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Exploring South African First-Year Students' Perspectives on Deep and Meaningful Online Learning Strategies for Enhancing Digital Abilities

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Abstract

The transition to online learning has highlighted significant digital competency gaps among first-year university students, particularly in South Africa, where many students come from underprivileged backgrounds with limited prior exposure to digital tools. This study explores the effectiveness of deep and meaningful learning (DML) in enhancing students' digital abilities within an online support course. Using a mixed-methods approach, quantitative survey data (n=338) and qualitative interview data (n=10) were analysed to examine student perceptions of the six DML dimensions: self-directed learning, collaborative learning, real-world learning, reflection, authentic assessments, and constructive feedback. Findings indicate that students valued self-directed learning and reflection for fostering autonomy and metacognition, while collaborative learning and authentic assessments were perceived as beneficial but presented challenges such as inconsistent peer engagement. The lack of personalised feedback emerged as a key limitation, highlighting the need for more structured support. This study contributes to literature on digital literacy and online learning by providing empirical evidence on the role of DML in supporting digital competency development. The insights gained from this study may inform the design of more effective online learning experiences that foster digital skills and meaningful engagement among first-year university students.

Keywords: deep and meaningful learning (DML), digital abilities, online learning, first-year university students, higher education

Declaration

I, Arshad Moolla (927263), declare that this research report is my own, unaided work. It is being submitted for the degree of Master of Education by coursework and research at the University of the Witwatersrand, Johannesburg. It has not been submitted for any degree or examination at any other university.

Arshad Moolla (927263)

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Contents

List of Figures

List of Tables

List of Abbreviations

CAQDAS	Computer Assisted Qualitative Data Analysis Software
CoI	Community of Inquiry
DAL	Digital Academic Literacy
DML	Deep and Meaningful Learning
ERT	Emergency Remote Teaching
HSS	Health Systems Science
ICT	Information and Communication Technology
IR 4.0	Fourth Industrial Revolution
LMS	Learning Management System
SRSWOR	Simple Random Sampling Without Replacement

Chapter 1: Introduction

1.1 Introduction

Globally, the transition from high school to university poses various challenges for students, especially in the context of online and blended learning environments (Cameron & Rideout, 2022; Hong & Kim, 2018; Ingratta et al., 2022). Students in today's post-COVID era are expected to not only possess the necessary digital abilities but also to engage in deep learning that promotes a thorough understanding and critical engagement with the content online. Digital technology also has a positive impact on students' deep learning outcomes. A meta-analysis of empirical studies by Wu (2024) found that digital tools enhance deep learning, particularly when combined with appropriate instructional guidance and collaborative learning approaches.

In educational institutions worldwide, students encounter a constant influx of information resources. However, there is increasing apprehension regarding the insufficient level of digital abilities among students (Mutula, 2010). This presents them with the daunting task of effectively and responsibly utilising these resources. Recent studies have challenged the notion of 'digital natives,' particularly those born after the mid-1980s, as inherently information-skilled due to their immersion in digital technology from birth (Kirschner & Bruyckere, 2017). Scientific evidence suggests that simply growing up in a digital world does not automatically equip individuals with a comprehensive understanding of technology or the ability to effectively leverage digital tools for learning. Indeed, many students, despite their familiarity with digital technology, often lack a deep understanding of its application, which limits their ability to adapt to new digital innovations and effectively use these tools for academic purposes (Ingratta et al., 2022).

Recognising the significance of these skills, higher education institutions across the globe are now acknowledging its importance as a crucial component of the curriculum. Therefore, to set students up for success in an increasingly digital world, South African higher education institutions should take on the task of imparting essential digital abilities to students (Anthonysamy et al., 2020; Civilcharran & Maharaj, 2018). However, due to the fast-paced evolution of the digital environment, digital abilities cannot be confined to surface-level knowledge and instead require constant nurturing and development. As such, an approach that promotes deep and meaningful learning experiences is vital.

As a rapid response to the COVID-19 pandemic, South Africa implemented Emergency Remote Teaching (ERT), which involved a shift from traditional face-to-face education to online and remote learning. This transition posed several challenges within the South African higher education context. One of these challenges included limited digital abilities among first-year students, particularly those who had inadequate access to computers and the internet during their schooling years (Barlow-Jones & van der Westhuizen, 2011; Magunje & Brown, 2013). For example, a study at a South African university found 82% of first-year students from rural areas had never used a computer before university (Oyedemi & Mogano, 2018).

This depth of learning is essential for students to effectively apply their knowledge in academic and professional settings despite operating from this new learning environment. Nevertheless, because of the rapidly evolving nature of technology, these digital abilities, along with the capacity for deep, meaningful engagement, require continuous improvement and adaptation to remain relevant and effective (Soltovets et al., 2020).

1.2 Background

The advent of the COVID-19 pandemic necessitated a swift and decisive move by South African higher education institutions towards online learning platforms and methodologies – referred to as Emergency Remote Teaching (ERT) (Ndzinisa & Dlamini, 2022). As a Learning Experience Designer at a large, research-intensive South African university, the researcher was directly involved in this transition, particularly in the adaptation of first-year student orientation programmes for an online setting. This institution found itself at the crossroads of change and was prompted to re-evaluate and re-design its approach to the foundational orientation programme of first-year students in a digital environment. Given the diverse academic and socio-economic backgrounds of these students – many of whom come from under-resourced communities with limited prior exposure to digital tools – there was a recognised need for a structured intervention to equip them with essential digital skills.

At the heart of this pedagogical shift was a two-week online Digital Abilities support course which aimed to not only equip students with fundamental digital literacy and skills, but also to instil in them a capacity for ongoing self-development in these competencies which are crucial for their academic success and future professional endeavours (Grayson & September, 2022). The course was particularly critical for students transitioning to an asynchronous, self-directed learning model, which required them to develop autonomy in navigating digital platforms while engaging meaningfully with content across disciplines.

The curriculum was informed by the Jisc Digital Capabilities Framework, which covers key digital competencies, including accessing, managing, manipulating, and creating digital information (Jisc, 2024). It delved into the workings of computers which acquainted students with both hardware

and software components as well as exposed them to various learning technologies prevalent at the university. It included Microsoft Office 365 and associated apps like Teams alongside the university's Learning Management System (LMS). This exposure was not just about mastering the tools – it was designed to open a world of content and possibilities that lay at the students' fingertips which could empower them to leverage these resources for their educational journey (Muloiwa-Klenam et al., 2023).

The course was crafted to foster deep, meaningful learning experiences which are guided by pedagogical principles such as self-directed learning, reflective practice, and collaborative engagement. These elements are recognised for their significant impact on students' academic performance (Cameron & Rideout, 2022; Hurtubise & Roman, 2014). The pedagogical approach adopted for this course was deeply rooted in the principles of deep and meaningful learning (DML), making it highly relevant for an online educational setting specifically for a cohort of students with varying levels of prior digital exposure (van As et al., 2024).

However, due to the fast-paced evolution of the digital environment, digital abilities cannot be confined to surface-level knowledge and instead require constant nurturing and development. As such, an approach that promotes deep and meaningful learning experiences is vital. Exploring the effectiveness of the course's DML-based design necessitated an inquiry into the student experience. Therefore, the focus of this study was to explore from the students' viewpoint whether the six dimensions from the DML framework implemented within the course effectively nurtured their digital abilities and facilitated deep learning. This investigation was important in understanding how these learning strategies impacted students' proficiency and confidence in using digital tools and platforms which is a key aspect of their development as digitally competent individuals.

In this context, the study aimed to bridge the gap between theoretical pedagogical strategies and the actual student experience by providing an insightful analysis of the role of DML in enhancing digital abilities among first-year students in a dynamic online learning environment.

1.3 Problem Statement

Research shows that as much as 20% of first-year students in South Africa enter higher education without the necessary digital abilities, making it difficult for them to effectively engage in online learning activities and access digital academic resources (Ingratta et al., 2022). This lack of digital competence negatively impacts students' ability to navigate learning management systems, conduct research, collaborate online, and participate in self-directed learning, directly affecting their academic performance. The challenge is more severe for students from underprivileged backgrounds who often have limited prior exposure to digital tools which widens the digital divide in higher education.

A study by Watted (2023) reveals a significantly positive relationship between academic performance and digital competence because of enhanced access to information, development of critical thinking and problem-solving skills, opportunities for collaboration and increased personalised and self-directed learning experiences. However, many first-year students struggle to engage meaningfully with digital learning content, which contributes to a reliance on surface learning strategies which involve rote memorisation rather than developing a deeper conceptual understanding (Ellis & Bliuc, 2019). This issue is particularly concerning in online education, where digital proficiency is essential for critical engagement and knowledge transfer across disciplines (Wu, 2024).

However, despite the recognised need for deep and meaningful learning (DML), there is a conspicuous gap in the design and implementation of online courses that facilitate such an approach, particularly for enhancing the digital abilities of first-year students who are transitioning into the higher education environment. Moreover, empirical research examining the effectiveness of the DML framework in this context remains scarce. This gap in research and practice highlights the need for a structured approach to digital abilities development that moves beyond basic technological exposure to fostering deep, meaningful engagement with digital learning tools and strategies.

1.4 Research Aim

The aim of this study was to explore first-year students' perspectives on the effectiveness of the dimensions of the deep and meaningful learning (DML) framework in an asynchronous online support course designed to improve their digital abilities upon entering university. Student perspectives can pinpoint strengths and areas for improvement in courses as well as contribute to the enhancement of teaching and learning (Cladera, 2021).

1.5 Research Objectives

The objectives of this study were to:

- Identify the DML dimensions that students found most effective in developing their digital abilities.

- Understand the underlying reasons for students' perceptions on the effectiveness of the DML dimensions in enhancing their digital and meaningful learning.
- Determine how the course's integration of DML dimensions can be used or adapted to effectively develop students' digital abilities online.

1.6 Research Questions

The main research question that framed this study is:

What are students' perceptions on the effectiveness of the deep and meaningful learning (DML) dimensions in an online course to promote their digital abilities?

The main question is further guided by the following sub-questions:

- What DML dimensions do students perceive as most effective and least effective in enhancing their digital abilities, and why?
- How do students perceive the role of the DML dimensions in fostering deep and meaningful learning?
- How can the DML framework be used to effectively develop students' digital abilities in an online learning environment?

1.7 Research Significance

The increasing reliance on digital learning environments has highlighted concerns about students' ability to engage meaningfully with digital tools in academic settings (Hong & Kim, 2018; Ingratta et al., 2022). While studies have examined digital literacy (Anthonysamy et al., 2020; Jantjies &

Dalasile, 2019), there remains a gap in understanding how deep and meaningful learning (DML) strategies influence the development of digital competencies in online support courses (Wu, 2024). Existing research tends to focus on surface-level digital skills rather than how pedagogical strategies enhance students' ability to think critically, collaborate, and apply digital tools effectively (van As et al., 2024).

This study contributes to the field of educational technology by examining the impact of DML-based strategies in an online support course and offering empirical insights for educators and instructional designers seeking to enhance digital learning through structured pedagogical approaches (Cameron & Rideout, 2022). Furthermore, addressing the digital skills gap among first-year students has broader policy and curriculum implications which may help ensure that students are not only digitally literate but can also engage in deeper, more meaningful online learning experiences (Vargas-Hernández & Vargas-González, 2022).

1.8 Overview of the Research Report

This research report comprises of six chapters, each contributing to a comprehensive understanding of the study's focus on students' perceptions of the effectiveness of the six deep and meaningful learning (DML) dimensions in enhancing their digital abilities within an online course.

CHAPTER 2 includes a literature review that explores key concepts related to digital abilities, and the principles and characteristics of deep and meaningful learning. This chapter also investigates relevant research on the effectiveness of DML strategies in various educational contexts.

CHAPTER 3 presents the research design and methodology, providing a rationale for the chosen approach. The discussion includes details on the study's quantitative and qualitative nature. The sampling strategy, participant selection criteria, and data collection procedures are also described.

CHAPTER 4 presents the findings of the study based on the analysis of the collected data. It provides a comprehensive account of students' perspectives on the effectiveness of different DML dimensions in promoting their digital abilities.

CHAPTER 5 delves into a discussion of the research findings. It examines the implications of the results in the context of the main research question and sub-questions. Furthermore, the discussion draws comparisons with existing literature to validate and contextualise the study's outcomes.

CHAPTER 6 concludes the study by presenting a summary of the key findings. It reinforces the significance of the study's contributions to the field of digital education and offers recommendations for further research.

Chapter 2: Literature Review

2.1 Introduction

This chapter reviews the deep and meaningful learning (DML) framework and its role in developing digital abilities among first-year university students. It contrasts DML with surface learning, explores its constructivist foundations, and examines how it supports digital competency. The chapter also discusses challenges first-year students face, the effectiveness of DML in online learning, and student perspectives on digital skills. These insights provide the foundation for understanding how DML strategies can enhance digital abilities in South African higher education.

2.2 Digital Abilities in Higher Education

2.2.1 Defining Digital Literacy, Skills, Competencies and Abilities

In an evolving digital age, the terms digital literacy, digital skills, and digital competencies (or abilities) are often intertwined, yet they retain distinct nuances (Iordache et al., 2017; Purina-Bieza, 2020; Sánchez-Caballé et al., 2020). To explain these terms and their interconnections, this section will dissect each one and then articulate their collective relationship.

Digital literacy is a nuanced competency centred on proficiently navigating the digital environment. It entails the ability to use, manage, assess, and understand technology, and encompasses tasks from searching and storing digital information to analysing and processing it (Purina-Bieza, 2020). Beyond mere technical handling, digital literacy emphasises critical

engagement with digital resources, involving discerning selection, evaluation, and judicious application of digital content. This competency also extends to encompassing contemporary social skills vital for responsible behaviour and security within the digital realm. Iordache et al. (2017) frame it as a fusion of awareness, skills, and competencies necessary for strategic digital communication and content creation, while (Martínez-Bravo et al., 2020) view it as the holistic development of competencies for effective and critical management of technology across varied contexts.

Digital skills pertain to the tangible, quantifiable aspects of digital proficiency and represents the practical outcomes of broader digital literacies. Specifically, digital skills are defined as the hands-on, measurable manifestation of knowledge and aptitudes in digital operations (Iordache et al., 2017). Furthermore, Van Deursen et al. (2014) posits that digital skills primarily focus on the technical dimensions of these competencies. They categorise them into six practice-driven skills: (1) operational skills, which revolve around the functional handling of computer and Internet tools, sometimes termed 'button knowledge'; (2) formal skills, denoting the aptitude to comprehend and employ foundational elements of computers and the internet, such as hyperlinks; (3) information skills, which encapsulate the capabilities to search, collate, manage, and critically assess digital contents; (4) strategic skills, reflecting the proficiency to harness the Internet for individual benefits; and the addition of (5) communication skills, referring to the adeptness required for online networking and digital communication strategies, and (6) content creation skills, highlighting the competencies essential for generating and disseminating content online.

Digital competencies, as outlined by Ala-Mutka (2011), represent the overarching framework encompassing both digital literacy and skills. This holistic concept encapsulates the integrated ability to apply digital knowledge (literacy) and skills in diverse real-world contexts, whether they

be personal, academic, or professional. It is this blend of theoretical knowledge and practical skills that furnishes individuals with a profound proficiency to traverse the digital landscape with confidence (Redecker, 2017).

In summary, while digital literacy offers the foundational knowledge and awareness, digital skills provide the technical proficiencies to engage with digital tools. Digital competencies (or abilities) bridge these two and embodies the comprehensive ability to use digital tools effectively in diverse contexts. Within the scope of this research report, the term ‘digital abilities’ will be employed as a synonym for digital competencies, encapsulating both literacy and skills.

2.2.2 The Importance of Digital Abilities for Students at University

Globally, the transition from high school to university poses various challenges for students, especially in the context of the online and blended learning environment (Cameron & Rideout, 2022; Hong & Kim, 2018; Ingratta et al., 2022). Students today are expected to possess the necessary digital abilities to effectively navigate academic life and future careers. Nevertheless, because of the rapidly evolving nature of technology, these digital abilities require continuous improvement and adaptation to remain relevant and effective (Soltovets et al., 2020).

There is also a significant positive effect of students’ digital abilities on their learning and performance within digital learning environments. Supporting these claims, research shows that improving students’ digital abilities leads to enhanced academic performance, with studies across various educational contexts consistently demonstrating the positive correlation between digital competence and academic achievement (Mehrvarz et al., 2021). Furthermore, in higher education, the acquisition of digital abilities is crucial in the face of rapid global digitalisation. Developing

digital abilities equips students with technical, cognitive, and ethical skills and knowledge, enabling them to engage in rational online communication, and find answers to questions through their digital proficiency (Mehrvarz et al., 2021).

2.2.3 Equipping First-Year South African University Students with Digital Abilities

In the South African context, it is worth noting that while there is generally a positive attitude towards online learning, a significant proportion of students (at least 20%) in one study expressed a sense of unpreparedness when it came to utilising essential digital tools such as the university's learning management system, standard Microsoft Office applications, and internet browsing upon entering university (Ingratta et al., 2022). This finding highlights the pressing need for additional training and support to ensure equitable access to digital resources for all students, particularly those from rural areas who may face additional challenges.

In a separate study conducted in South Africa, it was found that students' self-assessed digital abilities varied before entering university. While some students considered their skills to be poor or fairly poor, a significant portion felt moderately confident in their digital abilities acquired prior to university. It was observed that the university played a crucial role in empowering students with digital skills through institutional support. The workshops and training programmes offered to students covered a wide range of topics, including basic computer processing systems, email usage, and familiarity with the university's Learning Management Systems. These findings highlight the importance of higher education institutions in equipping students with necessary computing and digital skills, regardless of their specific programs of study (Jantjies & Dalasile, 2019).

2.3 Student Perspectives on Learning and Digital Abilities

2.3.1 Importance of Student Perspectives in Education Research

Student voice, as characterised by Holquist et al. (2023), signifies the opportunities for students to actively participate in and influence the pedagogical decisions within educational institutions. This concept has increasingly gained traction in contemporary educational landscapes. However, paradoxically, a significant portion of the student population believes that their avenues to influence decision-making within their educational settings remain limited. This sense of limited agency is especially pronounced among students who are marginalised or face academic challenges. Such demographics are seldom requested for their insights on potential enhancements in teaching approaches or broader educational reforms.

The emphasis on harnessing student voice emanates from an underlying ambition to bolster student engagement and participation in the educational journey. The foundational argument supporting this is put forward by Tuhkala et al. (2021) who contend that students, by virtue of their immersion in the learning environment, possess distinctive insights into the dynamics of teaching and learning. It is thus beneficial to allow these students to shape the way educational strategies are conceptualised and executed.

Further deepening the rationale for prioritising student perspectives is the educational theory of constructivism. This theory perceives the acquisition of knowledge and the construction of reality as inherently interactive processes. These processes are portrayed by students integrating new information into their existing knowledge bases, while concurrently co-constructing disciplinary understandings in collaboration with their peers. Such an approach transcends the mere rote

retention of information. Instead, as Sandu & Unguru (2017) explain, it empowers students to cultivate their interpretation of reality and foster a collectively negotiated worldview with their peers. The critical value of student voice thus lies at the intersection of these considerations, underscoring its importance in the quest for a more holistic, student-centred education.

2.3.2 Research Involving Students' Perspectives on Online Learning

Generation Z (or Gen Z) students, demographically identified as those born between the mid-1990s to the mid-2000s, are intrinsically related to the Fourth Industrial Revolution (IR 4.0)[1] (Talhah et al., 2020). This cohort's digital immersion offers unique insights into their preference for online learning which Chunta et al. (2021) outlines into three main teaching strategies below. However, it is essential to caution against a sweeping assumption that all Gen Z students are uniformly adept at online learning as echoed by Kirschner and De Bruyckere's (2017) critique of the 'digital natives' narrative discussed earlier.

Firstly, according to Chunta et al. (2021), there is an emphasis on cultivating engagement. For Gen Z, engagement transcends mere participation and signifies interactive discourse and technology-enhanced responses. Tools like blogs and multimedia forums emerge as the preferred platforms. Additionally, a shift from isolated assignments to collaborative projects is seen as a pivotal step in enhancing this interaction. Essential to this collaborative approach is the provision of clear guidelines which covers aspects from communication norms to the intricacies of virtual group dynamics. However, while technology-rich environments are often associated with enhanced

[1] The Fourth Industrial Revolution (IR 4.0) is based on digital innovations that have accelerated the development of groundbreaking technologies, significantly altering both our professional and personal practices (Dlamini, 2023).

engagement, there is a potential for digital distractions that can impede deep and meaningful learning. This is highlighted by the cognitive load theory which posits that the cognitive processing system in humans is severely constrained by the limitations of working memory and therefore heavily increased when unnecessary demands are placed on it (Sweller, et al., 2019).

The second dimension focuses on stimulating intellectual development. Gen Z's expectations are anchored in proactive digital engagement which views online learning as an active process. Here, the power of narrative takes centre stage. Authentic, emotion-driven stories, delivered via audio or video interviews, bridge the gap between theoretical constructs and their real-world indicators which fosters a rich, immersive learning environment. This aligns with DML's constructivist undertones which highlights the process of knowledge construction rooted in personal experiences (Howland et al., 2014).

Lastly, the cornerstone of effective online learning is the establishment of a robust teacher-student rapport. For Gen Z, this relationship is nurtured through timely and multifaceted feedback. It is not just about immediacy but also about facilitating the reflective processes integral to DML (van As et al., 2024). Gen Z gravitate towards visual, illustrative feedback modes, such as animated whiteboards, as opposed to traditional text-based comments (Chunta et al., 2021). By linking specific examples with instantaneous feedback mechanisms, teachers can create a resonating and effective learning experience for Gen Z students.

Furthermore, in the quest to understand students' perspectives on online learning, the research undertaken by Van Wart et al. (2020) offers invaluable insights. The starting point for their exploration takes its cue from the respected Community of Inquiry (CoI) model by Garrison et al. (2000). This model highlights three integral components for an enriching online educational experience: teaching presence, cognitive presence, and social presence.

From the students' viewpoint, the teaching presence is an essential pillar. It underscores the significance of teachers providing clear instructions, consistently staying on task, establishing transparent deadlines, and furnishing tailored feedback that highlights individual strengths and areas of improvement. In the domain of cognitive presence, students highlight the value of instructors stimulating their curiosity, offering opportunities for reflection, helping them construct explanations, and ensuring the applicability of material. This reinforces the idea that students value an active engagement where they can combine theory with practical applicability. The social presence factor resonates deeply with students by emphasising the importance of mutual connections within online courses which forms engaging and dynamic interactions (Garrison et al., 2000; Van Wart et al., 2020).

Beyond the CoI's triad, the students expressed the value of instructional support, a factor encapsulating the instructor's role in delivering a unified learning experience. For instance, detailed syllabi, structured feedback, and facilitating student interactions were vital. In the online social comfort realm, students spoke about their comfort in expressing ideas, disagreeing constructively, and viewing online platforms as conducive for social interaction. This echoes DML's endorsement of collaborative learning which are not just about interaction, but about co-constructing knowledge which signifies deeper learning (Vygotsky, 1978). Lastly, the interactive online modality surfaced as a preference for more vibrant communication tools like video conferencing and small group discussions (Van Wart et al., 2020). Thus, it becomes clear that students prioritise a learning environment where they can interact not only with their instructors but also actively engage with their peers.

2.3.3 Students' Perspectives on Digital Abilities and Their Relevance

In the digital era, understanding students' perceptions of digital abilities, is of paramount importance. A study by Smith and Storrs (2023) illuminates the perceptions held by undergraduates on this subject. Deploying a cross-sectional survey method, a stratified random sample of 2500 undergraduates at a Canadian undergraduate university was assessed. The results revealed a poignant contrast: while an overwhelming majority, upwards of 75%, affirmed the necessity of digital literacies for a spectrum of their activities, spanning academic, professional, and everyday contexts, a fraction reported an extensive engagement with these literacies within their undergraduate education. This dichotomy accentuates a discernible gap between the digital abilities students deem essential and their actual experiences within the undergraduate curriculum.

Research undertaken by Olatoye et al. (2021), involving 266 undergraduate students from the Universities of Fort Hare and Rhodes, underlined similar concerns. The findings from this study emphasised that the proficiency of these students in information and communication technology (ICT) and their expertise in utilising electronic resources were markedly deficient. Such restricted capability can considerably hinder their efficient use of e-resources. It was suggested that enhancing the ICT literacy skills of these undergraduates, via targeted programmes within their curriculum, could redress this imbalance.

Drawing from these empirical findings, it becomes evident that while students recognise and endorse the salience of digital literacies, their academic journey often leaves them underprepared in this domain. Thus, universities and academic institutions are faced with the pressing task of recalibrating their curriculum, ensuring a more robust integration of digital abilities that mirrors students' identified needs and real-world applicability.

2.4 Deep and Meaningful Learning (DML) as the Theoretical Framework

2.4.1 The Characteristics and Limitations of Surface Learning

In the educational landscape, three prominent learning approaches emerge: surface learning, deep learning and meaningful learning. Surface Learning, often considered as a less effective mode of student engagement, aims for mere reproduction of course material. Students adopting this approach primarily target sufficient knowledge acquisition to complete the given academic task or pass the course (Everaert et al., 2017). Their learning is often driven by the motivation to avoid failure but with a minimal investment of effort. Such students lean heavily on memorisation and reproductive techniques and often fail to discern the relationships among various pieces of information they encounter.

Surface learning approaches are associated with lower academic performance. Studies have shown that students who adopt surface learning strategies tend to perform poorly compared to their peers who use deep learning approaches (Asikainen et al., 2020; Everaert et al., 2017). The structure and organisation of educational programs can also influence students' learning approaches. Some studies suggest that first-year students may start with a deep learning approach but shift towards surface learning due to the educational design and assessment methods (Loras & Aalberg, 2020; McDonald et al., 2017). This shift can negatively impact their academic performance.

This surface approach is fundamentally fragmented, focussing on isolated facts and reproducing them without the intent to grasp their underlying meaning (Ellis & Bliuc, 2019). This approach can also be termed as ‘rote learning,’ a mode of teaching and assessment focused exclusively on remembering fragmented elements or facts. It is often divorced from any meaningful context

(Mayer, 2002). It is crucial to note that empirical research has indicated a significant negative correlation between the adoption of surface learning and academic achievement (Everaert et al., 2017). However, studies also suggest that effective design of learning tasks can steer students towards deeper, more meaningful forms of engagement, even in online environments (Ellis & Bliuc, 2019). Having expounded on the characteristics and pitfalls of surface learning, it is pertinent to contrast it with its opposing counterparts: Deep Learning and Meaningful Learning.

2.4.2 Constructivist Perspective

One of the pivotal theoretical frameworks that inform deep and meaningful learning (DML) is constructivism. Rooted in the pioneering work of Jean Piaget, constructivism posits that learning is an active, constructive process (Piaget, 1964). Contrary to traditional pedagogical models that view knowledge as something to be transmitted from teacher to student, constructivism underscores the role of the student in actively interacting with the environment to construct knowledge. Piaget articulated that "the development of knowledge is a spontaneous process, tied to the whole process of embryogenesis" (Piaget, 1964, p. 8), encompassing not only the development of mental functions but also the entirety of knowledge structures.

In this framework, learning materialises when students act upon objects or concepts, subsequently transforming them through their unique actions. Such active construction of knowledge is context-dependent and influenced significantly by a student's pre-existing knowledge and experiences (Piaget, 1964). It is against this backdrop of constructivism that DML can be fully comprehended. DML aligns with the constructivist philosophy by emphasising that students not only actively engage with their learning environment but also reflect deeply on their experiences (Howland et al., 2014).

DML and constructivism are intertwined, both subscribing to the view that knowledge is constructed rather than merely transmitted. DML, in accordance with constructivist principles, places emphasis on real-world application, complex problem-solving, and reflective thinking. It encourages students to adapt and reorganise their cognitive frameworks, thereby attaining not just understanding but also the skills for ongoing, lifelong learning.

2.4.3 Unpacking Deep and Meaningful Learning

Deep learning has its roots in the seminal research on cognitive processing strategies (Mystakidis, 2021). The framework for understanding deep learning was laid down by Marton and Säljö (1976), who observed two contrasting behaviours in students' learning approaches. Unlike surface students who aim to memorise isolated facts, students employing deep learning approaches actively seek to integrate new information with their existing knowledge base. In the deep learning approach, the student assumes a proactive role and directs his or her own learning process. Such students not only aim for a comprehensive understanding of the content but also critically reflect on the learning process itself while adapting their beliefs, behaviours, and values as necessary. Mystakidis (2021) suggests that deep learning incorporates creative, critical, reflective, and caring elements. This mode of learning particularly excels in problem-solving capabilities and processes. However, it is imperative to differentiate the term "deep learning" in educational contexts from its use in computational processing techniques within artificial intelligence. They are distinct concepts, and the former should not be confused with the latter.

To foster deep learning among first-year students in digital education, it is crucial to create authentic, engaging learning environments where students can actively apply their digital skills. Providing students with opportunities to collaborate online, solve real-world digital problems, and

reflect on their learning progress can enhance their ability to engage beyond surface-level digital literacy (van As et al., 2024).

Meaningful learning is a pedagogical strategy rooted in the practical realities of educational settings, aiming to cultivate student autonomy for optimal outcomes (Vargas-Hernández & Vargas-González, 2022). Unlike traditional learning approaches that emphasise mere cognitive retention, meaningful learning transcends the boundaries of cognition. It leverages contextualisation, underpinned by the opportunities for collective meaning-making. The design of meaningful learning is informed by cognitive-constructivist conceptual activities, focused on solving real-world problems pertinent to the students. Furthermore, the natural environment is harnessed as an invaluable educational resource. Meaningful learning facilitates the student's cognitive restructuring by enabling the integration and reconceptualisation of new learning content into existing cognitive frameworks.

Meaningful learning, according to Howland et al. (2014), is a multi-dimensional concept that transcends mere memorisation and information acquisition, encompassing five core elements.

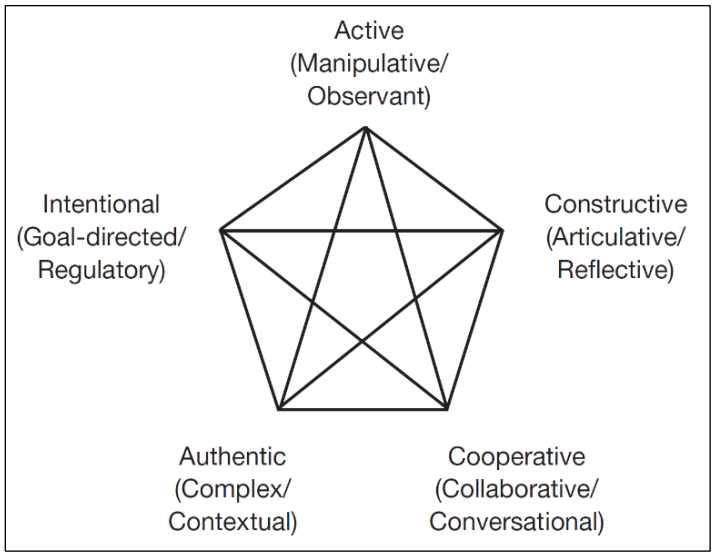


Figure 1: *Characteristics of Meaningful Learning (Howland et al., 2014)*

1. **Active Learning:** First-year students must engage directly with digital tools, such as Microsoft Office, learning management systems (LMS), and online collaboration platforms. It aligns with the constructivist theory, which asserts that knowledge is constructed through interaction with one's environment.
2. **Constructive Activity:** Beyond using digital tools, students need structured reflection and discussion spaces (such as online forums and peer review) to articulate their learning progress. This is corroborated by Vygotsky's (1978) sociocultural theory which emphasises the role of dialogue in cognitive development.
3. **Intentional Learning:** Digital learning environments should encourage students to set goals for improving their digital abilities and track their own progress. Adaptive online assessments and progress-tracking features in LMS platforms can support goal-oriented learning.
4. **Authentic Learning:** First-year students benefit most when digital skills are linked to real-world applications, such as collaborative digital projects.
5. **Cooperative Learning:** Digital collaboration is a key competency in higher education. Encouraging group-based digital assignments, online peer interactions, and shared problem-solving activities ensures that students develop strong collaborative digital literacy.

These five elements collectively contribute to a nuanced understanding and applicability of learned knowledge. By integrating these principles into pedagogical design, teachers can facilitate a more comprehensive and enduring learning experience.

As we move forward, it is crucial to highlight that this literature review will delve into the complementary principles of the deep and meaningful learning (DML) approach. In adherence

with constructivist principles, the DML approach prioritises authentic, context-specific experiences aimed at forging intricate connections between essential concepts, thereby achieving a profound understanding and long-term knowledge retention.

2.4.4 Components of the DML Framework

Building upon the principles of constructivism, the deep and meaningful learning (DML) framework (Figure 2), proposed by van As et al. (2024), provides a structured approach for implementing these strategies in an online course to promote meaningful learning experiences. Central to this framework are six dimensions each catering to specific facets of the learning process and fostering an environment conducive for holistic student development.

Firstly, ***self-directed learning*** anchors the student at the heart of their educational journey, encouraging autonomy and motivation. It places emphasis on aspects such as continuous personal development, the creation of learning portfolios, and the pursuit of individual activities (van As et al., 2024). This dimension underscores the significance of students actively searching for resources, solving problems autonomously, and selecting their learning activities, all of which foster independence.

The second dimension, ***collaborative learning***, champions the potency of communal knowledge acquisition and interaction. Through mechanisms such as case study reports, group discussions, and shared resources, students are motivated to engage in mutual intellectual endeavours (van As et al., 2024). There is an increased push towards utilising contemporary tools like Padlet and Miro for mind mapping or collaborating on documents via Google Docs which reinforces the idea of a collective intelligence and shared understanding.

Real-world learning stands as the third dimension, facilitating the bridge between theoretical constructs and pragmatic applications. By integrating vignettes of real-world scenarios, case studies, and tasks that prompt students to seek real-world examples, the curriculum becomes more relatable, thereby instilling a stronger sense of purpose and relevance in students (van As et al., 2024).

Reflection, the fourth dimension, emphasises the cyclical process of introspection and externalisation. It promotes profound thinking through activities like module reflections, end-of-session reflective questions, and the formulation of personal development goals. Such activities not only encourage students to contemplate their learning trajectories but also to envision future aspirations (van As et al., 2024).

The fifth dimension, ***authentic assessments***, transcends traditional testing mechanisms. Instead, it leans into more genuine forms of evaluation like literature review projects, organisational analysis, and interpersonal skills tasks. The creation of portfolios, presentation development, and the establishment of a professional presence, like setting up a LinkedIn profile, all combine to form a more holistic and genuine appraisal of a student's capabilities (van As et al., 2024).

Finally, the providing ***constructive feedback*** dimension accentuates the role of reciprocal communication in the learning process. Beyond just lecturer feedback, it encompasses peer reviews, tutor evaluations, and the provision of assessment exemplars at the course's onset (van As et al., 2024). Such multifaceted feedback mechanisms ensure that learning remains an iterative and evolving journey, where students are constantly equipped with insights to refine their understanding and skills.

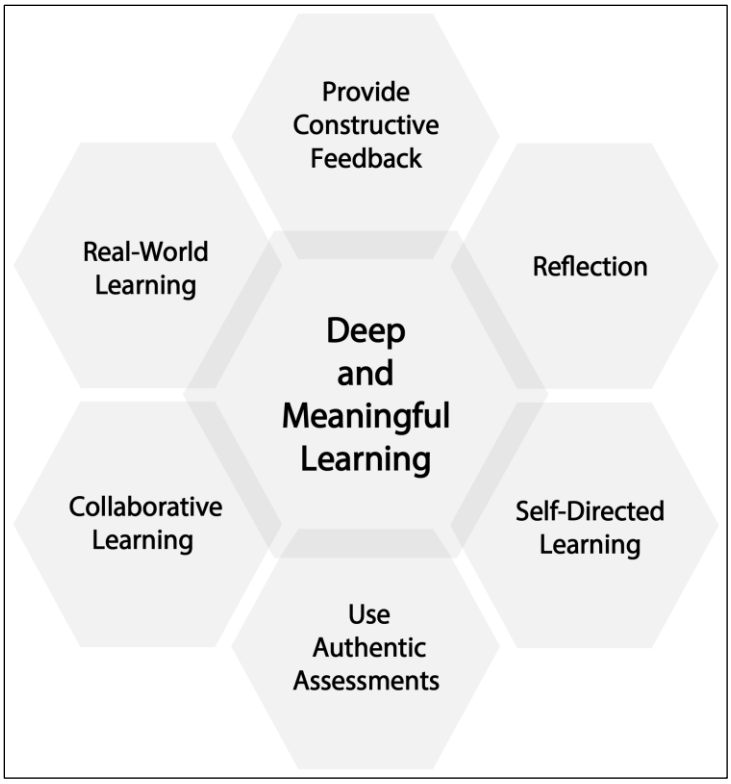


Figure 2: *The deep and meaningful learning design framework (van As et al., 2024)*

2.4.5 The Role of DML in Developing Digital Abilities

DML emphasises a competency-based approach to learning, which is particularly apt for online learning environments (Guàrdia et al., 2013). By shifting towards student-centred strategies, students transition from passive recipients of information to active constructors of knowledge. This participatory approach necessitates that students immerse themselves in tasks designed to foster specific competencies. Foremost among these is the embrace of deep, meaningful engagement with content as opposed to surface-level rote learning.

As articulated by Sánchez-Caballé et al. (2020), digital competence is not monolithic but consists of an intricate web of elements. These range from information skills, content creation, and

communication to more nuanced aspects such as ethical reasoning, problem-solving, technical usage, and strategic skills. This multi-dimensional perspective accentuates the necessity of a robust educational framework that addresses each facet comprehensively. Given this complexity, it is evident that a mere superficial grasp is insufficient – a deep and integrative understanding is essential.

Mystakidis (2021) contends that deep learning is the key, as it surpasses mere knowledge acquisition, striving for a rich disciplinary comprehension, transformative knowledge, and a plethora of skills encompassing personal meaning-making, emotional intelligence, critical thinking, creativity, and metacognition. When targeting the enhancement of digital abilities, the depth of understanding facilitated by DML becomes paramount. Such profound engagement prepares students to nimbly navigate the multifarious challenges of the digital realm, adapt to its dynamic nature, and proficiently wield their skills in diverse contexts.

Complementing this, Wang and Zhang (2018) highlight the profound merits of a deep learning approach in amplifying collegiate students' competencies. Their findings highlight the significance of course involvement, authentic assignments, and a blend of facilitation and coaching – elements that resonate deeply with the comprehensive facets of digital competence. By promoting assignments rooted in genuine, real-world challenges, teachers can better address the multifaceted elements of digital competence, ensuring that students are not just equipped with isolated skills but are adept at integrating and applying them in diverse digital contexts.

2.4.6 Comparing DML with Alternative Frameworks

Two alternative frameworks to DML are SAMR (Substitution, Augmentation, Modification, Redefinition) and TPACK (Technological, Pedagogical, and Content Knowledge). The SAMR framework is designed to help educators integrate technology into their teaching practices effectively. It outlines four levels of technology integration in education, progressing from basic enhancement to transformative use (Kelsch & Wang, 2021).

At the Substitution level, technology replaces traditional tools with no functional change, such as using a word processor instead of pen and paper. The Augmentation level introduces functional improvements, like using spell check in the word processor. Moving to Modification, technology significantly redesigns tasks, such as collaborating on a shared document in real time via cloud platforms. At the highest level, Redefinition, technology enables the creation of entirely new tasks that were previously inconceivable, such as students producing multimedia presentations that integrate virtual reality to explore historical events (Kelsch & Wang, 2021). Each level offers increasing opportunities for innovation, engagement, and deeper learning.

The TPACK framework provides a comprehensive model for integrating technology into teaching effectively. It emphasises the interplay between three core knowledge areas: Content Knowledge (CK), which refers to mastery of the subject matter being taught; Pedagogical Knowledge (PK), which involves understanding teaching methods and strategies; and Technological Knowledge (TK), which includes familiarity with digital tools and their applications (Aini, 2024). The framework highlights that effective teaching with technology occurs at the intersection of these domains, where educators can seamlessly integrate technology to enhance pedagogy and content delivery.

The DML framework contrasts with SAMR and TPACK by prioritising deep, meaningful learning through dimensions like self-directed learning and reflection which emphasises cognitive

engagement and skill application (van As et al., 2024). SAMR focuses on levels of technology integration, from Substitution, where technology replaces traditional tools, to Redefinition, which enables transformative tasks (Kelsch & Wang, 2021). TPACK, on the other hand, integrates Content, Pedagogical, and Technological Knowledge to enhance teaching strategies (Aini, 2024). While SAMR and TPACK centre on the role and integration of technology, DML emphasises student engagement and critical thinking, which makes it particularly suited for fostering digital abilities in higher education.

2.5 First-Year Students and Digital Abilities

2.5.1 Specific Challenges and Opportunities for First-Year Students

The transition from high school to university poses challenges for students, especially in the context of increased independence and blended learning environments. First-year students are expected to be capable of using effective learning strategies and managing their time to meet the demands of their courses (Cameron & Rideout, 2022). However, these are not the only skills students need during their academic journey. Self-directed learning, critical thinking, effective communication, and digital literacy are additional components that can enhance academic success (Youssef et al., 2022).

The process of maturing as a student is continuous and evolves over time. A significant portion of participants in the study by Cameron and Rideout (2022) explained how their learning and time management skills improved over their first year, offering opportunities for further refinement as they progressed. It underscores the iterative nature of cultivating self-regulated learning where feedback given to students from past encounters serve as a foundation for present and prospective

endeavours. Therein lies the imperative for academic institutions to provide resources and platforms for students to hone their self-directed learning capabilities which not only facilitates their adjustment to university but also bolsters their prospects for success.

Furthermore, the act of introspection and the evaluation of one's own learning – referred to as metacognitive reflection – are pivotal for academic success (Cameron & Rideout, 2022). Beyond individual reflection, the integration of social interactions also plays a significant role. Peer support emerged as a cornerstone for many first-year students, serving as a source of collaboration. The significance of social networks aids first-year students in navigating the complexities of university adaptation. Therefore, the role of peers transcends merely the academic as it provides both social and academic backing. It becomes evident that creating regular and sustained opportunities for students to collaborate within the classroom context could significantly ease first-year students' adjustment process to university life.

2.5.2 The Role of DML in Supporting the Transition to Higher Education

Deep and meaningful learning (DML) embodies an advanced pedagogical approach that acknowledges the complexities faced by first-year students transitioning to university. As previously discussed above, the leap from high school to university mandates a more nuanced set of skills, including self-directed learning, effective communication, and the ability to engage in reflective thinking. DML builds upon these foundational capabilities, offering students an environment that is conducive to holistic academic growth.

At the heart of DML is the emphasis on facilitating students' autonomy. As suggested by van As et al. (2024), students should be granted avenues to pose questions, thereby driving their own

learning journey. This act not only aids in constructing meaning but also in personalising their educational experience based on their unique perspectives and curiosities. Moreover, the DML framework advocates for a diverse learning ecosystem where students are exposed to myriad perspectives. By interacting with their peers, teachers, and the broader academic community, students gain multifaceted insights that allow them to consider problems in their full complexity. This not only widens their horizon but also furnishes them with the tools to develop alternative solutions to academic challenges.

Furthermore, DML promotes both independent and collaborative learning. Encouraging students to be self-directed ensures they take ownership of their learning trajectory. However, the power of collaboration cannot be understated. Collaborative efforts, as underscored by the experiences of first-year students in the preceding section, provide academic and social support. DML, thus, pushes students to be proactive and considerate when working in groups.

2.5.3 Strategies for Enhancing Digital Abilities Among First-Year Students

The advent of digital technologies necessitates the augmentation of digital skills among first-year university students to ensure adeptness in the evolving educational paradigm. To set the international context, Røkenes and Krumsvik (2014) conducted a meticulous review of various studies centred on digital competence in higher education. Collaboration is a primary method, with 25 out of 42 studies emphasising its value. This involves utilising synchronous and asynchronous technologies such as online forums, discussion boards, social networking sites, weblogs, and collaborative software. Metacognition or reflective practice is another pivotal approach where students critically reflect on how technology can be integrated into the learning process. They

often use online bulletin boards, multimedia artefacts, and discussion groups to stimulate reflection and evaluate technology uses. There is also an emphasis on active learning, advocating for a student-centred approach where students are actively engaged in the learning process, underscoring the importance of experiential learning.

In the South African context, Strydom et al. (2021) presented an innovative approach with a digital literacies short course for student teachers. Rooted in authentic learning, this course transcended traditional instructional design by immersing students in real-world challenges, fostering active participation in knowledge creation. The emphasis on 'authentic tasks', reflective of real-world scenarios, was particularly noted. Evaluative feedback from participants indicated an appreciation for these authentic assignments and the knowledge generation process. Strydom et al.'s (2021) endeavour, while promising, revealed a research gap in the South African context, suggesting further exploration of authentic learning approaches to elevate digital literacy among students.

Furthermore, the University of the Western Cape's Digital Academic Literacy (DAL) Programme addresses the crucial need for enhancing digital proficiency among first-year students. Beyond academic bolstering, the programme provides pivotal ICT support, cultivating skills that enhance students' employability. Its rapid expansion across departments highlights the immense demand for such a programme, particularly given the significant number of students who have historically lacked access to digital media for academic purposes (Leonard et al., 2016). DAL's aim is twofold: to level the playing field for these underprepared students and to develop graduate attributes tailored to specific disciplines. The programme's emphasis on customisation and its alignment with both academic and professional needs underscore its significance in bridging the digital divide, preparing students for academic achievement and future digital-oriented careers

(University of the Western Cape, 2023). The precise teaching methodologies remain unspecified, but the programme's intent and importance are clear.

2.6 Effectiveness of DML Strategies in Online Learning Environments

2.6.1 The Rise of Online Learning and Its Challenges

Online learning, often referred to as e-learning, encompasses education that is electronically facilitated through the deployment of digital technologies, including computers and the internet, with the overarching objective of enhancing student knowledge and performance. The evolution in the realm of online education signals a transformative period in the educational landscape that redefines the traditional role of the educator and paves the way for a more personalised and collaborative learning experience (Ruiz et al., 2006). Central to this transformation is the pivotal role played by information and communication technologies (ICTs). These technologies, with their numerous affordances, enrich online learning environments by fostering heightened communication and collaboration. This enhances information accessibility and caters to a diverse student population by offering immediacy which a salient feature that enables instantaneous interaction between students and educators.

The year 2020 marked a crucial moment in the trajectory of online education. Triggered by the COVID-19 pandemic, a pressing need arose for educational institutions to pivot towards online learning. Many institutions either fully embraced this mode or transitioned to a blended learning paradigm. This change accentuated the already increasing trend of online learning which underscores the imperative for educators to adeptly navigate this new terrain (König et al., 2020).

The ramifications of this shift were manifold. Educators from a diverse array of academic fields were met with the daunting task of adapting to this novel modality and were seeking to harness digital tools and resources to achieve their pedagogical objectives (König et al., 2020). This global phenomenon was mirrored in South Africa, which grappled with its own unique set of challenges in the online education sphere. Among these challenges were the limited accessibility to requisite digital devices and the prohibitive costs associated with data consumption (Dlamini, 2022). Compounding these hurdles was the fact that a substantial segment of educators, deprived of formal training for this digital transition, encountered difficulties in creating lessons grounded in robust pedagogical frameworks. Such frameworks are instrumental in crafting high-calibre instructional materials and realising successful learning outcomes (Khalil & Elkhider, 2016).

Complementing these developments, there has been a notable surge in the proliferation and refinement of online educational platforms and the tools they encompass. Among these tools are applications such as Zoom and Microsoft Teams, tailored for virtual engagements; Kahoot, designed for the formulation of pedagogical games and quizzes; and Google Docs, a platform optimised for student collaboration. However, towering over these tools in terms of ubiquity are Learning Management Systems (LMSs). Platforms like Sakai, Canvas, Moodle, and Blackboard Learn epitomise this category, functioning as specialised software applications primed to enhance the online learning experience (Conole & Dyke, 2004).

2.6.2 The Application of DML in Online Courses

— **1. The Health Systems Science (HSS) Programme:**

The integration of the deep and meaningful learning (DML) framework into the Health Systems Science (HSS) programme, as described by van As et al. (2024) offers a progressive, systematic approach to elevate the academic experience over a three-year trajectory. This multidisciplinary programme draws on 21st-century competencies and aimed to shift students away from simply memorising knowledge to developing and applying competencies to ensure that they are work-ready (van As et al., 2024).

As students transition into the domain of real-world learning, Year 1 immerses them in realistic case studies and insights derived from expert videos. The ensuing Year 2 accentuates this hands-on approach by leading students into the realm of application where theoretical constructs come together with practical applications in health systems. In Year 3, students are accorded the privilege of collaborating with established Health Care Organisations. This engagement furnishes them with invaluable mentorship and an authentic exposure to the nuances of real-world health systems.

The pivotal role of feedback is underscored throughout the HSS programme. Year 1 adopts popular communication platforms, such as WhatsApp, to render personalised feedback tailored to individual student needs. This is succeeded by Year 2, which introduces structured tutorials. These sessions, facilitated by subject matter experts, are instrumental in honing students' academic writing proficiencies. By the time students transition to Year 3, the emphasis pivots towards providing efficient, holistic feedback. This ensures that tutors are always ready to address student queries and uncertainties proactively.

At the heart of the DML framework lies the essential process of reflection. Encouraging introspection and self-assessment, students are tasked with curating portfolios throughout their academic journey. The initial phase in Year 1 necessitates students to engage in weekly reflections, fostering continuous self-awareness. As they advance to Year 2, the pedagogical design joins with

traditional methods with a blended-learning approach which integrates Professional Development sessions into the curriculum. The culmination of this reflective journey is witnessed in Year 3 where students are guided to pinpoint their professional aspirations which concludes their academic journey with a comprehensive reflective e-portfolio.

— **2. Academic Integrity Course for All Incoming First Years:**

To craft an Academic Integrity course which places incoming first-year students at its core, van As and Kluyts (2023) developed a course informed by the dimensions of the deep and meaningful learning (DML) framework.

Recognising the potential knowledge void that incoming first-year students might face, especially concerning academic practices such as plagiarism, referencing, and academic integrity, van As and Kluyts (2023) prioritised competence-building. The course thereby served as an orientation tool that informs students about the institution's expectations and standards. This aligns with the self-directed learning dimension of DML which empowers students to familiarise themselves with academic conventions and take charge of their learning journey.

The DML framework emphasises real-world learning and authentic assessments so therefore the course steered clear of superficial assessments. By anchoring assessments around practical scenarios that mirror academic challenges, students are propelled to engage deeply with content, apply critical thinking, and construct meaning. Such assessments not only enhance students' intrinsic motivation but also makes the process both relevant and rigorous.

Fostering deep and meaningful learning necessitates a shift in curricular strategies and so the course prioritises curriculum alignment with 21st-century skills by encapsulating the collaborative

learning and real-world learning dimensions of DML. By developing courses filled with real-world examples, students are encouraged to deliberate, debate, and deduce which ensures genuine engagement.

Furthermore, the transformative power of reflection is also woven into the course. Through periodic online check-ins, students introspect on their adherence to academic integrity, thereby aligning with the reflection dimension of DML. This not only fosters self-awareness but also cements the values of honesty, trustworthiness, and responsibility (van As & Kluyts, 2023).

While the integration of the deep and meaningful learning (DML) framework into both the Health Systems Science (HSS) programme and the Academic Integrity course has been comprehensively detailed, a noticeable gap emerges upon inspection. The current literature, as encompassed by van As et al. (2024) and van As and Kluyts (2023), offers detailed accounts of course design, pedagogical interventions, and theoretical underpinnings. However, notably absent is the voice of the primary beneficiaries – the students. Their firsthand experiences, interpretations, and feedback are instrumental in assessing the real-world efficacy and relevance of the DML framework.

The students' perspectives on how these DML-informed courses influenced their learning journey, the challenges they faced, and the insights they gained can offer a holistic understanding. Without this crucial feedback, educators and course designers risk neglecting essential experiential insights that could further refine and enhance the DML framework's application in varied academic contexts. As such, the study aimed to bridge this gap by actively seeking and incorporating student feedback to ensure a truly student-centric approach in line with the philosophy of DML.

2.7 Conclusion

The literature highlights the critical role of DML in fostering digital abilities, particularly for first-year students navigating online learning environments. While digital literacy is essential for academic success, many students – especially in the South African higher education system – struggle with the transition due to pre-existing digital skill gaps. DML provides a structured pedagogical approach that supports deep engagement, self-directed learning, and critical thinking, essential for meaningful knowledge acquisition.

Chapter 3: Research Methodology

3.1 Introduction

This chapter presents the research methodology, organised according to the research onion by (Saunders et al., 2019). It begins by outlining the study's philosophical stance, followed by the chosen research approach, then details the mixed-method design. Finally, the chapter discusses the time horizon, participant selection, data collection procedures, and analytical techniques.

3.2 Research Philosophy

This study adopted a pragmatist paradigm, which is typically associated with mixed methods research due to its focus on the consequences of research and the central importance of addressing the research questions rather than adhering strictly to specific methods (Creswell & Plano Clark, 2018). Pragmatism embraces pluralism and real-world practice by allowing for the integration of multiple methods of data collection that suit the research problem. Other paradigms, such as positivism and interpretivism, were not suitable for this study as positivism focuses on objective reality and relies primarily on quantitative methods to generate generalisable findings, while interpretivism prioritises subjective experiences through qualitative inquiry (Yanyu, 2019).

In alignment with pragmatism, the study utilised both qualitative and quantitative approaches to capture the complexities of the phenomenon. Within this framework, the qualitative component of the research employs an interpretivist epistemology, acknowledging the subjective and constructed nature of human understanding (Stake, 1995). This is particularly relevant to this research, where

the aim was not merely to measure the effectiveness of the DML framework objectively, but to explore the students' subjective experiences and interpretations of how the DML strategies influence their digital abilities. Pragmatism accommodates both singular and multiple realities, recognising the importance of theoretical underpinnings while also valuing the diverse perspectives and lived experiences of participants.

The epistemological stance of this study is underpinned by the belief that knowledge is context-dependent, provisional, and constructed through the integration of multiple perspectives derived from qualitative and quantitative findings (Saliya, 2023). This perspective aligns with the mixed methods approach employed in the study which seeks to provide a comprehensive understanding of the complexities surrounding digital abilities in higher education.

The axiological stance of the study is rooted in the principle of equity which reflects a commitment to fairness and inclusivity in educational research. This emphasis on equity aligns with prior research underscoring the importance of supporting marginalised groups in research settings (Ratnam, 2023). By focusing on the digital disparities faced by first-year students from underprivileged backgrounds, the study aims to contribute to addressing systemic inequalities and promoting equitable access to digital competencies.

3.3 Research Approach

This study combines deductive and inductive reasoning within a pragmatist paradigm to explore students' perceptions of the deep and meaningful learning (DML) framework in developing their digital abilities. The deductive approach tests the application of DML principles through quantitative survey data by assessing their effectiveness in an online learning context. It used the

DML framework to organise data around its six dimensions. Simultaneously, the inductive approach utilises qualitative interviews to explore students' lived experiences which allows for emergent themes beyond predefined assumptions.

3.4 Research Design

This research project adopted an explanatory sequential design. This approach involves two distinct phases: a quantitative phase followed by a qualitative phase. The quantitative study is conducted first while the qualitative study follows to explain the quantitative results (Ivankova et al., 2006). The context of this study was a two-week fully online digital abilities course designed for first-year Health Sciences students at a South African university. The course was constructed based on the DML framework, integrating its six dimensions: self-directed learning, collaborative learning, real-world learning, reflection, authentic assessments, and constructive feedback.

The integration of quantitative and qualitative findings occurred at multiple stages. During analysis, qualitative themes were used to provide explanations for the quantitative data patterns, revealing consistencies and discrepancies and ensuring alignment with observed trends. This iterative integration ensured a comprehensive understanding of the research problem.

3.5 Methodological Choice

Data for the study was collected through a mixed-method approach which encompassed both quantitative and qualitative methods. A quantitative approach seeks to explain phenomena through the collection of numerical data analysed using mathematical methods, particularly statistics. This approach is controlled, objective, and product-oriented, aiming to quantify variations in specific

situations or phenomena (Kandel, 2020). A qualitative approach, on the other hand, focuses on understanding the meanings people attach to their actions, decisions, beliefs, and values within their social worlds. It involves subjective data collection methods such as in-depth interviews and focus group discussions which allows for exploratory and open-ended inquiry (Kandel, 2020).

Mixed methods research is particularly effective in social sciences where the complexity of human behaviour and social interactions demands both broad, generalisable data and deep, contextual insights. As noted by Bigler et al. (2019), using mixed methods is almost inevitable when taking a holistic view to address a research problem because reality is typically too complex to be tackled one-dimensionally. This dual strategy is especially suitable for producing practical results for interventions, particularly in educational contexts where both the scope of impact and the depth of individual experiences are essential.

3.6 Time Horizon

This study adopted a cross-sectional time horizon. The online Digital Abilities course under investigation spanned two weeks. Survey data were collected within that window, with two weeks given for students to respond, while the qualitative interviews were conducted thereafter in the same semester. This approach provided a snapshot of how DML-based interventions influenced students' digital abilities during a short, discrete period of study.

3.7 Techniques and Procedures

3.7.1 Participants

The participants in this study were first-year Health Sciences students enrolled in a two-week online Digital Abilities course at a South African university. The course had 1187 students registered, all aged 18 years and above, to whom the survey was distributed. Out of these, 338 students completed the survey, forming the quantitative component of the study's sample.

A commonly accepted guideline for determining an appropriate sample size in quantitative research is based on confidence levels and margins of error. According to Barlett et al. (2001), an adequate sample size depends on factors such as population size, confidence level, and margin of error, with a 95% confidence level and a 5% margin of error being standard in survey research. For a population of approximately 1200, a sample size of around 291 is considered sufficient to ensure statistical reliability. Given that this study had 338 respondents out of 1187 students (28.5%), the sample size is acceptable and provides a reliable representation of the target population while minimising potential sampling bias.

Additionally, 10 students were selected for follow-up interviews, representing the qualitative component. These participants were chosen because they represented a group newly exposed to digital competencies through their initial academic engagement. This involvement provided a rich source of data for evaluating the pedagogical approaches and effectiveness of the course. The focus on students at the start of their university experience aimed to gather unique insights and perspectives on the initial assimilation of digital competencies.

3.7.2 Data Collection

Data for the study was collected through a mixed-method approach which encompassed both quantitative and qualitative methods.

— 3.7.2.1 Quantitative Data Collection

The quantitative data was gathered using an online survey (see Appendix A) distributed to all 1187 first-year Health Sciences students enrolled in the two-week online Digital Abilities course. The survey consisted of 12 questions, each rated on a Likert scale from 1 to 5. This method was selected for its efficiency in reaching a large sample size and its ability to collect standardised data across various dimensions of the deep and meaningful learning (DML) framework.

The survey was designed to measure changes in students' self-perception of their digital abilities and included questions related to each of the six dimensions of the DML framework: self-directed learning, reflection, collaborative learning, real-world learning, authentic assessment, and constructive feedback. The questions aimed to quantify students' perceived impact of each strategy on their digital abilities.

The surveys were administered using Microsoft Forms, chosen for its user-friendly interface, ease of access, real-time data collection and analysis capabilities, and its ability to ensure confidentiality and anonymity (Microsoft, 2023). Upon distribution, students were given two weeks to complete the survey, with reminders sent to maximise response rates.

— 3.7.2.2 Qualitative Data Collection

The qualitative data was collected through semi-structured interviews with a selected sample of students from the survey respondents. The interviews aimed to delve deeper into students' experiences and perceptions of the DML strategies implemented in the course, providing rich, detailed insights that complement the quantitative data.

A systemic review conducted by Hennink and Kaiser (2022) confirmed that in qualitative studies, relatively small sample sizes (9–17) can reach data saturation—the point at which no new findings are observed in the data (Vasileiou et al., 2018). Therefore, the sample size selected for the qualitative component of this study was 10 first-year Health Sciences students.

Interviewees were selected using simple random sampling, a method where each member of the population has an equal chance of being chosen (Bhardwaj, 2019). In this study, simple random sampling without replacement (SRSWOR) was employed to ensure no participant was selected more than once. Microsoft Forms assigned unique numbers to each respondent, which were then entered into the random picker tool from GIGAcalculator.com. This process was repeated until ten participants were chosen. They were subsequently invited via email to participate in the semi-structured interviews.

Interviews, each lasting approximately one hour, were conducted virtually using Microsoft Teams, which provided audio recording and live transcription with the participants' consent. The open-ended interview questions (see Appendix B) targeted each of the six DML dimensions. The flexible, semi-structured format enabled follow-up questions based on participant responses (Diefenbach, 2009). Data saturation was monitored throughout and was deemed achieved when no new insights emerged.

3.7.3 Data Analysis

The six dimensions of deep and meaningful learning (DML) serve as the theoretical and analytical framework underpinning this study. The framework guided the design of the digital abilities course, the formulation of research questions, and the development of data collection instruments. The choice of DML is particularly pertinent given its emphasis on fostering competencies, a central

theme in the development of digital abilities. As students navigate the digital realm, the dimensions of DML empower them to not just acquire skills, but to contextualise and apply them in diverse scenarios. Additionally, the framework was used to provide predefined dimensions, such as self-directed learning and collaborative learning, that were instrumental in evaluating and interpreting findings.

— 3.7.3.1 Quantitative Data Analysis

The quantitative component of the study may provide a general overview of the students' perceptions regarding the effectiveness of each DML dimension in improving their digital abilities. The raw data from the survey was downloaded from the Microsoft Forms interface and imported for analysis into GPT-4o (the current flagship artificial intelligence (AI) model from OpenAI). The data was subjected to descriptive statistical analysis, which is a method recommended and commonly used to describe information in quantitative research (Creswell & Plano Clark, 2018).

The decision to use GPT-4o to analyse the quantitative data is supported by the results from a comparative analysis by Huang et al. (2024) who found it to be an extremely efficient tool for statistical analysis. The results showed that GPT-4 "demonstrated high result consistency, greater analytical efficiency of code or operations, and more intuitive user-friendliness compared to [traditional statistical software like] SAS, SPSS, and R" particularly when performing descriptive statistics (Huang et al., 2024, p. 5).

According to Mishra et al. (2019), there are three major types of descriptive statistics which include measures of (1) frequency, (2) measures of central tendency, and (3) measures of dispersion. All three types were used to analyse the quantitative data in this study.

The measure of frequency in descriptive statistical analysis refers to the number of times each specific response or rating occurs within the dataset (Mishra et al., 2019). In the context of this study, frequency analysis involved counting how many respondents selected each rating (from 1 to 5) for each question. This helped in understanding how responses were distributed across the different rating options. The measures of central tendency involved finding the mean (average rating for each question), median (middle value when the ratings are ordered from least to greatest) and mode (most frequently occurring rating for each question). Each of these measures describes a specific distribution of scores on a variable by outlining a central point (Cooksey, 2020). Lastly, the measures of dispersion looks at how spread out the data is (Mishra et al., 2019). This study looked at the standard deviation (a measure of the amount of variation or dispersion in the ratings to the mean value), and the 25^{th} percentile and 75^{th} percentile values to further understand the distribution of responses.

— 3.7.3.2 Qualitative Data Analysis

This study employed both inductive and deductive approaches to analyse the qualitative data derived from the semi-structured interviews. An inductive analysis involves developing themes directly from raw qualitative data without any preconceived ideas (Fereday et al., 2006). Conversely, a deductive analysis applies existing theoretical frameworks to test against the qualitative data (Proudfoot, 2023). Given this study's aim to explore students' perceptions through the lens of the deep and meaningful learning (DML) framework, a combined inductive and deductive approach was used. This hybrid approach ensures that participants' voices are valued while also enabling theory-driven analysis (Bingham & Witkowsky, 2022). This method enhances rigor through mutual reinforcement (Xu & Zammit, 2020).

To apply this mixed approach systematically, the five-phase process of qualitative analysis outlined by Bingham (2023) was adopted (see Figure 3). The phases are: (1) organising the data, (2) sorting data into relevant topical code categories, (3) open coding, (4) identifying patterns and themes, and (5) applying theory to explain findings. This structured approach facilitated a systematic and transparent analysis which supported the study's trustworthiness.

Phase 1: Organising the Data

Qualitative data can be analysed manually or using Computer Assisted Qualitative Data Analysis Software (CAQDAS). The use of CAQDAS enhances the analysis process, providing in-depth analysis capabilities and comprehensive visualisations (Friese et al., 2018; Mattimoe et al., 2021). The chosen CAQDAS tool for this study was ATLAS.ti, available to students at the University of the Witwatersrand.

Each interview transcript was imported into ATLAS.ti and automatically assigned a unique identifier. The transcripts were read and re-read to gain a thorough understanding of the data, ensuring deep immersion in the content and better comprehension of participants' perspectives (Braun & Clarke, 2012). This phase organised the data effectively and provided an opportunity to become familiar with the collected data (Bingham, 2023).

Phase 2: Sorting Data into Relevant Topical Code Categories

This phase involved deductive coding, sorting the data into broad topical code categories aligned with the DML theoretical framework. Coding organises data and assigns labels to ideas representing broader viewpoints (Creswell & Plano Clark, 2018). Deductive code categories were

created *a priori* in ATLAS.ti based on the six DML dimensions: self-directed learning, collaborative learning, real-world learning, reflection, authentic assessments, and constructive feedback. Each transcript was reviewed line by line, identifying relevant phrases or sentences and organising them into the pre-established code categories. This process maintained a clear focus on the research objectives and filtered out irrelevant information which set the stage for inductive analysis (Bingham & Witkowsky, 2022; Proudfoot, 2023).

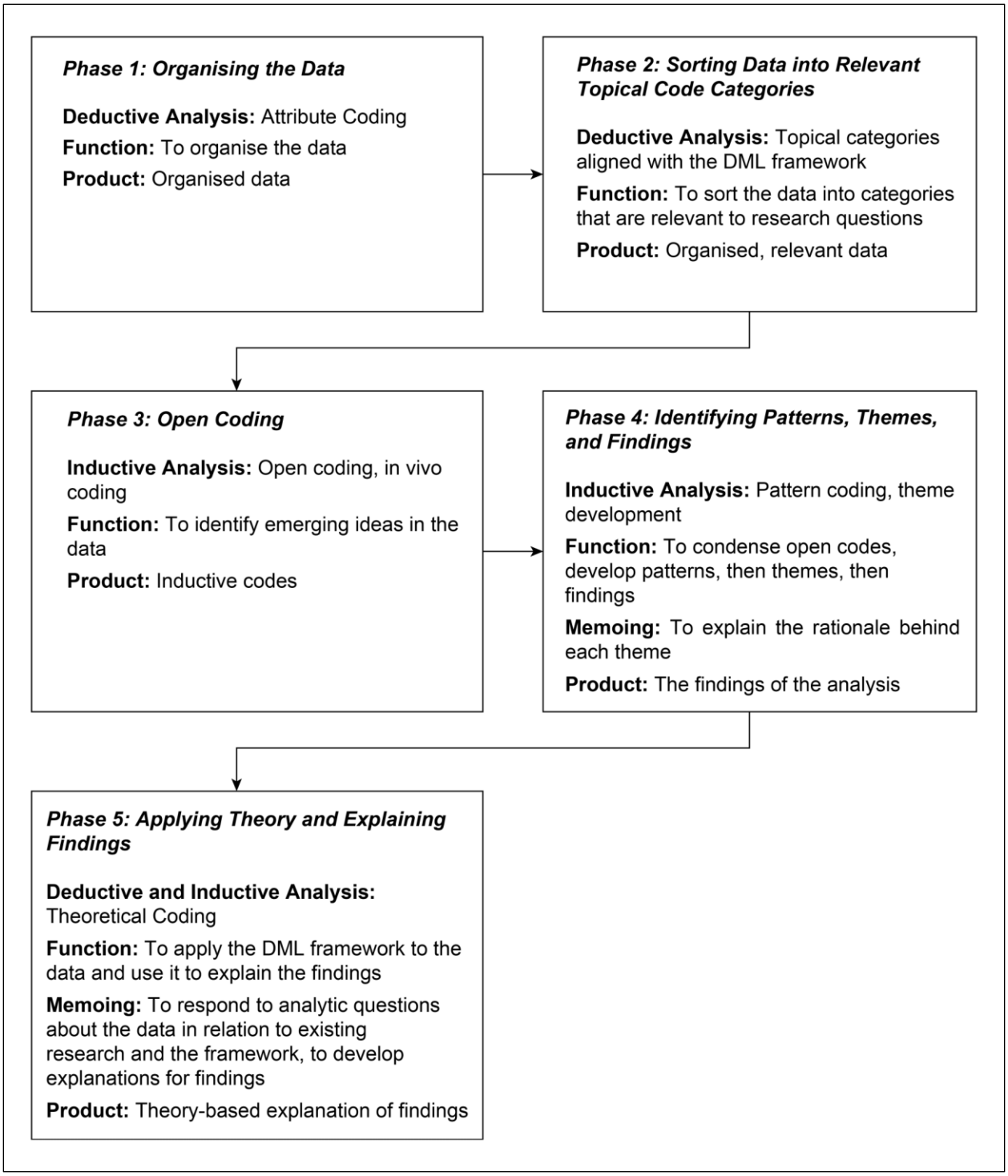


Figure 3: *The five-phase process of qualitative analysis used in this study. Adapted from Bingham and Witkowsky (2022).*

Phase 3: Open Coding

During this inductive coding phase, the data within each topical code category was examined in detail. Inductive analysis allowed themes to emerge naturally from the data, facilitating a data-driven understanding (Naeem et al., 2023). The transcripts were analysed line by line, capturing nuances and complexities in students' experiences and perceptions. Codes emerging from the data were continuously compared and refined, ensuring accurate representation (Bingham, 2023).

Phase 4: Identifying Patterns, Themes, and Findings

The initial codes were analysed for themes and patterns using pattern coding, grouping similar codes to identify overarching themes (Bingham, 2023; Miles et al., 2014). Each theme was defined and named, capturing its essence. Detailed descriptions and definitions of each theme were documented in ATLAS.ti using memos and annotations to explain the rationale behind each theme (Braun & Clarke, 2012). This phase transformed raw data into meaningful insights.

Phase 5: Applying Theory and Explaining Findings

Finally, the DML theoretical framework was applied to interpret the findings. Deductive codes related to the six dimensions of DML were revisited, and the inductively derived themes were examined in relation to these dimensions. Theoretical codes provided a deeper understanding of how the findings fit within the broader DML context (Bingham, 2023). Analytic memoing was applied to document potential explanations for the findings to ensure a robust and transparent analysis (Mihas, 2022).

3.7.4 Validity and Reliability

Validity in research assesses whether the measurement methods accurately capture what they are intended to measure. It examines the extent to which the research truly reflects the phenomena it aims to study, ensuring the trustworthiness of the results (Golafshani, 2003). Reliability, on the other hand, pertains to the consistency, dependability, and replicability of the findings, evaluating whether the same results can be consistently reproduced under identical conditions (Zohrabi, 2013).

In this mixed-methods study, valid knowledge is constructed through the convergence of both quantitative and qualitative data sources to ensure a comprehensive understanding of the phenomena under investigation. By employing a mixed-methods approach, the study leverages data triangulation through the integration of multiple data sources to enhance both validity and reliability (Crowe et al., 2011). Specifically, surveys were utilised to gather quantitative data, while semi-structured interviews provided qualitative insights. This triangulation strategy allowed for a more holistic view of the effectiveness of the deep and meaningful learning (DML) strategies in the online course.

To achieve triangulation, the quantitative data from surveys were cross validated with qualitative findings from the interviews. This approach ensured that the conclusions drawn were not solely dependent on a single method, thereby minimising potential bias or inaccuracies (Bans-Akutey & Tiimub, 2021). The integration of these data sources allowed for a more nuanced understanding of how the DML dimensions impacted students' digital abilities, as the quantitative findings were supported and enriched by the qualitative narratives provided by the students.

For the qualitative component, trustworthiness was established through credibility, transferability, confirmability and dependability (Morse, 2015). Credibility was supported through triangulation of data sources, ensuring that findings were corroborated by multiple perspectives. Transferability was facilitated by providing detailed descriptions of the course context and participants, enabling readers to assess the applicability of the findings to other settings. Confirmability was achieved through reflexivity, with the researcher actively minimising bias by reflecting on their role and maintaining objectivity throughout the study. Dependability was ensured through an audit trail, documenting data collection procedures, analysis processes, theme derivation, and results. This comprehensive record enhances the reliability of the study and supports its potential replication by future researchers (Crowe et al., 2011; Golafshani, 2015).

The researcher's role was clearly articulated, detailing every aspect of the research process, including the rationale, design, and participant selection. This transparency is crucial for understanding the context and potential biases that might influence the research outcomes (Zohrabi, 2013). Ethical considerations and awareness of researcher bias shaped methodological choices, ensuring reflexivity and fairness in participant engagement and data interpretation. The process of triangulation further strengthened the study's validity by allowing for cross-verification of data through different lenses, thereby ensuring the robustness and reliability of the findings.

3.7.5 Limitations

This study has several limitations that warrant consideration. First, the research was conducted within a single institution and involved a specific group of students. As a result, the findings may not be universally applicable to all first-year university students or other educational settings,

potentially affecting the generalisability of the results (Yin, 2014). However, rather than viewing this study as a mere sample, it is more appropriate to consider it as an opportunity to shed empirical light on theoretical concepts related to deep and meaningful learning (DML) within a digital learning environment. Similar to how a laboratory experiment aims to test broader scientific principles, this study strives to generate analytic generalisations that extend beyond the specific context of the study. Therefore, while caution should be exercised when applying these findings to different contexts, the insights gained from this study contribute to a broader understanding of the principles of DML and their application in enhancing digital abilities among students.

Another limitation is the absence of demographic data, such as gender, age, and baseline data to determine the Health Sciences students' digital abilities before taking the course. The lack of this information limits the ability to conduct a more detailed analysis of how these factors might influence students' experiences with the digital abilities course. It is important, however, to explicitly mention and justify this omission to avoid any ambiguity (Buttery et al., 2022). Therefore, although this omission restricts the scope of the analysis, it is not crucial to understanding the research questions and will be considered when discussing the findings.

Finally, the qualitative analysis involved a degree of subjectivity, which could influence the interpretation of the data (Golafshani, 2003). Although efforts were made to ensure rigor, such as through triangulation of data sources, the potential for alternate interpretations remains. This subjectivity is a common aspect of qualitative research and should be considered when interpreting the findings.

These limitations suggest areas for further research, such as the inclusion of baseline measures, demographic data, and objective assessments of digital abilities. While they do pose some

constraints, the findings of this study still offer meaningful contributions to understanding the role of deep and meaningful learning strategies in enhancing students' digital abilities.

3.7.6 Ethics

When designing a research project involving human subjects, it is crucial to consider potential ethical issues and ensure that no harm comes to the participants. Sufficient information must be provided to reviewers, ethical board members, and participants to fully understand the scope of the research project (Dooly et al., 2017). Key ethical issues addressed in this study include ethical clearance and permission, informed consent, voluntary participation, anonymity, and confidentiality.

Ethical clearance for this study was granted by the Wits School of Education Ethics Committee, constituted under the Non-Medical University Human Research Ethics Committee (Protocol Number: 2023ECE40M) (see Appendix C). Following this, a research proposal and the ethics clearance certificate were submitted to the Office of the Deputy Registrar to obtain permission to access university students as research participants. Permission was granted (see Appendix D) on the condition that the research complies with all university regulations and respects participants' rights to withdraw from the study at any time.

Obtaining informed consent is fundamental to ethical research, as it provides participants with a voluntary choice based on sufficient information about the proposed research (Xu et al., 2020). Participation in both the quantitative survey and the qualitative semi-structured interviews was entirely voluntary. Informed consent was obtained electronically for the survey (via a tick-box and submit button) and through signed forms for the interviews. For both components, participants

received an information sheet (Appendix E and F) and a consent form (Appendix G and H) at the beginning, explaining the study's purpose, procedures, potential risks and benefits, and their rights as participants.

Confidentiality is a major safeguard against the invasion of privacy in research. Researchers should differentiate between types of data – those that can be published, those shared among co-researchers, and data that should remain in a personal journal (Goodwin et al., 2020). In this study, the confidentiality of all participants was strictly maintained. Data was stored securely, with access limited to the researcher.

To further protect participant identities, all personal identifiers were removed from the collected data. For the quantitative survey, responses were collected anonymously, with no identifying information linked to the survey data. Each participant in the qualitative interviews was assigned a unique code, which was used instead of their names on all research documents and data sets. This ensured that individual responses could not be traced back to specific participants, maintaining their anonymity (Poper & Mays, 2020).

To reduce potential bias in interview responses, the interview schedule was designed to be neutral by avoiding leading questions. Participants were reminded that there were no right or wrong answers and that their responses would not affect their academic standing. This helped to create a non-judgemental environment that encouraged honest and open participation.

By adhering to these ethical principles and procedures, the research aimed to respect and protect the rights and well-being of all participants, ensuring the integrity and ethical rigor of the study.

3.8 Conclusion

This chapter detailed the research methodology used to explore students' perceptions of deep and meaningful learning (DML) in developing digital abilities. A mixed-methods approach combined quantitative surveys and qualitative interviews for a comprehensive analysis. Aligned with Saunders' research onion (Saunders et al., 2019), the study ensured methodological rigor in research design, data collection, and analysis. Ethical considerations, reliability, and validity were addressed to enhance credibility. The next chapter presents the findings and analysis, and offers insights into the effectiveness of DML in digital abilities development.

Chapter 4: Research Findings

4.1 Introduction

This chapter presents the core findings of the study based on the analysis of the quantitative and qualitative data that was collected. It provides a comprehensive account of students' perspectives on the effectiveness of different DML dimensions in promoting their digital abilities. A background on the course will be presented first, followed by the quantitative findings and finally the qualitative insights derived from semi-structured interviews.

4.2 The Digital Abilities Course

Digital Abilities is a two-week, 20 notional hours course that was developed for first-year students as part of their orientation programme. This course provided students with the opportunity to practice using technology to access, manage, manipulate, and create information. They were shown how to work with computers, including the hardware and software components, gain exposure to various learning technologies most commonly used at the university like Microsoft Office and apps like Microsoft Teams, BigBlueButton, Turnitin, Google Docs, as well as the university's learning management system. Students were introduced to information literacy, shown how to improve their digital wellbeing, and how to stay safe online by learning about cybersecurity.

The course was structured using the deep and meaningful learning framework and focused on providing students with opportunities to practice using these tools in order to become more

competent in using the learning technologies mix at the university. It aimed to help them gain the digital skills necessary to engage in online learning as well as to develop the confidence in using many of the digital tools and to also explore the variety of content and possibilities that are accessible online.

The purpose of the Digital Abilities Course is two-fold:

1. To provide students with the fundamental knowledge and skills relating to the foundational concepts of both digital literacy and digital skills. This includes using technology to access, manage, manipulate, and create information using computers and learning technologies commonly used at the university.

2. To equip students with an understanding of the importance of having these skills in order to have meaningful learning experiences regardless of their degree or career aspirations, and to encourage the development of a positive attitude towards furthering their digital abilities even after completing the course.

4.3 Quantitative Findings

The quantitative findings are derived from the analysis of survey responses from students who participated in the online course. The survey aimed to measure the effectiveness of various DML dimensions in enhancing students' digital abilities. Descriptive statistics were calculated for each DML dimension, which may offer insights into students' perceptions and experiences.

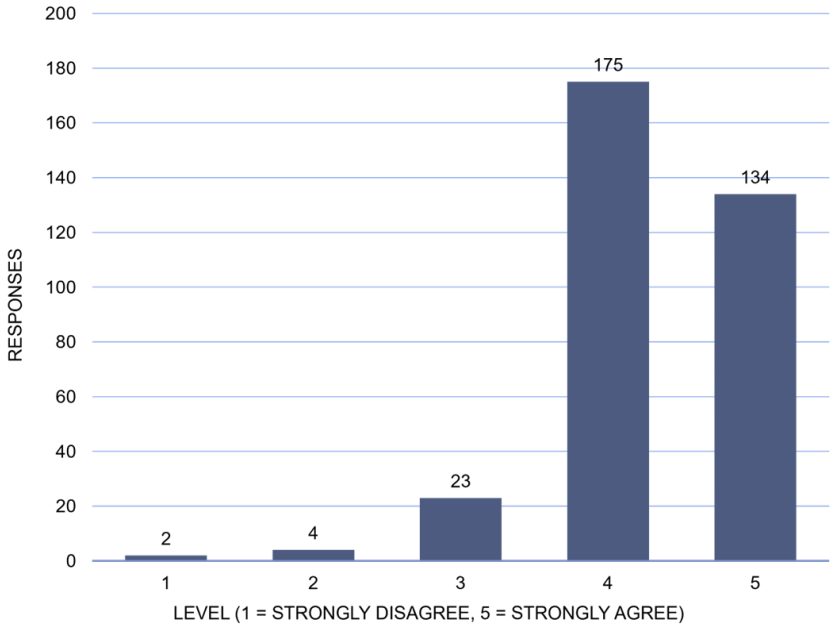
4.3.1 Descriptive Statistics for Each DML Dimension

This section provides a analysis of the survey responses, focusing on each of the six DML dimensions: self-directed learning, collaborative learning, real-world learning, reflection, authentic assessments, and constructive feedback. The descriptive statistics include measures of central tendency (mean, median, mode), measures of dispersion (standard deviation), and frequency distribution.

— 1. Self-directed Learning

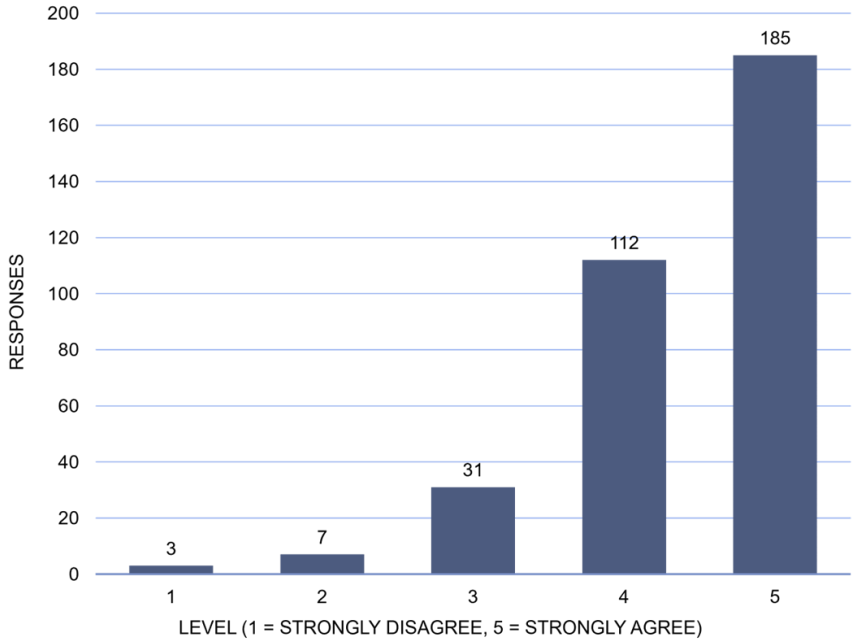
The analysis for the self-directed learning dimension included two survey questions aimed at assessing students' proficiency and capacity to direct their own digital learning. The first question assesses whether the course has encouraged students to independently seek out and apply new digital tools, which is a critical aspect of becoming a self-directed student. The second question may provide insight into whether the course has improved students' overall approach to self-directed learning, including their ability to take control of their digital learning pathways.

Question 1: *As a result of this course, I have become more proficient in independently exploring and learning new digital tools.*



Mean	4.29
Median	4.0
Mode	4
Std Deviation	0.70
25th Percentile	4.0
75th Percentile	5.0

Question 2: *The course has boosted my capacity to direct my own digital learning.*



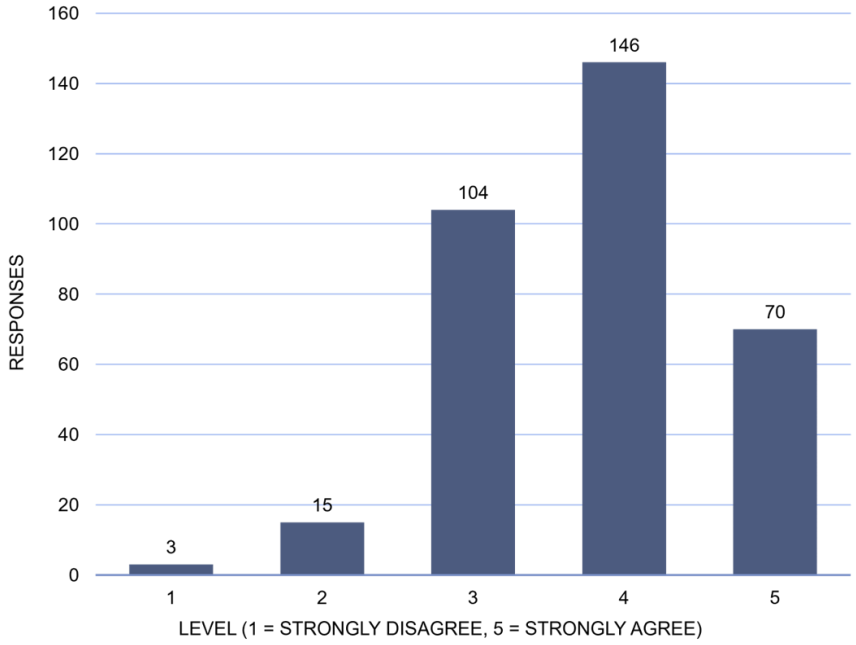
Mean	4.39
Median	5.0
Mode	5
Std Deviation	0.81
25th Percentile	4.0
75th Percentile	5.0

The results suggest a high level of perceived improvement in self-directed learning among students. With mean scores of 4.29 and 4.39 for the two relevant questions, students generally agreed that the course significantly boosted their ability to explore and learn new digital tools independently. The median and mode values being at 4 and 5 respectively, coupled with low standard deviation values, indicate that the majority of the students had similar positive experiences. This suggests that the course may have encouraged autonomous learning and boosted students' confidence in directing their own digital learning efforts.

— **2. Collaborative Learning**

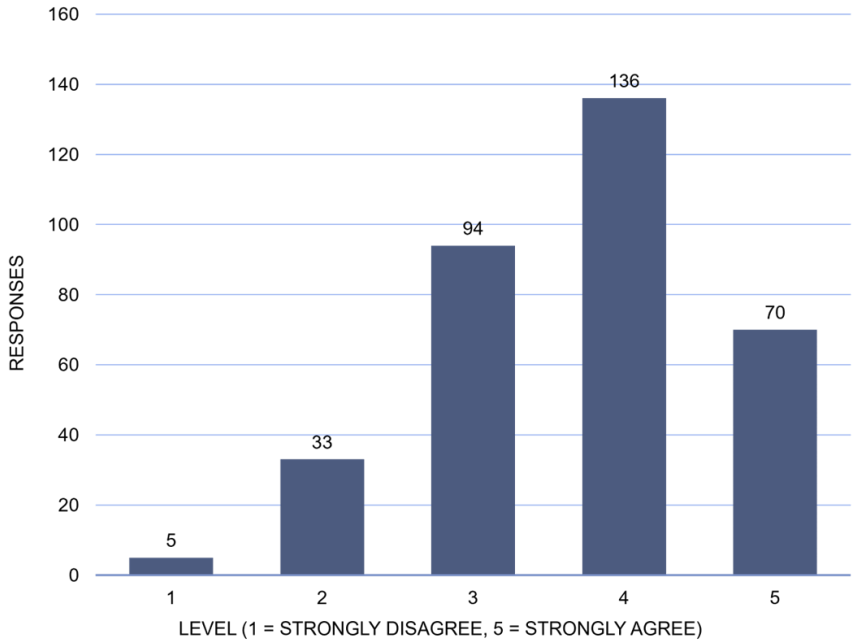
The analysis for the collaborative learning dimension included two survey questions aimed at assessing students' confidence and competence in digital collaboration. The first question provides insights into whether the course has effectively built students' self-assurance in digital communication and teamwork, which is critical for fostering meaningful collaboration in academic and professional digital spaces. The second question sheds light on whether students perceive digital collaboration as a key factor in enhancing their technical skills. It allows for analysis on the course’s success in using collaborative projects not just for teamwork, but also as a mechanism for skill development in digital competencies.

Question 3: *After completing the course, I feel more confident collaborating digitally with others.*



Mean	3.78
Median	4.0
Mode	4
Std Deviation	0.85
25th Percentile	3.0
75th Percentile	4.0

Question 4: *Collaborating on digital projects during this course has notably enhanced my digital competencies.*



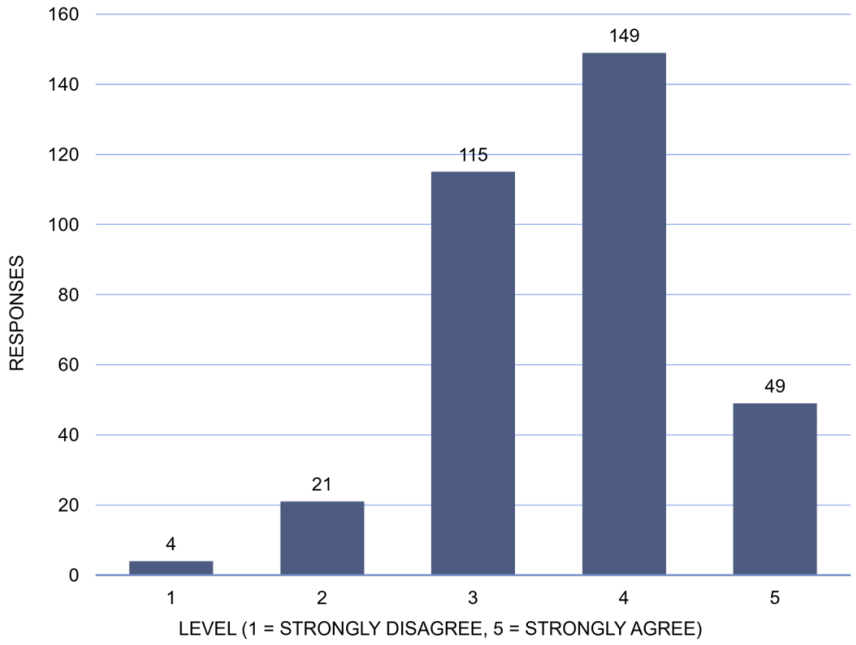
Mean	3.69
Median	4.0
Mode	4
Std Deviation	0.96
25th Percentile	3.0
75th Percentile	4.0

The data suggests a positive but somewhat varied perception of collaborative learning. With mean scores of 3.78 and 3.69, students generally agreed that the course improved their confidence and competence in digital collaboration. The median and mode values at 4 indicate a tendency towards agreement, though the higher standard deviations suggest some variability in the students' experiences. This highlights the potential effectiveness of collaborative activities but also indicates room for improvement to ensure more consistent positive outcomes across all students. The inconsistency in students' experiences with collaborative learning may stem from differences in their baseline digital abilities, engagement levels, and preferences for group work.

— **3. Real-World Learning**

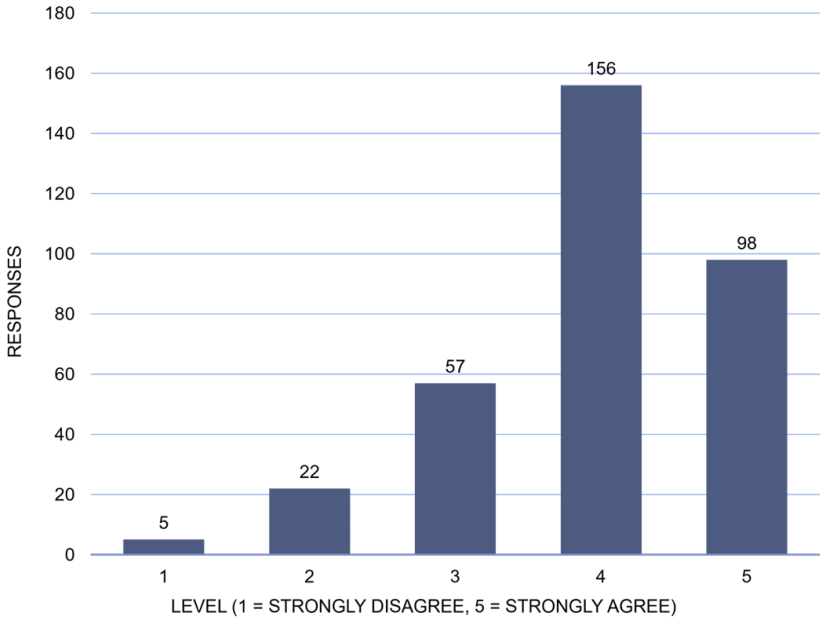
The analysis for the real-world learning dimension included two survey questions aimed at assessing students' ability to apply digital tools in real-world contexts. The first question provides insights into whether students can effectively translate what they learned during the course to practical tasks or challenges they encounter in real-world contexts. It gauges the course's effectiveness in ensuring that students do not just learn digital tools theoretically but are able to use them in practical, problem-solving situations, which is crucial for developing meaningful, adaptable digital skills. The second question helps to assess whether the strategy of integrating real-world tasks was effective in deepening students' understanding and enhancing their practical digital skills.

Question 5: *The course has effectively improved my ability to apply digital tools to real-world contexts.*



Mean	3.64
Median	4.0
Mode	4
Std Deviation	0.85
25th Percentile	3.0
75th Percentile	4.0

Question 6: *Real-world digital tasks incorporated in the course have contributed to my understanding and application of digital tools.*



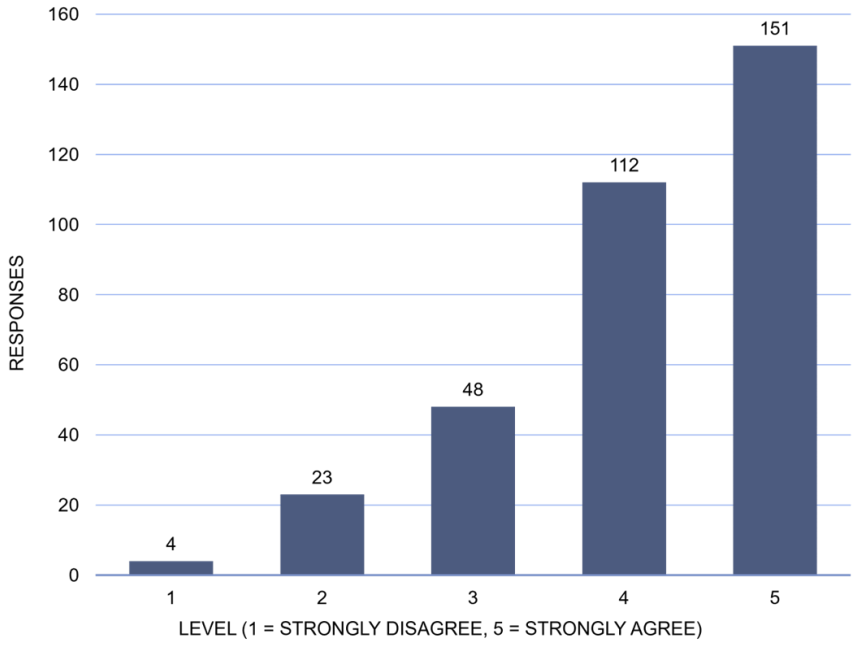
Mean	3.95
Median	4.0
Mode	4
Std Deviation	0.92
25th Percentile	4.0
75th Percentile	5.0

Students perceived a notable improvement in their ability to apply digital tools to real-world contexts. The mean scores of 3.64 and 3.95 reflect general agreement on the effectiveness of real-world tasks in enhancing digital competencies. The median and mode values at 4, and a relatively low standard deviation, indicate that most students had similar experiences, appreciating the practical application of digital tools in real-world scenarios. These findings align with the course design, which incorporated practical, real-world digital tasks such as utilising professional software tools like Microsoft Office 365, email and web browsers. However, the slightly higher standard deviation for question 6 suggests some differences in individual experiences which could be attributed to varying levels of prior exposure to digital tools among students or differences in their academic backgrounds and access to resources.

— 4. Reflection

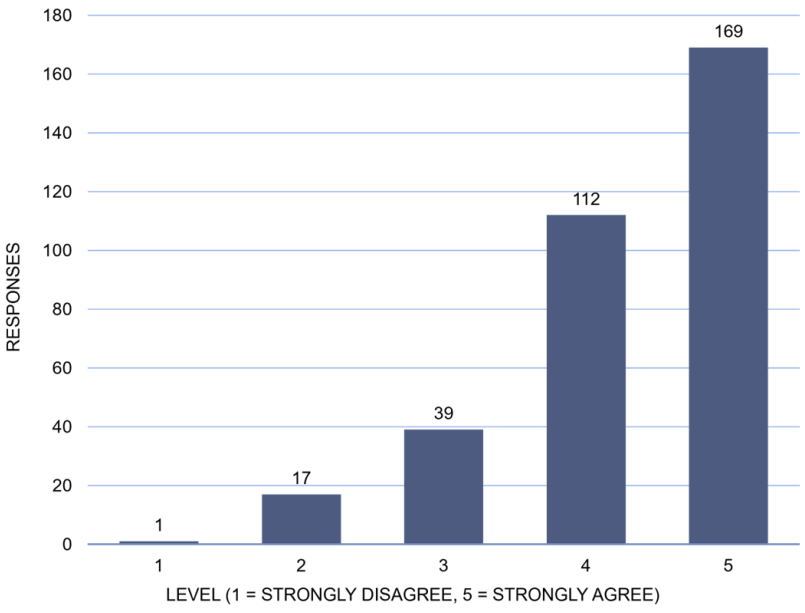
The analysis for the reflection dimension included two survey questions aimed at assessing the impact of reflection activities on digital skills improvement. The first question gauges how effectively the course encouraged students to think critically about their learning experiences and whether this introspection resulted in noticeable improvement in their digital abilities. The second question measures the long-term impact of the course in empowering students to independently assess their learning experiences and make informed decisions about areas that need further development. It highlights whether the reflective practices used in the course allowed students to feel more autonomous in managing their digital learning process.

Question 7: *Reflecting on my digital learning experiences during the course has played a key role in improving my digital skills.*



Mean	4.13
Median	4.0
Mode	5
Std Deviation	0.98
25th Percentile	4.0
75th Percentile	5.0

Question 8: *After completing the course, I am more confident in evaluating my digital learning experiences and identifying areas for improvement.*



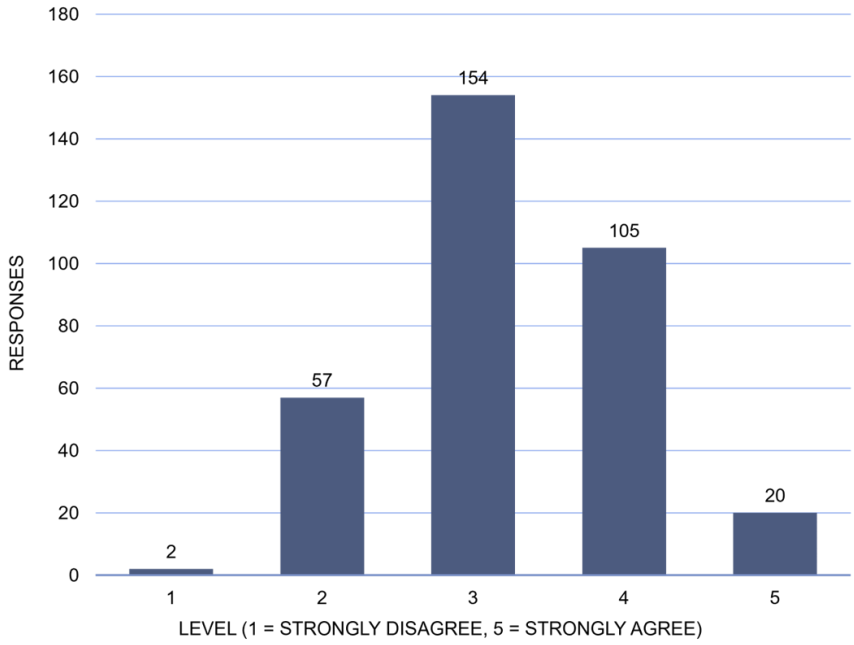
Mean	4.28
Median	4.5
Mode	5
Std Deviation	0.88
25th Percentile	4.0
75th Percentile	5.0

Reflection activities were perceived as highly valuable by students, as indicated by the high mean scores of 4.13 and 4.28. The median and mode values suggest strong agreement that reflection significantly contributed to improving digital skills. The low standard deviation values further indicate that most students shared this positive perception. This could potentially be attributed to the structured nature of the reflection tasks and their alignment with course learning outcomes, which were presented to students as a checklist at the end of each topic to help them critically evaluate and enhance their digital competencies. These results highlight the effectiveness of reflection in fostering deeper learning and skill development.

— 5. Authentic Assessments

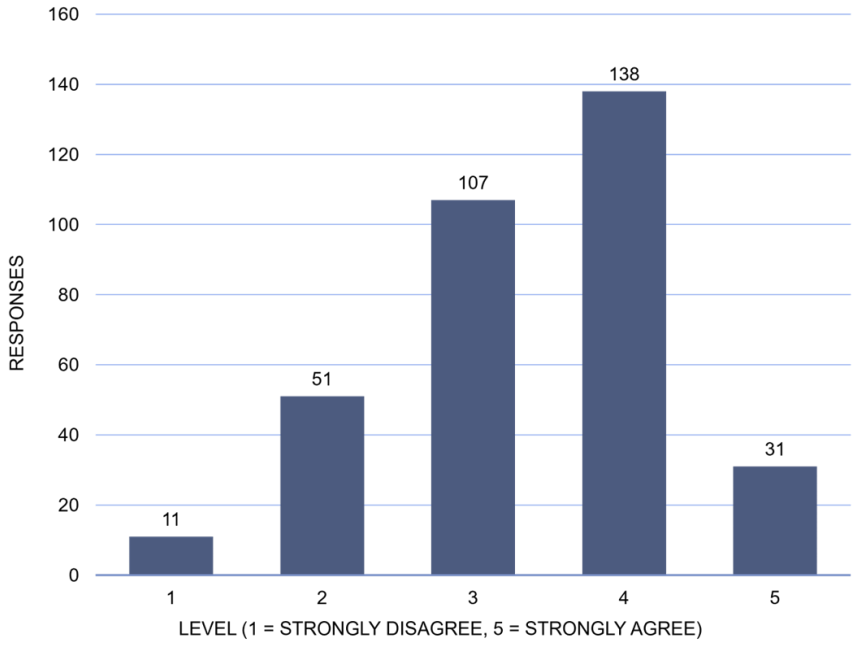
The analysis for the authentic assessments dimension included two survey questions aimed at evaluating the impact of assessments on understanding and applying digital tools. The first question gauges the effectiveness of the course assessments in enhancing students' ability to apply what they learned to real-world situations and evaluates whether the assessments provided opportunities for them to use digital tools in practical, hands-on contexts such as those they may encounter in academic or professional settings. The second question evaluates whether the assessments provided students with opportunities to practice and improve their digital competencies and allows for analysing the extent to which the assessments contributed to enhancing students' proficiency with the digital tools introduced during the course.

Question 9: *The assessments in the course have deepened my understanding of how digital tools can be used in real-world scenarios.*



Mean	3.25
Median	3.0
Mode	3
Std Deviation	0.82
25th Percentile	3.0
75th Percentile	4.0

Question 10: *The assessments in the course have enhanced my digital skills.*



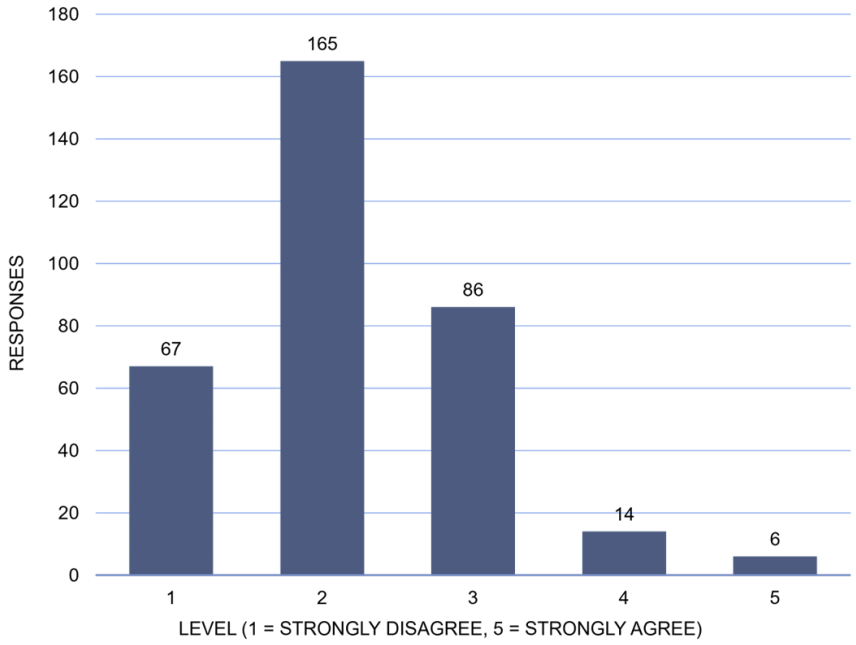
Mean	3.38
Median	3.5
Mode	4
Std Deviation	0.96
25th Percentile	3.0
75th Percentile	4.0

The results for authentic assessments show moderate effectiveness, with mean scores of 3.25 and 3.38. These findings indicate that while assessments were seen as beneficial in enhancing understanding and application of digital tools, there were mixed experiences among students. The median and mode values around the middle range suggest varying levels of agreement, and the higher standard deviations point to a wider spread in responses. This variability may be connected to differences in students' familiarity with real-world tasks, as noted in the findings on applying digital tools to real-world contexts where students generally appreciated the practical application but also exhibited some variation in experiences. Factors such as students' prior exposure to real-world digital tasks, the relevance of the tasks to their academic or personal goals, and the support provided during the assessments may have contributed to these mixed perceptions.

— **6. Constructive Feedback**

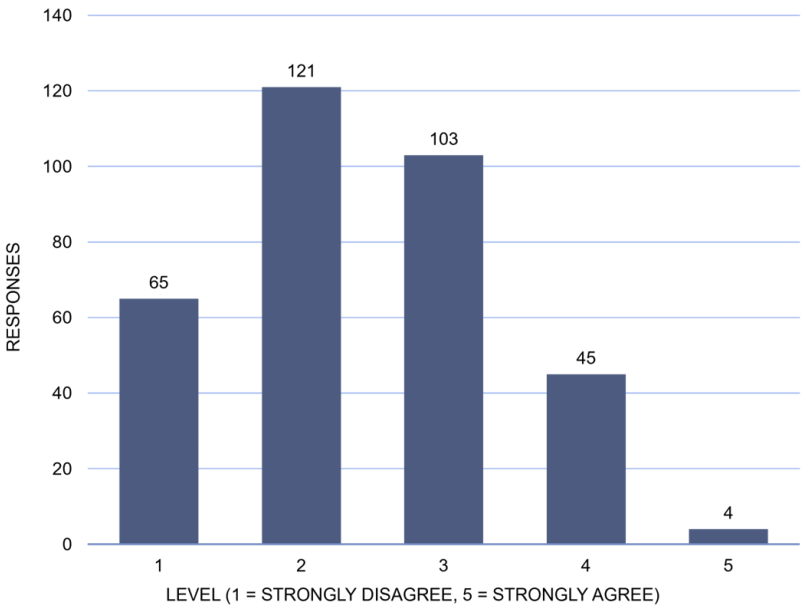
The analysis for the constructive feedback dimension included two survey questions aimed at assessing the impact of feedback on digital abilities improvement. The first question gauges whether the feedback helped students identify areas for improvement in their digital abilities and correct any weaknesses. It also explores whether the feedback was actionable and allowed students to use it to make improvements in their digital competency. The second question assesses whether the course has improved students' ability to reflect on and apply feedback to elevate the quality of their work. This evaluation is essential in determining whether feedback was not only given but understood and utilised effectively.

Question 11: *The feedback I received on my work during the course has helped in improving my digital abilities.*



Mean	2.19
Median	2.0
Mode	2
Std Deviation	0.8h6
25th Percentile	2.0
75th Percentile	3.0

Question 12: *As a result of this course, I have become more adept at utilising feedback to enhance the quality of my work.*



Mean	2.41
Median	2.0
Mode	2
Std Deviation	0.98
25th Percentile	2.0
75th Percentile	3.0

Constructive feedback was perceived as the least effective dimension, with low mean scores of 2.19 and 2.41. These low scores suggest that students may not have found the feedback provided during the course particularly helpful in improving their digital abilities. The higher standard deviations indicate significant variability in responses, reflecting diverse experiences and perceptions of the feedback process.

4.4 Qualitative Findings

The qualitative findings from this study may provide a comprehensive understanding of students' perceptions of the deep and meaningful learning (DML) strategies implemented in the online course. The analysis was conducted using a combination of inductive and deductive approaches, which allowed for the development of themes directly from the raw data while also aligning them with the theoretical framework of DML.

The semi-structured interviews enabled a detailed exploration of each DML dimension, encouraging students to share their perceptions and experiences. The flexibility of this format allowed for probing questions and tailored follow-ups, fostering a comprehensive understanding of the course's impact on their digital abilities. This methodological rigor ensures that the findings presented here are firmly grounded in participants' authentic voices and experiences.

The five-phase process outlined by Bingham (2023) guided the systematic analysis of the qualitative data, ensuring a structured and transparent approach. This section presents the findings of the analysis, highlighting the key themes that emerged within each DML dimension and illustrating these themes with representative quotes from the semi-structured interviews. By

integrating both the inductive and deductive analyses, this study provides a nuanced understanding of how DML strategies impact students' digital abilities and overall learning experiences.

4.4.1 Phase 1: Organising the Data

This phase involved organising the data using attribute coding to manage the data efficiently. Each interview transcript was imported into ATLAS.ti, assigned a unique identifier, and thoroughly read to gain a comprehensive understanding of the content.

4.4.2 Phase 2: Sorting Data into Relevant Topical Code Categories

In this phase, a deductive analysis was conducted by sorting the data into broad topical code categories aligned with the DML theoretical framework. The six pre-established code categories are: ***self-directed learning***, ***collaborative learning***, ***real-world learning***, ***reflection***, ***authentic assessments***, and ***constructive feedback***.

4.4.3 Phase 3: Open Coding

During this phase, an inductive analysis was conducted to identify emerging ideas in the data. Each topical category was examined in detail, allowing codes to emerge naturally. A total of 28 codes were identified across the six pre-established deductive code categories.

Deductive Code Category	Inductive Codes
Self-Directed Learning	• Independence in learning • Flexibility • Exploration and autonomy • Resource availability • Personalised learning
Collaborative Learning	• Peer interaction • Media sharing • Community building • Learning from others • Discussions
Real-World Learning	• Practical application • Academic and personal use • Relevant tasks • Preparation for future tasks
Reflection	• Identifying improvement areas • Enhanced awareness • Tracking progress • Continuous improvement • Checklist
Authentic Assessments	• Real-world relevance • Incremental complexity • Feedback for improvement • Skill demonstration • New skills
Constructive Feedback	• Guided improvement • Specificity and timeliness • Desire for more depth • Encouraged reflection

Table 1: *Deductive Code Categories and Inductive Codes.*

4.4.4 Phase 4: Identifying Patterns, Themes, and Findings

This phase involved pattern coding to condense open codes into themes. Three themes were identified within each of the six topical code categories. The identified themes were clearly defined and named which helped to capture their essence. The table below presents the inductive codes

and their corresponding frequencies, organised under the six deductive code categories aligned with the deep and meaningful learning (DML) framework.

Deductive Code Category	Inductive Codes (Frequency of Participants)	Themes
Self-Directed Learning	• Independence in learning (10) • Flexibility (7) • Exploration and autonomy (5) • Resource availability (4) • Personalised learning (6)	1. Autonomy and Flexibility 2. Resource Utilisation and Exploration 3. Challenges and Support
Collaborative Learning	• Peer interaction (6) • Media sharing (4) • Community building (5) • Learning from others (5) • Discussions (7)	1. Enhanced Digital Communication Skills 2. Peer Learning and Community Building 3. Practical Application of Collaboration Tools
Real-World Learning	• Practical application (7) • Academic and personal use (6) • Relevant tasks (5) • Preparation for future tasks (6)	1. Practical Relevance of Digital Skills 2. Academic and Personal Integration 3. Preparation for Future Tasks
Reflection	• Identifying improvement areas (7) • Enhanced awareness (6) • Tracking progress (7) • Continuous improvement (6) • Checklist (8)	1. Self-Awareness and Skill Improvement 2. Guided Progress Tracking 3. Continuous Learning and Re-evaluation
Authentic Assessments	• Real-world relevance (7) • Incremental complexity (5) • Feedback for improvement (4) • Skill demonstration (5) • New skills (6)	1. Real-World Task Relevance 2. Incremental Skill Development 3. Practical Skill Demonstration
Constructive Feedback	• Guided improvement (4) • Specificity and timeliness (3) • Desire for more depth (5) • Encouraged reflection (4)	1. Feedback for Guided Improvement 2. Specificity and Timeliness 3. Desire for More Detailed Feedback

Table 2: *inductive codes and their corresponding frequencies, organised under the six deductive code categories along with the themes.*

The themes in this study were derived systematically by analysing the initial inductive codes under each deductive category. Using pattern coding, similar codes were grouped together to identify overarching themes, as described in Phase 4 of the data analysis process. For instance, within **self-directed learning**, codes such as "independence in learning" and "flexibility" were combined to form the theme ***autonomy and flexibility*** which reflects students' ability to adapt and take control of their learning processes. Similarly, in **constructive feedback**, codes like "guided improvement" and "encouraged reflection" contributed to the theme ***feedback for guided improvement*** which highlight the role of feedback in promoting skill development. Each theme was documented with supporting evidence in ATLAS.ti using memos and annotations and this helped to ensure that they accurately represent the essence of students' experiences and perceptions. Additionally, this method ensured that the themes were grounded in the data and also aligned with the theoretical framework which resulted in meaningful insights into the students' perspectives on the DML strategies.

To preserve participant anonymity, pseudonyms have been assigned to each interviewee (Participant 1-10). While detailed demographic data such as gender, prior digital experience, or specific course enrolments were not collected, the participants' shared context as first-year health sciences students engaging with the Digital Abilities course provides a meaningful lens through which their responses can be interpreted. The analysis of their responses follows a systematic approach which categorised their perspectives into the six DML dimensions: self-directed learning, collaborative learning, real-world learning, reflection, authentic assessments, and constructive feedback.

The presentation of findings below is organised by these dimensions. For each theme, direct quotes are used to illustrate students' experiences and perceptions in order to provide insights into both the strengths and challenges of the course as reported by participants. These quotes have been contextualised within the framework of the study to ensure clarity and relevance.

— 1. Self-Directed Learning

Theme 1.1: Autonomy and Flexibility

Participants valued the ability to control their learning pace and schedule, enhancing their engagement and mastery of digital skills.

> *"I enjoyed the self-directed nature of the course as it allowed me to work at my own pace. I could spend more time on sections I couldn't fully grasp and quickly move through the parts I was already familiar with." (Participant 1)*

The ability to choose the time of day to engage with the course material accommodated individual schedules and learning preferences, improving the overall learning experience by allowing students to engage when they felt most productive.

> *"By having been able to complete it in my own time I could really take my time with the work and ensure I knew what I was doing without feeling stressed."(Participant 3)*

This illustrates how self-paced learning can alleviate pressure and provide students with a more effective and personalised approach to mastering digital competencies.

> *"It gave me flexibility on which part of the day I would like to engage with it." (Participant 6)*

Having the freedom to engage with the course material at their most productive times reduced stress and enhanced learning efficiency, making the learning process more effective.

> *"Self-directed learning is good for those that are disciplined since it allows them less pressure to get through content and more time to discover and pick up new information." (Participant 4)*

Students who are disciplined benefit more from self-directed learning, as it enables them to explore beyond the basic requirements and develop deeper digital competencies.

Theme 1.2: Resource Utilisation and Exploration

The availability of resources and the freedom to explore different tools and platforms independently contributed significantly to learning.

> *"The course provided us with additional resources at the end and also gave us a checklist that we could use to make sure we learnt everything we needed to." (Participant 1)*

The exploratory aspect of self-directed learning allowed students to independently discover and utilise various tools and resources, fostering a deeper understanding and proficiency in digital skills.

> *"Self-directed learning gave me a chance to learn on my own and discover many things this system has to offer through exploration and guides." (Participant 2)*

Support systems such as email and community forums were essential in mitigating the challenges of self-directed learning, providing students with the necessary assistance to navigate digital learning environments effectively.

> *"I felt on my own but knew that help was available through the different support channels like email and Yammer communities where I discussed my issues with other students and saw what they are struggling with." (Participant 2)*

Theme 1.3: Challenges and Support

While self-directed learning presented challenges, such as difficulty in understanding new tools independently, the support systems like additional resources and community forums provided essential assistance.

> *"Well, it was difficult at times to figure things out on my own, but the course provided us with additional resources at the end and also gave us a checklist that we could use to see if we learnt everything we needed to." (Participant 1)*

Knowing that support was available through various channels helped students navigate the challenges of self-directed learning and provided a sense of community and shared learning. Initial guidance, such as introductory videos, played a crucial role in helping students understand the course structure and requirements, setting the stage for effective self-directed learning.

> *"There were many bits of information and links and videos to provide support." (Participant 10)*

Introductory videos played a crucial role in helping students understand course expectations and set a foundation for independent learning.

— **2. Collaborative Learning**

Theme 2.1: Enhanced Digital Communication Skills

Collaborative activities, such as discussion forums and group projects, improved participants' ability to communicate digitally, including sharing media and engaging in online discussions.

> *"I experienced collaborating with other students via the discussions platform where I could post my thoughts and ideas and also add on to other students' posts in these discussions." (Participant 1)*

Mandatory participation in structured collaborative tasks fostered engagement and improved digital communication skills, ensuring active involvement in the learning process.

> *"We collaborated in the discussions sections where we needed to provide input. In some instances, we had to post something in order to access everyone else's answers which really forced me to participate." (Participant 5)*

Mandatory participation in discussion forums ensured that students actively engaged with their peers, fostering collaboration and critical thinking.

Theme 2.2: Peer Learning and Community Building

Learning from peers and building a sense of community were key benefits, fostering a supportive environment where students could share knowledge and perspectives.

"Collaboration is good for community building because I didn't get to meet most of my classmates in person." (Participant 9)

The sense of community helped create a collaborative learning environment that was conducive to mutual support and learning.

"Seeing different perspectives and sharing knowledge is great and helped me to feel more involved in the course." (Participant 5)

Interactions with peers through collaborative platforms introduced students to various digital tools and techniques, significantly enhancing their digital abilities.

Theme 2.3: Practical Application of Collaboration Tools

The use of collaborative tools like Yammer and discussion platforms in real academic settings helped students apply their digital skills practically.

"I found the discussions tab to be quite helpful in engaging with fellow students digitally and also allowing me to see things from other perspectives." (Participant 1)

The use of collaborative tools for academic tasks enhanced students' digital skills, particularly in finding credible information and engaging in informed discussions.

"Collaborating with others on the discussions and Yammer platforms. Both platforms allowed me to put forward my thoughts and answers to questions posed." (Participant 3)

Findings show that digital tools play a crucial role in supporting a collaborative learning environment.

"It allowed me to convey information more effectively to my classmates' using pictures or text." (Participant 10)

As illustrated by the participants, these tools allowed them to communicate and share resources.

— **3. Real-World Learning**

Theme 3.1: Practical Relevance of Digital Skills

The practical relevance of digital skills taught in the course motivated students to engage deeply with the content, as they could immediately apply these skills in both academic and personal contexts.

"The section on using Google effectively to find what you are looking for has come in handy many times as I'm now confidently able to create a concise search for information that I need in school and general life settings." (Participant 1)

The focus on practical applications of digital skills, such as using Microsoft tools for academic tasks, demonstrated the usefulness of the course content in real-world scenarios, enhancing students' digital competencies.

"I would say that the Microsoft module was one I could really see a lot of real-world applications. I have had to use it for various assignments and even though I have used it prior to this course, I learnt a few tips and tricks to make doing certain tasks easier." (Participant 2)

Theme 3.2: Academic and Personal Integration

Participants were able to integrate digital skills into both their academic work and personal lives, enhancing their overall digital competence.

> *"I think that using the internet effectively not only for academic research but also in my personal life researching things I might want to learn more about." (Participant 1)*

Connecting course content to real-world tasks motivated students to improve their digital skills, as they could see the practical applications and benefits of their learning.

> *"By showing us and making us think about how our skills could be transferred to real tasks we would need to complete in university made me work more on enhancing my digital skills." (Participant 8)*

Theme 3.3: Preparation for Future Tasks

The practical nature of the tasks prepared students for future academic and professional tasks, making them feel more confident and capable.

> *"By showing us how these tasks in this course would be required in our actual degree, I would say my skills have definitely improved and I have made sure to work hard in bettering them to make it easy for myself as well." (Participant 3)*

— **4. Reflection**

Theme 4.1: Self-Awareness and Skill Improvement

Reflective activities promoted self-awareness, helping students identify their strengths and areas for improvement in digital skills. Reflective practices also gave students a sense of control over their learning journey.

> *"The reflection questions provided made me think back in each section to see if I have understood what was required from me in the module." (Participant 2)*

Theme 4.2: Guided Progress Tracking

Checklists and reflection prompts provided a structured way for students to track their progress and ensure comprehensive learning.

> *"I used the reflection tabs to think back on what was covered and what I am able to remember and carry out." (Participant 3)*

Theme 4.3: Continuous Learning and Re-evaluation

Reflection encouraged continuous learning and the re-evaluation of skills, leading to sustained improvement and mastery over time.

> *"Reflecting back on work is a good thing to give ourselves an idea of where we are in a certain skill so it made me more aware of what could be a problem later on if I didn't go back and work harder on a skill I wasn't very good at." (Participant 6)*

— **5. Authentic Assessments**

Theme 5.1: Real-World Task Relevance

Assessments that mirrored real-world tasks were particularly effective in engaging students and enhancing their digital skills.

> *"I found the assessments to be quite relevant as they allowed me to see which aspects of these digital tools I would really need to know about for future use." (Participant 2)*

The practical nature of the assessments helped students see the direct relevance of their learning to their academic and professional lives, motivating them to engage more deeply with the material.

Theme 5.2: Incremental Skill Development

The progression from basic to more complex tasks in assessments facilitated incremental skill development, ensuring foundational skills were solid before advancing.

> *"The practical nature of the assessments was beneficial as they allowed me to build on the skills I had in a practical manner." (Participant 2)*

Theme 5.3: Practical Skill Demonstration

Authentic assessments provided opportunities for students to demonstrate and practice their digital skills in meaningful contexts.

> *"These assessments improved my digital abilities as I was now able to search for trustworthy information on the internet which I couldn't do so well before doing this course." (Participant 3)*

— 6. Constructive Feedback

Theme 6.1: Feedback for Guided Improvement

Constructive feedback was crucial for guiding students towards improvement, highlighting areas needing more attention and practice.

> *"I used the graded quiz feedback to see where I needed to work harder." (Participant 1)*

Feedback helped students understand their mistakes and how to improve, supporting the aim of enhancing digital abilities.

> *"The fact that there was some sort of feedback however was helpful in guiding me to improve certain skills as opposed to no feedback or corrections at all." (Participant 3)*

Theme 6.2: Specificity and Timeliness

Timely and specific feedback was more effective, helping students correct mistakes and enhance their digital abilities promptly.

> *"I liked that the feedback was not very delayed and allowed me to see where I went wrong while the activities were still fresh in my mind." (Participant 4)*

Theme 6.3: Desire for More Detailed Feedback

There was a consistent desire for more personalised and detailed feedback, indicating that generic or automated feedback was less effective in promoting deep learning. This relates to the research

objective of identifying students' challenges with the course delivery approach, highlighting the need for more specific and individualised feedback mechanisms.

> *"Maybe more personalised and individual feedback instead of automated feedback. While I did receive feedback, it lacked depth in explaining why a certain response was incorrect or how to improve." (Participant 7)*

Students sought more in-depth feedback to understand their mistakes and improve their skills, aligning with the objective of identifying less effective DML dimensions.

> *"I would have loved to have more specific feedback as in how a certain solution had come about and not just the correct answer." (Participant 1)*

The above response highlights the importance of detailed explanations in feedback, as simply providing correct answers does not help students understand the reasoning behind their mistakes.

> *"One issue I had with the constructive feedback was its vagueness. I think that individual feedback would have helped me to reflect on specific aspects of my digital skills that require improvement." (Participant 6)*

The above quotes illustrate the consistent need for more detailed and personalised feedback, which suggests that while feedback was generally helpful, its lack of depth and specificity was a limitation.

4.4.5 Phase 5: Applying Theory and Explaining Findings

The final phase involves applying the DML theoretical framework to interpret the findings. This step will be discussed comprehensively in the Discussion section, where the themes will be

examined in relation to the DML dimensions. This will provide a deeper understanding of how the findings fit within the broader context of the DML framework.

4.5 Conclusion

The findings from both quantitative and qualitative analyses may provide a comprehensive overview of students' perceptions and experiences with the deep and meaningful learning (DML) strategies implemented in the online Digital Abilities support course.

Quantitative data highlighted varied effectiveness across DML dimensions, with Constructive Feedback emerging as the least effective, indicated by low mean scores (2.19 and 2.41) and high variability. This suggests that students may have found the feedback insufficient for enhancing their digital abilities, pointing to a potential need for improved feedback mechanisms. Qualitative findings offered deeper insights, identifying strengths and challenges in each DML dimension through emerging themes. The balanced inductive and deductive analyses ensured that the findings were data-driven and theoretically sound, providing a richer understanding of the strategies' impacts.

Chapter 5: Discussion

5.1 Introduction

This chapter reflects on the findings presented in Chapter 4 in relation to the overarching research questions and objectives that guided this study. It begins with a summary of the research questions which provides an evaluation of how effectively the findings address students' perceptions of the deep and meaningful learning (DML) framework in enhancing their digital abilities. Thereafter, the chapter is structured around the six DML dimensions – self-directed learning, collaborative learning, real-world learning, reflection, authentic assessments, and constructive feedback – offering a detailed discussion of the key findings for each dimension.

The discussion integrates both quantitative and qualitative data to interpret the perceived effectiveness of these dimensions by highlighting areas of strength and potential improvement. These sections also consider the broader implications of the findings for the field of online education, with a particular focus on strategies to enhance digital competencies in first-year university students. Finally, the chapter explores the theoretical and practical implications of the study and seeks to situate the results within the existing body of research.

5.2 Discussion of Findings by DML Dimension

This section will look at the findings for each DML dimension by integrating the quantitative and qualitative results to provide a comprehensive understanding of their perceived effectiveness in

enhancing students' digital abilities. Each dimension will be discussed in terms of its strengths, challenges, and broader implications for online course design.

5.2.1 Self-Directed Learning

Self-directed learning places the student at the centre of their educational journey while also fostering autonomy, intrinsic motivation, and ownership of learning. Within the DML framework, it is critical for online education where students independently navigate activities and manage their time. This dimension emphasises personal development, problem-solving, and resourcefulness which equip students with the attributes of independence and adaptability which are essential for thriving in a digital learning environment (van As et al., 2024).

Students strongly agreed that the course enhanced their ability to explore and learn digital tools independently, as reflected in the high mean scores (4.29 and 4.39) and consistent responses (low standard deviations). The course effectively provided resources and flexibility which enabled them to engage deeply with the content. This finding aligns with the literature which indicates that the encouragement of self-directedness and resource recommendations by the teacher increases students' autonomy in a digital learning environment (Lai, 2015, 2019). The autonomy promoted by the course allowed students to adapt learning strategies to suit their individual needs which resulted in a boost of confidence and digital competence.

However, some students mentioned that they had trouble at times with the self-directed component of the course, which may indicate a need for more guidance, especially for students with lower digital literacy. This aligns with the need for scaffolding in self-directed learning to support students at different proficiency levels. Scaffolding, according to Li et al. (2023), is the practice of

providing structured guidance within a learning environment to help students acquire specific knowledge and skills that they can demonstrate independently. It has been shown to improve academic performance and the achievement of learning outcomes, especially when used with self-directed learning in responding to the needs of individual students (Guo, 2022).

5.2.2 Collaborative Learning

Collaborative learning within the DML framework focuses on fostering teamwork, communication, and shared knowledge creation. It plays a vital role in online learning by providing students with opportunities to engage with peers and develop essential digital collaboration skills which can be used in their academic, professional, and personal lives (van As et al., 2024).

While students generally found the collaborative activities beneficial, as evidenced by the moderate mean scores (3.78 and 3.69) and median/mode values of 4, the higher standard deviations reveal some variability in experiences. This suggests that students with stronger digital communication skills likely benefited more, while those less confident in digital collaboration faced challenges. While the quantitative results suggest overall positive perceptions, the qualitative insights reveal underlying challenges.

Participants highlighted the value of peer discussions, while some found group work challenging and cited difficulties in communication and task management. The asynchronous nature of the course may have contributed to these mixed experiences. Students who were proactive in engaging with peers benefited more, whereas those less accustomed to digital collaboration faced hurdles. These mixed experiences highlight the need for structured guidance and clearer expectations in group activities. While the literature underscores the value of collaborative learning in building

digital and interpersonal skills (Hervás-Torres, 2020; Zappatore, 2022), it also indicates possible challenges of unequal participation and varying skill levels which can result in a negative impact on the potential benefits of collaborative learning (Kwiatkowska & Wiśniewska-Nogaj, 2022; Luengo-Aravena et al., 2024).

The effectiveness of collaborative activities depends heavily on both the structure and the support provided for these tasks (Liang et al., 2023). Structure ensures that students clearly understand their roles, expectations, and the goals of the collaboration. In this course, the collaborative activities were well-structured, as evidenced by the provision of clear instructions and specific criteria, which helped guide students in completing the tasks. These elements contributed to the relatively positive feedback from students who appreciated the guidance provided.

However, support is equally crucial for collaborative activities, particularly in online learning environments where communication barriers and logistical challenges can arise (Näykki et al., 2021). This course fell short in offering sufficient support mechanisms such as real-time facilitation that could enhance group communication. Several students mentioned difficulties in coordinating with peers due to asynchronous schedules and insufficient access to immediate support when challenges arose. This gap may have hindered some students' ability to fully benefit from the collaborative activities. This highlights the need for more robust support structures, such as scheduled check-ins, instructor-led group discussions, or tutorials on effective digital collaboration tools.

5.2.3 Real-World Learning

Real-world learning integrates practical tasks that simulate real-life applications of digital skills which aim to prepare students for academic, personal, and professional scenarios. This approach ensures that the digital tools and tasks are relevant to students' future needs (van As et al., 2024). Real-world learning also develops students' critical thinking, problem-solving, and adaptability skills and can lead to higher engagement and motivation, as they find the learning process more relevant and interesting (Shashidhara et al., 2024).

Students rated this dimension positively, with mean scores of 3.64 and 3.95 which suggests an agreement that the course helped them apply digital tools in real-world contexts. The slightly high standard deviation for the two quantitative questions (0.85 and 0.92) indicates some variability. Participants frequently mentioned how the course tasks mirrored real-life scenarios, while a few students felt the tasks could have been more challenging or tailored to their specific future careers. The focus on tools like Microsoft Office 365 and the LMS played a significant role in ensuring practical relevance, but the course could expand to include more industry-specific tools for health sciences.

In a course as large as the Digital Abilities, it is expected that there will be students from diverse backgrounds. This can pose significant challenges but also present opportunities to design inclusive learning and teaching practices (W. Wu, 2021). In addressing the diversity of backgrounds, it is crucial to acknowledge the varying levels of prior digital exposure and experience that students bring to the course. Inclusive learning practices should cater to this diversity by offering differentiated instruction, adaptive learning pathways, and scaffolding support to ensure equitable access to digital competencies (Riedl et al., 2024). Moreover, fostering

a collaborative learning environment can encourage peer-to-peer learning by allowing students with varying abilities to support one another.

5.2.4 Reflection

Reflection activities encourage students to evaluate their learning and thereby fostering self-awareness and continuous improvement. In online education, reflection supports metacognition and deeper engagement with course material (Awidi & Klutsey, 2024). Students who engage in repeated reflection activities perform better in exams and develop stronger self-directed abilities leading to an improvement in academic achievement (Clark et al., 2023; van As et al., 2024).

Reflection received high ratings, with mean scores of 4.13 and 4.28, indicating strong agreement that it contributed to digital skill improvement. The low standard deviations (0.67 and 0.58) show consistency in positive perceptions across the student cohort. The strong alignment between quantitative and qualitative findings underscores the effectiveness of reflection activities and the consistency in responses highlights the universal value students placed on this dimension.

The structured reflective prompts and checklists in the course likely contributed to these positive outcomes as they guided students in systematically assessing their progress. This aligns with the literature which suggests that structured online reflective practices help develop metacognitive awareness, which is essential for deep learning and problem-solving. It also improves student engagement and learning outcomes (Mair, 2012).

Additionally, the timing of reflective prompts is crucial and should be strategically placed to align with learning activities and assessments to maximise their impact (Fessl et al., 2016, 2017). In this course, students were provided with reflective prompts after each session to encourage them to

evaluate their learning experiences, identify challenges, and assess their progress. These prompts aimed to deepen students' understanding of their digital abilities by linking their learning to practical applications and broader contexts.

However, one participant's feedback about the repetitiveness of these prompts suggests there is room for refinement. This concern is supported by several studies that highlight the importance of variety and timing in reflective prompts to maintain engagement and effectiveness. Reflective prompts can become repetitive, leading to disengagement. This is a common issue that needs addressing to keep students motivated (Fessl et al., 2015).

5.2.5 Authentic Assessments

Authentic assessments are designed to simulate real-world scenarios which aim to evaluate students' skills and knowledge in a manner that is both meaningful and impactful (van As et al., 2024). These assessments replicate tasks and performance standards typically found in professional environments, thereby enhancing student learning and preparation for future tasks related to their careers (Akbari et al., 2022).

The quantitative findings revealed moderate perceptions of the effectiveness of authentic assessments, with mean scores of 3.25 and 3.38. The higher standard deviations (0.82 and 0.96) suggest variability in how students experienced the assessments. While some students found the tasks beneficial, others may have struggled to connect them to real-world applications or felt unprepared to engage with them effectively. However, qualitative findings did not reveal direct negative feedback regarding the assessments, indicating that while challenges existed, students did

not explicitly express dissatisfaction. This suggests that the structure and content of the assessments may have been appropriate but required more support to maximise their effectiveness.

One of the challenges inherent in authentic assessments is their complexity. Unlike traditional assessments focused on memorisation and knowledge recall, authentic assessments promote deep and meaningful learning by often requiring students to solve real-world problems that demand critical thinking, adaptability, and the ability to apply digital skills in unfamiliar contexts (Ihsan Nurrahman et al., 2024). This aligns with the Digital Abilities course's approach, where students were tasked with using Microsoft Word, Excel, Microsoft Teams, and the university LMS to complete assignments that mirrored professional and academic scenarios.

However, qualitative feedback revealed that some students struggled to connect the assessments to real-world applications or felt unprepared to engage with them effectively. This may be attributed to a lack of prior exposure to similar tasks, insufficient scaffolding during the course, or misalignment between student expectations and the complexity of the assignments (Apps et al., 2020; Rehmat et al., 2020). Additionally, the absence of targeted instructor support during the assessments could have limited students' ability to navigate challenges effectively (Schmidt et al., 2017). These findings highlight the importance of refining assessment design to include clearer instructions, step-by-step guidance, and optional support mechanisms to bridge the gap between task complexity and student readiness.

5.2.6 Constructive Feedback

Constructive feedback provides students with guidance on their performance by highlighting areas for improvement and recognising their achievements. Effective feedback is detailed, actionable,

and timely, while also ensuring that students understand how to enhance their performance (Susilana & Pribadi, 2021; van As et al., 2024). Timeliness is particularly crucial in online learning environments, as prompt feedback can sustain motivation, clarify misconceptions, and reinforce the achievement learning outcomes (Awofeso & Bamidele, 2016). When feedback is delayed or generic, it may fail to address students' specific needs, resulting in frustration and disengagement.

Findings from this study indicate that constructive feedback was rated the lowest among the six DML dimensions with mean scores of 2.19 and 2.41, suggesting significant dissatisfaction with the feedback provided. However, the high standard deviations (0.86 and 0.98) suggest that not all students had negative experiences, and perceptions of feedback varied. Qualitative findings reinforce this variability, as while some students acknowledged receiving feedback, many expressed a desire for more personalised and detailed input.

A key limitation of the feedback provided in the course was its asynchronous and automated nature. Most feedback was automatically generated through quizzes and assessments, which, while efficient, lacked personalisation. Generic feedback often fails to address individual learning gaps or provide meaningful guidance, leading students to perceive it as less useful (Leppanen et al., 2022; Yu et al., 2017). Qualitative findings revealed that students frequently expressed a desire for more detailed and actionable feedback, particularly on how to improve specific digital competencies. This highlights a gap between student expectations and the generic nature of automated feedback, which limited its perceived effectiveness.

This shortfall may be attributed to both limitations in the design of automated feedback systems and insufficient methods of providing detailed, constructive feedback in online settings. Research suggests that personalised feedback, tailored to students' specific needs and progress, is more effective in supporting learning and fostering deeper engagement (Leppanen et al., 2022).

Addressing these gaps requires integrating mechanisms for more personalised feedback, such as instructor comments or peer reviews, alongside automated systems.

5.3 Demographic Influences on DML Engagement

Variability in students' experiences with DML strategies can be attributed to demographic factors such as gender, socioeconomic background, and prior digital experience. Gender differences in digital competence reveal that females often excel in digital communication and collaboration (Rodafinos et al., 2024). This suggests that gender may influence how students perceive and engage with DML strategies.

The socioeconomic background of students significantly impacts their digital competence. Students from disadvantaged settings often face limited access to technology, resulting in lower self-perceived competence and reduced engagement with self-directed and real-world learning strategies (Timsal et al., 2024). Addressing this digital divide requires scaffolding and targeted interventions to support underprivileged students.

Prior digital experiences also shape students' attitudes and engagement. Those with early exposure to digital tools are more likely to excel in DML strategies, while those without foundational experience may face challenges in applying digital competencies effectively (Kim et al., 2018).

Although this study did not explicitly analyse demographics, these factors provide a critical lens for understanding variations in DML engagement.

5.3 Summary of Quantitative and Qualitative Findings: Similarities and Differences

The findings from both the quantitative survey data and qualitative interview responses offer complementary insights into the effectiveness of the Digital Abilities course in fostering deep and meaningful learning (DML). While both datasets highlight strengths and areas for improvement, they also reveal some inconsistencies in students' experiences.

Self-directed learning was rated the highest in both quantitative and qualitative findings. Survey results showed strong agreement (mean scores of 4.29 and 4.39) that the course enhanced students' ability to explore and learn digital tools independently. Interviews confirmed this, with students highlighting flexibility and access to resources. However, qualitative data also revealed that some students, particularly those with lower prior digital literacy, struggled with fully engaging in self-directed learning, suggesting a need for additional guidance.

Collaborative learning received mixed perceptions, with moderate mean scores (3.78 and 3.69) and higher standard deviations, indicating varied experiences. While survey data showed general agreement on its effectiveness, qualitative findings revealed challenges related to asynchronous communication, unequal participation, and lack of immediate instructor support. Some students benefited from peer interactions, whereas others found it difficult to coordinate tasks effectively.

Real-world learning was positively rated, with mean scores of 3.64 and 3.95. Both quantitative and qualitative findings confirmed that students appreciated the practical relevance of tasks. However, interview responses added nuance, as some students felt the tasks could have been more challenging or tailored to their academic and professional needs.

Reflection was one of the most well-received dimensions, with high mean scores (4.13 and 4.28) and consistent responses across students. Survey data suggested strong agreement that reflection improved digital skills, which was confirmed by qualitative feedback. However, interviews revealed that some students found the prompts repetitive, suggesting the need for more variety in reflective activities.

Authentic assessments received moderate ratings (3.25 and 3.38), with quantitative data showing variability in student experiences. While surveys indicated that students found assessments beneficial, qualitative responses revealed that some students struggled to apply digital tools to complex real-world problems, highlighting the need for more structured guidance.

Constructive feedback was rated the lowest, with mean scores of 2.19 and 2.41, indicating significant dissatisfaction. Both survey and interview data pointed to issues with the automated nature of feedback, which students found impersonal and unhelpful. While the quantitative data showed overall dissatisfaction, qualitative insights explained the need for more personalised and meaningful feedback mechanisms.

The diagram below summarises the key findings from this research.

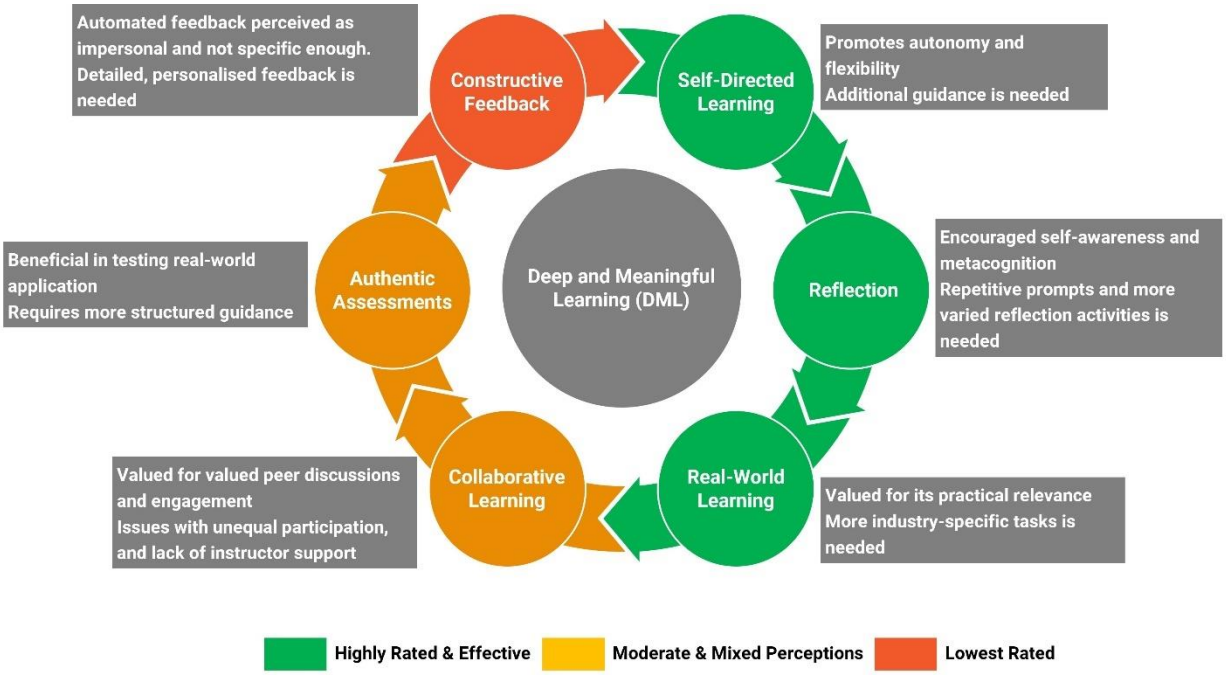


Figure 4: *Enhancements to the DML Framework Based on Findings.*

5.4. Conclusion

The findings suggest that while self-directed learning and reflection were consistently well-received, collaborative learning, real-world learning, and authentic assessments showed mixed perceptions, with some students benefiting while others faced challenges. Constructive feedback emerged as the weakest area, with a clear need for improvement. The qualitative data provided deeper explanations for the variability in quantitative responses, revealing specific challenges that were not immediately evident in the survey results.

Chapter 6: Recommendations and Conclusion

6.1 Introduction

This chapter presents recommendations derived from the study's findings and discusses their implications for improving the design and implementation of the Digital Abilities course. The recommendations are structured around the six deep and meaningful learning (DML) dimensions – self-directed learning, collaborative learning, real-world learning, reflection, authentic assessments, and constructive feedback – which are all informed by both quantitative and qualitative results. These suggestions aim to enhance the effectiveness of the course in developing students' digital abilities. The chapter also concludes the study by summarising the key findings, and proposing directions for future research.

6.2 Recommendations

6.2.1 Enhancing Self-Directed Learning

Self-directed learning was one of the strongest-performing dimensions in this study, with students expressing high confidence in their ability to explore and learn digital tools independently. However, some students struggled with aspects of self-directed learning, particularly those who had lower initial digital literacy levels. To further enhance self-directed learning while accommodating varying levels of digital proficiency, the following strategies are recommended:

Provide structured scaffolding: While autonomy is crucial, some students require initial guidance to develop self-directed learning habits. The course should incorporate tiered support systems,

such as introductory tutorials, guided pathways, and scaffolded learning tasks that gradually reduce instructor support as students gain confidence (Guo, 2022; Li et al., 2023).

Introduce adaptive learning pathways: Digital learning platforms can offer personalised recommendations based on student progress. Implementing AI-driven learning analytics or LMS-based adaptive learning can provide individualised learning materials that align with each student's proficiency level which can help ensure that they receive the appropriate level of challenge and support (Lai, 2015, 2019).

Encourage digital literacy self-assessments: Before engaging with the course content, students should have the opportunity to evaluate their own digital competencies. A pre-course diagnostic assessment can help identify students who may require additional support and direct them to relevant resources before they engage with self-directed tasks (van As et al., 2024).

6.2.2 Strengthening Collaborative Learning

Collaborative learning was moderately well-received, but some students encountered difficulties in coordinating and engaging with peers. To strengthen the effectiveness of collaborative learning, the following strategies are recommended:

Improve structured group work: Providing clear guidelines for online collaboration, such as defined roles and expectations, can help students navigate group activities more effectively (Liang et al., 2023).

Enhance communication support: Integrating live chat options, discussion forums, and scheduled peer feedback sessions can create more meaningful interactions (Näykki et al., 2021).

Encourage peer mentoring: Pairing students with different levels of digital proficiency can facilitate peer learning and build digital collaboration confidence (Hervás-Torres, 2020; Zappatore, 2022).

6.2.3 Expanding Real-World Learning Opportunities

While students appreciated real-world learning tasks, some desired more complexity and industry-specific relevance. To expand on this dimension, the following strategies are recommended:

Integrate industry-specific digital tools: Expanding beyond Microsoft Office 365 to include tools relevant to students' fields of study can enhance relevance (Shashidhara et al., 2024).

Provide scenario-based learning: Embedding case studies and real-world digital challenges can improve problem-solving and application skills (van As et al., 2024).

Develop career-oriented digital projects: Assignments that mirror workplace scenarios can make learning more engaging and meaningful (Wu, 2021).

6.2.4 Embracing Reflection Practices

Reflection received high ratings, but some students found the prompts repetitive. To improve reflective activities, the following strategies are recommended:

Vary reflection prompts: Introduce different types of reflection, such as self-assessments, peer reviews, and guided questions (Clark et al., 2023).

Tie reflection to digital skill progression: Align reflective tasks with digital milestones to allow students to see tangible improvements (Awidi & Klutsey, 2024).

Use interactive reflection tools: Digital journals, discussion forums, and video reflections can increase engagement (Fessl et al., 2015, 2016, 2017).

6.2.5 Refining Authentic Assessments

Authentic assessments were viewed positively, but some students struggled to connect tasks to real-world applications. To enhance assessments, the following strategies are recommended:

Increase assessment complexity gradually: Designing assessments with progressive difficulty levels can help students develop confidence in applying digital skills (Ihsan Nurrahman et al., 2024).

Offer scaffolding for complex tasks: Providing step-by-step guidance and support can ease students into real-world problem-solving (Leppanen et al., 2022).

Incorporate real-world digital assignments: Practical assignments linked to real professional or academic scenarios can enhance student engagement (Akbari et al., 2022).

6.2.6 Improving Constructive Feedback

Constructive feedback was rated the lowest among the DML dimensions, with students expressing dissatisfaction with its depth and timeliness. To enhance feedback, the following strategies are recommended:

Personalise feedback: Using AI-driven or instructor-led personalised feedback can make it more relevant to individual students (Yu et al., 2017).

Increase feedback frequency: Providing formative feedback throughout the course, rather than solely on assessments, can better support student learning (Awofeso & Bamidele, 2016).

Introduce peer feedback mechanisms: Encouraging peer review and discussion can complement instructor feedback and create a supportive learning environment (Susilana & Pribadi, 2021).

6.3 Conclusion

This study explored first-year students' perceptions of the effectiveness of the DML framework in an asynchronous online course aimed at developing digital abilities. The findings suggest that while students generally viewed the DML dimensions as beneficial, variability in experience was observed, particularly in collaborative learning and constructive feedback. High engagement was noted in self-directed learning and reflection, whereas authentic assessments and real-world learning demonstrated mixed experiences, highlighting the need for more structured support.

The findings underscore the value of the DML framework in shaping digital competencies. By refining instructional strategies based on student feedback, online courses can become more effective in equipping students with essential digital skills and in preparing them for academic and professional success in an increasingly digital world.

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Appendix A

Deep and Meaningful Learning (DML) Course Evaluation Survey

Dear Participant,

We are conducting a study to understand the effectiveness of the deep and meaningful learning (DML) strategies in the online digital abilities course. Your feedback is essential in helping us improve our strategies and course content. Please take a moment to complete this survey.

For each statement below, please indicate your level of agreement on a scale of 1 to 5, where 1 means “Strongly Disagree” and 5 means “Strongly Agree”.

Self-directed Learning:

1. As a result of this course, I have become more proficient in independently exploring and learning new digital tools.

1	2	3	4	5

2. The course has boosted my capacity to direct my own digital learning.

1	2	3	4	5

Collaborative Learning:

3. After completing the course, I feel more confident collaborating digitally with others.

1	2	3	4	5

4. Collaborating on digital projects during this course has notably enhanced my digital competencies.

1	2	3	4	5

Real-World Learning:

5. The course has effectively improved my ability to apply digital tools to real-world contexts.

1	2	3	4	5

6. Real-world digital tasks incorporated in the course have contributed to my understanding and application of digital tools.

1	2	3	4	5

Reflection:

7. Reflecting on my digital learning experiences during the course has played a key role in improving my digital skills.

1	2	3	4	5

8. After completing the course, I am more confident in evaluating my digital learning experiences and identifying areas for improvement.

1	2	3	4	5

Authentic Assessments:

9. The assessments in the course have deepened my understanding of how digital tools can be used in real-world scenarios.

1	2	3	4	5

10. The assessments in the course have enhanced my digital skills.

1	2	3	4	5

Constructive Feedback:

11. The feedback I received on my work during the course has helped in improving my digital abilities.

1	2	3	4	5

12. As a result of this course, I have become more adept at utilising feedback to enhance the quality of my work.

1	2	3	4	5

Appendix B

Semi-Structured Interview Guide

The following interview guide will be used to conduct semi-structured interviews with students to gather qualitative data for the study. This guide will aid in evaluating the effectiveness of the DML framework in enhancing students' digital skills.

The questions align with the six dimensions of DML:

1. Self-Directed Learning

- Can you describe a particular instance during this course when you had to independently learn a new digital skill or tool?
- How did the course's emphasis on self-directed learning influence your approach?
- Can you discuss any improvements in your digital abilities that you attribute to this self-directed learning aspect of the course?

2. Collaborative Learning

- Can you share an experience during this course where you collaborated with other students?
- How did this collaborative learning affect your digital abilities?
- Can you describe any improvements in your digital skills that you associate with this collaboration?

3. Real-World Learning

- Could you share an instance where you applied the digital skills you developed in this course to a real-world problem or task?

- How did the course's focus on real-world applications influence your digital abilities?
- Could you discuss any improvements in your digital skills that you link to this real-world application aspect of the course?

4. Reflection

- Can you talk about how you used reflection in this course to identify areas for improvement in your digital skills?
- How did the course's emphasis on reflective learning affect your digital skills?
- Can you describe any improvements in your digital skills that you associate with this reflective aspect of the course?

5. Authentic Assessments

- Could you describe your experience with the course's authentic assessments related to digital skills?
- How did these assessments contribute to your learning or enhancement of digital abilities?
- Can you identify any improvements in your digital skills that you attribute to these authentic assessments?

6. Constructive Feedback

- Can you provide an example from this course where you used the feedback to enhance your digital abilities?
- How did the course's approach to providing constructive feedback influence your digital skills?
- Can you describe any improvements in your digital abilities that you associate with this feedback process in the course?

Appendix C

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG | WSoE Wits School of Education

SCHOOL OF EDUCATION ETHICS COMMITTEE

CONSTITUTED UNDER THE UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: 2023ECE40M**
PROJECT TITLE	Promoting First-Year Students' Digital Abilities in an Online Course Using Deep and Meaningful Learning Strategies: A Case of a South African University
INVESTIGATOR	**Arshad Moolla**
SCHOOL/DEPARTMENT OF INVESTIGATOR	Wits School of Education
DATE CONSIDERED	10 July 2023
DECISION OF THE COMMITTEE	Approved unconditionally
RISK LEVEL	Low risk
EXPIRY DATE	Date of submission of the Research Report
ISSUE DATE OF CERTIFICATE	**CHAIRPERSON** Mbokane
21 July 2023	Dr. Batseba Mofolo-Mbokane

cc: Dr Nokulunga Ndlovu

DECLARATION OF INVESTIGATOR

To be completed in duplicate and **ONE COPY** returned to the Chairperson of the School/Department ethics committee.

I fully understand the conditions under which I am are authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee.

Moolla
Signature

13 / 08 / 2023
Date

Appendix D

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

OFFICE OF THE DEPUTY REGISTRAR

14 August 2023

Arshad Moolla
Student Number (927263)
Master of Education by Coursework and Research Report
Wits School of Education

TO WHOM IT MAY CONCERN

"Exploring Students' Perspectives on Deep and Meaningful Learning Strategies for Enhancing Digital Abilities: A Case Study of an Online Course."

This letter serves to confirm that the above project has received permission to be conducted on University premises, and/or involving staff and/or students of the University as research participants. In undertaking this research, you agree to abide by all University regulations for conducting research on campus and to respect participants' rights to withdraw from participation at any time.

If you are conducting research on certain student cohorts, year groups or courses within specific Schools and within the teaching term, permission must be sought from Heads of School or individual academics.

Ethical clearance has been obtained. (Protocol number: 2023ECE40M)

Research Expiration: (Research submission date)

Nicoleen Potgieter
University Deputy Registrar

Private Bag 3, WITS, 2050, South Africa | T +27 11 717 1204/8 | E nicoleen.potgieter@wits.ac.za | www.wits.ac.za
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Appendix E

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Participant Information Sheet - Survey

Dear Participant,

My name is Arshad Moolla, a master's student in the School of Education at the University of the Witwatersrand I am conducting a research study titled *Exploring South African First-Year Students' Perspectives on Deep and Meaningful Online Learning Strategies for Enhancing Digital Abilities.*

I kindly invite you to participate in this study, which involves completing an online survey. The survey should take approximately 20 minutes to complete.

Please be assured that your participation will remain confidential and anonymous. In any publications or presentations, I will not include your name or any information that could identify you. With your permission, the anonymous data may be used for future research studies.

Your participation in this study is entirely voluntary. You are free to opt out at any time, and you may choose not to answer any specific questions without any consequences. There will be no direct benefits or costs for participating in this study, and you will not be compensated for your time.

Please note that there are no significant risks associated with participating in this study beyond everyday experiences.

The findings of this research study will be disseminated in a research report which will be made available at the university's library website. If you wish, I would be pleased to provide you with a summary of the report.

If you have any further questions or concerns about this study, you are welcome to contact me or my supervisor at the contact details provided below. Should you have any ethical concerns or complaints, please contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za.

Thank you for considering this invitation. Your insights and experiences are valuable to this study and to enhancing the digital abilities of first year students in higher education.

Yours sincerely,

Researcher (Arshad Moolla) | Arshad.Moolla@wits.ac.za | 011 717 9801

Supervisor (Dr Nokulunga Ndlovu) | Nokulunga.Ndlovu@wits.ac.za | 011 717 3077

Appendix F

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Participant Information Sheet - Interview

Dear Participant,

My name is Arshad Moolla, a master's student in the School of Education at the University of the Witwatersrand I am conducting a research study titled *Exploring South African First-Year Students' Perspectives on Deep and Meaningful Online Learning Strategies for Enhancing Digital Abilities.*

Following the survey participation, you have been selected to participate in a more detailed phase of my research, which involves a one-on-one interview. This interview will take about an hour and will be conducted at a convenient time for you. The interview can be carried out via a secure online platform or in person, based on your preference.

With your consent, I would like to audio record the interview for transcription purposes. This data will be securely stored in a password-protected computer. Only I, as the researcher, will have access to this data.

Please be assured that your participation will remain confidential and anonymous. In any publications or presentations, I will not include your name or any information that could identify you. With your permission, the anonymous data may be used for future research studies.

Your participation in this study is entirely voluntary. You are free to opt out at any time without any consequences. There will be no direct benefits or costs for participating in this study, and you will not be compensated for your time.

Please note that there are no significant risks associated with participating in this study beyond everyday experiences. However, should you feel uncomfortable during the interview, we can pause or reschedule for another time.

If you have any further questions or concerns about this study, you are welcome to contact me or my supervisor at the contact details provided below. Should you have any ethical concerns or complaints, please contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za.

Thank you for considering this invitation. Your insights and experiences are valuable to this study and to enhancing the digital abilities of first year students in higher education.

Yours sincerely,

Researcher (Arshad Moolla) | Arshad.Moolla@wits.ac.za | 011 717 9801

Supervisor (Dr Nokulunga Ndlovu) | Nokulunga.Ndlovu@wits.ac.za | 011 717 3077

Appendix G

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Consent Form – Survey

Title of Project: Exploring South African First-Year Students' Perspectives on Deep and Meaningful Online Learning Strategies for Enhancing Digital Abilities

Name of Researcher: Arshad Moolla

I, ……., agree to participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
I understand that I can volunteer to take part in this survey.	YES	NO
I agree that my participation will remain anonymous (my name will not be used by the researcher in their research report).	YES	NO
I agree that other researchers may use the information I provide in my interview (depending on their own ethics clearance being obtained) but my name and any personal information will not be used or passed on.	YES	NO

…… (signature)

…… (name of participant)

…… (date)

Moolla

…… (signature)

Arshad Moolla

…… (name of researcher)

26/06/2023

…… (date)

Appendix H

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Consent Form – Interview

Title of Project: Exploring South African First-Year Students' Perspectives on Deep and Meaningful Online Learning Strategies for Enhancing Digital Abilities

Name of Researcher: Arshad Moolla

I, ……., agree to participate in this research project.

I agree to the following:

(Please circle the relevant options below)

The research study was explained to me. I understand what this study is about.	YES	NO
I understand that I can volunteer to take part in the interview.	YES	NO
I agree that the interview may be audio recorded.	YES	NO
I agree that direct quotations from my interview activity may be used by the researcher in their research report.	YES	NO
I agree that my participation will remain anonymous (my name will not be used by the researcher in their research report).	YES	NO
I agree that other researchers may use the information I provide in my interview (depending on their own ethics clearance being obtained) but my name and any personal information will not be used or passed on.	YES	NO

…… (signature)

…… (name of participant)

…… (date)

A Moolla

…… (signature)

Arshad Moolla

…… (name of researcher)

26/06/2023

…… (date)