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Exploring postgraduate students' research identities when using digital technology for research

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Abstract
Postgraduate students use digital technology for their research, adopting specific identities related to their digital practices. Research identities are cognitive positions taken by researchers when using digital technology for research. Debate exists in literature regarding the classification of these research identities, with concepts like professional, societal, personal, and natural identities being prominent. Given the diverse age groups and digital competency among postgraduate students, their research identities vary widely. In this qualitative case study reported on here, we explored how 4 purposively and conveniently selected master's students identified their research identities using digital technology such as laptops, Google Scholar, YouTube, Grammarly, WhatsApp, Microsoft Office, and EndNote. Data were generated through reflective journals, semi-structured interviews, and focus group discussions, and analysed using thematic interpretation and the unified theory of acceptance and use of technology (UTAUT) framework. The findings reveal that participants mostly recognised their professional, societal, and personal research identities, but failed to recognise their natural identities. We recommend that postgraduate students reflect on their personalisation identities to better understand their individual and research needs.

Keywords: digital technology; identity; postgraduate professional; research; social

Introduction
When participating in an activity, a person shares their unique identity with others to achieve a particular goal (Hashim & Jones, 2007). Research indicates that students employ digital technology for research, exhibiting varied identities influenced by factors such as their backgrounds, digital competencies, and generational experiences (Bosch, 2009; Deng & Tavares, 2013; Khoza & Manik, 2015; Prensky, 2001). In postgraduate education, the student population is diverse in terms of age, gender, and socio-economic background. This diversity extends to their research identities. In this article, research identity refers to how postgraduate students identify themselves using digital technology in research.

From the literature Prensky (2001) derives two concepts to inform the identities of users of digital technology (researcher identities) by mainly referring to generational segregation. Students who have not stayed abreast of the constant digital changes in academia have been carrying the identity of digital immigrant (Kesharwani, 2020). Students constantly need to learn how to use new digital technology as they were born at a time when such were not in prominent use (Berkup, 2014; Prensky, 2001). Other scholars identify students born during the 1960s and 1970s as Generation X or Digital strangers (Bejtkovský, 2016; Kamber, 2017).

Palfrey and Gasser (2011) define digital natives as individuals born after 1982, a time when digital technology was widely used and accessible. Prensky (2001) further explains that digital natives are typically skilled in digital technology and generally enjoy using it. As a result, students born in the digital age and engaging in new ways of learning involving the use of digital technology are often referred to as digital natives or the Net generation and Generation Z (Bennett, Maton & Kervin, 2008; Kesharwani, 2020; Kincl & Štrach, 2021; Prensky, 2001; Tapscott, 1999). Other scholars have developed emerging research identities such as social identity (Deng & Tavares, 2013; Khoza, 2017; Madge, Meek, Wellens & Hooley, 2009), professional identity (Dlamini, Ramatsetse, Zenda, Gorimbo & Mpungose, 2024; Khoza, 2023; Makumane, 2020; Mpungose, J 2010), digital refugee identity (Coombes, 2009; Khoza & Manik, 2015; Khoza & Mpungose, 2022), decolonial identity (Mpungose, CB 2019), and natural identity (Khoza, 2023).

While recent studies (Khoza, 2024; Khumalo, Shoba & Khoza, 2023; Mthembu & Khoza, 2024; Prakash, Stephens, Hoffman, Singh & Fields, 2021) may acknowledge the age factor, they discovered that research identity seems to be influenced by the nature of an individual's unique natural identity. A cause for concern arises when neither digital natives nor digital immigrants have achieved 100% in their research marks, which shows that neither of these identities enhances their performance. For this reason, we aimed to explore the diversity of identities, focusing on the identities demonstrated by postgraduate (masters) students as they interacted with digital technology in their research. The focus was on how postgraduate students identified themselves when using digital technology. In this study we were guided by the following key research questions and objectives:

1) What are postgraduate students' research identities when using digital technology in research?
2) What informs postgraduate students' research identities?

Research Objectives
1) Identify the postgraduate students' research identities when using digital technology in research.
2) Understand the sources of postgraduate students' particular research identities when using digital technology in research.

Literature Review

In higher education in the 21st century, research activities involving digital technology have become common due to unprecedented and rapid natural change processes. Natural processes that have influenced research are automation of the Third Industrial Revolution (3IR), digitalisation of the Fourth Industrial Revolution (4IR), and personalisation of the Fifth Industrial Revolution (5IR) (Sarfraz, Sarfraz, Iftikar & Akhund, 2021). Automation of the 3IR influenced research through the development of mainframe computing, the semiconductor (1960s), the personal computer (PC) (1970s and 1980s), and the internet (1990s), promoting automation identities through technology. The digitalisation of the 4IR, which began at the turn of the 21st century, influenced research through the generation of big data (BD), artificial intelligence (AI), robotic technology, and the internet of things (IoT), to name a few. The personalisation of the 5IR resulting from the coronavirus disease (COVID-19) pandemic in 2020 has compelled humans to embrace posthumanism (Du Preez, Le Grange & Simmonds, 2022) by becoming more reliant on technology.

The automation focused on producing technology programmed with research content mainly produced and displayed through print media. It was this process that Prensky (2001) observed and identified as people printing everything (even electronic mails [emails]) displayed on their screens to read on paper (static activity) instead of reading from the screen as digital immigrants. This is called static activities because changes could not only be on paper. These static print media activities were identified as legacy content, also known as school or professionalisation knowledge, for digital immigrants (Hoadley, 2018; Khoza, 2020; Prensky, 2001; Sokhulu, 2021). This static process or system was succeeded by digitalisation.

The digitalisation process of the 4IR was perceived as promoted by the focus of digital natives who enjoyed reading from screens as screenagers of future content, also known as everyday or socialisation knowledge (Hoadley, 2018; Khoza, 2020; Prensky, 2001; Sokhulu, 2021). The 4IR dynamically promoted the digitalisation of digital technology and increased the digital divide between digital immigrants and digital natives. The digital divide refers to the gap between those who have access to and use digital technology effectively and those who do not (Van Dijk, 2020). This digital divide is concerning and seems to widen in South Africa, an economy with unequal access to digital infrastructure (Mhlanga, 2021).

Digital technology is a user interface developed and used by humans to represent their truth for survival based on their unique needs of space and time (Khoza, 2024; Prakash et al., 2021). The 4IR started at the turn of the 21st century. The 4/5IR was formed by the staggering confluence of emerging technology breakthroughs, covering wide-ranging fields such as AI, the IoT, robotics, autonomous vehicles, nanotechnology, biotechnology, and three-dimensional (3D) printing, to name a few (Khoza, 2023; Schwab, 2016; Sutherland, 2020).

Nonetheless, technology was found useful in the personalisation process or system in the 5IR during the COVID-19 lockdowns, which influenced research processes. For example, in 2022, Sam Altman developed a chat generative pre-trained transformer (ChatGPT) through OpenAI as a user interface trained on a large amount of text to produce human-like language outcomes through dialogues. Altman did not complete his second year of Bachelor of Science in Computer Studies at Stanford University in 2005, since his ideology (identity) was that whatever knowledge we needed existed in the world database and was accessible through a relevant user interface/technology. Although ChatGPT is being used worldwide (Haman & Školník, 2024; Rahman, Terano, Rahman, Salamzadeh & Rahaman, 2023), most users are not aware of Altman's identity of knowledge, and the truth (circuits, pixels, etc., used to produce it) of this user interface, which they use for their research needs. Therefore, findings from (Haman & Školník, 2024; Rahman et al., 2023) studies suggest that most users rely on ChatGPT primarily for basic research tasks such as searching for information, often without fully considering the accuracy or objective grounding of the responses. However, the true underlying data structures, processes, and limitations of the system remain known only to its developers, and even they cannot provide users with complete objective certainty regarding every output. Consequently, ChatGPT can only offer information that is contextually useful for users' practical and immediate needs, but it cannot guarantee absolute truth. This highlights the importance of digital literacy and critical evaluation when engaging with AI-generated information. (Khoza, 2024; Prakash et al., 2021).

Searching for general or everyday information (socialisation knowledge) is based on people's opinions that generate societal identities (Hoadley, 2018; Zuma, Khoza & Sokhulu, 2022). This suggests that, ideologically, users of digital technologies operate within frameworks shaped by the identities and worldviews of their developers and founders (Fields, Hoffman, Prakash & Singh, 2018). This dynamic appears to extend across most digital technologies, where user interfaces serve primarily as tools for users' practical navigation, while the deeper truths, mechanisms, and intentions underlying these systems remain largely in the possession of their creators. However, it is up to the users to verify the truth generated by digital

technology and declare the information they have thus generated.

For instance, one may ask ChatGPT to create ideas and references about a specific issue. Once generated, one may use search engines like Google Scholar to verify the closeness of the ideas and references to the truth of the problem because it may produce outdated or fake information (Mohamed, Shaaban, Bakry, Guillén-Gámez & Strzelecki, 2025; Strzelecki, 2025). Google Scholar is a search engine that generates peer-reviewed publications from the world's databases. Google Scholar was co-founded by Anurag Acharya, an Indian-American engineer, with Alex Verstak, a Caucasian American, in 2004. It is useful in verifying information from digital technology such as generative AI tools, including ChatGPT.

Other digital technology influencing research activities include YouTube, EndNote, Grammarly, Zoom, and others (Haleem, Javaid, Qadri & Suman, 2022; Sokhulu, 2023b). YouTube is a website for uploading, sharing, and viewing online videos invented by Chen, Hurley, and Karim in February 2005 (Mthembu & Khoza, 2024; Putri & Sari, 2020). Ordinary people can create their own YouTube accounts and upload/share online videos on their opinions to address their needs based on their identities. This suggests societal and/or personal identities where these videos may not necessarily be peer-reviewed before publication. Although they are not peer-reviewed, they have been revolutionised by artificial intelligence to address human needs. When cited, such videos need to be referenced, for which digital reference management technology such as EndNote and Mendeley may be used. Niles developed EndNote in 1988 to assist researchers with professional referencing (automation example) when users are required to create error-free lists of references, like in postgraduate dissertations. This suggests that EndNote is driven by a professional identity that requires users to follow specific, prescribed steps or structures (Branch, 2020; Makafane & Chere-Masopha, 2021; Makumane, 2023; Sokhulu, Nzimande & Makumane, 2024).

Grammarly is another professionally driven application as it promotes authentic English and discourages sanitised English (Kim & Kim, 2021; Kristiani & Pradnyadewi, 2021; Mthembu & Khoza, 2024). Grammarly was developed by Lytvyn, Shevchenko, and Lider in 2009, during their time at the International Christian University in Ukraine. They first developed My DropBox, a plagiarism-detection company that inspired the idea for Grammarly. Dmytro Lider, as a software engineer, made Grammarly available under a freemium model with the option to purchase upgraded versions. In other words, Grammarly detects both similarities and sanitised English that need to be corrected by the users. These issues may be socially discussed through video communication technology (VCT) such as Zoom (developed by Yuan in April 2011), Skype (invented by Zennstrom, Friis, and four Estonian developers released in August 2003), Microsoft Teams (Bill Gates decision of 14 March 2017), WhatsApp (invented by Acton and Koum in February 2009), among others.

Like theories, user interfaces (digital technology) represent their founders' unique ideologies and needs (identities). The founders of digital technology are aware of the power of identities carried by each of those theories/digital applications, which shape people's thoughts according to the identities of the founders. As a result, founders of digital technology keep reflecting on their unique experiences and produce and promote their unique digital technology to be used by other people who cannot invent their own unique digital technology. For example, Eric Yuan invented Zoom VCT in 2011 while Skype was still active, and Bill Gates advocated for Microsoft Teams in 2017 while Zoom was still active. At the same time, end users still actively used Zoom because they were not aware that the user interfaces were influenced by the founders' unique needs (identities), and this was not important for end users who used these for survival.

This suggests that while end-users of digital technology or theoretical frameworks may not be fully aware of the underlying truths embedded within them, the inventors and developers are conscious of the power dynamics and identities encoded in these technologies. As a result, they create unique technologies to assert autonomy and avoid being influenced or constrained by the dominant identities represented in existing systems. (Khoza, 2024; Prakash et al., 2021). However, for end users, the truth/objective reality (identity) about digital technology or theory may not be important if it helps them survive at their level of experience because they may not have time to reflect on their experiences, understand their needs, or identities to be aligned with such digital technology. As a result, end users are easily controlled by the identities of the inventors of digital technology or theories they may not be aware of, because they may not reflect and understand their identities before they use the digital technology.

However, in a study on decolonising educational technology conducted by Makumane, Nkohla and Khoza (2024), the authors argue that even if end users are closer to the truth about digital technology, they may not always use digital technology to achieve one hundred percent (100%) outcomes. They may not reach 100% because outcomes or consequences of human actions are naturally driven (Khoza, 2023). Even studies (Deng & Tavares, 2013; Madge et al., 2009; Sokhulu, 2021, 2023a; Thompson & Savenye, 2007) that have explored students' use of digital technology in research have confirmed that digital technology has

been used as a user interface for survival since 100% is mostly not achievable. For this reason, the outcomes/consequences of actions are naturally driven, and we used unified theory of acceptance and use of technology (UTAUT) as philosophical lens to frame the study.

Unified theory of acceptance and use of technology (UTAUT)

In this research we used the UTAUT (Venkatesh, Morris, Davis & Davis, 2003) framework to explore postgraduate students' research identities when using digital technology for research. The UTAUT framework, which includes key principles such as performance expectancy, effort expectancy, social influence, and facilitating conditions, was employed to analyse and enhance the understanding of postgraduate research identities (Akinnuwesi, Uzoka, Fashoto, Mbunge, Odumabo, Amusa, Okpeku & Owolabi, 2022). The UTAUT principles also aid in understanding students' behaviour and experiences with digital technology, which shape their research identities. UTAUT was thus useful as a framework to interpret the findings of this study.

According to UTAUT, users' experiences with digital technology and their research identities are influenced by four key constructs: performance expectancy (professional identity), effort expectancy (personal identity), social influence, and facilitating conditions (societal identity). These constructs are notably influenced by natural factors that may be dynamic (such as age), static (such as gender), and environmental conditions (such as experience or voluntariness of use) in the use of digital technology. Therefore, based on these factors, users of digital technology may use digital technology for performance expectancy (following prescribed rules for addressing professional needs), effort expectancy (addressing unique personal needs), and/or social influence with facilitating conditions (working in groups to address societal needs), and/or personally use digital technology to address their research needs (Makumane et al., 2024; Venkatesh et al., 2003, Venkatesh, Thong & Xu, 2016; Zuma et al., 2022). This suggests that users should reflect on their experiences to understand their needs and identities and identify or use relevant digital technology.

Research Design and Methodology

In this section we present the research approach; design and paradigm; sampling; data generation methods; location of the study; ethical considerations; trustworthiness; limitations of the study; data analysis; and findings.

Research Approach, Design, and Paradigm

We used a qualitative case study methodology to achieve an in-depth and descriptive understanding of the phenomenon under study (Baškarada, 2014; Yin, 2009). Qualitative case studies are particularly suited for exploring complex issues and providing rich, detailed insights. The interpretive paradigm was adopted to further understand students' research identities and construct meaningful interpretations of their experiences with digital technology (Guba & Lincoln, 1994).

Sampling and Data Generation Methods

Participants were selected through purposive and convenience sampling, a method that involves deliberate choices about which individuals, groups, or objects are included in a study based on specific criteria (Cohen, Manion & Morrison, 2011). For this research, four Master of Education (M.Ed.) students who were actively engaged in using digital technology for their postgraduate research studies were purposively and conveniently selected from a specific university in KwaZulu-Natal (KZN). Reflective journals, semi-structured interviews, and focus group discussions were used to generate data to inform the study findings. Reflective journals, semi-structured interviews, and focus group discussions are qualitative research methods that are useful in generating thick data that can be used to create deep meaning (Scotland, 2012).

Location of the Study and Ethical Considerations

The study was conducted at an institution of higher education (university) located in the Durban area of the KwaZulu-Natal province of South Africa. Ethical approval was granted by the relevant institution, and informed consent was obtained from the four participants. Pseudonyms were used to protect participants' identities in order to adhere to the ethical considerations of anonymity and confidentiality. Table 1 shows the participants' profiles and the pseudonyms used.

Table 1 Participants' profiles

Participant's name	Gender	Age group
1) Gcinile	Female	26–30
2) Dudu	Female	36–40
3) Rose	Female	26–30
4) Crystal	Female	26–30

Trustworthiness

The trustworthiness of qualitative studies evaluates the credibility, transferability, dependability, and confirmability of research findings (Adler, 2022). To ensure trustworthiness in this study, interviews and focus group discussions (FGDs) were carefully recorded and transcribed, which contributed to the credibility and confirmability of the findings. Detailed reporting of the data findings was carried out, and three distinct methods were employed to generate data, enhancing the dependability of the study. This comprehensive approach aimed to provide robust and detailed findings, ensuring reliable and beneficial data. Where applicable, readers may transfer the study's findings to similar contexts.

Limitations of the Study

Participants occasionally postponed scheduled interviews and FGDs, which impacted the research timeline. Thus, data generation took longer than anticipated as we had to take the participants' availability into account. Additionally, the interviews and FGDs were conducted virtually using Zoom software, which had its own limitations, such as internet connectivity issues. To address this limitation, we requested the participants to ensure that they had reliable internet connectivity for the interviews and FGDs. Furthermore, when the participants were disconnected by chance, we repeated the questions to ensure that no questions were left unanswered. Despite these challenges, we aimed to maintain the rigour and relevance of the findings.

Data Analysis

In this study we employed both deductive and inductive analyses. Initially, we used deductive analysis by applying pre-determined concepts from existing literature to generate codes for data analysis, and organising data into categories that reflected literature-derived findings or principles from the conceptual framework (Azungah, 2018). This approach provided a structured method for interpreting the data in line with established concepts. We also incorporated inductive analysis to draw themes directly from the data generated empirically. This involved transcribing and analysing data from reflective journals, semi-structured interviews, and FGDs. Themes include performance expectancy (professional identity), effort expectancy (personal identity), social influence, and facilitating conditions (societal identity).

Findings

The findings are presented in themes relating to researchers' identities about how master's students perceived themselves when using digital technology for research. To explore these identities, themes such as performance expectancy (professional identity), effort expectancy (personal identity), social influence, and facilitating conditions (societal identity) are discussed in detail.

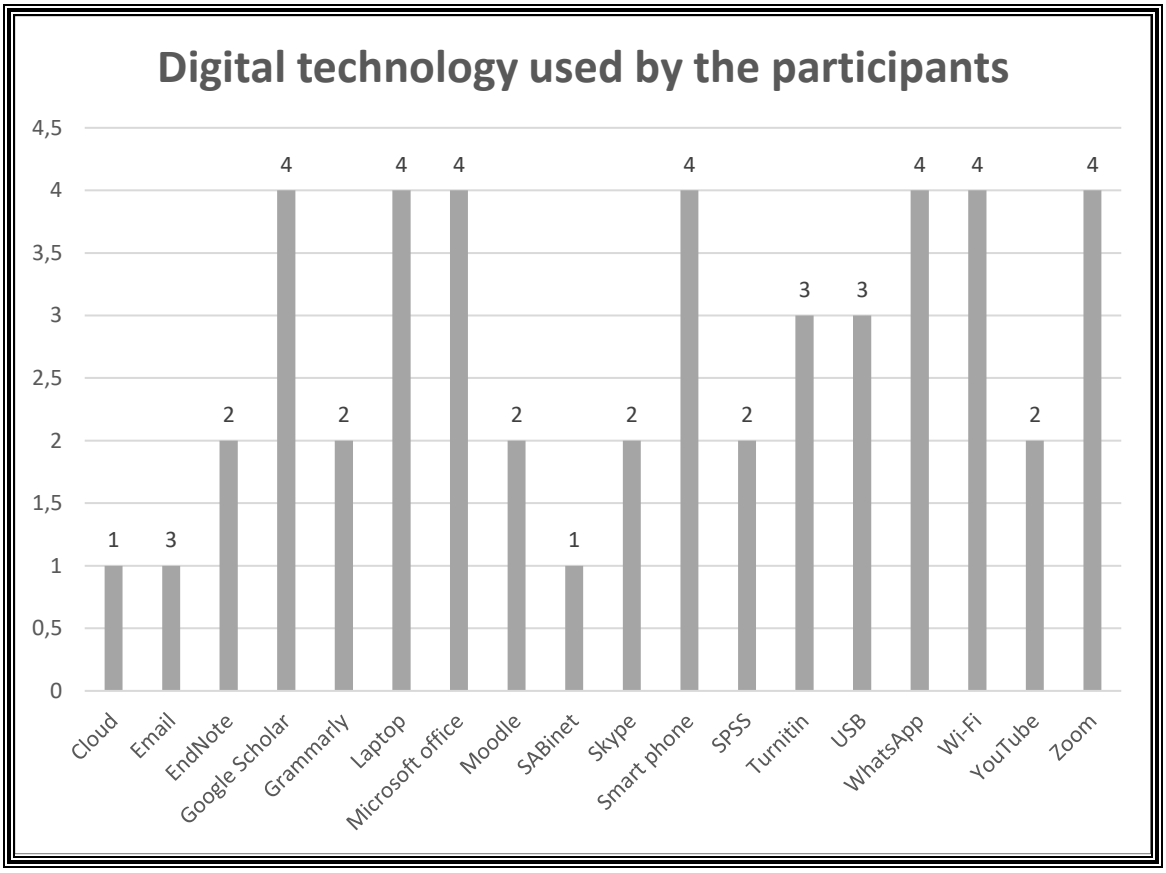

Figure 1 Digital technology used by the participants

Figure 1 presents the digital technology used by the four participants. All the participants used Google Scholar, laptops, Microsoft Office, smartphones, WhatsApp, Wi-Fi, and Zoom. Dudu, Gcinile, and Rose used Turnitin to check similarities while writing up their research reports. Crystal, Gcinile, and Rose used, among others, USBs (universal serial bus) to save their research work.

Gcinile used cloud storage to store data and other information for her research. Crystal, Dudu, and Rose included the use of emails as important digital technology used for their research. Dudu included Sabinet (South African Bibliographic and Information Network) as one of the search engines she used for her research. Crystal and Gcinile used EndNote to manage referencing and references. Crystal and Dudu used Grammarly to manage their use of the English language in writing their research reports. Dudu and Gcinile used modular object-oriented dynamic learning environment (Moodle) for research. Crystal and Dudu used Skype as their VCTs to communicate with their supervisors and used the Statistical Package for the Social Sciences (SPSS) to analyse the quantitative data. Crystal and Rose used YouTube channels or videos to support their research activities.

Theme 1: Performance Expectancy (Professional Identity)

Digital technology commonly used by the participants to promote their professional identity (automation of the 3IR or professionalisation) were EndNote, Google Scholar, Grammarly, laptops, Microsoft Office, Turnitin, Wi-Fi, and Zoom. When digital technologies are prescribed for end users and used by following clearly defined, linear steps, they support performance expectancy and reinforce the development of a professional identity (Nkohla, 2025). It was compelling for the participants to access most of these digital technology or resources. For example, Dudu used Grammarly because English was her second language, and Grammarly helped her edit her work. She said, "*... Grammarly edits your work and paraphrases your sentences. You just put your work there, and it highlights and edits it so you do not have to take your work to the editor.*" Dudu's sentiment is also held by Mthembu and Khoza (2024) who claim that Grammarly is programmed for authentic or formal English and is used by professionals to produce professional documents.

Crystal also used Grammarly and SPSS introduced to her by her supervisor. She also used YouTube videos to refresh her memory and assist her in writing her research report. "*I went onto YouTube and then checked how to create the table of contents and the details of how to go into* [SPSS]." She felt that YouTube videos came to the rescue because she was confused by the fact that she was not aware that she "*would use many technologies*." Crystal and Dudu used SPSS for basic functions that can be done using Microsoft Excel; however, SPSS is more advanced than Excel. Crystal said: "*I have to input all that data into SPSS and then create graphs*." SPSS was invented by Norman, Dale, and Hull in 1968 and was later developed further in order to remain relevant. SPSS is still relevant to advance the needs of quantitative data and is also used for descriptive statistics (calculating mean, median, mode, standard deviation, and other descriptive statistics), inferential statistics (performing *t*-tests, ANOVA, regression analysis, and more), data management (tools for data cleaning, merging datasets, and restructuring data), and visualisation (creating charts and graphs to visualise data and analysis results). Moreover, the participants had no awareness of the underlying technical structures, such as the motherboard, central processing unit (CPU), graphics processing unit (GPU), random access memory (RAM), or storage components, or how these were configured during the development and use of digital technology. Nor were they conscious of the ideologies embedded by the inventors. Consequently, they lacked understanding of both the technological foundations and the full functions of the tools they relied on.

The findings suggest that participants engaged with digital technologies in a largely passive manner, treating them as basic interfaces rather than critically interrogating how these tools functioned or what truths underpinned them. Yet, gaining deeper insight into the objective realities of the technology they use has the potential to enhance students' academic success, improve their adaptability, and strengthen their overall digital competence (Fields et al., 2018; Prakash et al., 2021). Instead of developing such informed engagement, participants relied heavily on socialisation processes, often depending on peers' opinions, trial-and-error practices, and shared user experiences to navigate digital platforms (Branch & Lee, 2020; Mashinini, 2020; Sokhulu, 2021). This highlights a gap between functional use and critical digital literacy.

Theme 2: Social Influence, and Facilitating Conditions (Societal Identity)

The digital technology used by the participants, WhatsApp, Skype, and YouTube, was largely adopted due to factors such as research practices, social influences, and supportive conditions. The digital technology played a role in shaping societal identity through digitalisation and socialisation within the context of 4IR. For example, the participants used WhatsApp to communicate with friends, other students (peers), or supervisors whenever needed. Gcinile, supported by others, only used it when she wanted to "*ask something from a friend or a certain person ... WhatsApp group created by our supervisor where she provides us with information about seminars*." Likewise, Dudu indicated that although they used WhatsApp to exchange essential readings, the communication was strictly professional. She stated the following: "*Although we communicate through WhatsApp, we know our boundaries. We only talk about umsebenzi wethu (our work) and nothing outside that.*"

The findings suggest that the participants became passive users because they were deprived of

the social spaces and interactive environments that normally encourage active engagement. Without opportunities to interact with peers, lecturers, and other groups, they lacked the collaborative and dialogic experiences that typically stimulate participation, confidence, and active learning. As a result, their engagement shifted from active involvement to passive consumption (Biesta, 2015; Czerniewicz & Brown, 2014; Kim & Kim, 2021). However, there is limited conclusive evidence that indicates that active students can use user interfaces (digital technology) to achieve 100% in their research. In other words, being active students (digital natives) using digital technology may not necessarily mean they will achieve 100% outcomes. Venkatesh et al. (2003) recommend that a taxonomy be developed that integrates facilitated socialisation spaces with professional learning environments to enhance effort expectancy. Effort expectancy emphasises the importance of creating spaces where students can engage in meaningful self-reflection, enabling them to recognise their unique values, needs, and areas requiring focused effort. Such integrated spaces would support improved performance and more effective engagement within both social and academic contexts.

Theme 3: Effort Expectancy (Personal Identity)

Effort expectancy is an important subjectification (personalisation of the 5IR) space of education where students can self-reflect and critique their experiences with accountability to understand the values that constitute their unique identities (Biesta, 2015; Khoza, 2023; Makumane et al., 2024). Values are aligned with the needs that emerge from individual experiences that combine actions, consequences, and reasons or beliefs behind them (Govender & Khoza, 2024). The meaning of actions of using user interfaces is found in the consequences/outcomes (Morgan, 2014). In other words, positive results of students indicate effective actions in using user interfaces (digital technology and/or theories) in their studies. However, the consequences or outcomes of optimised actions may not be what we expect because they are naturally driven (Khoza, 2025). In this study, the participants did not have subjectification spaces to self-reflect before, during, or after they used the user interfaces for their studies. This lack of self-reflection was noted in utterances from participants such as Dudu when she said,

> *I am just a follower, I am doing what others are doing. I could also say I am doing what I am supposed to do … I just followed the instructions, there is nothing I want to do that is special unless it's going to help me, then I am going to learn it.*

Discussion of Findings

The concept of digital technology and the theoretical frameworks used to study it have been shaped by the automation associated with the Third Industrial Revolution, further advanced by the digitalisation of the Fourth Industrial Revolution, and now increasingly influenced by the personalisation characteristic of the Fifth Industrial Revolution. These developments intensified during the early 21st century and were accelerated by the digital demands of the COVID-19 pandemic. The 4/5IR has moved most digital technology to cloud computing. For instance, in this study, Gcinile was the only participant who used cloud computing, an essential feature of the 4IR, to supplement her USB for file storage. It was introduced to her by a Doctor of Philosophy (PhD) student. Cloud computing assists users in accessing and storing data remotely, anywhere (space) and anytime (time). For example, if EndNote runs on cloud computing, it can be accessed from computers connected to the internet through a username and password, anywhere and anytime.

However, cloud computing operates on more modern programming and web-based languages, which allow greater compatibility with contemporary digital platforms. For example, the Canvas learning management system can integrate social media sites through cloud-based application programming interfaces (APIs) because it is built using newer web languages and frameworks. In contrast, Moodle (used by Dudu and Gcinile) may have limitations in such integrations because parts of its system rely on older programming structures that are not easily recognised or supported by newer platforms.

This suggests that the participants used digital technology superficially for survival without striving to come closer to their truth to produce unique user interfaces relevant to their needs. If digital technology users strive to understand the truth of the technology they use, they come to a stage where they reflect on their needs and produce user interfaces that are based on their identities. For example, Nikolai and Pavel Durov used WhatsApp (invented in 2009), understood its truth, and invented Telegram in 2013 to accommodate a larger number of people in groups than WhatsApp.

Therefore, knowing the truth about digital technology makes users better at producing more user interfaces that directly address the unique needs of their identities (Prakash et al., 2021). Based on their unique identities and ideologies, digital technology inventors produce more user interfaces for end users. However, end users may only use these interfaces for professional and societal needs because they do not know the truth about them, which was the case with the participants in this study. Inventors or holders of the truth may not have the ability to 100% share the truth about the user interfaces because they may be developed above the levels of the end users' experiences. As a result, end users may be given simple, prescribed steps that

promote professional identities or imitate others with some basic ideas for societal identities.

Reflecting on the study findings, it appears difficult for postgraduate students to achieve outstanding academic performance in their research if their research content and digital technology challenge them. In other cases, postgraduate students use digital technology that are challenging for them to impress their supervisors or friends who introduced the technology to them. In other words, they may use them only to connect to their friends/supervisors, even if they have evidence that the technology is useless. In this study, participants indicated that their supervisors introduced them to WhatsApp groups. This suggests that end users may ignore evidence if they still need to belong to the groups. Crystal and Rose used YouTube videos to understand technology that their supervisors demanded (Grammarly) and user interfaces for analysing quantitative studies (SPSS).

This highlights the significance of automation (static processes), digitalisation (dynamic processes), and personalisation (context-responsive processes) in generating meaningful and effective research within a posthumanist framework (Du Preez et al., 2022; Khoza, 2024; Sarfraz et al., 2021). On the one hand, the automation of the 3IR mainly generated user interfaces that presented prescribed static quantitative research content. These primarily came from the natural sciences, where the truth/objective reality is single or static because it is measured through standardised user interfaces. For example, to know the dimensions of a table, one uses a tape measure to determine the dimensions. Another example is when researchers want to determine whether a particular teaching method (independent variable) leads to improved learner performance (dependent variable), using a theory of effectiveness to guide their investigation. User interfaces can be designed using principles from the theory of effectiveness, enabling researchers to evaluate the effectiveness of a particular teaching approach. This allows the system to generate a consistent and reliable outcome based on the criteria defined by the theory.

This automation system can also be observed using user interfaces such as EndNote reference management software. When researchers use EndNote for referencing, they all produce the same answer if the format of the libraries is the same. This practice extends to other user interfaces as well, as they are programmed to receive data and generate outcomes that reflect the underlying assumptions, perspectives, and identities of their creators.

On the other hand, the digitalisation of the 4IR opened up the process by generating user interfaces that allowed for multiple outcomes or realities. This allowed humanities and social sciences to focus on qualitative studies driven by grounded theories of inductive reasoning. For example, if researchers wish to understand the dimensions of a table, they may choose to gather participants' interpretations rather than use a tape measure, thereby generating multiple, dynamic perspectives rather than a single fixed outcome. The findings of dynamic and subjective outcomes through human realities are more important than knowing the answer from a user interface. The outcomes of actions and internal intelligence behind them are naturally driven. They seem to be influenced by naturalism or posthuman identity because even when supervisors and students optimise their actions through their intelligence, they mostly fail to achieve 100% outcomes. Other students even fail their dissertations or theses with advanced user interfaces or theories. Other students may pass their dissertations or theses with little effort in the reading and writing of their dissertations or theses.

This suggests that research outcomes may be influenced by students' natural identities, as the objective reality behind passing theses remains potentially unknowable (Khoza, 2024). This is reinforced or intensified by the fact that most supervisors and students, especially from developing countries, use theories or user interfaces that are externally developed in the global North. In other words, they use theories or user interfaces that are foreign to them and have the power to colonise their minds. Therefore, supervisors and students should not be too hard on themselves when they do not achieve perfect outcomes, as they can only control the optimisation of their actions based on their intelligence, not the outcomes themselves. In turn, researchers produce theories through human interaction processes of their research.

However, other user interfaces have been generated before qualitative or induction reasoning processes. For example, NVivo qualitative data analysis software was developed by QSR International (Lumivero) in 1981, revised in 1997, and further revised in March 2020 to produce multiple realities. Other user interfaces of the digitalisation process are Short Message Service (SMSs) that produce groups of human interaction (humanism). This process has been focusing on humanism (the prime importance of humans in finding solutions to world activities) and limited personalisation or posthumanism (the interconnectedness of humans, non-humans, and user interfaces).

Personalisation processes or systems of the 5IR began in 2020 during the COVID-19 pandemic, when the interconnectedness of humans, non-humans, and user interfaces, known as posthumanism, surfaced (Du Preez et al., 2022; Sarfraz et al., 2021). ChatGPT, developed by Sam Altman in November 2022, is an example of how humans have begun to use user interfaces to mimic the human mind, which is divided into conscious, subconscious (preconscious), and unconscious

(Khoza, 2023). When ChatGPT responds to human questions, it responds through Sam's ideology that whatever information we need is available in the world's databases to be accessed through relevant user interfaces. Moreover, it seems that AI demonstrates humans and technology working together in collaboration rather than in competition.

Implications and Conclusion

The findings of this study indicate that participants were primarily motivated by their professional identities, which focused on meeting the academic requirements to pass their studies through research, and other prescribed processes. Additionally, they engaged with their social identities to address specific study needs, such as communicating with supervisors and peers over social media technology. The study further reveals that master's students who participated in this study invested more effort into using user interfaces that supported their research goals, regardless of whether those user interfaces were categorised as social or professional. This behaviour reflected their personalisation identities, which influenced their unique research endeavours. Based on these findings, we recommend that postgraduate students need to reflect on their personalisation identities to better understand their individual and research needs. By doing so, they can use user interfaces that most effectively support their research practices, allowing them to rely on their strengths in addressing academic challenges for posthuman identity. In other words, they may become aware that when they optimise their actions and beliefs based on their lived experiences, they should involve the interconnectedness of humans, non-humans, and user interfaces for desired outcomes. Even if the desired outcomes were not achieved after they optimised their actions and beliefs, they should not be hard on themselves because outcomes are naturally driven to give us the meaning of our actions and beliefs. Therefore, we may not have 100% control over the outcomes, but we may optimise or control our actions and beliefs based on research evidence and self-reflection, with accountability.

Authors' Contributions

LHS analysed the empirical data, wrote the theoretical framework and methodology sections. NN wrote the abstract, introduction, and references. She also critically read the manuscript. SBK developed the literature review and strengthened the data analysis section with visuals.

Notes

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