

GILE Journal of Skills Development

The Use of Social Media and Artificial Intelligence Tools by Online Doctoral Students: Skills Needed and Challenges

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Abstract

Our paper aims to explore how doctoral EdD students in their thesis stage made use of digital technologies, social media (SM), and artificial intelligence (AI) tools. In this study, AI does not involve data on the use of the new generation of AI, which has been introduced in more recent years after this study took place. This paper refers to a 2nd stage qualitative analysis of semi-structured interviews collected from research undertaken in 2018 into student use of digital technologies in an online professional doctorate programme. The original study utilised an exploratory case study approach, an online survey ($n = 28$), and a series of semi-structured interviews ($n = 9$). This study will add further qualitative findings and perspectives to those that emerged in the previous study. This study will help to provide new insights into the interview data that was used to inform the initial paper resulting from the research in 2018. We argue that the unique characteristics of online doctoral students as both individuals and learners determine the popularity of some digital tools and that, in order to make the best use of the full range available they need to develop new skills and a better understanding of the pedagogy associated with those digital tools and the value they can add to an educational context. This can be achieved through the provision of more systematic coaching and support systems. This in turn will contribute to enhancing students' feelings of belonging to a real academic learning community and their self-confidence and autonomy as online learners in general and in their performance in a Viva in particular.

Keywords: online doctoral study, doctoral students, EdD programme, digital tools, social media, artificial intelligence

1. Introduction

Social media (SM) has been increasingly used in education at all levels. There has also been a commensurate uptick in the use of Artificial Intelligence (AI) because of its rapid development as an educational tool. SM is a mode of interaction that combines web-based applications and social software (Procter et al., 2010) that can be regarded as a collaborative conversational platform, located in open or closed online communities. Popular SM tools such as Facebook®, Skype®, YouTube®, blogs, and Twitter® created from Web 2.0 technologies are believed to improve learning outcomes and academic achievement (Junco et al., 2010) as well as promote networks and strengthen social relationships within a community of practice (Llorens & Capdeferro, 2011). Parr (2016) contends that the use of digital tools by students is contingent on the capacity of the technology to support the management of information and resources, and Dabbagh and Fake (2017) add that the facilitation of personalised learning experiences and enhanced experiential learning through collaboration and interaction are also germane. At the same time, the relatively newly developed AI tools which are associated with integrated semantic web technologies including 3D virtual worlds such as Second Life®, Joost®, and 3D avatars, are believed to provide learners with immersive, intuitive, and productive learning experiences (Rajiv & Lal, 2011). They can also be a further aid to communication, provide opportunities for the personalisation and differentiation of the curriculum, and allow students to explore beyond the immediate. Both SM and AI are increasingly playing a critical role in every aspect of learning and teaching in Higher Education (HE). In this paper, we use “digital tools” as an overarching term to describe both SM and AI.

A substantial amount of the available literature focuses on how digital tools are perceived by students and to what extent they impact their learning and social relationships at school and the undergraduate level. There are a very limited number of studies available on the use of digital tools for scholarly communication, high-level thinking, and peer support among mature online students at the post-graduate and doctoral levels (Gu & Widén-Wuff, 2010; Labib & Mostafa, 2015; Steindal et al., 2021). This is a missed opportunity because the online doctoral journey, although unique, has characteristics similar to those found in other contexts. It is an “*intensely emotional, ego-threatening venture*” (Hawley, 2010, p.7), with a 50% or higher attrition rate on some programmes for online learners (Park & Choi, 2009; Perkins & Lowenthal, 2014). As Hopwood (2010) points out, “*relatively few accounts of doctoral education present students as agentically shaping their own learning, practices or wider social environments*” (p. 194). Despite Boud and Lee’s (2005) claim about the importance of doctoral students’ capacity to use a range of tools and networks to become autonomous agents of their own learning, there is little empirical and theoretical evidence available on whether and how they make use of those resources.

In response to this relatively unexplored research area, our study aims to add to the literature on how mature students in the latter stages of their doctoral journey use digital tools (Wang et al., 2018a). Although this paper uses some of the qualitative data from the research done in 2018, we offer a different perspective from that of the initial published work (Wang et al., 2018b) as a result of an alternative type of methodology and analysis.

This paper will explore the literature on the use of social media and artificial intelligence in Higher Education and then explain why phenomenology is the main research methodology used in the study and related research questions. It will then analyse the four themes that emerged from the thematic analysis, namely: the use of digital tools; compulsory and non-compulsory

tools; the challenges of belonging to a virtual community, and the need for guidance, coaching, and training on the use of these tools. The paper will discuss each of the themes and it will draw conclusions on how the findings will have an impact on the development of online doctoral students' skills and the challenges they face.

2. Literature Review

Most of what is known about the use of digital tools for educational purposes in the HE context has resulted from survey studies conducted mainly with students at the undergraduate level who are engaged in face-to-face (FtF) learning and teaching. The main findings of these studies indicate that SM rather than AI tools have been used far more for entertainment and communication purposes than for learning. In distance learning, Rothkrantz (2016) contends that SM tools have similarly been used on a much greater scale than AI tools. This is confirmed in the relatively small number of papers examining AI in HE in the last few decades. However, given the current debate about AI it is unsurprising to note that there has been a significant increase in papers in 2021 and 2022 on the topic (Crompton & Burke, 2023).

2.1. The Uses of Social Media in Higher Education

In a survey of 150 Nigerian undergraduate students, Eke, Obiora and Odoh (2004) found that social networking sites including Facebook®, 2go®, WhatsApp®, Google+®, YouTube®, Yahoo®, Skype®, Blackberry® messenger and blogs were mostly used for entertainment and communication purposes. In 2013, Yaoyuneyong et al. noted that the US students they surveyed had positive experiences with networking sites like Facebook® and X (formerly Twitter®) and video tools like YouTube®. Similarly in Malaysia, Goh et al. (2013) found that the majority of the 153 undergraduate students in their study claimed to use Facebook® primarily for social purposes such as keeping up with family and friends. Less consensus appears to exist with regard to the use of SM tools for educational purposes. Salmon et al. (2015) concluded that many of their students enjoyed and benefitted from using SM tools such as Facebook® and Twitter® to enhance their learning through collaboration with a diverse range of people with whom they could network and exchange knowledge. An examination of the use of digital tools for effective learning by US college students revealed that search engines, social networking sites, online videos, and eBooks were more frequently employed than blogs, podcasts, mobile applications (apps), and digital libraries (Dabbagh et al., 2015). The students' adoption of self-directed approaches to learning was reinforced by the results of Dabbagh et al.'s (2019) survey of graduate and undergraduate students ($n = 463$) at a large public university in the US revealing that search engines, file-sharing tools, digital libraries, videos, and Wikis were the tools most frequently used for learning purposes. Other research is less conclusive. In Goh et al.'s study (2013) in a Mexican university, only a minority of the students who used Facebook for academic purposes valued its effectiveness and suitability as a learning tool. Goh's findings are comparable with those resulting from the work of Aucoin (2014) with adult Canadian mid-career learners who had mixed feelings about the value of using SM tools in their learning environment. There was nevertheless a small minority who did use these tools for educational and professional purposes. Similar results had been reported in previous studies showing little effectiveness of SM tools to enhance academic performance (Gupta et al., 2013; Li & Ranieri, 2010); and faculty members' disbelief in the value of Facebook® for classroom teaching (Moran et al., 2011). A more frequent use of SM tools for educational and professional purposes appears to occur among postgraduate students. Yadav and Vohra's (2016) survey of 116

postgraduate Social Science students in India indicated that SM tools were mainly used for searching for relevant information and promoting their research work. These findings are supported by the outcome of a survey of 300 doctoral students, also in India, suggesting that, apart from communication and entertainment purposes, the Web was often used to search subject databases, retrieve research-related materials, access e-journals and e-books, as well as for publishing and career information purposes (Shabna & Haneefa, 2016).

In online learning, there is scarce empirical evidence comparing faculty and students in relation to their use of SM. However, Roblyer et al.'s (2010) survey included 62 faculty members and 120 students in a mid-sized university in the southern United States. The survey revealed that students were much more likely to engage with Facebook© and were open to the possibility of using it and similar tools to support classroom work, whilst the faculty members were more likely to use traditional tools such as email for communication purposes.

Technology may have an impact on students' perceptions and use of SM tools for learning purposes. A study was conducted in China by Xiangming and Song (2018) with a total of 387 engineering students at the graduate level on the use of Rain Classroom, which the developers at Tsinghua University and XuetangX in China describe as a smart mobile-based digital toolbox specially designed to be used in blended learning, providing real-time feedback from teachers to students. The study revealed a statistically significant association with learning engagement and a willingness to share the learning experience. The effect of this type of technology used in more formal learning and teaching contexts is also evident in Sun et al.'s (2018) survey of 78 pre-service student teachers exploring the use of both mobile and web-based technology for learning purposes. The findings highlight how an instant messaging mobile app in conjunction with a discussion board used for knowledge construction purposes helped the development of social interaction and team building among the student teachers. These two studies provide some evidence of the potential of mobile technologies such as instant messaging or similar to promote a sense of engagement, commitment, and belonging among online learners.

Although this paper does not cover mobile technologies and SM apps, it is pertinent to include some reference to them given that they can be readily employed in an educational environment. However, the findings need to be considered with a degree of caution. Students with limited or no experience of using SM tools tend to be more reluctant and pessimistic about them (Goh et al., 2013), which suggests that their effect on learning cannot be simply attributed to the use of technologies per se but to the way they are used. (Wang et al., 2018b). Hence, one possible way of increasing the effectiveness of SM tools in learning and teaching is to encourage occasional and reluctant users to employ Web 2.0 tools for leisure and entertainment, whilst also encouraging them to capitalise on the affordances of these tools for their education (Costa et al., 2016).

Despite the lack of conclusive evidence, Chugh and Ruhi (2018) suggested that the “rapid adoption of social media technologies has resulted in a fundamental shift in the way communication and collaboration takes place. As staff and students use social media technologies in their personal lives it is important to explore how social media technologies are being used as an educational tool” (p. 605).

More recent studies (Oleškevičienė et al., 2022) on the use of social media by HE students (not necessarily those engaged in doctoral studies) report that it becomes more acceptable when directly linked to the process of learning and teaching. Another study (Al-Rahmi et al., 2022) reported the

findings from a survey undertaken by over 430 HE students in Saudi Arabia during the pandemic. They concluded that in order for social media to improve student satisfaction and performance it needed to be embedded, provide opportunities for collaboration, be readily accessible, and be perceived to be easy to use. Collaboration and connectivity appear to be the most significant.

2.2. Artificial Intelligence Tools Used in Higher Education

Despite the recent emergence of ChatGPT[®], empirical research on the use of AI tools in the HE context is even more scarce when compared with that available on social media. However, one such study was conducted in Russia by Atabekova et al. (2018) who investigated university students' use of Google web-based artificial intelligence tools for informal learning purposes. The findings of this study point to the potential of such web-based tools to develop students' self-diagnostic and self-control abilities, foster motivation for social interaction in quasi-professional contexts, and enhance learners' productive, reflective, and strategic skills. Another study involving 42 Turkish HE students in an Instructional Technology and Material Design course during the 2014–2015 spring semester concluded that they valued AI tools for allowing easier access to information and speeding up learning, and for being more reliable in terms of data and information safety (Yucel, 2017). The affordances of web-based AI tools reported by Atabekova et al. (2018) are of particular relevance in view of the need for these tools to become more understandable and easier to use by teachers and students (Morris, 2011). With the advancement of AI tools and the semantic web, it will be possible to develop new and more sophisticated software with the potential to better determine the needs of learners and tailor their learning experiences accordingly (Wang et al., 2018a).

A more recent study (Xin et al., 2022) employed an online survey of 274 Year 5 undergraduate, masters, and postgraduate students studying medicine in Singapore to examine their behavioural attitudes towards AI. The survey revealed that even though some students already had a basic knowledge of AI it did not mean that they were more inclined to learn about its use in medicine or employ it as a learning tool. Furthermore, Buchanam et al. (2021) in a scoping review of published work on nursing curriculum, reported that student nurses will be increasingly required to develop the skills, knowledge and understanding of AI in order to use it safely and effectively in their clinical practice.

Moreover, Alzahrani (2023) explored the attitudes of 350 students in Saudi Arabia toward the use of AI in higher education by employing a wide variety of theories and models including the 'unified theory of acceptance' and 'the use of technology' model as the lenses through which to view this issue. She found that despite any perceived negativity the potential benefits of using AI significantly influenced students' attitudes, behaviour, and intention towards using it. Shah (2023) believes that students need to develop the right skills in the use of AI, especially how to access and use it for learning purposes, particularly in the development of critical thinking.

Finally, Bissessar (2023) undertook a phenomenological study with students and staff at the University of Guyana who were interviewed about the benefits and challenges of using ChatGPT and assistive AI tools to complete assignments. Seventeen students and six faculty were involved. Results indicated that there was a need for the development of policies and procedures toward the appropriate use of AI tools. The benefits for both students and faculty in using these technologies were perceived to be the time saved by generating information and support for the teaching/learning process. The disadvantages were students' apparent lack of

creativity and their inability to think critically, the cost of the AI assistive tools, and the possibility of false information being generated.

In conclusion, the lack of consensus in these studies can be partly explained by differences in context, location, and culture. Ease of access to the internet, varying academic practices, the background of students, and the time when the studies were conducted may also be factors. Nevertheless, they do provide some evidence that highlights the potential for both SM and AI web-based tools to enhance online collaborative learning and engagement. However, given the exponential rate of change in the development of technology, more investigation is required before it is possible to draw firm conclusions about how it can be best utilized. This is particularly true in relationship to an under-researched area such as the use of web-based digital and artificial intelligence technologies by postgraduate students for doctoral studies.

3. Methodology

In this paper we adopted a qualitative methodology to provide an additional perspective on data from the original research study that investigated the extent to which EdD thesis students used digital tools to support their learning, why they used them, and what impact they had (Wang et al., 2018b). For that purpose, we formulated the following new questions:

1. How did the students employ the different digital tools they claimed to have used during their thesis journey?
2. How did the students feel about the use of digital tools in the EdD programme?

In the new study, we adopted a phenomenographic approach which Stolz (2020) explains as: “phenomenography is concerned with investigating the qualitative ways in which people experience, conceptualise, perceive, and think about various aspects of phenomena in the world ... [and] with revealing individual and collective levels of variation by focusing on the way people and certain groups or populations experience specified aspects of the world” (pp. 1081-1082).

The original study involved a “convenience” sample (Creswell, 2012) of 9 thesis stage students who showed an interest in the study and had the availability to participate. Data were collected via 40 to 60 minute semi-structured interviews conducted via Skype. They were audio-recorded and transcribed verbatim. The interview protocol in the first study was developed from a review of relevant literature. The current study used these same interview transcripts, but a different approach for analysing them. Indeed, a five-step process of analysis (Marton, 1986; Säljö, 1997) was employed which is consistent with our phenomenographic approach: (i) familiarisation through reading the transcripts to develop a good sense of the breadth and depth of the participants’ responses; (ii) data reduction and condensation through identifying the most relevant parts in the data that represent patterns of responses; (iii) classification through building an initial set of categories by comparing and contrasting similarities and differences in the responses that reflect the variation of the experiences; (iv) labelling through applying appropriate descriptors that best represent the categories; and (v) refinement through following the iterative nature of phenomenographic data analysis in order to modify the initial categories and reach a final set of categories that best represent the qualitative variations of the phenomenon as experienced by the participants. In order to gain a deeper understanding of the phenomenon under investigation we incorporated both a semantic and a latent perspective (Braun & Clarke, 2020; Terry et al., 2017) into the analytical process. Whereas with semantic coding our aim was to identify explicit meaning of the participants’ testimonials, latent coding

aimed at capturing and interpreting the implicit meanings of the participants’ ideas, conceptions, and experiences. NVivo (v12) software was also used to aid this process. The interview data were analysed first by each individual author. The findings were then discussed and refined by the whole team, who collectively determined the final outcome of the analysis. This procedure allowed us to incorporate a form of “investigator triangulation” described by Denzin (2009) as a process involving different investigators observing the same data as a means to mitigate bias and enhance validity. Investigator triangulation and the incorporation of a semantic and latent perspective to the analysis served to ensure dimensions of “confirmability” and “credibility” of our analysis and thus enhance the “trustworthiness” (Lincoln & Guba, 1985) of our findings.

4. Interview Findings: Additional Perspectives

As a result of this second qualitative data analysis, four main categories emerged:

1. The use of digital tools.
2. Compulsory and non-compulsory tools.
3. The challenges of belonging to a virtual community.
4. The need for guidance, coaching, and training on the use of these tools

Each of these categories was further subdivided to aid the analysis. Category 1 related to Research Question 1 whilst Categories 2, 3, and 4 related to Research Question 2.

4.1. The Use of Digital Tools

The interview findings highlighted how various SM and AI tools were used in different ways and for different purposes by EdD students.

TABLE 1: LIST OF KEY SM AND AI TOOLS AND THEIR USE BY EDD THESIS STUDENTS

Tool	Personal	Professional	Interaction
Facebook	x	x	
LinkedIn		x	x
WhatsApp		x	x
YouTube		x	
Skype		x	x
Google Search		x	

Source: own compilation/calculations

The personal column indicates exchanges outside the scope of the programme. The professional and interaction columns apply to those activities which support learning. It is important to note that only Facebook© embraced both the personal and professional domains, whilst LinkedIn©, WhatsApp©, and Skype© were used in order to get in touch with other EdD students. The remaining tools were used to meet individual needs.

Facebook©

Those who used this tool did so frequently, very often on a daily basis. However, there was scepticism about its value amongst most of the participants. They were concerned about privacy

and the possibility of their public image being distorted. Perhaps these attitudes are symptomatic of an adult student group.

LinkedIn©

This SM tool was used widely by the participants, but unlike Facebook©, it raised far less issues connected to identity and image.

WhatsApp©

This tool has a special role within the EdD programme. Set up by the students themselves, it is used as a means of connecting those in the thesis stage in order to:

- Readily share documents,
- Ask questions and provide answers
- Act as an additional support mechanism
- Offer encouragement and congratulations on milestones reached.

It was one of the most important and heavily used of all the available tools, especially because of its utility and accessibility via mobile devices. The level of interaction inside the group was very high. Perhaps significantly the EdD faculty had no access to this WhatsApp group.

YouTube©

From the interviews, it was apparent that EdD students also made considerable use of YouTube©, especially for gathering information on how to write the literature review chapter and on how to structure the overall thesis. Clearly this was an individual pursuit which did not directly increase the level of interaction amongst students or with others outside the program.

Skype©

This was already one of the most widely used SM communication tools in the EdD. It was a central component of the student /supervisor relationship, facilitating real time personal interactions that were much more difficult to provide effectively by email. It also helped to engender a sense of belonging to a community, thus helping to limit the sense of isolation that is common in some aspects of the doctoral journey. Hence, Skype was highly valued.

Google© Search

This appeared to be the most well-known and the most used AI tool among those readily available to EdD thesis students. It was accessed almost daily in the search for information, knowledge, and understanding germane to the EdD. Interestingly Google© searches could result in connections being made to some of the other tools mentioned in this research, particularly YouTube.

The comments below are typical of the views of the participants and support the above findings.

P6. ‘... more often than not I use SM for, again educational purposes, I’m a little bit of nerd. I read articles that are of interest, like LinkedIn for example or on Facebook, Twitter and other SM that I use. I usually stay away from the gossip type things, I read more intellectual stuff. As an EdD student, I use the workup group and I quickly look at it. Currently, we have over 30 people and sometimes it’s just a little bit too much, too many things sometimes and sometimes it is towards the gossip type you know, I don’t like that. If somebody asks a specific type of question where I can be of help then I am very happy to help. If I need some information which I think perhaps these people can

provide me with, I ask, and again when somebody shares something relevant and meaningful, purposeful, I have a look and take it further. You can summarise it as I take it with a pinch of salt’.

P2. ‘...I’m quite active on SM; I’m on LinkedIn, Facebook, Instagram. I have also used Snapchat, I have two teenage daughters who give me an update. I’m also in the education industry myself we run colleges in Bombay, so I am quite familiar with SM used by younger kids.’

4.2. Compulsory and Non-compulsory Tools

From the nine interviews, it emerged that students categorised the SM and AI tools into two groups: those they regarded as compulsory and those that were not. The former group is mainly associated with official communication, whilst the latter with self-directed information gathering and sharing, as well as communication.

TABLE 2: COMPULSORY AND NON-COMPULSORY TOOLS

Tools Regarded as Compulsory	Tools Regarded as Non-Compulsory
<p>Students were officially required by the University to use specific tools in the thesis stage. These included Blackboard©, institutional email, Skype© and other similar video-conferencing platforms.</p> <p>It was believed that they would help students to feel part of a community, especially those who for various reasons failed to fully engage with their supervisors and/or their peers. The common linking factors between them in this context is that they facilitated a degree of central control and involved no choice in what was used.</p>	<p>These tools were not officially required or indeed recommended by the University. They included WhatsApp©, LinkedIn©, and Google© Search. Similar to the tools deemed compulsory, they could help students feel part of a community, especially those who for various reasons failed to engage fully with their supervisors and/or their peers. However, because they were not controlled centrally, students were free to interact with each other as they wished. The main activity associated with the use of these tools appears to have been the exchange of relevant information, although this was not done on a regular basis.</p>

Source: own compilation/data

Participants suggested that by making some of the non-compulsory tools compulsory much time would have been saved if it was accompanied by suitable training in their use in order to develop relevant skills. Some also claimed that these tools could expand the social and academic environments to which they had access. This would help to overcome the difficulty of connecting with their peers who were based in many different locations and who faced varied challenges in undertaking research at the doctoral level. They further argued that this could raise self-confidence and encourage more reflectivity.

4.3. Feeling Part of a Community

One of the distinct features that emerged from the additional analysis was the belief that if students were armed with the knowledge of how these tools should and could be used, a greater sense of belonging to a real community might emerge. In addition, they also claimed that the resulting increase in self-confidence could have a positive effect on their ability to prepare for and take part in an online Viva. Those tools with a significant interactive dimension such as WhatsApp© and Skype©, were highly valued.

In this context, we regard the term community as an online group that is both sustainable and academically purposeful. This concept owes much to the seminal work of Garrison and Anderson (2003) which resulted in a framework for a “Community of Inquiry”. However, P3 had an interesting if alternative view on this:

“WhatsApp (community), you have to be invited into the WhatsApp app. So I don’t know how to get into that, and even if I were, I would not be part of a research community, I would be part of a student community, they are different things”

The issue of how to transition the group from the latter to the former is clearly important.

4.4. Guidance, Coaching and Training

This final category is perhaps the most significant of all. Some of the interview participants indicated that they were reluctant to use many of the tools available because of a lack of knowledge, skills, and confidence and/or the time to experiment. In order to address these limitations others suggested that the university should make a greater range of tools compulsory, thus increasing their use. They also stressed that there should be a concomitant increase in training and the opportunities to develop relevant skills. A few claimed that their understanding of what these tools were and how to use them would increase with much more targeted support and direct guidance from their supervisors. Knowing more about issues such as the pedagogy, the security, and the potential to add value to the learning experience of these tools would help in making informed choices about how best to use them.

5. Discussion

In this section, we briefly discuss the findings of our study with a focus on the two research questions and the four themes that emerged from our analysis.

5.1. Using Digital Tools to Support Learning in the Thesis Stage

This section addresses Research Question 1 and related themes. Our findings indicate that EdD students use a selection of digital tools to support their learning during the thesis stage and are generally more broadly aware of what is available. YouTube©, Skype©, and WhatsApp© proved to be the most commonly used for contacting thesis supervisors and peers and for seeking information on thesis related topics. Facebook© was popular with all the study participants but its use was limited to personal and other professional non-thesis related activities. These findings are in line with those of Goh et al. (2013) and Gupta et al. (2013) who conducted research in Malaysia's private higher education institution on Facebook© as a learning tool with a group of undergraduate students. They are also similar to some of the findings reported by Roblyer et al. (2010) who attempted to determine how likely higher education faculty ($n = 62$) and students ($n = 120$) were to use Facebook© for either personal or educational purposes, at a mid-sized American university in the South.

It is interesting to note that WhatsApp©, which is used on mobile platforms, was highly regarded by participants. The use of mobile technologies and applications and their impact on online doctoral students’ work would be a useful area for future research.

Though there are positive aspects to our findings, they also suggest a failure on the part of participants to take full advantage of internet-related technologies in their learning. Perhaps concerns about security and privacy limit their use. It is questionable to what extent current SM

tools and those soon-to-come, can be used effectively by mature online doctoral students, given their unique characteristics as learners and the complexities of the online learning contexts in which they operate and their apparent lack of skills.

Unlike SM, the participants claimed to have little specific knowledge of AI tools, except for Google©'s Search Engine, which they used primarily to gather specific information and resources for their own research. This is reflected in the work done by Atabekova et al. (2018) who examined international student attitudes towards Web 3.0 tools at three Moscow universities and Avci Yucel's (2017) case study examining Turkish students' perceptions of Web 2.0 tools.

Although AI has great potential to transform the Internet from a platform of global interactivity and information sharing to an intelligent and efficient tool for information management, most of our study participants remain ignorant of what it is and how it can be applied. Given this lack of use of AI tools, its impact on online doctoral thesis students' remains unclear. Therefore, it is important to consider how AI tools are introduced to students and how they should be integrated into online learning settings, such as the EdD programme, to make full use of them.

5.2. Possible Impact of Digital Tools on the Online Thesis Stage

This section addresses Research Question 2. The impact of digital tools on doctoral thesis students is four-fold: they contribute to and enhance self-esteem, engender a sense of belonging to a community of learners, prompt greater reflection on the application of non-compulsory tools in support of learning, and create more awareness of the need for coaching and training activities in these tools.

5.2.1. Improvement in Self-esteem

Self-esteem is a combination of one's self-respect and self-confidence (Branden, 1969). Some researchers such as Jan et al. (2017) have claimed that self-esteem can be negatively affected by digital tools because they are used for interacting and engaging with others as well as gathering and sharing information. This could directly apply to those with less 'digital' experience and knowledge. SM tools, such as Facebook© and Instagram©, tend to expose the lives of users to others, thus provoking comparison. This may promote envy and dissatisfaction in equal measure (Jan et al., 2017; Steers et al., 2014). Whilst this observation has some merit, our study findings indicate otherwise. A number of our interview participants clearly stated that the use of SM resulted in an increase of self-respect and self-confidence. This growth in their self-image was achieved by being allowed to safely articulate their ideas and opinions publicly (via LinkedIn©), by learning from others (via YouTube©), and by getting support from their learning community (via Skype© and WhatsApp©). In this regard, we would argue that, unlike those who are younger, our participants were all mature, independent learners who have life and work experiences to draw upon. As a group, they appeared to be very critical of new technologies and rather than becoming actively involved at the outset tended to remain cautious. However, with familiarity, they recognised the potential of these tools and used them appropriately to best suit their specific needs. This supports our beliefs that the use of digital tools and the outcomes from such use is affected by a number of variables related to the users' characteristics (i.e., age, educational and professional background, life experience, knowledge base, etc) and their environment (i.e., cultural, political, and social factors).

5.2.2. *Feeling Part of a Community of Learners*

The idea of community pertains to social cohesion: relationships, trust, shared interests, and problems and solutions among individuals (Bond & Lockee, 2014). Within a community, learning and new knowledge are associated with professional and emotional help. Lave and Wenger (1991) asserted that a community incorporates not only dialogue and task completion, but reciprocal respect and support. Those within a community may comfort and collaborate with one another to enhance knowledge (Bond & Lockee, 2014), hence improving their general well-being. To some participants, digital tools such as Skype© and WhatsApp© provide a channel for emotional and social support so that they might be “travelling alone to individual destinations, but [be] together on the route” (Piercy & Gordon, 2015, p. 397). However, we noted that, from our data, not all study participants have developed a sense of belonging to an online community, and this seems to align with the findings of Crosta et al. (2016), who concluded that a majority of online post-graduate students in their study did not feel they belonged to an authentic learning community of peers.

5.2.3. *Use of Non-compulsory Tools*

The findings from our study highlight how students who readily engaged with technology valued the opportunity to use communication channels outside those prescribed by the University whilst involved in thesis-related activities. This not only improved interaction and information exchange, among others, but may have also encouraged some to explore new and/or different types of SM and AI tools. Although this form of exploratory activity was neither encouraged nor discouraged, the lack of time and the need to use the approved communication channels for thesis purposes meant that even the more adventurous generally used only what was required. The difficulties of becoming part of an online learning community, as discussed in 5.2.2, may also help to explain why students tended to avoid using non-compulsory tools. In addition, the fear of potential harm as a result of security and privacy issues, and the lack of belief in the usefulness of digital tools as a source of learning when compared with face-to-face interaction (Wang et al., 2018b) may also account for the students' tendencies to be conservative in the face of using these platforms. They appear to prefer to stick to those tools which were familiar and/or used for social and entertainment purposes. However, greater encouragement and support from peers might have boosted the students' interest in and confidence to try unfamiliar tools. Findings from other research indicate a positive association between the use of instant messaging mobile apps and students employing SM tools for learning purposes (e.g., Goh et al., 2013; Sun et al., 2018; Xiangming & Song, 2018). Building on such evidence it is justifiable to suggest that encouraging the greater use of instant messaging tools amongst this cohort of students will lead to their use as aids to learning in formal academic contexts.

5.3. **Coaching and Training**

The research participants clearly identified the need for systematic and formal coaching and support systems to promote a better understanding of what tools are available, the pedagogy associated with them, and how they can add value to an educational context. They believed that this should be the responsibility of those academics directly involved in their learning and teaching and/or the University itself. The need for this training is exacerbated due to the following:

1. The lack of familiarity with and the time to explore SM and AI tools by mature students. It could be argued that some in this group lack digital literacy, which is separate from computer literacy. It requires not only practical skills in the use of technology, but also

critical thinking skills, an awareness of the affordances of these tools, an understanding of the shared social issues created by them, and the necessary standards of behaviour expected in online environments (OECD, 2018).

2. Education is not immune to the effects resulting from a world characterised by unprecedented social, economic, and environmental challenges driven by globalisation and an accelerating rate of technological change. The use of both SM and AI tools in education is thus inexorably expanding.

The effect of rapidly evolving technology in education calls for an increase in the digital literacy of those involved. Chetty (2012) and Ohei and Brink (2019) believe that “...the key element of social revolution and transformation in educational institutes is nothing less than equipping students with general ICT knowledge and skills ... [which] includes technical exposure to inspire lifelong learning; making best and appropriate use of social software technologies for conceptualization, representation, communication; individual development and professional competence” (p. 1841). Thus, a more explicit reference to the affordances of SM and AI tools and support in how to use them and developing connected skills may be important strategies to aid learning in online environments. Digital literacy in a strict sense, as an ability to use technology, should not be seen as an ultimate solution. How students make use of technology may also depend on their styles and preferences as learners and their own and their tutors’ perceptions of learning.

6. Conclusion

The phenomenography study reported in the present paper aimed at exploring the use of digital tools by students in the thesis stage of a doctoral programme and to understand their perceptions about them. This type of qualitative data analysis allowed for an additional and deeper understanding of the participants’ beliefs about and purposes for using digital tools, and the affordances of those tools as educational resources. The unique characteristics of the doctoral students appear to have determined their preference for some digital tools over others. The findings of this study help us to better understand their digital experience and skills as both individuals and learners. This understanding is becoming increasingly important as broader societal changes are reflected in the transformation of educational practice. Such changes are not just about a shift from the traditional classroom to online settings; instead, they imply a different learning mix. The future of brick-and-mortar universities could be limited as they become too expensive and time-consuming. However, they may “...continue to exist, but unless they completely customize their offer, students may have serious problems...[entering]... the labour market, despite the expensive course they attended and the degree obtained” (Sousa & Florencio da Silva, 2020). This has a particular bearing on the future of higher degree programmes.

We believe that more explicit encouragement, support, and training should be provided in the use of digital tools in postgraduate online doctoral education. This can be done in different ways: making support available to students through access to a resource centre that can provide timely guidance on the use of platforms and other tools particularly suitable to meet individual students’ needs to perform the academic tasks at hand. Training can be provided in general and specifically, either through the integration of a specific course module on preparing for the thesis stage or through a collection of videos and other materials that students can use for the purposes of their research. More research is needed that addresses “when” and “how” involvement with digital tools would be best incorporated. However, it is our view that AI-driven technology, for example, can be of assistance to researchers, higher education leaders

and decision-makers in providing them with indicators to identify students' difficulties with access and use of digital tools, assess what students need for the successful completion of their studies, and make informed decisions about improvements in the support systems provided to students.

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Declaration Statements

Conflict of Interest

The author reports no conflict of interest.

Funding

This research was supported by funds received from a Hybrid Teaching & Learning Research Grant, which was created by the Research Office in the Academic Quality and Accreditation Unit of the Laureate Network Office to support research that investigates the impact of digital teaching and learning methods on learning outcomes. For more information on the grant or the LNO Research Office, please contact LNOResearch@laureate.net.

Ethics Statement

No dataset is associated with this article.

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