaire and document analysis as well as the literature review regarding this study.

### **3.6 Data Analysis**

Qualitative data analysis involves categorising and interpreting non-numerical data that were collected through research instruments, such as questionnaires, interviews, document analysis, and focus group discussion (Akyıldız & Ahmed, 2021). There are two main approaches that the researcher can take on to perform the data analysis: inductive and deductive data analysis.

Inductive data analysis is used when there are no set themes or previous studies that can be used to test the existing theory (Streefkerk, 2022). Therefore, inductive reasoning aims to develop a new theory. An inductive approach to data analysis begins with the trimming down of data, grouping relevant data together, and then identifying themes and concepts that indicate possible theoretical relationships (Moser & Korstjens, 2018; Pietilä, Nurmi, Halkoaho, & Kyngäs, 2020). These relationships, concepts, and themes can then be used to answer the research questions and to argue the conclusion.

Deductive data analysis tests existing concepts, categories, or theories against new data and within a new context (Pietilä et al., 2020; Streefkerk, 2022). A deductive content analysis starts

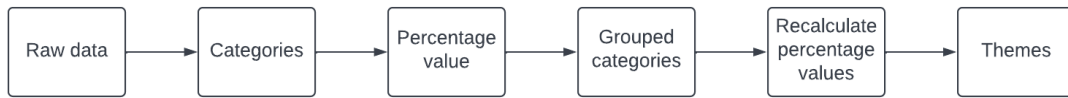
with using an existing theoretical framework as the major premise and then using the data findings from the research study to form a minor premise (Bradford & Weisberger, 2021). The major premise together with the minor premise can be compared to form a valid conclusion. Some research studies with a deductive approach use the theoretical framework to create a coding matrix and then analyse the findings against this matrix (Moser & Korstjens, 2018; Pietilä et al., 2020). In this case study, the researcher used a deductive data analysis approach since the data were compared to the P21 theoretical Framework to organise and analyse the findings from the questionnaire, document analysis, and interviews.

Figure 3.3 shows the data coding process that was followed (Moser & Korstjens, 2018). The raw data from the questionnaire was exported from the Qualtrics application to an Excel spreadsheet. The spreadsheet was protected with a unique password and stored on the cloud-storage drive. Once the spreadsheet was secured, the analysis of the data continued by first dividing the data into categories. The categories were determined by identifying the most commonly used words in the responses of the educators (Owen, 2014). The responses in each category were then translated into a percentage value to determine the highest- and lowest-ranking responses. The categories were further grouped together based on the same concept. The percentages of the grouped categories were then merged, recalculated, and organised from large to small. The analysed data were then converted to charts to visually illustrate the trends and patterns of the data. Finally, the analysed data was again stored on the cloud-storage drive with a password for protection.



### Figure 3.3

*Data coding process (Moser & Korstjens, 2018)*



The next data analysis process was for the document analysis. The curriculum documents and resources of the educators' online modules were downloaded and captured from the learning management system of the institution. All the files were worked through, and the relevant content was evaluated and compared against a checklist (see [Appendix B](#)) that was designed based on the P21 Framework definitions of the 4Cs (Partnership for 21st Century Skills, 2009) and the affordances of DET (National Academies of Sciences, Engineering & Medicine, 2018). The curriculum documents and the analysis of these documents were all captured in an Excel spreadsheet and saved on the cloud-storage drive and assigned a unique password to secure access.

The last analysis process was for the data retrieved from the interviews. First, the video recordings were transcribed with transcription software called Descript. The transcript text was then captured into an Excel spreadsheet under each main topic and questions that were discussed. The Excel spreadsheet was then stored with a unique password on the cloud-storage drive. Once the spreadsheet was saved, the analysis continued by grouping each topic's results per theme and summarising the discussion to draw conclusions about the topic. The final spreadsheet with findings was safely stored on the cloud-storage drive with a password to secure the data.

All the secured data files and findings as mentioned above were stored on a cloud-storage drive that was secured with its own distinct password. Only the researcher, supervisor, and co-supervisor had access to the cloud-storage drive (containing the data files and findings) to ensure the security and confidentiality of the information.

The University of Pretoria requires research data to be stored for a minimum of 10 years (University of Pretoria, 2007). In this research study, the data and findings will be stored for 15 years from the date of collection.

### **3.7 Trustworthiness**

The truthfulness of findings in qualitative research is related to the accurate recording of data and constant verification of the data collected without the influence of preconceptions from the researcher (Cypress, 2017). Therefore, it can be said that the quality of the research is related to the trustworthiness, or authenticity of the findings. The trustworthiness of a study is justified when different data collection methods are used and the procedures that were followed throughout the study up to the conclusions were explained to the reader (Quintão, Andrade, & Almeida, 2020). According to Guba and Lincoln (1994), the four criteria of credibility, dependability, confirmability, and transferability can ensure the trustworthiness of a qualitative study.

#### **Credibility**

The credibility of a study refers to how convincing a study is based on the truthfulness of its data (Noble & Heale, 2019), while dependability refers to how consistent the study's data and findings are, without being influenced by the researcher's viewpoints (Korstjens & Moser, 2018). In this study, three data collection methods were combined to gather in-depth data and different

perspectives from the participants to enhance the credibility and dependability of the findings. This process of using a combination of data collection methods is known as data triangulation. According to Shah et al. (2019), data triangulation increases a study's quality because it acknowledges the different perspectives of the participants which relate to how it is in the real world. Furthermore, the researcher remained as an observer in the study to identify the experiences and perspectives of the participants and the affordances of the DET.

### **Dependability**

Dependability refers to the consistency of the research process and the findings over time (Korstjens & Moser, 2018). In this study, the researcher explained the procedures in detail throughout this study to ensure the research path is clear and transparent. Furthermore, the emerging themes and results were integrated and linked back to the research questions to ground the findings of this case study in the data (Nguyen et al., 2021).

### **Confirmability**

Confirmability refers to whether the data is a true representation of the participant's responses and not influenced by the researcher (Håkansson, 2013). According to Junjie and Yingxin (2022), if the researcher explained the research procedures of the study it increases the confirmability of a study. In order to ensure confirmability in this study the researcher kept an open mind and set aside presumptions to ensure the focus remained mainly on the topic and the experiences of the participants as well as the research findings.

### **Transferability**

Lastly, transferability implies how findings are relatable and can be applied to other situations (Shah et al., 2019). Therefore, to foster transferability in this study, in-depth information about

the research process, participants, and the affordances of DET were provided to help the reader relate and apply the findings to their own situation. The findings and conclusions of this study were also presented in such a manner that educators in fully online learning from other higher education institutions can relate and apply the findings to their current practices (Korstjens & Moser, 2018).

### **3.8 Limitations**

A limitation of this study is the small sample size since only one higher education institution could be accessed. Another limitation includes that the research was focused on fully online modules only, not fully online programmes, so there might be a possibility that 21st-century skills were incorporated in other modules offered throughout the rest of the programmes.

### **3.9 Ethical Considerations**

Ethical research is important especially when the research involves interacting with members of the general public (Arifin, 2018). The interaction with these members can happen in several ways, such as through interviews, questionnaires, focus groups, and observations. It is the researcher's responsibility to consider the harm or negative impact these interactions might have on the participants (Baxter, Courage, & Caine, 2015). Ethical considerations aim to provide accountable research to the general public by protecting the research participants and ensuring a certain standard is followed in research (Iphofen & Tolich, 2018; Pietilä et al., 2020). A research study can be conducted ethically if the participants give informed consent and voluntarily choose to participate. To further protect participants their confidentiality and anonymity must be conserved as far as possible during and after the research study (Arifin, 2018; Iphofen & Tolich, 2018). It is also important that the researcher considers ethics during

the data collection and analysis phases to keep protecting the participants' information (Aurini, Heath, & Howells, 2021).

In this research, ethical clearance was first obtained from the Faculty of Education where this study is hosted, the registrar of the higher education institution, and then the relevant academic faculties. Next, the email information of the participants was obtained from the institution's public website. The participants were then approached through email with an informed consent letter and documents that discussed the details of the study. The participants were recruited based on whether they voluntarily agreed and were willing to participate in this study. The email information of each participant was only used to get the participants' consent and was in no other way used in the research report. The participants were explicitly asked if they were willing to participate, if they were willing to complete the questionnaire, and if they were willing to participate in a follow-up interview and/or focus group discussion. The informed consent letter also asked the consent from the participants to allow the researcher to access their online modules and curriculum documents.

In the data collection stage, it was decided to only conduct interviews and not focus group discussions. The reasoning was that the questionnaire and document analysis provided enough feedback and results and continuing with the focus group would have been redundant. Therefore, it was decided to only continue with the interviews. Only five participants explicitly agreed to participate in a follow-up interview and provided their email information via the questionnaire. Hence, only five interviews were conducted in this research study. The interview participants were sent a final consent letter to agree to participate in the interview and for the interview to be recorded. Once the consent had been received each interview participant was sent an invitation via email for their own online video interview, meaning that only one

participant would be present in an interview session at a time. The participants were informed in both the consent letters that they were free at any time during the process to withdraw their consent to participate in the study. The purpose of the consent letters was to ensure the participants understood the intent of the study, voluntarily agreed to participate in the study, and agreed to their data being used (Arifin, 2018; Iphofen & Tolich, 2018). To further ensure the confidentiality of the information collected, each participant was given an alphanumeric coded number (e.g., P1Q). The data files of all the records were stored electronically via a cloud-based storage drive with a secure password. The password will be updated regularly for security purposes. All the information obtained during the research study was treated confidentially.

At no time were the participants mentioned by name nor were they allowed to be identified by any manner or means whatsoever in the research report. The final results are published in such a manner that participants remain unidentifiable and each participant was provided with a copy of the research report containing both the findings of the study and recommendations.

### **3.10 Summary**

Throughout this chapter, the research methods that were used to answer the research questions for this study have been explained. Furthermore, the research participants and data collection procedures were discussed in detail. A qualitative case study approach was used to gather the opinions, perspectives, and ideas of participants. This approach assisted the researcher to develop theory based on the use of DET for the development of 21st-century skills within their online modules. The researcher adopted an interpretive approach to guide the findings of the study to gather the authentic experience of the educators in the fully online learning environment. The participants contributed to this theory by providing their perspectives and experiences through the questionnaire and interviews, as well as providing access to their online modules for document analysis.

In the next chapter, the findings are discussed. The aim was to determine what the data showed in terms of the extent to which educators were making provision for the development of 21st-century skills in fully online courses. Additionally, the aim was to determine what affordances of DET support the development of 21st-century skills.

## **Chapter 4: Findings and discussion**

### **4.1 Introduction**

The objective of this chapter is to analyse and discuss the data to address the research questions. This chapter starts with background information regarding the online modules that formed part of the analysis of this study. Then the findings of the data analysis are collectively presented through an integrated data analysis of all the data instruments. The integrated analysis provides an overall interpretation of the data to respond to the research questions.

### **4.2 Contextualisation of online modules analysed in this study**

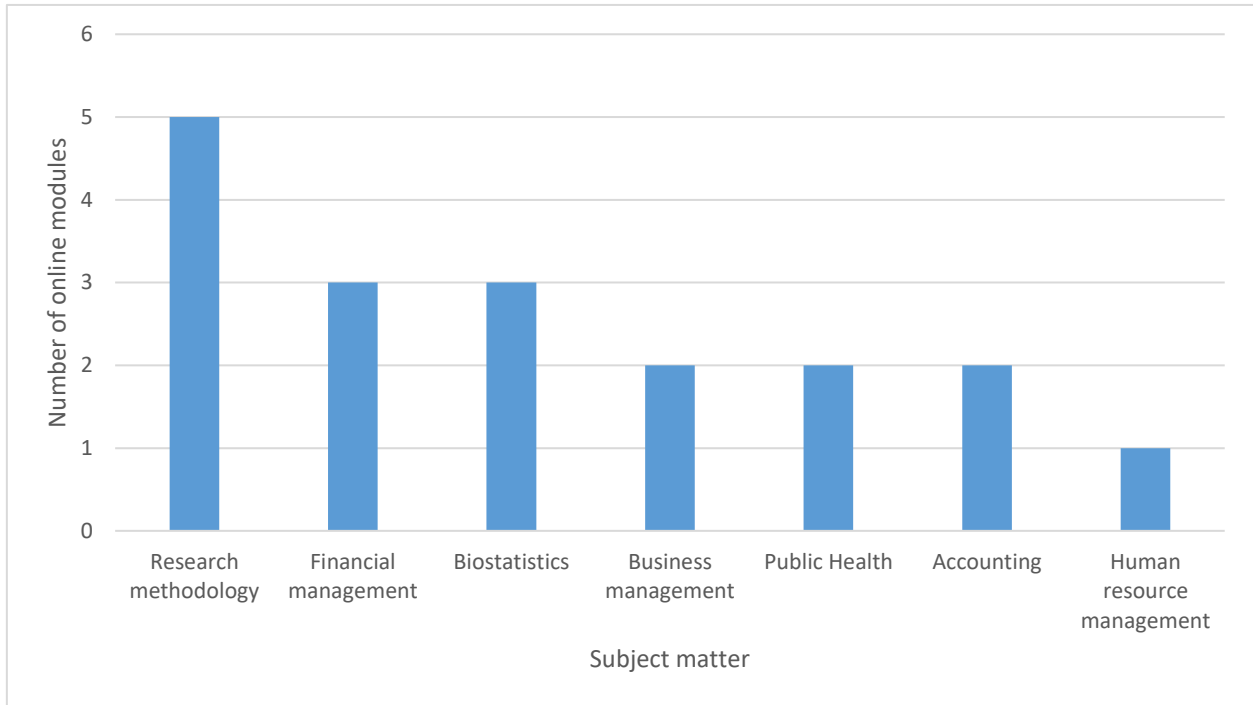
This section covers the subject matter, duration of offering, and degree levels of the online modules that were analysed through document analysis and referred to by the participants in their responses in the questionnaires and interviews. Although this online module information does not form the basis of the study, it is useful for contextualising the findings.

Between the 11 participants, a total of 18 different online module codes were submitted in order for the researcher to review the curriculum documents and resources as part of the document analysis. These 18 modules are the fully online modules that these participants were teaching at the time of the study. However, to retain confidentiality, only the main subject matter of each module will be mentioned and not the module codes. Some of the modules' subject matter was grouped together in one category. For example, the modules 'Quantitative Research Methods' and 'Introduction to Research Methodologies' were grouped into one category called 'Research Methodology'. The main subject matters derived from the responses together with the number of modules per subject matter can be seen in Figure 4.1.



**Figure 4.1**

*Subject matter of online modules*



As shown in Figure 4.1, a wide variety of subject matter was part of the analysis of the online modules. It is also worth noting that more than half of these 18 online modules were offered over a period of a year, whereas the other modules were offered over a semester or as short courses.

**Figure 4.2**

*Degree levels of online modules*

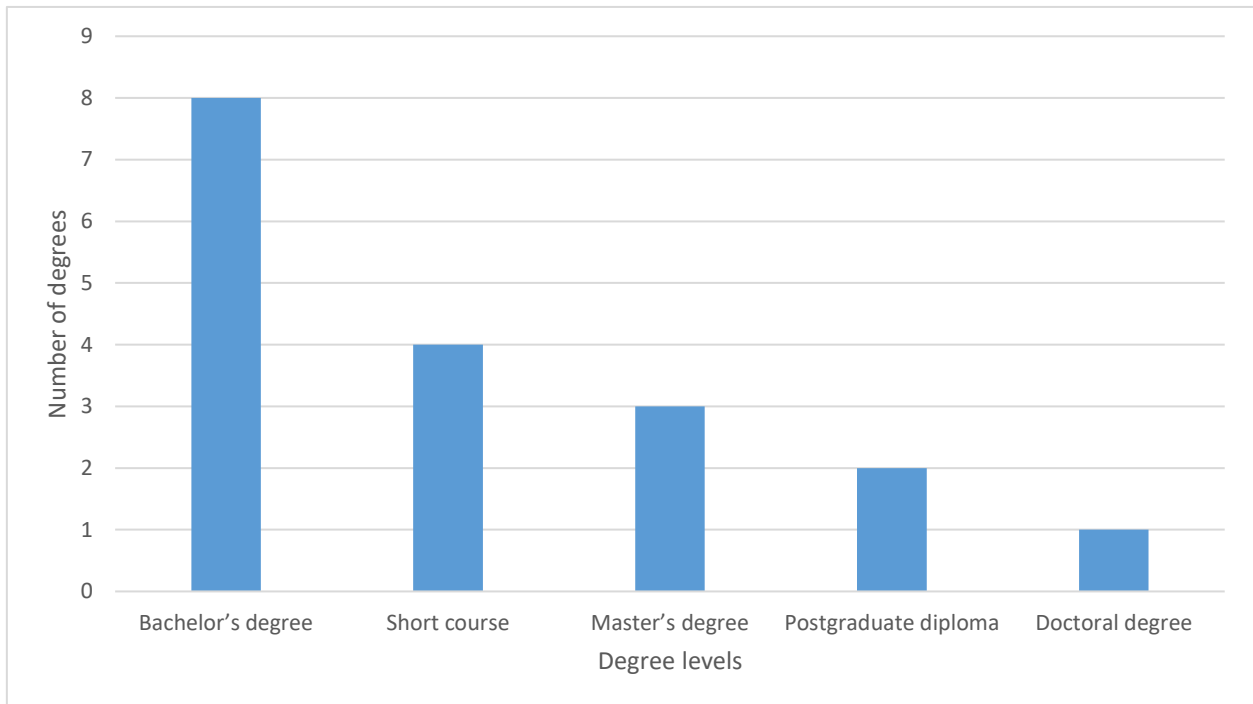


Figure 4.2 shows that the online modules contributed to all the degree levels from bachelor's up to doctoral degrees, as well as short courses for non-degree purposes. The variety of subject areas and levels of the online modules show that the study was not limited to a specific degree or year level. Moreover, the results of this study do not reflect the occurrence of a one-time event, or the occurrence of online modules offered during a specific period of time or for a short period of intervention.

### **4.3 Affordances of Digital Educational Technology**

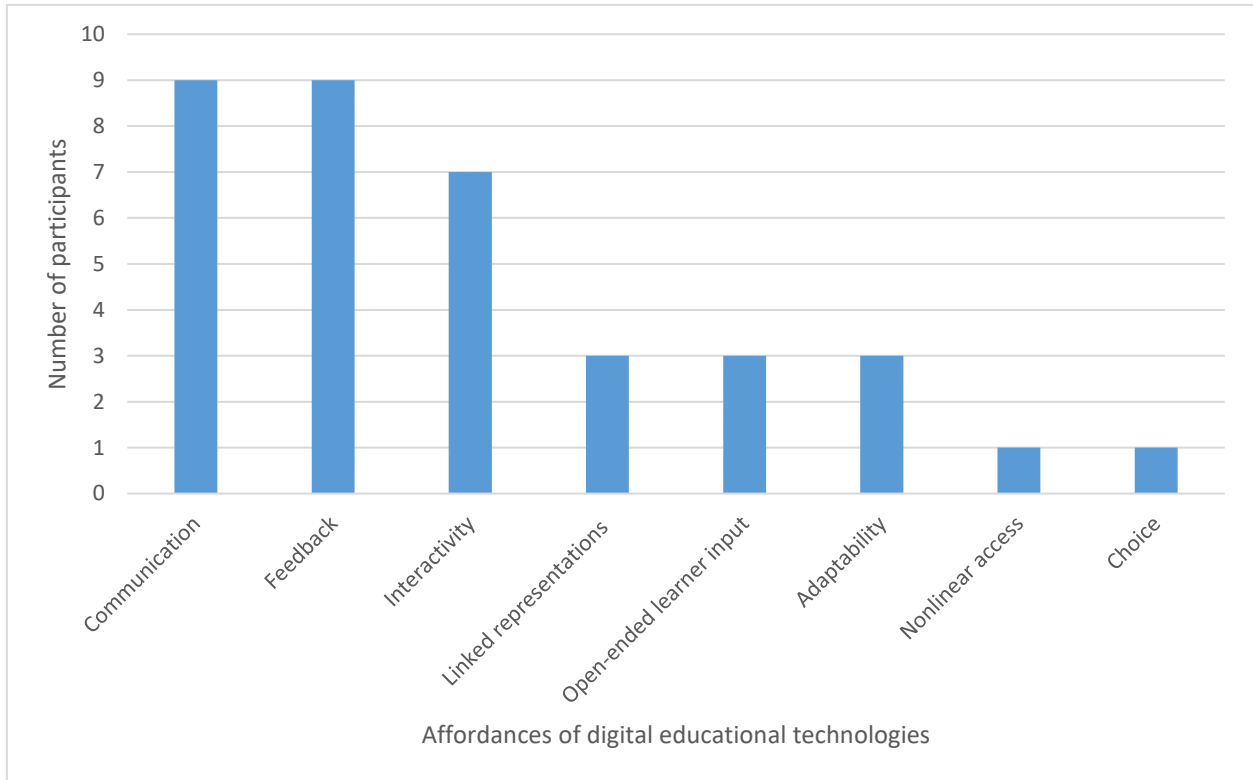
This section covers the data analysis and the interpretation to determine what affordances of DET support the development of 21st-century skills in online learning. The section starts by unpacking the types of DET the participants were using, followed by the affordances of the DET.

The types of DET that were utilised in this study include learning management system technology, collaborative, audio, and visual technology. The most used DET was a learning management system (LMS). Ten of the participants said they were using the LMS (P1-P9Q, P11Q). Document analysis and questionnaire responses confirmed that the LMS was used to host and build all the online modules in this study. Other DET that the participants used were PowerPoint (DM9), Flipgrid (DM18), Padlet (DM9), Zoom (P4I), Microsoft Teams (P8I), Google Meet (P4I), and Google Drive (P8I).

Affordances of DET in this study refer to the characteristics that DET has that make it capable of performing certain tasks or practices (Al-Maawali, 2020; Hoven, 2007; Ng, 2015). For example, an LMS provides the capability of communication by means of a discussion forum and feedback through the Grade Center functionality, and interactivity by embedding interactive videos using the content collaboration framework H5P. The NASEM found that the following affordances for DET support the development of 21st-century skills: adaptivity, interactivity, feedback, nonlinear access, choice, linked presentations, open-ended learner input, and communication (National Academies of Sciences, Engineering & Medicine, 2018). The participants in this study used a variety of corresponding affordances of DET, such as communication, feedback, and interactivity. Figure 4.3 shows all the affordances of the DET that the participants were generally using according to the questionnaire responses.

**Figure 4.3**

*Affordances of DET used in the online modules*



### **Communication**

One of the most popular affordances of DET used by participants in their online modules was communication. The affordance of communication allowed students to communicate with others in their learning environment, such as educators, tutors, academics, and peers. Participants indicated that by using the affordance of communication students could communicate about the subject matter (P1Q, P2Q, P4Q-P9Q, P11Q). According to Raba (2017), when students communicate, they do not only practice their communication skills, but also their critical thinking, creativity, and collaboration skills. Document analysis confirmed that in all 18 modules the affordance of communication provided by a variety of DET was used (DM1-DM18). In the majority of the modules the communication affordance of the LMS was used to encourage

students to communicate by using the discussion forum, wiki page, and/or video conferencing tools (DM1, DM3- DM5, DM9-DM18). Other than the LMS, alternative collaborative technologies were utilised for the affordance of communication, such as Microsoft Teams (P8I), Zoom (P4I), and Google Meet (P4I).

## **Feedback**

The affordance of DET to provide feedback was another popular characteristic that the participants used. The affordance of feedback provides the opportunity for educators to give students comments and pointers using a DET to help students to improve their overall performance in the module (Winstone & Boud, 2019). An example of how the affordance of feedback can be used is to set up quizzes with correct and incorrect feedback settings which will give students automated feedback once they answer a quiz question. By using feedback, students can cultivate their critical thinking skills by analysing the comments and suggestions to make improvements accordingly (Colthorpe et al., 2014; Hayes & Devitt, 2008). In this study, only one participant (P8Q) said they did not provide students with feedback in their online modules. However, document analysis showed that the affordance of feedback was used in all the 18 online modules, albeit to differing extents (DM1-DM18). Nine of the participants used the LMS for feedback (P2Q, P4Q-P9Q, P11Q). Feedback via the LMS was given to students in the form of their marks, individual comments, and/or general or group feedback. Participant P8I used another collaborative technology:

“I created individual Google drives for each student and then I'll just pop the feedback in the Google drive and then just send a general email: ‘Your assignment marks are in your Google drive attached is the link to your individual files.’”

In 10 of the 18 modules, students were allowed to ask questions regarding their feedback through the discussion forum feature of the LMS (DM2-DM4, DM9- DM13, DM16, DM18). Additionally, the participants that were interviewed confirmed that they use video conferencing sessions (P6I, P8I, P9I, P11I), discussion forums (P7I, P9I), emails (P8I), and/or Google Chat (P6I) to give students the opportunity to ask questions about their feedback.

### **Interactivity**

As indicated in the questionnaire responses, seven of the participants used the interactivity affordance of the LMS (P1Q, P3Q, P5Q-P7Q, P9Q, P11Q). According to research, the interactivity of DET can be described as how the students interact with the DET, the learning content, and other stakeholders whilst using the DET (Beauchamp & Kennewell, 2010; Lippert et al., 2019). The interactivity affordance encourages students to communicate, collaborate and critically think whilst they interact with their learning content and peers (Krusche & Seitz, 2019). Therefore, the more the students use DET tools to engage with the learning content, complete automated quizzes to get feedback, and work with others in a group setting, the higher the level of interactivity present in a module.

As mentioned, seven of the participants (P3Q, P5Q, P6Q, P7Q, P9Q-P11Q) indicated in their questionnaire results that they use the LMS affordance of interactivity in their online modules. In contrast, document analysis showed that only DM2, DM4, and DM14 did not make use of the interactivity affordance of the LMS indicating that most of the online modules did actually utilise the interactivity affordance. The discrepancy between the questionnaire and document analysis results might mean that some of the participants did not understand what interactivity entails, or they did not realise that they were utilising the interactivity affordance of the LMS.

In order to determine the level of interactivity in modules the researcher looked at the number of interactive activities that were included in the module and how often it was required for students to complete these interactive activities (Smith & Winking-Diaz, 2004; Weber & Ahn, 2021). In this case, an analysis of LMS data showed that the three modules with the most interactivity included all the following activities for students to complete on a weekly basis: reading materials, embedded videos, automated quizzes, and group work (DM9, DM10, DM18). Interestingly, participant P7I said students are "...quite eager to participate. I think, especially with the online environment, that's the only way they can engage. So they prefer to engage."

In contrast, DM2 and DM4, which showed limited interactivity only included the necessary course materials, such as the study guide and assessment information in the online module. Just having access to necessary course materials could have resulted in students interacting with the LMS technology (and content) perhaps once every few weeks to download the necessary information as needed. In these instances, students most probably did not access or interact with the LMS on a continuous (daily or weekly) basis, as compared to the other modules with more interactivity. It is also worth noting that in the modules with limited interactivity the LMS was not used to develop any 21st-century skills.

### **Linked representations**

The LMS that was used for all the online modules provided a built-in feature for linked representations which is an affordance that allows documents to be accessed in alternative formats. When educators present content in multiple formats it can provide a different perspective on the content which encourages students to critically think about what they are learning (Abdurrahman et al., 2019). In this case, only three of the participants mentioned that

they utilised the linked representations affordance (P3Q, P6Q, P11Q). In the document analysis, however, it was found that all the modules used the linked representation affordance of the LMS to present documents in different formats (DM1-DM18). For example, a PDF document could also be downloaded in audio, HTML, electronic braille, or ePub (for e-books) formats. It is important to note that the affordance of providing alternative formats was enabled by an automatic setting on the LMS which means educators did not have to intentionally include different formats of their documents. However, document analysis did show that only seven of the participants (P2Q, P4Q, P6Q, P7Q, P9Q-P11Q) intentionally included other alternative formats, such as videos, video transcripts, PowerPoint slides, and visuals (drawings, illustrations, and graphics). Therefore, it is clear there is an inconsistency between the participants' responses and document analysis regarding the use of linked representations.

### **Open-ended learner input**

The LMS allowed users to input different formats of files which forms part of the open-ended learner input affordance of the LMS. The affordance of open-ended learner input allows students to input and express their knowledge and understanding through different formats, for example, through visuals or audio (National Academies of Sciences, Engineering & Medicine, 2018). By providing students with opportunities to provide inputs in different formats the students are encouraged to be more creative and to think critically (Kurniawan et al., 2018; Romli et al., 2018). Only three of the participants said they used open-ended learner input in their online modules (P3Q, P9Q, P11Q). Therefore, it was expected that less than half of the modules made allowance for the development of creativity and critical thinking skills through the affordance of open-ended learner input. However, document analysis indicated that the majority of the online modules (DM1-DM5, DM9-DM18) used the open-ended learner input functionality of the LMS to allow students to provide their own understanding or responses to questions. One



example of how the affordance of open-ended learner input was used was to allow students to submit solutions to activities/assessments on the LMS as videos, graphics, presentations, or wiki pages. Other DET used, included Flipgrid (DM18) and Padlet (DM9) which allowed students to submit text, graphics, audio, or videos as part of their inputs to a particular topic.

### **Adaptability**

The affordance of adaptability refers to the ability of a DET to adapt the content or learning path of a student based on the student's behaviour, input, and responses to a system (Lippert et al., 2019). Document analysis and interviews confirmed that none of the participants used the affordance of adaptability of the LMS. However, one of the participants involved in module DM9 indicated that they used the affordance of adaptability via PowerPoint. The participant made interactive PowerPoint slides with branching options available to students which meant that the presentation branched out to certain slides and content based on the inputs given by a student. Making content adaptable for students gives them a personalised learning experience based on their own behaviour, which also prompts learners to make decisions and/or solve problems that aids the development of their critical thinking skills (Liu et al., 2017). Other researchers state that technologies that allow for personalised learning experiences can be used to encourage students to communicate, collaborate, and to be more creative (Fitzgerald et al., 2018; Graesser, 2019; Han & Ellis, 2020).

### **Nonlinear access**

It is worth noting that only one of the participants indicated in the questionnaire that they use the LMS affordance of nonlinear access in their online module. The affordance of nonlinear access refers to the ability of DET to allow students to complete their learning content in a preferred order and at a comfortable pace. Document analysis confirmed that in all the modules

students were required to follow a weekly schedule of tasks and activities that had to be completed (DM1-DM18). Students were also given set due dates for assessments. Therefore, document analysis confirmed that in none of the modules the affordance of nonlinear access was utilised. Although students had the freedom to decide when to work within a week, due to the set schedule, they did not have complete freedom to work through the content at their own pace, or to proceed in their own preferred order. When students are provided with flexibility in terms of how and when they learn it encourages them to engage more with the learning content and to take responsibility for their learning and choices (Huang, Liu, Tlili, Yang, & Wang, 2020).

### **Choice**

The choice affordance of the LMS was not used by any of the participants according to the document analysis. The affordance of choice is present when DET allows students to make selections in terms of what content, themes, or activities, such as assignments and quizzes, they want to complete as part of their module participation (McDowell et al., 2019). The fact that participants did not use the affordance of choice does not mean students were not provided with choices of topics throughout a module's curriculum. However, it does mean that no specific feature of the LMS was used to offer students choices throughout their learning experience. Participant P7I said in the interview that the subject matter of their online module does not allow them to give students the option of choice. Their reasoning was as follows:

“I think it's different at Masters level and PhD level where they can maybe adapt their research process, you know. But at Honours level, research is also very, very much introductory. The [DM15] module - although it's an Honours module, it's at introductory level for research. They haven't been exposed to any form of research at the undergraduate studies. So we really can't actually allow them to adapt. We don't have that luxury because

they haven't been exposed to research. So we have to set clear boundaries and limits and rules of what they can do and can't do, and I think you can do it more with more advanced students or a more advanced or the senior students. You can provide the adaptability.”

All three affordances of adaptability, choice, and nonlinear access encourage a personalised learning experience for students (Fitzgerald et al., 2018; Han & Ellis, 2020). These affordances are not a popular option for educators to include in modules, since it requires extensive time and effort to set up different topics throughout the curriculum and to manage students who are completing modules in a different order and at a different pace (Kucirkova, Gerard, & Linn, 2021). Also, the syllabus of a module might be set up in such a way that one topic builds upon another which does not allow for a personalised learning experience (Petersen & Gundersen, 2019). Another reason could be that the participants did not have the necessary skills or knowledge to use the affordances of DET to allow personalised learning experiences for students.

#### **4.4 Development of 21st-century skills**

This section covers the data analysis and interpretation to determine to what extent the online modules were making provision for the development of 21st-century skills (RSQ1). The section starts with the participants' perspectives on the importance of 21st-century skills and then highlights their understanding of what 21st-century skills entail. How participants were incorporating the development of 21st-century skills within their online modules follows and the section then concludes with the assessment strategies participants were using as it relates to 21st-century skills (RSQ2).

#### **4.4.1 Perspectives regarding 21st-century skills**

The participants' perspectives on the topic were revealed when they emphasised the importance of developing 21st-century skills in their modules. The consensus was that since not everyone was exposed to or had the opportunity to develop 21st-century skills in secondary school, it was important to develop these skills, even at higher education levels. Participant P5Q expressed the notion that the development of 21st-century skills was important because "...these are not skills that all people have. The skills need to be developed and enriched through teaching". Participant P4Q agreed and added the following "Yes, the children who are born today will grow up with these skills, but there is a generation before this and an in-between generation who are not necessarily fully proficient". This suggestion that not everyone is exposed to the opportunity to develop 21st-century skills was confirmed by research that found not all schools have the necessary access to resources or are adapting their practices to accommodate the development of 21st-century skills (Sulaiman & Ismail, 2020; Teng et al., 2019).

Other educators indicated that having the necessary 21st-century skills was important since these skills were in demand in the society of the time and especially in the workplace (World Economic Forum, 2020a). In addition, participant P7Q said, "Yes, digital savvy or digital acumen is critical for success in the workplace". Participant P1Q added that "Students need to be equipped to function in the real world."

Participants in this study seemed to have realised the importance of adapting teaching and learning practices to enable universities to deliver employable graduates. Participant P11Q remarked that lecturers need to equip the students "...especially in the current climate where we need innovative solutions. We need to have the foresight to transform teaching and train next

generation professionals”. Participant P5Q added that “these skills need to be developed and enriched through learning”.

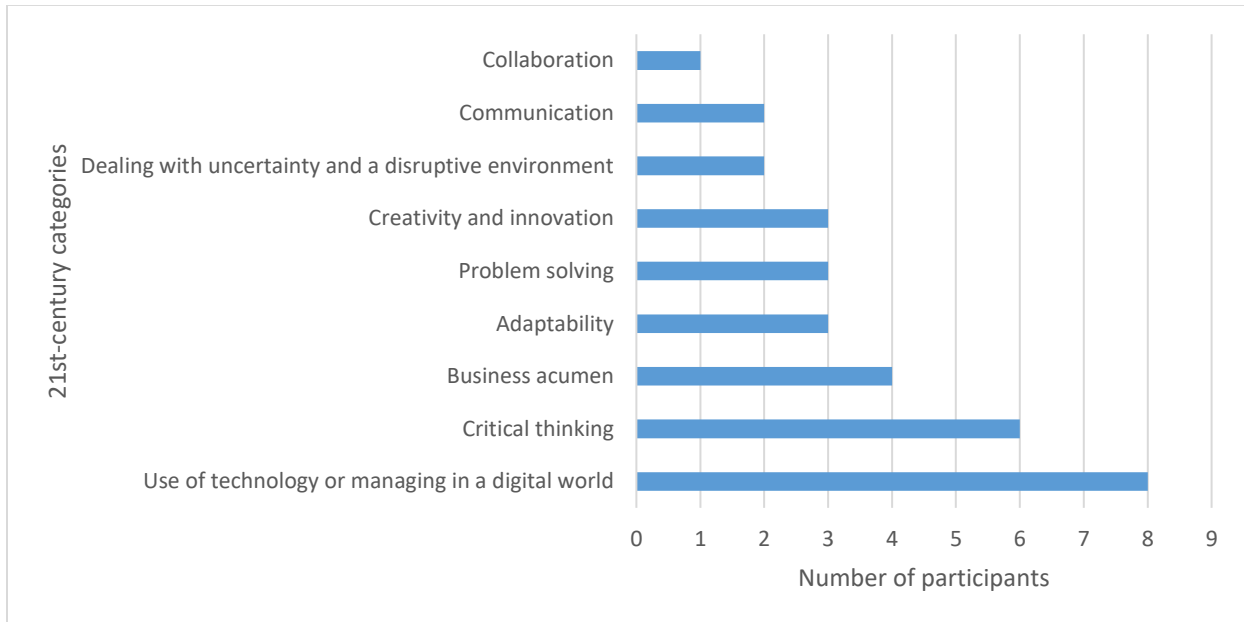
Document analysis showed that all the participants made a conscious effort to develop critical thinking and creativity amongst their students (DM1-DM18). However, document analysis furthermore revealed that less than half of the modules included activities to develop communication and collaboration skills (DM2, DM6- DM10, DM15, DM18). As participants consciously implemented only half of the 4Cs of education, one could argue that the participants were not as serious about developing 21st-century skills as they might have portrayed themselves to be. Consequently, their recognition of the importance of incorporating 21st-century skills and what they have actually implemented in their online modules did not correspond.

#### ***4.4.2 Understanding of 21st-century skills***

From the 10 questionnaire responses, it was clear that the participants’ descriptions of their understanding and the examples of 21st-century skills varied. The key phrases from the participants’ description of 21st-century skills were gathered from the questionnaire and grouped into categories as shown in Figure 4.4.

**Figure 4.4**

*Participants' understanding of 21st-century skills*



From Figure 4.4 it is firstly evident that the use of technology or managing in a digital world (digital literacy) was the 21st-century skill that was selected by eight of the 10 participants to indicate their view of 21st-century skills. Secondly, participants emphasised the importance of critical thinking as part of 21st-century skills. Digital literacy and critical thinking forms part of the top 10 skills identified by the World Economic Forum (2020b). Among these top 10 skills were creativity, problem-solving, and adaptability. Most 21st-century skills frameworks not only include the skills of critical thinking, problem-solving, creativity, and digital literacy, but also communication and collaboration (Caena & Redecker, 2019; Care et al., 2018; Kereluik et al., 2013). Only two of the participants (P1Q, P5Q) mentioned communication, and one participant (P9Q) mentioned collaboration skills as their understanding of what 21st-century skills entail. Participant P5Q described 21st-century skills as “...using technology, but also being able to communicate in an effective manner. Furthermore, one needs to be a critical thinker and be creative to adapt to strange situations”. As mentioned earlier, document analysis highlighted

some discrepancies between what the participants perceived as 21st-century skills and what they have incorporated within their modules, especially in the case of communication, collaboration, and creativity skills.

#### **4.4.3 Methods of incorporating 21st-century skills within online modules**

The majority of the participants (P1Q-P3Q, P5Q-P11Q) confirmed that they were **incorporating** the development of 21st-century skills within their online modules. Several of these participants further agreed that the 21st-century skills incorporated into their online modules were in line with the workforce requirements for graduates (P1Q, P3Q, P5Q-P11Q). As a result of aligning the 21st-century skills with the workforce requirements, participants P1Q and P6Q specifically said they were receiving positive feedback from employers.

However, P5Q also confessed, "...we are probably not addressing all the skills that the employers would like us to address". Similarly, participant P6Q said that they did plan to incorporate the development of 21st-century skills but once the year started and challenges arose, such as the COVID-19 pandemic, unplanned circumstances interfered with the initial planning. Another participant (P9Q) confirmed that they aligned their content to what the specific job industry requires, for example, "the public sector requires students who can solve or contribute to solving complex societal problems". While, participant P11Q said they attempt to align their "...activities, tasks, and skills with what is required for a Public Health professional in the real world".

In contrast with the other participants, P2Q indicated that the skills incorporated into their online module/s are not in line with employers' or workplace requirements. The participant mentioned that academic environments have certain limitations when it comes to developing

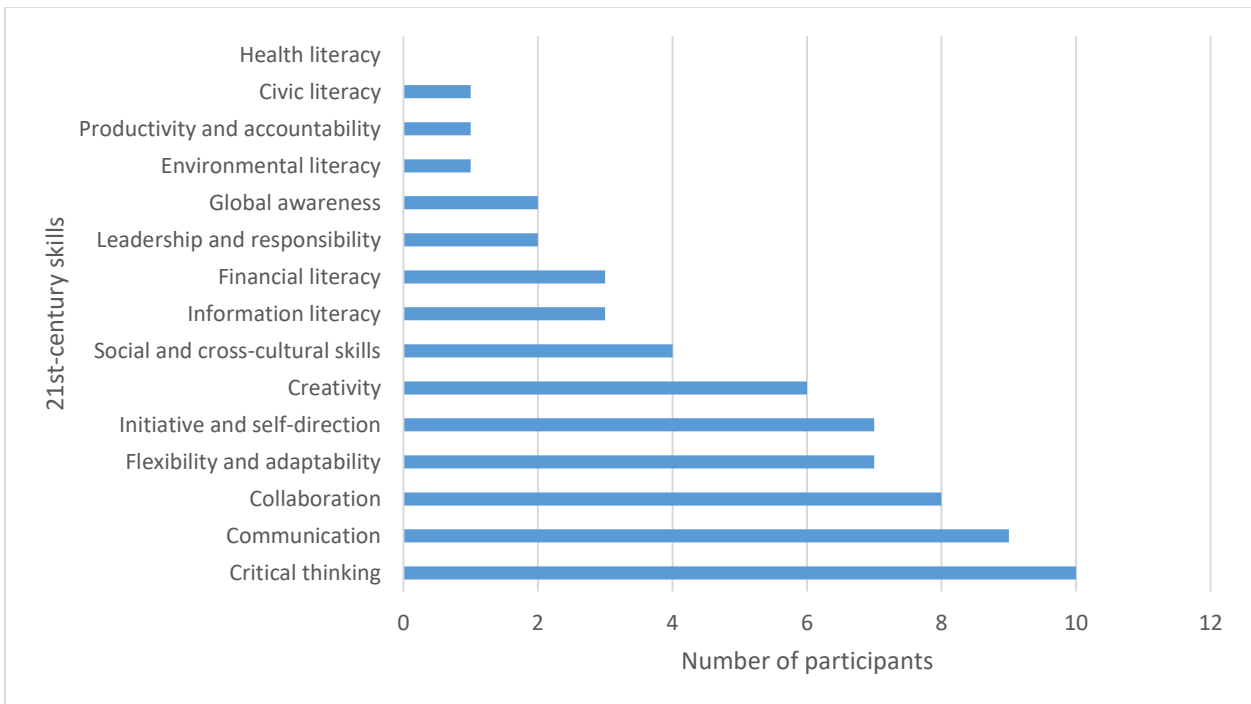
21st-century skills but did not indicate what these limitations were. However, participant P2Q did indicate that students did not seem interested in developing 21st-century skills because they “...only seem to be interested in doing things for marks and not seeing the value of anything that does not include marks”.

The participants who said they were incorporating 21st-century skills within their modules could choose from 15 skills listed in the questionnaire to indicate the 21st-century skills they were incorporating within their modules. These 15 skills, as shown in Figure 4.5, are identified by the P21 Framework as 21st-century skills that should be integrated into teaching and learning practices (Battelle for Kids, 2019). From Figure 4.5, it is evident that three of the 4Cs (critical thinking, communication, and collaboration) also scored the highest amongst participants with the last one of the 4Cs, creativity, ranking in fifth place. Corresponding with the P21 Framework, the participants also recognised that these are important skills for students to develop. Consequently, the participants did include the development of these skills within the design and planning of their modules. The 4Cs, critical thinking, communication, collaboration, and creativity, also form part of the P21 Framework that guided this study.



**Figure 4.5**

*21st-century skills incorporated within online modules*



### **Critical thinking**

Critical thinking forms part of the 4Cs (Battelle for Kids, 2019) and was the most mentioned 21st-century skill. From the questionnaire responses, participants indicated that an LMS could be used to develop critical thinking (P2Q, P5Q, P6Q, P11Q). When all 18 modules had been analysed, it became clear that all the modules were using the affordances of the LMS to develop critical thinking skills to some extent. It is important to note that to determine whether critical thinking skills are being developed in the online modules, the P21 Framework’s definition of critical thinking was considered to identify keywords within the modules together with appropriate synonyms of these keywords (Partnership for 21st Century Skills, 2009). Table 4.1 summarises these keywords that encourage critical thinking. These keywords were included in the learning outcomes, instructions of learning materials, such as the study guides, notes,

videos, quizzes, activities, graphics, and/or assessments of all the online modules that were investigated in this case study.

**Table 4.1**

*Summary of keywords for critical thinking*

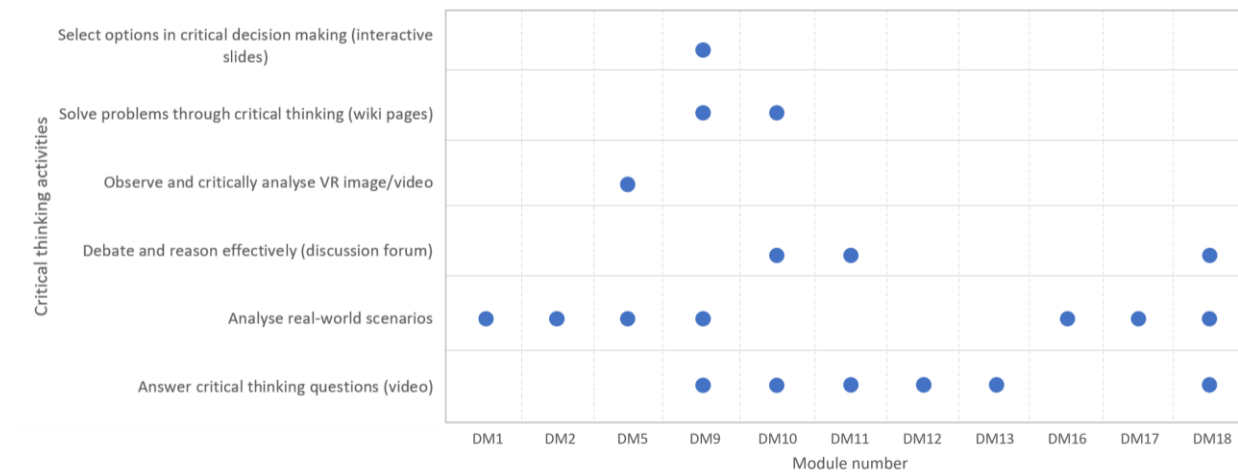
Analyse	Criticise	Interpret	Reflect
Assess	Differentiate	Investigate	Report
Calculate	Distinguish	Justify	Research
Categorise	Estimate	Motivate	Review
Characterise	Evaluate	Present	Revise
Classify	Examine	Prioritise	Select
Compare	Explain	Recognise	Summarise
Conclude	Express	Recommend	Synthesise

This evidence of critical thinking opportunities in the online curriculum corresponds with most of the participants' understanding that critical thinking forms part of 21st-century skills (Figure 4.5). The differences that were found in the number of participants implementing critical thinking and the evidence in the modules could be an indication that the participants did not consider the affordances of the LMS that allows students to access uploaded materials and activities as contributing to the development of critical thinking skills. As mentioned in Chapter 2, the affordance of linked representation coupled with audio and visual technology also develops

critical thinking skills (Abdurrahman et al., 2019). This was also observed during the document analysis (DM1, DM5-DM13, DM15, DM16, DM18). For example, students were given videos to watch together with main points to focus on so that they could critically analyse the content of the videos, or they were presented with questions that require critical thinking to be answered after they had watched a video. Only five of the modules (DM9- DM12, DM18) included transcripts with the videos, whereas modules DM3 and DM16 allowed students to access the PowerPoint slides used in the video recordings. In the modules where transcripts or alternative formats for videos were not provided, there could be a possibility that students might not have gained access to that part of the syllabus. For example, if students might experience technical problems or might not have sufficient Internet bandwidth to access these videos, then a transcript could be an alternative way to access the content (Spina, 2021). Figure 4.6 below shows more examples of how critical thinking was encouraged within the online modules.

**Figure 4.6**

*The use of critical thinking activities in modules*



The most popular activity for critical thinking was to include real-world scenarios and/or case studies in the modules. The open-ended learner input affordance of the LMS was used to allow

students to critically analyse real-world scenarios and/or case studies to draw conclusions, and/or to provide their own interpretation of the information. Participant P11Q mentioned that they ask students to critically analyse a real-world scenario and formulate a solution to the problem or indicate their insights. Then the students had to use the communication affordance of a DET, called Flipgrid, to communicate their solution or insights via a radio broadcast to their peers. Demonstrating how 21st-century skills are intertwined in nature, this activity used by P11Q provided possibilities to develop both critical thinking and communication skills.

Participant P6I said they encourage critical thinking through:

“...class discussions and debating. I'll use the similar example with that sustainability topic. Then we said, you know what, this is what's happening on a global scale. All these global leaders are meeting. If you were to prioritise. So it was a matter of if you were a business manager and had to prioritise sustainability issues for their company, which ones would they be for the South African context? And why?”

Only a few of the modules used the communication and interactivity affordances of the LMS for critical thinking (P6I, P9I, DM5). For example, participant P6I confirmed that they use discussion forums to encourage students to debate topics and to work together effectively to solve real-world scenarios or problems. Participant P9I also confirmed in their interview that they encouraged students to read through their peers' comments regarding a topic and then communicate their own insights and findings by replying to their comments. Another example where critical thinking skills were developed in a module, (DM5), was where students had to do a virtual reality activity to observe and then critically analyse a situation. Furthermore, only module DM9 used the affordance of adaptability of PowerPoint to include interactive slides that

students had to critically analyse to make decisions based on different scenarios. According to the P21 Framework, these types of activities encourage the development of critical thinking skills (Partnership for 21st Century Skills, 2009).

The P21 Framework further suggests that giving students opportunities to reflect on their learning experiences and processes, requires critical thinking skills on their part (Partnership for 21st Century Skills, 2009). Participant P9Q confirmed that they designed activities and self-reflection questions to enable students to think critically. In this case, the feedback affordance of the LMS was used to either give feedback through marks, to individual students, and/or overall feedback so that students could reflect on their work and make improvements. Document analysis showed that feedback was given by providing students with the marks of their assessments and activities as part of self-reflection and correction (DM1-DM5, DM9-DM18). In contrast, participant P8I said they didn't use the feedback affordance of the LMS because they didn't know how to set up the grade book and how to use it effectively.

Although individual feedback was provided to students, only a few participants, (DM9, DM10, DM13), provided individual feedback by means of the feedback affordance of the LMS, which means the feedback was displayed with the students' marks in the grade book. In some of the other modules, (DM6, DM7, DM8), individual feedback was given as comments within the students' assessment/activity documents which were then uploaded on Google Drive for students to access.

It should be noted that the ratio of lecturer and/or tutors to the number of students where individual feedback was given averaged about one lecturer/tutor to 24 students. In the modules where no individual feedback was given the ratio was one lecturer/tutor to 383 students.

Participants P9I and P7I confirmed that it took long to provide individual feedback, especially to large groups, and they did not always have the capacity to do so. It is worth noting that the feedback affordance of the LMS allowed the setup of detailed rubrics which could be used for online marking and then made available to students as feedback. Online rubrics are especially helpful for giving individual feedback to large groups. However, the fact that participant P8I said they did not know how to use the grade book tool of the LMS is an indication that they might not even be aware of this feedback affordance, and that is why they rely on Google Drive to give students individual feedback. Participant P6I mentioned that they had tutors that used Google Meet or Google Chat to deal with students individually to attend to their queries about their feedback.

Students were also provided with general and overall feedback (DM1-DM5, DM9, DM10, DM15). In all the modules students were given general, summarised, or overall feedback on assessments and activities by using the announcements feature or by uploading notes on the LMS. In doing so, the problems and/or queries the students were addressed. Participants P7Q and P9Q used the audio and/or video features of the LMS to give general feedback to students. For example, the option to attach a voice recording made it possible for the participants to record a voice clip and send it to students to give them general feedback on the main problem areas of the assignment/activity.

In these cases, where only general/overall feedback was given, the ratio of lecturers and/or tutors to the number of students varied. Two modules had an average ratio of one lecturer/tutor to 194 students (DM1, DM5). The other modules had an average ratio of one lecturer/tutor to 26 students (DM2- DM4, DM9, DM10, DM15). Hence, the argument that these participants did not have the capacity to give individual feedback might not be valid in this case. However,

participant P7I said:

“...whether it's multiple choice, or match column A to B, or when it's one of those short type of questions - we give immediate feedback. But when it's like maybe short answer questions - I think it's just because we are stressed for time, and we don't provide the feedback”.

Participant P8I confessed that “...I don't give them a lot of feedback on how they're progress. I don't, because I don't know how to use it.”

## **Communication**

The announcement tool of the LMS was mostly used for its communication affordance. The announcement feature was used by the participants to communicate important information regarding weekly lessons, assessments, and other module-related information to the students. Although seen as communication, it is worth noting that the announcement tool only allows one-way communication from the participants to the students and therefore could not be considered to develop students' communication skills.

Participants also mentioned in the questionnaire that they incorporate communication as part of their online learning (P1Q, P3Q, P5Q-P9Q, P11Q). When analysing their online modules, it was clear that in all the modules the students were encouraged to practise their communication skills. The discussion forum tool of the LMS was actively used in nearly all the online modules (DM2-DM4, DM9-DM13, DM16, DM18). The communication affordance of the discussion forum allowed students to communicate with their peers as well as their educators regarding assessments, topics, and other subject-related content. However, it was a disappointment that in only a few online modules discussion forums were used for their open-ended learner input affordance (DM10, DM11, DM18). The affordance of open-ended learner input allowed students to discuss specific topics with their peers to provide their own understanding or perspective

regarding the topics for an assignment or activity or to give peer input. In module DM9 the participant specifically created discussion forum activities for students to discuss their submissions with each other and to give peer feedback. Additionally, the students were asked to provide their perspectives on a specific topic via the communication affordance of the discussion forum, and then the students had to provide a different perspective on the same topic in the following week (DM18). In the follow-up interview, it was found that in DM18 the participant included discussion forum activities to allow students to practise how to communicate different perspectives and information since this is what would be required of them in the specific profession. These activities or assignments in the above-mentioned modules (DM10, DM11, DM18) contributed to the final mark for the modules. Therefore, in modules DM10, DM11, and DM18 there was a degree of certainty that communication skills were developed. However, these activities focused on developing students' written communication skills rather than both oral and written communication skills.

To further develop communication skills, the built-in video conferencing tool of the LMS was used to simulate a virtual classroom (DM1, DM3, DM5, DM9, DM11, DM13-DM18). The video conferencing tool of the LMS allowed educators and students to meet in a virtual classroom setting and includes features such as video conferencing, sharing of files and screens, and a virtual whiteboard. Participant P7I mentioned in the interview that they chose to use the built-in video conferencing tool of the LMS. Their reason was its ease of use and lecturers, as well as students, familiarity with this video conferencing tool as everyone from the institution used the same LMS.

The affordances of communication and interactivity of the video conferencing tool allowed students to develop oral and even some nonverbal communication skills. In the interviews and



the document analysis it was confirmed that some of the modules used other collaborative technology for communication, such as Microsoft Teams, Zoom, Google Meet, and Google Chat. Participant P8I said they preferred using Zoom or Microsoft Teams, rather than the LMS, to increase students' access to the module and the interactive sessions. The reason was that some students experienced challenges during the registration period and could not always get access to the LMS for the first few video conferencing sessions of the module (P8I). Therefore, by using a third-party video conferencing tool all students could access the first sessions of the module whilst they waited for access to the LMS. In module DM18 another DET, called Flipgrid, was used to allow students to practise their oral communication through a radio broadcast activity where they had to discuss different perspectives and information based on real-world scenarios.

Taking into consideration the use of the LMS video conferencing functionality, and other collaborative technology, it can be argued that oral and nonverbal communication skills are being developed in nearly all of the modules (DM1, DM3, DM5-DM11, DM13-DM18). This leaves a few modules (DM2, DM4, DM12) where no oral and nonverbal communication skills were developed. In these three modules, participants were only using the communication affordance of the discussion forum functionality to encourage written communication among students and educators. Participant P6I said in their interview that they only used discussion forums since there was no provision made within the syllabus or plans for the module/s to use other DET for communication. In addition, some of the students might have minimal or no communication with their educator/s and peers through discussion forums as the activities are not compulsory (DM2, DM4, DM12). This casual use of the discussion forum resulted in missing opportunities for students to practise oral, written, and nonverbal communication skills and

therefore effectively acquire the required communication skills according to the P21 Framework (2009).

It is important to note that to develop the acquired communication skills, according to the P21 Framework (Partnership for 21st Century Skills, 2009), both the communication and interactivity affordances of DET had to be utilised. Although most participants (P1Q, P3Q, P4Q-P9Q, P11Q) did say they were developing communication skills, only some of the modules (DM2, DM3, DM9- DM11, DM13, DM16, DM18) were fully developing communication skills according to the P21 Framework's definition thereof (Partnership for 21st Century Skills, 2009). As a result, graduates' lack of comprehensive communication skills could be problematic since communication skill is one of the top 21st-century skills that employers seek in future employees and are also one of the essential skills needed in South Africa (Aarts & Kunn, 2019; Local Government Sector Education and Training Authority, 2018; Stewart et al., 2016; World Economic Forum, 2016).

Participants insisted that the feedback affordance of the LMS was developing communication and collaboration skills (P1Q, P3Q, P6Q, P7Q, P9Q). However, there was no evidence found in the document analysis that the feedback affordance was a collaborative process or even allowed students to communicate regarding their feedback. In the interviews, however, four participants could confirm that the feedback process was indeed interactive (P6I, P8I, P9I, P11I). To receive feedback from students, and to encourage two-way communication, P9I mentioned that they used the polling function and break-out rooms of the communication affordance of the LMS. Both participants P9I and P8I said they also allowed students to contact them, or the tutors, via email to ask for further explanation regarding their feedback. Another interesting approach by participant P11I was to use an online Google Form to allow students to

submit questions. The Google Form responses were collated in an Excel spreadsheet that gave the participant an overview of the questions and problems that the students had. Then, the following week, the participant addressed these questions in a video conferencing session with the students. It is worth mentioning that the feedback process needs to be a collaborative experience and requires engagement from both students and educators to develop communication and collaboration skills (Carless & Boud, 2018). Therefore, it can be argued that participants only allowed students in some modules to develop communication and collaboration skills by using the feedback affordance of the LMS (DM6-DM9, DM16-DM18).

### **Collaboration**

Collaboration was also one of the skills that the participants mentioned that formed part of their online modules. In fact, many of the participants said that they were incorporating collaboration within their modules (P1Q, P3Q, P5Q-P10Q). However, only P9Q included collaboration skills as part of their understanding of 21st-century skills. The P21 Framework describes collaboration as the ability to work in groups with the willingness to compromise to reach a common goal and to share responsibility by making equal contributions to the group work (Partnership for 21st Century Skills, 2009).

After considering the P21 Framework's definition of collaboration skills, it was confirmed that in most of the video conferencing sessions mostly the communication affordance was used and not the interactivity affordance. Therefore, document analysis determined that only communication skills, and hardly any collaboration skills, were practised in these video conferencing sessions. Similarly, other researchers have also refrained from using the interactivity affordance of video conferencing especially when the student groups were too big to have an efficient online collaboration session (Massner, 2021; Vandenberg & Magnuson, 2021).

Gillet-Swan (2017) also reported that most students are not comfortable to participate in an online, real-time environment, such as video conferencing, and therefore they also did not use it. Furthermore, some students might not have adequate Internet bandwidth to connect in real-time or have poor connection which restricts participation (Mpungose & Khoza, 2021;; Vandenberg & Magnuson, 2021). The lack of digital access was also confirmed by participants P6I, P7I and P11I who said that, in their experience, some students did not have access to Internet bandwidth, a stable Internet connection, or the right equipment to participate in collaborative activities.

Participant P9I said that they tried to avoid all group work activities since some students did not know how to use the collaborative technology, or the students simply chose not to contribute to the group work. Another reason given was overwhelming group dynamics and administration that needed to be managed and the educators did not have the capacity to address all these challenges (P9I). As a result, only a few of the participants considered collaborative technology to develop collaboration skills (P6I, P7I, P11I). Participant P8I explained in their interview that sometimes during their video conferencing session there was so much work to get through and not enough time to allow students to collaborate and interact during the session. Document analysis also confirmed that only in a few modules were collaboration skills developed by means of the inclusion of group activities (DM2, DM5-DM10, DM15, DM18). Some of these group activities were implemented by the interactivity affordance of the wiki tool of the LMS to allow students to work together on creating a wiki page about a specific topic (DM9, DM10). Participant P11I said in their interview they asked students to create a cartoon strip where each student in a group had to create a few cartoon panels and in the end combine all the panels. The participant chose the cartoon strip activity to give students a real-world experience of working together in a group and to allow students to practise collaboration. In other modules,

assessment activities were designed with the open-ended learn input affordance of the LMS to allow students to submit their group solutions to given questions, scenarios, or case studies (DM2, DM15, DM18).

Although discussion forums were used, only a few of the modules (DM9, DM10, DM18) required students to either interact on discussion forums, submit group activities, and attend video conference sessions. It is also worth noting that none of the participants thought that the choice affordance of the LMS developed collaboration skills. However, research done by McDowell et al. (2019), insisted that the choice affordance provides opportunities for students to actively engage in their learning by collaborating with their peers and instructors. It is also worth mentioning that none of the participants considered that the adaptability affordance developed collaboration or creativity skills. In contrast, research has shown that the adaptability affordance of DET promotes student engagement and the development of their collaborative and creativity skills (Fitzgerald et al., 2018; Han & Ellis, 2020; Lippert et al., 2019).

## **Creativity**

The last of the 4C skills is creativity. According to the participants' responses in the questionnaire, creativity skills are being incorporated within many of the online modules (P1Q, P7Q-P11Q). In contrast, only three of the participants mentioned creativity as part of their understanding of 21st-century skills (P1Q, P5Q, P6Q). For this study, the P21 Framework's definition of creativity was considered, which indicates that students need to be active in creating, brainstorming, evaluating, implementing, and developing new ideas or techniques to foster creativity skills. Students should also be provided with opportunities to elaborate, analyse, and evaluate their own or others' ideas to improve their efforts (Partnership for 21st Century Skills, 2009). Considering the P21 Framework's definition of creativity, it was determined that

some of the modules used the affordances of videos to create opportunities for developing creativity (DM9, DM18). For example, modules DM9 and DM18 used the open-ended learner input functionality of the LMS and video technology to allow students to create their own videos to represent their ideas and perspectives regarding a particular topic and then submit their work for grading on the LMS. In addition, document analysis determined that three of the modules allowed students to visually present their ideas regarding a topic or concept by creating different items (DM9, DM10, DM18). These formats include either graphics, presentations, mind maps, brochures, or flowcharts. These visual presentations were possible because of the drawing affordance of PowerPoint and Word.

Interestingly, module DM9 used DET, called Padlet, with the affordance of open-ended learner input that allowed students to submit text, graphics, or videos as part of their inputs to a particular topic that all the students could access online. Module DM18 encouraged students to be creative by writing their own blogs which was implemented through the open-ended learner input and interactivity affordances of the LMS. The same module required students to create a cartoon storyboard by using the drawing function of DET called StoryboardThat. The students were even further challenged in module DM18 to conduct radio broadcasts which was made possible through the open-ended learner input and communication affordances of an audio and visual technology called Flipgrid.

When educators allowed students to present their work by different means, such as verbally or visually, it can encourage students to develop their creativity, problem-solving and critical thinking skills (Kurniawan et al., 2018; Romli et al., 2018). However, some participants said they did not allow students to submit activities or assessments in different formats (P1Q, P2Q, P4Q, P5Q, P7Q, P8Q, P10Q). By not providing students with opportunities to submit different formats,

students were potentially deprived of the opportunity to develop creativity, problem-solving and critical thinking skills. Bhuana and Apriliyanti (2021) attribute the lack of a variety of formats to educators' limited instructional design and/or technological skills to create various activities and/or assessments that allow different formats of submission. The lack of technical skills amongst educators was confirmed when participant P9I said they could only include activities that allow for different formats of submission when they are assisted by the learning designers at the institution. Additionally, participant P6I said in the interview that it was difficult to assess videos and/or infographics in large volumes unless you allow students to work in groups. Other participants that did use videos, graphics, and wikis, also confirmed that without their tutors' assistance with marking they would have not had the capacity to assess activities submitted in different formats (P9I and P11I). Therefore, it could be a possibility that participants chose not to use activities and/or assessments that allow different formats of submission due to the difficulties of marking and/or large volumes of marking. Participant P7I said in their interview that they didn't allow students to submit in different formats, such as videos or graphics, since it was not an appropriate method for assessing the specific subject matter. The lack of technical and instructional design skills might have robbed students of opportunities to develop creativity which forms part of 21st-century skills.

In contrast, the participants did say that they used audio and visual technology for developing creativity skills (P1Q, P3Q, P6Q, P7Q, P10Q, P11Q). One reason could be that participants assumed that using videos and/or graphics in their module/s to explain or demonstrate concepts would encourage students' creativity (Dewantara, Mahtaari, & Misbah, 2021). However, as mentioned, the P21 Framework's definition requires students to be active in creating or implementing something new to foster creativity skills.

In terms of using self-reflection to encourage creativity, the open-ended learner input functionality of the LMS was used to include self-assessed activities and/or self-reflection journals (DM6, DM7, DM9, DM11, DM18). These activities encouraged students to evaluate their own efforts and make improvements as they progress through the module. In addition, the interactivity and communication affordances of the LMS were used for group activities (DM2, DM6-DM10, DM15, DM18). The group activities encouraged students to work together creatively as a team to share ideas, solve problems, and provide feedback to each other. Taking the definition of creativity into consideration and the analysis of the activities above, it can be argued that in many of the modules, students were encouraged to develop their creativity skills (DM2, DM6-DM11, DM15-DM18).

The type of activities, 21st-century skills, affordances, and type of DET that were used by the participants in their online modules are synthesised in Table 4.2.

**Table 4.2**

*Summary of activities, 21st-century skills, affordances, and DET that were used in the online modules*

<b>Type of activities</b>	<b>21st-century skills</b>	<b>Affordances of DET</b>	<b>Type of DET</b>
Automated quizzes	Critical thinking	Interactivity	LMS
Group work	Critical thinking Collaboration Communication Creativity	Interactivity Communication	LMS Audio and visual technology Collaborative technology



<b>Type of activities</b>	<b>21st-century skills</b>	<b>Affordances of DET</b>	<b>Type of DET</b>
Reading materials (notes, documents, etc.)	Critical thinking	Interactivity	LMS
Videos, graphics, audio and e-books as part of content	Critical thinking	Interactivity Linked representations	Audio and visual technology
Adaptable slides	Critical thinking	Adaptability	PowerPoint
Create content such as videos, graphics and/or presentations	Creativity	Open-ended	LMS Other technology (PowerPoint and Word)
Discussion forums	Critical thinking Communication	Communication	LMS
Video conferencing/virtual classrooms	Communication	Communication	LMS Collaborative technology
Activities/assignments referring to real-world examples and/or case studies	Critical thinking	Open-ended learner input	LMS
Virtual Reality/360 images/videos for evaluation	Critical thinking	Open-ended learner input Linked representations	LMS Audio and visual technology

Type of activities	21st-century skills	Affordances of DET	Type of DET
		Interactivity	
Wiki pages	Critical thinking Communication Collaboration	Interactivity Open-ended learner input	LMS
Write a blog	Creativity	Interactivity Open-ended	LMS
Radio broadcast	Creativity	Interactivity Open-ended	Audio and visual technology
Self-assessed and/or self-reflection activities	Creativity	Interactivity Open-ended	LMS
Assessments	Critical thinking Collaboration Communication Creativity	Interactivity	LMS
Assessments and activities that count towards the mark of the module	Critical thinking	Feedback	LMS

The participants identified critical thinking as one of the 21st-century skills and the analysis of their modules showed that they made a conscious effort to develop critical thinking in their students (P1Q-P3Q, P5Q-P11Q). It might be that critical thinking closely relates to higher-order thinking skills which educators instinctively incorporate throughout their curriculum (Watson, 2020). However, there were still some discrepancies between what the participants perceived

as 21st-century skills and what they incorporated within their module/s, such as in the case of communication, collaboration, and creativity skills. Although participants might not be able to clearly define 21st-century skills, they did intuitively incorporate some of these skills.

One of the participants said that they were not incorporating the development of 21st-century skills within their online module/s. This claim is justified when the participant said, “I trust my students have learned the necessary skills in their undergraduate degrees” (P4Q). Some participants might not deem it necessary to include 21st-century skills development in higher degrees, such as master’s and doctorate degrees, since they assume these skills had been developed in previous undergraduate degrees. However, some participants might also not fully understand 21st-century skills as a concept or have a misconception about 21st-century skills (Voogt et al., 2013). In some instances, the nature of the degree already requires students to apply 21st-century skills. For example, being able to complete a master’s or doctorate degree might already incorporate some of the 21st-century skills, such as critical thinking and complex problem-solving which are required to perform research (Ain, Sabir, & Willison, 2019). Therefore, it is understandable that some participants did not intentionally include the development of 21st-century skills within their modules but assumed that it was embedded based on the nature and level of the programme.

#### **4.4.4 Assessment strategies for 21st-century skills**

According to the P21 Framework, assessments should be implemented to determine students’ competency in terms of 21st-century skills (Partnership for 21st Century Skills & AACTE, 2010). Assessments also form part of the support systems of the P21 Framework which assist in the development of 21<sup>st</sup>-century outcomes for graduates. Therefore, the

assessment strategies that the participants implemented in their online modules were also looked at in this study.

While all 10 of the participants who were incorporating the development of 21st-century skills within their modules were also assessing 21st-century skills, most participants were assessing 21st-century skills as part of the subject matter content (P1Q-P3Q, P5-P7Q, P9Q-P11Q). In this regard, the assessments were not only designed to assess subject matter content, but also to incorporate the use of 21st-century skills. Similarly, Voogt & Roblin (2012), recommend that the best method to include 21st-century skills within a curriculum is to integrate the development of the skills across the curriculum and during the assessments. In this study the assessment of 21st-century skills was recognised when critical thinking questions were added in assessment activities and group assignments were designed that require communication and collaboration skills.

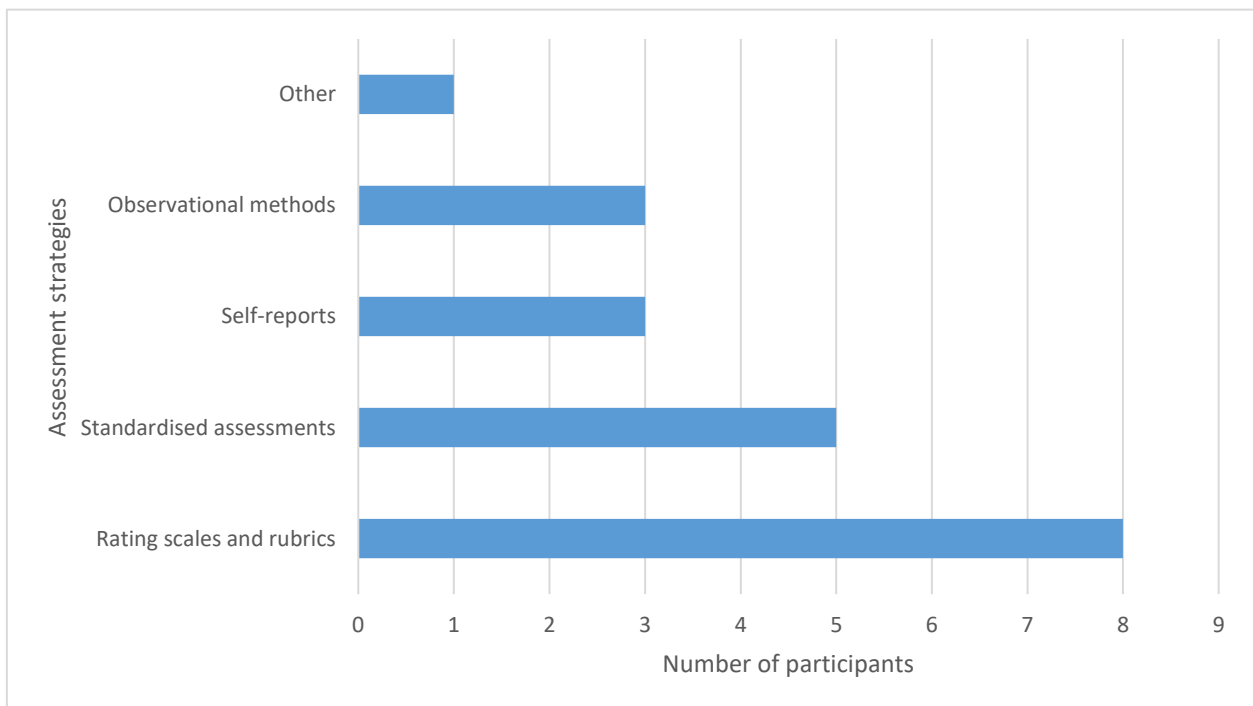
In contrast, only P5Q used separate assessment strategies to assess students' 21st-century skills. Participant P5Q created a separate standardised assignment where students had to observe a 360° video to answer questions and reflect on the events in the video. The aim of the assignment was to assess students' communication and critical thinking skills (DM5).

As shown in Figure 4.8, the most popular strategies for assessment are rating scales and rubrics. Participants mostly used criteria or a scoring guide to evaluate 21st-century skills together with subject matter content within their online module/s. Participant P11I said they also discussed these rubrics with the relevant tutors to ensure there was consistency and standardisation of the marking process. Furthermore, five of the participants used standardised assessments which would include short questions, such as multiple-choice, and open-ended

questions (P2Q, P6Q, P7Q, P10Q, P11Q). These assessment strategies might be the most popular choice since they would provide the most accurate and unbiased results of students' knowledge about the subject matter as well as their development in 21st-century skills (Education, 2022; Hicks & Diefes-Dux, 2017).

**Figure 4.7**

*Participants' assessment strategies*



The least popular assessment strategies are observational methods and self-reports. Since these are fully online module/s, observing students' behaviour and abilities in relation to 21st-century skills would be difficult or a tedious task (Salter, 2016). Another reason could be that other assessment methods were more likely to yield authentic results when it came to the students' skills (Liang & Creasy, 2004). Participants might not use self-reports as an assessment method because they did not trust the results of the self-reports or participants did

not know about using self-reports (P2Q-P4Q, P6Q-P8Q, P10Q). Some argued that self-reports do not always represent a true reflection of the students' skills and abilities since students might answer according to their own perceptions or experiences (West, 2014). Additionally, others question whether students will answer truthfully in their self-reports (Pekrun, 2020).

P9Q mentioned that they used peer learning and reviews as an assessment strategy for "...communicating/presenting and co-creating content (scavenger hunts and curated portfolios)". Therefore, students are not just communicating and collaborating, but they are also working through feedback and reflecting on each other's work which can further improve the students' critical thinking (Colthorpe et al., 2014).

#### **4.5 Role Of Support**

Participant P4Q, who did not incorporate the development of 21st-century skills within their modules, said they trusted the students had already developed 21st-century skills. However, Participant P4Q also said they were willing to incorporate some 21st-century skills, such as the 4Cs, if they had the necessary support from their higher education institution. Although the participant did not incorporate 21st-century skills within their module/s it might not have been due to the lack of willingness, but due to the lack of understanding or support regarding 21st-century skills. The participant (P4Q) further specified that if they had support in terms of professional development, as well as teaching and learning resources, they could gain a better understanding and develop content for developing 21st-century skills.

The participant who did incorporate 21st-century skills also emphasised the importance of support. The sentiment was echoed by participant P6I who said that if they had training in presentation skills, as well as how to use technology to make engaging presentations, it would

assist them as lecturers to help students interact more in the online environment. In addition, participant P9I said in their interview that they would like to know how to ask the right kind of questions and which activities to use to enable students to critically think and/or deliberate their insights with other students. Similarly, participant P7I said that their biggest challenge was to create activities and assessments for a fully online environment since it requires more time and creativity as well as the technical skills to set up these activities and assessments. Similarly, other researchers found that most educators do not have the necessary technical or instructional design skills to use online learning platforms to their fullest and/or to create fully online learning resources (Bhuana & Apriliyanti, 2021; Uerz et al., 2018).

However, participant P7I did say if they had some professional training, especially in instructional or learning design, it could help them to set up and design these activities/assessments more effectively and for the right purpose. Participant P8I said in their interview that they also preferred instructional/learning design and DET training but in individual sessions (not in a group). For instance, they (P8I) would like to focus on their specific subject matter content in terms of how it could be designed and how DET could be used to fit the requirements of the specific module whilst incorporating some of the 21st-century skills.

Considering all the participants' inputs above, the type of professional development that would help was said to be digital education technology workshops, instructional/learning design training, and information sessions on 21st-century skills. Furthermore, participants mentioned that a framework to support students in developing 21st-century skills would also be helpful. These suggestions correspond with the guidelines of the P21 Framework that states that educators need foundational support systems in place to help them produce 21st-century outcomes for graduates (Battelle for Kids, 2019). In this regard, a possible solution for

supporting educators in the development of 21st-century skills in fully online module/s could be to provide group and individual workshops. These workshops could be based on 21st-century skills, a 21st-century skills framework, and DET that support the development of 21st-century skills.

#### **4.6 Summary**

In this chapter the data were presented collectively through an integrated data analysis of all the data instruments. The analysis indicated that a combination of different types of DET and affordances of DET can be utilised to develop a variety of 21st-century skills. Participants used LMS technology, collaborative technology, and audio and visual technology. The most popular affordances of DET that were used included the affordances of communication, feedback, and interactivity.

The participants' perspectives and understanding regarding 21st-century skills were discussed. All the participants believed that it was important to allow their students to develop 21st-century skills so that they could be prepared for and successful in the job industry. Most of the participants' understanding of 21st-century skills included the ability to use technology, to apply critical thinking, have business acumen, and to be creative and innovative. More than half of the participants either included communication or collaboration as part of their understanding of 21st-century skills which forms part of most of the 21st-century skill frameworks and the 4Cs of education (P1Q, P3Q, P4Q-P9Q).

How the participants incorporated various 21st-century skills within their online modules were also discussed in this chapter. The most popular skills that were incorporated included critical thinking, communication, collaboration, creativity, adaptability and flexibility, and initiative and



self-direction. Even though there is a discrepancy between the participants' understanding of 21st-century skills and what they incorporated within their online modules, they still intuitively incorporated the most salient 21st-century skills within their modules, which are the 4Cs of education. The participants used a variety of activities and affordances of DET to facilitate the development of 21st-century skills. The activities that developed most of the 4Cs of education were group work activities, wiki pages, and assessments. The affordances of DET that were used in these activities included a combination of interactivity, open-ended learner input, and communication affordances of the different DET.

It was also determined that most of the participants preferred to assess 21st-century skills by integrating these skills within their standard assessments for assessing the subject matter content. The most popular assessment techniques for assessing 21st-century skills included rating scales and rubrics.

Lastly, it was made clear that if participants had the necessary support, they believed they could be more successful with incorporating 21st-century skills within their online modules. It was determined that the type of support they require included professional development in learning design and how to use DET.

The next chapter provides the conclusions and limitations of this study and is structured around the research questions. The chapter then concludes with recommendations for further research and practices in education.

## Chapter 5: Summary and Conclusions

### 5.1 Introduction

In this chapter the researcher concludes, summarises, and reflects on the research findings of this study. The focus of the research and research questions are discussed in terms of what novel insights have been found and what value it contributes to the body of knowledge in this field. Furthermore, the limitations of the study and recommendations for future research conclude this chapter.

### 5.2 Summary of the Research

In Chapter 1 of this study, it was established that 21st-century skills are the top skills employers are currently looking for in graduates in the workplace (Kereluik et al., 2013; World Economic Forum, 2016, 2020a). Research findings indicate a gap between what skills the workplace requires and the skills of graduates, which contributes to the low employability rates of graduates (Teng et al., 2019; Van Dam, 2017). It was argued that if students from higher education institutions develop these 21st-century skills, it can ultimately make them more employable and prepared for the world of work. Thus, the focus of this study was to determine if educators in higher education institutions were, at the time, creating opportunities for students to develop 21st-century skills and what practices they were implementing to do so in fully online learning modules.

In this study, the researcher specifically explored what DET affordances and practices educators were using and applying to develop 21st-century skills in fully online modules. The focus was on fully online learning not only due to the fast growth in the online learning industry in the past few years, but also because there were still some issues with developing 21st-

century skills in fully online learning environments (Bhowmik & Dipak Bhattacharya, 2021; Davey et al., 2019; Gillett-Swan, 2017; Li & Lalani, 2020; Martin et al., 2019).

To address the problem of the study the following research question was asked: “How can digital educational technology be used to develop 21st-century skills in fully online learning?”. To respond to the main research question, two sub-questions were further addressed. The two sub-questions enabled the researcher to link the type of pedagogical activities with DET affordances that the educators were using in their online modules. These activities and affordances were then further linked to specific 21st-century skills and how they were used to develop these skills.

The first sub-question, “What affordances of digital educational technology support the development of 21st-century skills in fully online learning?”, was asked to determine what type of DET the educators were using to develop 21st-century skills in their online modules. Furthermore, in asking this question the researcher was assisted to get detailed information about which affordances of DET best supported the development of 21st-century skills. The full discussion of the findings is found later in this chapter.

The second sub-question, “To what extent do current fully online modules provide for the development of 21st-century skills?”, allowed the researcher to establish the educators’ perspectives and understanding of 21st-century skills. From the educators who indicated that they were incorporating the development of 21st-century skills, the researcher could determine what pedagogical activities they used to develop these skills and what 21<sup>st</sup>-century skills these were. Furthermore, the researcher was able to establish what support educators in higher

education institutions may need in order to incorporate or improve the development of 21st-century skills in fully online learning.

Chapter 2 presented an overview of the existing literature in an attempt to classify and emphasise the importance of 21st-century skills. It was established that there is indeed a need for 21st-century skills in the world of work. Furthermore, the effects of the Fourth Industrial Revolution were explored to determine the most acquired and essential skills that will be needed in the workplace. Some of these essential skills include communication, collaboration, problem-solving, critical thinking, self-management, and creativity (World Economic Forum, 2020a).

Having identified a lack of 21st-century skills amongst graduates, the Department of Basic Education (2019), South African Qualifications Authority (South African Qualifications Authority, 2014), and other education authorities, as well as higher education institutions in South Africa, were investigated in relation to their stance on 21st-century skills. Although most of these authorities and institutions include these skills in their planning and policies, concerns still remain about *how* 21st-century skills are implemented within the curriculum and pedagogies.

In this study, the focus was mainly on higher education institutions. Due to the fast growth of the online learning industry over the past few years, most educational institutions had to adapt their practices to online learning environments. Therefore, online learning was considered a possible solution for higher education institutions to implement the development of 21st-century skills. Literature shows that online learning provides many benefits and opportunities for students to get access to education and to develop their skills. However, the shift from traditional learning to online learning highlighted several challenges, especially regarding the

development of 21st-century skills, such as collaboration and communication. It was established that educators need tools to assist them in developing 21st-century skills in fully online learning environments.

Several resources were investigated, and it was found that DET can contribute to the development of 21st-century skills. The three most common categories of DET were identified as learning management systems (LMS), collaborative technology, and audio and video technology. The affordances of DET were defined in order to determine the capabilities of DET to help support the development of 21st-century skills. The NASEM identifies the following affordances that support the development of 21st-century skills: interactivity, adaptivity, feedback, choice, nonlinear access, linked representations, open-ended learner input, and communication (National Academies of Sciences, Engineering & Medicine, 2018). The researcher focused on these affordances of DET as part of the research study to determine how DET can be used for the development of 21st-century skills.

The P21 Framework was used as a theoretical framework to guide this study (Battelle for Kids, 2019). The P21 Framework was used to determine the main 21st-century skills that were focused on in this study, which were identified as the 4Cs: critical thinking, creativity, collaboration, and communication. The P21 Framework was further used to define each of the 4Cs. The researcher used the P21 Framework's definitions to determine which skills were being developed within the syllabus of the online modules (from the document analysis). Additionally, the researcher could also determine the themes from the responses of the participants (from the questionnaire and interviews). According to the P21 Framework, the support systems that are needed to successfully develop 21st-century skills are assessment strategies, curriculum activities, professional development, and learning environments. Therefore, the researcher

chose to include the support systems of the P21 Framework as part of this study to determine what would educators possibly need to successfully develop 21st-century skills within their online modules.

In Chapter 3 it was reported that this study adopted a qualitative case study approach. This case study focused on one higher education institution that offered fully online learning modules. The educators were selected based on voluntary, convenience, and purposive sampling. The researcher collected data from 11 educators at a specific point in time by collecting questionnaire responses, conducting interviews, and analysing curriculum documents in selected online modules. The data yielded by each data instrument were coded so that the results from the different data instruments could be identified. To analyse the data the researcher adopted a deductive analysis approach to compare the results from the different data instruments against each other, as well as the P21 Framework that was chosen to guide this study.

Chapter 4 presented an integrated analysis of the results from the three data instruments to provide an overall interpretation of the data. The researcher further compared the findings with existing literature related to the affordances of DET and the development of 21st-century skills in higher education institutions. The results of this study are summarised in the following section.

### **5.3 Discussion and Reflections**

In this section, the researcher discusses the results and reflects on the lessons that were learned from this research study. The section starts with a methodological reflection to iterate the research approach of the study and how the framework guided the study. The next section

discusses the substantive reflection to compare the main findings with previous research based on the same subject matter. Lastly, the scientific reflection establishes the overall lessons that were learned, which can contribute to research, and the limitations of this study.

### **5.3.1 Methodological Reflection**

This study followed a qualitative case study research method which allowed the collection of in-depth information about the educators' approaches to using DET for the development of 21st-century skills within their online modules. The research instruments that were used in the study included an online questionnaire, document analysis, and interviews. Eleven participants responded to the questionnaire, 18 of the participants' fully online modules were submitted for document analysis, and five of these participants were also interviewed.

The online questionnaire ([Appendix A](#)) consisted of 13 multiple-choice questions and eight open-ended questions focussing on participant demographics and to what extent the participants were developing 21st-century skills within their fully online modules. When the researcher looked at the responses of the participants and the findings of the module analysis, there were some discrepancies when the results were compared. For example, only a few participants said in the questionnaire that they use LMS technology to develop critical thinking skills, while the analysis showed that all the modules used affordances of the LMS to develop critical thinking skills (P2Q, P5Q, P6Q, P11Q). This is an indication that some participants did not know the meaning of concepts or did not know how to give an example to express their perspective about 21st-century skills and how they have been using DET to develop 21st-century skills. Based on the above-mentioned experience, the researcher realised that consideration must be given to how the questions are designed; it is best to keep questions as simple and clear as possible and to provide explanations of concepts to participants.

Additionally, by conducting follow-up interviews clear explanations can be provided and clarity regarding the participants' responses can be elicited.

The researcher compiled a checklist ([Appendix B](#)) based on the P21 Framework definitions (2009) of 21st-century skills and the type of affordances of DET that support the development of 21st-century skills (National Academies of Sciences, Engineering & Medicine, 2018). Following the questionnaire, the researcher completed a document analysis of the participants' online modules which added up to a total of 18 different online modules that were reviewed. From the document analysis the researcher learned that it is sufficient to include a maximum of two modules per educator. Having more than three modules per educator is unnecessary since the educator usually follows the same approach in all of their modules. The researcher recommends that consideration should be given to modules with different subject matter from one educator, where possible, to confirm if the same approach is followed regardless of subject matter.

The researcher observed through document analysis that participants don't always consciously use specific affordances of DET to develop 21st-century skills. However, in most cases, the affordances of the DET actually support the development of 21st-century skills. Another observation from the document analysis is that educators' approaches to fully online learning differ in various aspects, such as structure (learning path), activities, resources, interactivity, and communication. Therefore, consideration should be given to having a standard or benchmark for educators. The researcher recommends having a standard or benchmark that can be used in the higher education institution to ensure consistency in the learning approach and the learning path of online modules.



After the document analysis, interviews were conducted with five of the 11 participants ([Appendix C](#)). The interviews allowed the researcher to gather in-depth details of the participants' pedagogies that could not be established from the questionnaire results or the document analysis. Therefore, it was helpful to use more than one data instrument since it provided opportunities to gather clear explanations and context regarding the situation and to seek clarification if necessary. By having descriptive details and context, it minimised the risk of making assumptions during the document analysis.

The P21 Framework played an integral role in this study. The P21 Framework guided the researcher to determine which 21st-century skills should be the focus of this study. The 4Cs – critical thinking, creativity, collaboration, and communication – were identified as the main 21st-century skills considered in this study. The P21 Framework definitions guided the researcher to create a checklist against which they could analyse and compare the online modules, including the modules' activities, assessments, and other curriculum resources. In this manner, the researcher was able to establish which 21st-century skills the participants incorporated within their online modules. Additionally, when the researcher analysed the responses to the questionnaire and interviews they used the P21 Framework definitions to determine which 21st-century skills the participants incorporated within their modules. Furthermore, the P21 Framework definitions assisted the researcher to establish to what extent these 21st-century skills were being developed in the participants' online modules.

The P21 Framework (Partnership for 21st Century Skills, 2009) support systems provided the researcher with main areas to focus on in order to establish how the participants incorporated the development of 21st-century skills. These four support systems are standards and assessments, curriculum and instruction, professional development, and learning environments

that the participants were utilising. In this study, the researcher was able to establish some examples of assessment strategies that the participants were using for assessing 21st-century skills. The curriculum and instruction resources that the participants were using for the development of 21st-century skills were established through the document analysis and the interview responses. The researcher was able to determine, through the questionnaire and interviews, what professional development the participants may need in order to enhance or to include the development of 21st-century skills in their online modules, which are mostly technical and instructional design training. Lastly, the researcher found that the learning environment that mostly supported the participants to incorporate 21st-century skills within the online modules is a learning management system. The researcher realised that since they used more than one data collection instrument it provided them with more valuable and in-detail information about the support systems that participants need to be able to include more opportunities for the development of 21st-century skills in their online modules.

### **5.3.2 Substantive Reflection**

The main findings of this research study are discussed by linking the affordances of DET with the 21st-century skills. The findings are derived from the two sub-questions that were asked in order to address the main research question: “How can digital educational technology be used to develop 21st-century skills in fully online learning?”

#### **Communication**

Although a variety of DET was used, ten of the participants used the LMS of the higher education institution (P1-P9Q, P11Q). The results show that the communication affordance of the LMS contributes to the development of all the 4Cs (critical thinking, communication, collaboration, and creativity). The literature also indicates that if students can communicate

effectively, it builds confidence and motivation which further encourages the development of critical thinking, collaboration, and creativity skills (Raba, 2017; Wahyuni, 2018). The LMS discussion forum tool is used to give students the opportunity to practise their written communication skills with their peers and educators about assessments, topics, and other subject-related matters. Additionally, the video-conferencing tool of the LMS and other collaborative technology are used to provide students with opportunities to practise their verbal and non-verbal communication skills. Since the video conferencing sessions were mostly used for the communication affordance and not the interactivity affordance, it can be argued that both discussion forums and video conferencing sessions are mostly used for communication and not for collaboration. Researchers have also found that video conferencing, especially with large groups, is not always the best DET to encourage student collaboration (Gillett-Swan, 2017; Mpungose & Khoza, 2021; Vandenberg & Magnuson, 2021).

## **Feedback**

Literature shows that giving students feedback is a collaborative process that develops both collaboration and critical thinking skills (Carless & Boud, 2018; Colthorpe et al., 2014). However, the results of this study show no evidence that collaboration skills are developed when the feedback affordance is used. The affordance of feedback was used to develop critical thinking and communication skills only. The results further indicate that the feedback affordance is the most popular affordance of the LMS for the development of critical thinking skills. The affordance of feedback was used to either give feedback to students about marks individually and/or to give overall feedback so that students could reflect on their work and make improvements. In some of the modules, students were allowed to communicate with educators and peers regarding their feedback on marks and progress throughout their learning path.

## **Interactivity**

The affordance of interactivity supports the development of critical thinking, communication, collaboration, and creativity skills if this affordance is used in the form of group work activities. Literature confirms that the interactivity affordance allows students to interact with the learning content and their peers which develops critical thinking, communication, collaboration, and creativity skills (Beauchamp & Kennewell, 2010; Krusche & Seitz, 2019; Weber & Ahn, 2021; Yalcinalp & Avci, 2019). Using the interactivity affordance of the LMS, the participants of this study were able to support the development of the 4Cs by creating a variety of assessments such as assignments and automated quizzes. Another popular interactive activity is to use the wiki tool of the LMS to develop students' critical thinking, communication, and collaboration skills. Additionally, it was found that the blog tool of the LMS can be used to encourage creativity amongst students.

## **Linked representations**

The questionnaire results indicate that linked representations can be used to develop critical thinking, communication, and creativity skills. However, document analysis findings indicate that only critical thinking skills are developed when students are provided with different modes of representation or linked representations. This agrees with the research of Abdurrahman et al. (2019) and Araiza-Alba et al. (2021). The results further show that the affordance of linked representations of the LMS and audio and video technology is the second most popular affordance used to develop 21st-century skills. The linked representation affordance was used to provide alternative formats of content, such as videos and visuals, which students could critically analyse in order to provide feedback/answers.

### **Open-ended learner input**

The findings of the document analysis correspond with literature that suggests that the open-ended learner input affordance develops critical thinking, communication, and creativity skills (Kurniawan et al., 2018; National Academies of Sciences, Engineering & Medicine, 2018; Romli et al., 2018). The affordance of open-ended learner input of the LMS was used in some of the modules to allow students to do self-assessed activities and/or self-reflection journals. In some of the modules, collaboration skills were developed by including group work activities that allowed students to submit their content in different formats. In other modules the open-ended learner input of the LMS allowed students to create and submit their own videos which encouraged students to think creatively.

### **Adaptability**

Fitzgerald et al. (2018) and Liu et al. (2017) indicated that the adaptability affordance of DET develops collaboration and creativity skills. In contrast, the results of document analysis conducted in this study show that only one of the modules used the adaptability affordance to develop critical thinking skills. In the module in question, the participant used adaptable PowerPoint slides to allow students to make choices and then the slides branched out to different content based on the students' inputs. Some participants claimed in the questionnaire that they used the adaptability affordance of DET for communication purposes. However, no evidence was found in this case study that the affordance of adaptability is used to develop collaboration and creativity skills.

### **Nonlinear access**

Although only one of the participants indicated that they use the LMS affordance of nonlinear access the document analysis confirmed that none of the modules utilised the nonlinear access

affordance. All of the online modules required students to follow a weekly schedule and lacked the flexibility for students to work through the content at their own pace or preferred order (DM1-DM18). Research have shown that granting students the freedom to learn at their own pace and preference enhances their engagement with the learning material and fosters a sense of responsibility for their education and decisions (Huang, Liu, Tili, Yang, & Wang, 2020).

### **Choice**

Similarly, only one of the participants indicated in the questionnaire that they were using the affordance of choice to develop students' communication, creativity, and critical thinking abilities. Literature confirms that the choice affordance can be used to develop collaboration and critical thinking skills (McDowell et al., 2019; Wilkinson, 2020). However, in this study, no actual evidence was found that DET with the affordance of choice is utilised to develop communication, creativity, and critical thinking skills. As mentioned previously, the discrepancy between the participants' responses to the questionnaire and the document analysis findings indicates that participants do not necessarily know the meaning of concepts or terms and, in this case, what the affordance of choice entails.

After the document analysis, where the researcher looked at the affordances of DET and how it was used to develop 21st-century skills, it could be determined to what extent the fully online modules were used to provide for the development of 21st-century skills. It was found that the participants incorporate critical thinking, communication, collaboration, and creativity skills. These skills are in line with the top 10 skills for 2025 in the workplace according to the World Economic Forum (2020b), which include problem-solving, working with people (collaboration), flexibility (adaptability), technology use, creativity, and critical thinking. The results of this study further show that the 4Cs are developed to various extents throughout the

fully online modules. Critical thinking skills and creativity were developed in most of the modules, while communication and collaboration skills were developed in only a few modules. There seems to be a gap in participants' ability to recognise the importance of communication and collaboration skills or in their experience of developing these two skills in students. The findings suggest that this may be due to students' lack of access to and familiarity with DET which was also an issue raised in other research (Mpungose & Khoza, 2021; Vandenberg & Magnuson, 2021). Lack of planning results in participants not making provision for communication and collaboration opportunities in the syllabus. Group dynamics and the administration to manage communication and collaboration activities are contentions for some educators who do not have the capacity to address all these challenges. Therefore, it is recommended that educators be made more aware of what 21st-century skills entail (including communication and collaboration) and equipped with the necessary knowledge and skills to develop these two skills effectively using DET effectively.

### **5.3.3 Scientific Reflection**

This case study aimed to contribute to the body of knowledge in regard to the development of 21st-century skills in fully online learning modules. The researcher was able to gather an understanding of educators' practices in their online modules and the use of affordances of DET for the development of 21st-century skills within a fully online learning environment. The researcher found that some of the participants unintentionally developed some of the 21st-century skills as a result of the affordances of the LMS they used. This means that certain affordances of the LMS do, to some extent, support the development of 21st-century skills naturally and intuitively. However, other research and this study's findings have also shown that DET on its own does not necessarily develop 21st-century skills to their full potential (Amin, 2019; Huang, Spector, & Yang, 2019), and some DET does not naturally develop specific skills,

such as creativity. Therefore, further consideration should be given to the design of the activities and how DET is set up to develop 21st-century skills to their full extent (Amin, 2019; Huang et al., 2019).

The researcher discovered the value of a framework, like the P21 Framework, to guide a research study. The P21 Framework can also guide educators to integrate 21st-century skills within their teaching practices and curriculum (Battelle for Kids, 2019). Firstly, the P21 Framework identifies and fully defines each of the 21st-century skills that are needed to succeed in the workplace (Partnership for 21st Century Skills, 2009). Secondly, the P21 Framework refers to the four support systems that can be focused on and that should be aligned to offer the best support for producing 21st-century skills. These systems are standards and assessments, curriculum and instruction, professional development, and learning environments.

The researcher compiled a checklist (refer to [Appendix B](#)) based on the P21 Framework definitions of 21st-century skills (Partnership for 21st Century Skills, 2009), and the types of affordances of DET that promote 21st-century learning (National Academies of Sciences, Engineering & Medicine, 2018). The checklist can be used by educators as a means to evaluate or design online modules to ensure the learning path, activities, resources, and DET support the development of 21st-century skills. Table 4.2 summarises the type of activities used to develop 21st-century skills as well as the affordances of different types of DET used. This summary can be used by educators as suggestions of what activities, types of DET, and affordances of DET can be implemented for producing the indicated 21st-century skills.



## **5.4 Recommendations**

Based on the results of this study, the following recommendations are made for higher education institutions that aim to develop 21st-century skills in their fully online programmes.

### ***5.4.1 Recommendations for Practice***

Awareness of and training in both what 21st-century skills entail and the use of DET are essential to thoroughly develop students' 21st-century skills in fully online modules. As mentioned previously, simply by using DET educators may intuitively incorporate some of the 21st-century but only to a limited extent. However, if educators have knowledge about 21st-century skills, the use of DET, instructional and learning design, they can develop 21st-century skills to their full extent. Therefore, training and professional development in the areas of 21st-century skills, the affordances of DET, and instructional or learning design are recommended.

### ***5.4.2 Recommendation for Future Research***

One limitation of the study was the small sample size since only one higher education institution in South Africa could be accessed. In this regard, the researcher recommends future research on this subject that include a variety of higher education institutions from South Africa, or globally, to get more contextual results regarding the affordances of DET for the development of 21st-century skills.

Another limitation of the study was that the focus was on individual online modules only. The study did not include the full spectrum of modules that students cover in completing an online programme. Hence, students could have developed these skills in other modules throughout their learning journey. Therefore, another recommendation for future research is to conduct studies based on a programme's full curriculum. Such studies could aim to establish to what

extent 21st-century skills are incorporated over the course of an entire programme and/or if the students would have acquired the necessary 21st-century skills once they've graduated from the programme.

## 5.5 Conclusion

This study investigated the development of 21st-century skills in fully online learning modules at a higher education institution in South Africa. The aim of the study was to determine which affordances of DET support the development of the much-needed 21st-century skills required by the workplace. Another aim was also to determine to what extent, 21st-century skills are being developed in fully online learning modules at a higher education institution. The P21 Framework guided this study in terms of identifying the most important 21st-century skills. These skills, namely the 4Cs – critical thinking, communication, collaboration, and creativity – formed the main focal point of this study. Furthermore, the P21 Framework provided the researcher with the definitions of 21st-century skills so that the researcher could analyse, identify and compare these skills with the data of this study.

This study adopted a qualitative research methodology using a case study approach. The following data collection instruments were used: an online questionnaire, document analysis, and interviews. The findings of the study revealed that educators are incorporating the development of 21st-century skills (critical thinking, creativity, collaboration, and communication) within their online modules but to different extents. Furthermore, it was found that the participants used a variety of DET affordances to develop these 21st-century skills within their online modules. In this study, the affordances of feedback and linked representations of the LMS are the most popular choice for encouraging critical thinking. For developing communication, the affordances of communication and interactivity of the LMS are used to

conduct video conferences and discussion forums. Collaboration skills are mostly developed by means of the open-ended learner input and interactivity affordances of the LMS. Lastly, the affordances of interactivity, communication, and open-ended learner input are the most popular choices for promoting creativity amongst students.

This case study contributed valuable findings to the development of 21st-century skills within fully online learning modules. The researcher anticipates that the findings of this study may have implications for practice where educators can use the information to develop and/or teach online learning content to adult learners at a higher education institution. The findings are also valuable for quality purposes since educators can use the checklist developed in this study to evaluate the incorporation of 21st-century skills in online modules.

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## Appendix A – Online Questionnaire

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### **Digital education technologies to develop 21st-century skills in online learning.**

My name is René Leus and I am currently enrolled for my Master's in Education: Computer-Integrated Education, at the University of Pretoria. You are invited to participate in a questionnaire regarding the use of digital educational technology in the development 21st-century skills in fully online learning in higher education. This study aims to determine if educators are currently creating opportunities for the development of 21st-century skills and, if so, how they are developing these skills within their fully online modules. Secondly, the researcher aims to explore what digital educational technology can be used to develop these 21st-century skills in fully online learning modules, which can ultimately lead to graduates being more employable and prepared for the workplace.

The findings will be used in my research dissertation. Please also note that each individual's participation in the study will be completely voluntarily and will in no way either advantage or disadvantage you. Each participant will be free, at any stage during the process to withdraw their consent to participate, in which case their participation will end immediately without any negative consequences.

Thank you for your time and inputs in this research study.

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## Digital educational technologies to develop 21st-century skills in online learning

---

Q1 What is your age?

- 18 - 24 years old
  - 25 - 34 years old
  - 35 - 44 years old
  - 45 - 54 years old
  - 55 years or older
- 

Q2 What is your gender?

- Female
  - Male
  - Prefer not to answer
  - Other (please specify) \_\_\_\_\_
- 

Q3 What is the highest education degree you have completed?

- Bachelor's degree
- Honours degree
- Master's degree
- Doctorate degree
- Other (please specify) \_\_\_\_\_

---

Q4 What is your current employment status?

- Full-time employee (work 40+ hours per week)
  - Part-time employee (work less than 40 hours per week)
  - Contract employee (work for certain period only)
  - Other (please specify)
- 

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Q5 How many years' experience do you have in the education sector? Please provide details of your experience.

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Q6 What fully online module/s are you teaching?

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Q7 Which degree and level are your fully online module/s contributing to?

---

---

Q8 Explain what is your understanding of 21st-century skills?

---

Q9 Do you think it is important to develop 21st-century skills? Explain your answer.

---

Q10 Are you incorporating the development of 21st-century skills in your online module/s?

Yes

No

*Skip To: End of Block If:*

*Are you incorporating the development of 21st-century skills in your online module/s?*

*= No*

Q11 Please select all the 21st-century skills you are incorporating into your online module/s.

Communication

Collaboration

Creativity

Critical thinking

Media literacy

Information literacy

Information and communication literacy

Productivity and accountability

Leadership and responsibility

Flexibility and adaptability

- Social and cross-cultural skills
  - Initiative and self-direction
  - Environmental literacy
  - Global awareness
  - Financial literacy
  - Health literacy
  - Civic literacy
- 

Q12 Do you think the 21st-century skills incorporated into your online module/s are in line with the employers or workplace requirements? Explain your answer.

---

Q13 Are you assessing 21st-century skills within your online module/s?

- Yes
- No

*Skip To: Q16 If:*

*Are you assessing 21st-century skills within your online module/s? = No*

Q14 Are you assessing 21st-century skills separately or is it integrated within the subject matter content?

- Separately
- Integrated within subject matter content

---

Q15 What assessment strategies are you using to measure the development of 21st-century skills within your online modules?

- Rating scales and rubrics - educators evaluate skills performance based on a scoring guide and/or criteria provided.
- Standardised assessments - educators assess skills based on multiple-choice items, open-ended questions, etc.
- Observational methods - educators evaluate skills performance based on observing learners during the course of a semester or whilst conducting certain tasks.
- Self-reports - students evaluate their own skills and behaviours through surveys or keeping notes over a period of time.
- Other. Please specify in the textbox below.

---

Q16 Choose the digital educational technologies that you are using in your online module/s. Then select the 21st-century skills that are developed whilst using the selected digital educational technology.

	What digital educational technologies are you using in your online module/s? Select all the digital educational technologies that apply.	What 21st-century skills does this digital educational technology develop?			
	Choice	Communication	Collaboration	Creativity	Critical thinking
Software applications such as LMS, online courses, and assessment software.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Collaborative technologies such as social media networking, discussion forums, wikis, and cloud-based technology.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	What digital educational technologies are you using in your online module/s? Select all the digital educational technologies that apply.	What 21st-century skills does this digital educational technology develop?			
	Choice	Communication	Collaboration	Creativity	Critical thinking
Audio and Visual technology such as digital videos, graphics, animations, and audio clips.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Virtual classrooms that include tools such as webcams, digital materials, and whiteboards.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other educational technologies. Please specify in the textbox below.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q17 Choose the affordances of the digital educational technologies that you are using in your online module/s. Then select the 21st-century skills that are developed whilst using the selected digital educational technology.

	What affordances of digital educational technologies are you using in your online module/s? Select all the affordances that apply.	What 21st-century skills does this affordance of digital educational technology develop?			
	Choice	Communication	Collaboration	Creativity	Critical thinking
Interactivity - learners engage with the technology and environment as they progress through the content	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Adaptability - technology adapts to the learner's responds and tasks (personalised learning experience)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



	What affordances of digital educational technologies are you using in your online module/s? Select all the affordances that apply.	What 21st-century skills does this affordance of digital educational technology develop?			
	Choice	Communication	Collaboration	Creativity	Critical thinking
Feedback - technology tool allows educators and peers to give feedback	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Choice - students can choose their own topics and presentation as long as it meets certain requirements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nonlinear access - the order and pace of learning depends on the learner	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	What affordances of digital educational technologies are you using in your online module/s? Select all the affordances that apply.	What 21st-century skills does this affordance of digital educational technology develop?			
	Choice	Communication	Collaboration	Creativity	Critical thinking
Linked representations - technology allows for different types of representations such as media and pedagogical strategies	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Open-ended learner input - learners can provide input through drawings, pictures and other types of communication (freely express their learning)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	What affordances of digital educational technologies are you using in your online module/s? Select all the affordances that apply.	What 21st-century skills does this affordance of digital educational technology develop?			
	Choice	Communication	Collaboration	Creativity	Critical thinking
Communication - learners can communicate to peers and subject matter experts with different media (social interaction)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q32 Will you be willing to participate in a follow-up interview or focus group discussion? If yes, please provide your contact information (email) below.

---

*Skip To: End of Survey If Condition:*

*Will you be willing to part... = Is Displayed.*

*Skip To: End of Survey.*

**End of Block: Default Question Block**

---

**Start of Block: Block 1**

Q18 Explain why you are not incorporating the development of 21st-century skills in your online module/s?

---

---

Q19 If your institution provided you with the necessary support to develop 21st-century skills which skills would you incorporate into your online modules? Choose all that apply.

- Communication
- Collaboration
- Creativity
- Critical thinking

---

Q20 What institutional support do you need so that you can incorporate the development of 21st-century skills in your online module/s? Select all that apply.

- Professional development

- Technical support
  - Teaching and learning resources
  - Mentorship
- 

*Display This Question:*

*If What institutional support do you need so that you can incorporate the development of 21st-century... = Professional development*

Q21 What professional development would have assisted you to incorporate the development of 21st-century skills in your online module/s?

- Training on the instructional design of course content to support the development of 21st-century skills.
- Training on pedagogies to support the development of 21st-century skills.
- Digital educational technology workshops.
- Information session on 21st-century skills and a framework to support students in developing 21st-century skills.

**End of Block: Block 1**

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## Appendix B – Evaluation Criteria for Document Analysis

### Document Analysis Checklist

<b>Module code:</b>
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Type of DET	Included in this module:
Software applications such as LMS, online courses, and assessment software.	
Collaborative technologies such as social media networking, discussion forums, wikis, and cloud-based technology.	
Audio and Visual technology such as digital videos, graphics, animations, and audio clips.	
Virtual classrooms that include tools such as webcams, digital materials, and whiteboards.	
Other educational technology. Please specify in the textbox below.	

<b>DET affordances</b> (National Academies of Sciences, Engineering & Medicine, 2018)	<b>Included in this module:</b>
<b>Interactivity</b> - learners engage with the technology and environment as they progress through the content.	
<b>Adaptability</b> - technology adapts to the learner's responds and tasks (personalised learning experience).	
<b>Feedback</b> - technology tool allows educators and peers to give feedback.	
<b>Choice</b> - students can choose their own topics and presentation as long as it meets certain requirements.	
<b>Nonlinear access</b> - the order and pace of learning depends on the learner.	
<b>Linked representations</b> - technology allows for different types of representations such as media and pedagogical strategies.	
<b>Open-ended learner input</b> - learners can provide input through drawings, pictures and other types of communication (freely express their learning).	
<b>Communication</b> - learners can communicate to peers and subject matter experts with different media (social interaction).	

21st-century skills extracted from P21 framework (Partnership for 21st Century Skills, 2009)	Associated Keywords	Included in this module:
<p><b>Critical thinking</b></p> <ul style="list-style-type: none"> <li>• Use various types of reasoning (inductive, deductive, etc.) as appropriate to the situation.</li> <li>• Analyse how parts of a whole interact with each other to produce overall outcomes in complex systems.</li> <li>• Effectively analyse and evaluate evidence, arguments, claims and beliefs.</li> <li>• Analyse and evaluate major alternative points of view.</li> <li>• Synthesise and make connections between information and arguments.</li> <li>• Interpret information and draw conclusions based on the best analysis.</li> <li>• Reflect critically on learning experiences and processes.</li> <li>• Solve different kinds of non-familiar problems in both conventional and innovative ways.</li> <li>• Identify and ask significant questions that clarify various points of view and lead to better solutions.</li> </ul>	Analyse Problem solve Reason Evaluate Argue Synthesise Interpret Conclude Reflect Ask questions Clarify	



<p><b>Communication (oral, written and nonverbal)</b></p> <ul style="list-style-type: none"> <li>• Articulate thoughts and ideas effectively using oral, written and nonverbal communication skills in a variety of forms and contexts.</li> <li>• Listen effectively to decipher meaning, including knowledge, values, attitudes and intentions.</li> <li>• Use communication for a range of purposes (e.g. to inform, instruct, motivate and persuade).</li> <li>• Utilise multiple media and technology and know-how to judge their effectiveness a priori as well as assess their impact.</li> <li>• Communicate effectively in diverse environments (including multi-lingual).</li> </ul>	<p>Articulate</p> <p>Communicate</p> <p>Listen</p> <p>Decipher meaning</p> <p>Inform</p> <p>Instruct</p> <p>Motivate</p> <p>Persuade</p>	
<p><b>Collaboration</b></p> <ul style="list-style-type: none"> <li>• Demonstrate ability to work effectively and respectfully with diverse teams.</li> <li>• Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal.</li> <li>• Assume shared responsibility for collaborative work, and value the individual contributions made by each team member.</li> </ul>	<p>Team work</p> <p>Flexible</p> <p>Help</p> <p>Responsibility</p> <p>Collaborate</p> <p>Contribute</p>	

<p><b>Creativity</b></p> <ul style="list-style-type: none"> <li>• Use a wide range of idea creation techniques (such as brainstorming).</li> <li>• Create new and worthwhile ideas (both incremental and radical concepts).</li> <li>• Elaborate, refine, analyse and evaluate their own ideas in order to improve and maximize creative efforts.</li> <li>• Develop, implement and communicate new ideas to others effectively.</li> <li>• Be open and responsive to new and diverse perspectives; incorporate group input and feedback into the work.</li> <li>• Demonstrate originality and inventiveness in work and understand the real-world limits to adopting new ideas.</li> <li>• View failure as an opportunity to learn; understand that creativity and innovation is a long-term, cyclical process of small successes and frequent mistakes.</li> <li>• Act on creative ideas to make a tangible and useful contribution to the field in which the innovation will occur.</li> </ul>	<p>Create ideas</p> <p>Elaborate</p> <p>Refine</p> <p>Analyse</p> <p>Evaluate</p> <p>Creative</p> <p>Develop</p> <p>Implement</p> <p>Communicate</p> <p>Responsive</p> <p>Feedback</p> <p>Inventive/Innovative</p> <p>Reflect</p> <p>Contribute</p>	
---	---	--

Assessment strategy	Included in this module:
Rating scales and rubrics	
Standardised assessments – multiple choice, open-ended questions, etc.	
Self-reports – students evaluate their own skills and behaviours through surveys or keeping notes over a period of time.	
Observational methods – during the course of a semester or whilst conducting certain tasks.	
Other	

## Appendix C – Interview Questions

### Follow-Up Questions:

- Tell me how did you use a collaborative technology in your online module/s?
  - What technology did you use?
  - Was it used as individual or group activities?
  - Why are you using these activities/technology?
  - Did the students participate?
    - *Why do you think students do/do not participate?*
  - You are not using it, why?
    - *What is the average group size?*
    - *Why do you think students do not participate?*
    - *What needs to be in place for you to use it?*
- Did you allow students to submit different types of files for activities or assessments, such as submitting a video or blog page? Why or why not?
  - *What would you need to design or setup these kinds of activities/assessments?*
- How did you provide feedback to your students?
  - Individually or overall feedback?
  - Why not individually?
    - *Lack of time or too many students?*
  - Did you provide feedback through the gradebook of the LMS or another technology?
    - Why not the gradebook feature of the LMS?
    - What other technology?
    - Why did you choose to use this technology?
  - Would you say the feedback process is collaborative?
    - How so?
    - What DET was used to make it a collaborative process?

- Why was it not a collaborative process?
- Do you make provision for personalised learning experiences?
  - How or what do you use?
  - How does it develop 21st-century skills?
  - Why not?
  - *What needs to be in place before you will use it?*

More questions:

- How did the students interact with the various modes of representations, activities, and assessments you offered in your module/s?
  - How does it develop 21st-century skills?
- What challenges have you experienced with incorporating 21st-century skills in your online module/s?
- What support would you like or need to incorporate the development of 21st-century skills within your online module/s?

Exit Question:

- Is there anything else you would like to add about 21st-century skills development and/or digital educational technology used for educational purposes?
- What other examples or suggestions can you think of?

## Appendix D – Consent Letter for Educators



UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA

Faculty of Education

Educator

University XXXXX, School of XXXXX

Dear Educator

### **INVITATION TO PARTICPATE IN RESEARCH PROJECT –**

#### **Digital educational technologies to develop 21st-century skills in online learning.**

I am currently enrolled for a Masters degree at the University of Pretoria. Part of the requirements for the awarding of this degree is the successful completion of a significant research project in the field of education.

The title of my approved research study is “**Digital educational technologies to develop 21st-century skills in online learning**”.

This study aims to determine if educators are currently creating opportunities for the development of 21st-century skills and, if so, how they are developing these skills within their fully online modules. Secondly, the researcher aim to explore what digital educational technologies can be used to develop these 21st-century skills in fully online learning modules, which can ultimately lead to graduates being more employable and prepared for the workplace.

Your faculty is hereby invited to participate in this research project, which intends to understand:

- How can digital educational technologies be used to develop 21st-century skills in fully online learning?
- To what extent do current fully online modules make provision for the development of 21st-century skills?
- What affordances of digital educational technologies support the development of 21st-century skills in fully online learning?

Below is the scope and responsibility of your participation. To gather information, I require to approach you as an educator and/or course designer, of a fully online module. I request permission to ask you to complete a questionnaire, participate in an interview and/or focus group discussion and access your online module and curriculum documents. Those who do agree to participate will be asked about certain aspects of digital educational technology and how they are using it for developing 21st-century skills. Each participant will be asked to complete a questionnaire that will not take longer than 20 minutes and can be conducted on any device that has Internet access. Some participants will be requested to also participate in an interview and/or focus group to discuss the topic in-depth, the discussions will not take longer than 60 minutes and can be conducted on any device that has Internet access.

Please take note that the anticipated completion date for this research project is the 31 July 2022.

There are no high risks associated with this study. The only possible risks involved is a social risk of labelling the higher education institution with the negative outcome of not incorporating 21st-century skills within their modules which might be required according to their educational policy. Secondly, there could be a possibility of loss of confidentiality for the participants identity, since the individual might be associated with the subject matter of the online module, within the particular higher education institution.

This study may benefit you as a participant since you could gain new insights into your own online modules and gain new knowledge, in regards with digital educational technologies, to support the development of 21st-century skills for their online modules. This study results may also contribute to existing research on how to develop 21st-century skills within online learning in Higher Education. The research may also contribute to the benefits of using digital technologies for educational purposes and will identify the type of digital technologies that can be used for educational purposes. Furthermore, the research may provide a possible solution to prepare graduates for the workplace and increase the graduates' employability rate.

We also would like to request your permission to use your data, confidentially and anonymously, for further research purposes, as the data sets are the intellectual property of the University of Pretoria. Further research may include secondary data analysis and using the data for teaching purposes. The confidentiality and privacy applicable to this study will be binding on future research studies.

Please understand that the decision for you to participate is completely voluntary and that permission for your participation will also be protected by the Department of Higher Education and Training. Please also note that each individual's participation in the study will be completely voluntarily and will in no way either advantage or disadvantage you. Each participant will be free, at any stage during the process to withdraw their consent to participate, in which case their participation will end immediately without any negative consequences. Any and all data collected from them up to that point in the study will then be discarded.

This research project was submitted to the Faculty of Health Sciences Research Ethics Committee, University of Pretoria, telephone numbers 012 356 3084 / 012 356 3085 and written approval has been granted by that committee.



All the information obtained during the research study will be treated confidentially. Each participant will be given an alphanumeric coded number (e.g. P1Q). This will ensure confidentiality of the information collected. At no time will either you as an individual be mentioned by name or be allowed to be identified by any manner or means whatsoever in the research report. Only the researcher will be able to identify you as a participant. Results will be published or presented in such a manner that participants remain unidentifiable. The data files of all your records will be stored electronically via a cloud-based storage drive with a secure a password. The password will be updated regularly for security purposes.

At the end of the research study you will be provided with a copy of the research report containing both the findings of the study and recommendations. This research study presents a unique opportunity for you to get involved in the process of research aimed at investigating technology acceptance in South African Higher Education Institutions. If you decide to participate in this research study, kindly indicate this by completing the consent form at the end of this letter.

Thanking you for your consideration in this research study.

Yours in service of education,

Mrs René Leus

Student Researcher

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(012) 420 5570

## LETTER of CONSENT

### INDIVIDUAL PARTICIPANT

#### VOLUNTARY PARTICIPATION IN THE RESEARCH PROJECT ENTITLED:

**“Digital educational technologies to develop 21st-century skills in online learning”.**

I, \_\_\_\_\_, hereby voluntarily and willingly agree to participate as an individual in the above-mentioned study introduced and explained to me by Rene Leus, currently a student enrolled for a Masters degree at the University of Pretoria.

I further declare that I understand, as were explained to me by the researcher, the aim, scope, purpose, possible consequences and benefits and methods of collecting information proposed by the researcher, as well as the means by which the researcher will attempt to ensure the confidentiality and integrity of the information she collects.

\_\_\_\_\_  
Full name

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

## Appendix E – Consent Letter for Faculty



Faculty of Education

The Deputy Dean of XXXX

University of Pretoria

Dear Prof/Sir/Madam,

### RE: PARTICIPATION IN A RESEARCH PROJECT

I am currently enrolled for a Masters degree at the University of Pretoria. Part of the requirements for the awarding of this degree is the successful completion of a significant research project in the field of education.

The title of my approved research study is “**Digital educational technologies to develop 21st-century skills in online learning**”.

This study aims to determine if educators are currently creating opportunities for the development of 21st-century skills and, if so, how they are developing these skills within their fully online modules. Secondly, we aim to explore what digital educational technologies can be used to develop these 21st-century skills in fully online learning modules, which can ultimately lead to graduates being more employable and prepared for the workplace.

Your faculty is hereby invited to participate in this research project, which intends to understand:

- How can digital educational technologies be used to develop 21st-century skills in fully online learning?
- To what extent do current fully online modules make provision for the development of 21st-century skills?
- What affordances of digital educational technologies support the development of 21st-century skills in fully online learning?

Below is the scope and responsibility of your participation. To gather information, I require to approach educators and/or course designers, of fully online modules, with an individual invitation to participate. Those who do agree to participate will be asked about certain aspects of digital educational technology and how they are using it for developing 21st-century skills. Access to their fully online module and curriculum documents are required for analysis. Each participant will be asked to complete a questionnaire that will not take longer than 60 minutes and can be conducted on any device that has Internet access. Some participants will be requested to also participate in an interview and/or focus group to discuss the topic in-depth, the discussions will collectively not take longer than 120 minutes and can be conducted on any device that has Internet access.

We also would like to request your permission to use your data, confidentially and anonymously, for further research purposes, as the data sets are the intellectual property of the University of Pretoria. Further research may include secondary data analysis and using the data for teaching purposes. The confidentiality and privacy applicable to this study will be binding on future research studies.

Please understand that the decision for your faculty to participate is completely voluntary and that permission for your participation will also be protected by the Department of Higher Education and Training. Please note that each individual's participation in the study will be completely voluntarily

and will in no way either advantage or disadvantage them. Each participant will be free, at any stage during the process to withdraw their consent to participate, in which case their participation will end immediately without any negative consequences. Any and all data collected from them up to that point in the study will then be discarded.

All the information obtained during the research study will be treated confidentially, At no time will you as an individual be mentioned by name or be allowed to be identified by any manner or means whatsoever in the research report.

At the end of the research study you will be provided with a copy of the research report containing both the findings of the study and recommendations. This research study presents a unique opportunity for your faculty to get involved in the process of research that is aimed at how digital educational technology can be used for the development of 21st-century skills in online learning. If you decide to allow your faculty's participation, kindly complete the consent form at the end of this letter.

Thanking you for your consideration in this research study.

Yours in service of education,

Ms René Leus

Student Researcher

University of Pretoria

[U20756683@tuks.co.za](mailto:U20756683@tuks.co.za)

(061) 523 1605

Prof. L Van Ryneveld

Supervisor

University of Pretoria

[linda.vanryneveld@up.ac.za](mailto:linda.vanryneveld@up.ac.za)

(012) 420 5570

## LETTER of CONSENT

### FACULTY AS PARTICIPANT

#### VOLUNTARY PARTICIPATION IN THE RESEARCH PROJECT ENTITLED:

**“Digital educational technologies to develop 21st-century skills in online learning”.**

I, \_\_\_\_\_ the dean of  
\_\_\_\_\_ hereby voluntarily and  
willingly agree to allow my faculty to participate in the above-mentioned study introduced and  
explained to me by Rene Leus, currently a student enrolled for a Masters degree at the University  
of Pretoria.

I further declare that I understand, as was explained to me by the researcher, the aim, scope,  
purpose, possible consequences and benefits, and methods of collecting information proposed by  
the researcher, as well as the means by which the researcher will attempt to ensure the  
confidentiality and integrity of the information she collects.

\_\_\_\_\_

Full name

\_\_\_\_\_

Signature

\_\_\_\_\_

Date

**Official Stamp**