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A Postphenomenological Study of the Digital Experience of Islamic Boarding School Graduates Transitioning to University Education

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Abstract:

This study investigates how graduates of Islamic boarding schools with less exposure to digital technology adapt to the new digital conditions of university life. Islamic boarding schools foster an educational culture which restricts students' access to digital technologies. Graduates who have experienced this culture may represent a distinct group when compared to their peers from other formal educational institutions who have benefited more from exposure to digital technology upon entering university-level education. For university students, digital skills are essential in academic and social life. Due to their background, however, Islamic boarding school graduates' digital journey may thus be far more difficult, and their digital literacy may be less accomplished than that of their peers upon entering university life. To investigate this phenomenon, this study will explore in-depth the digital experience of Islamic boarding school graduates as they commence their university education through a postphenomenological study of 8 participants in order to determine how they adapt to the digital aspects of university life. The results reveal the unique digital experience of each research participant both while studying at the boarding school and when commencing university education. The study also represents this digital experience under three different analytical themes: exposure, adaptation and experience. There was a distinct difference between their lifeworld in their boarding school when contrasted with their university, which was influenced by technological exposure. It also highly affected their adaptation to technology when commencing their university. Technology is also shown to significantly shape and influence the students' behaviours and assumptions about the digital.

Keywords: digital experience, digital literacy, digital adaptation, postphenomenology

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1 Introduction

University students' digital competency is influenced by the skills and resources available to them in their prior formal education settings (Van de Werfhorst et al., 2022). Unfortunately, due to various factors, not all students will receive similar digital readiness preparation as part of their secondary education (Egan, 2020). Some students, such as those from Islamic boarding schools, will not have fully benefited from the digitalisation occurring in other school settings. This is because these institutions' methods of instruction are designed differently from most other formal schools (Budianti & Pasi, 2022; Putra et al., 2019), which may significantly affect their students' digital literacy. Due to Islamic Boarding Schools' strict rules for accessing information technology (Al Anshori et al., 2022), their graduates may be regarded as a social group that has been less exposed to digital technology. Thus, their digital literacy may not be on par with their peers as they progress to a university education. In other words, they typically start university at a considerable disadvantage with respect to digital skills.

Digital literacy is often seen as a key skill for navigating and thriving in a contemporary digitally-driven society. In recent decades, digitalisation has influenced students' use of digital technology for academic and social life (Gutiérrez-Ángel et al., 2022; Kim et al., 2018). They are exposed to a broad digital environment that supports their studies and daily activities. Furthermore, an accelerated digital transformation during the COVID-19 pandemic also required many universities to adopt remote teaching through digital technologies (Francico et al., 2021; García-Peñalvo, 2021). The impact of the pandemic on students was significant, as it forced them to quickly and fully adapt to the digital environment, particularly in enhancing their educational pursuits (Al-Kumaim et al., 2021; Plakhotnik et al., 2021).

Digital literacy is thus considered a key skill for any student entering university education, and digital skills, in general, are normalised in today's digitalised society. The Islamic boarding school graduate's digital experience, however, is likely to be a distinct phenomenon that also affects their ability to adapt to the digital aspects of university life. The first author of this paper completed her studies at an Islamic boarding school before pursuing further education at university. While at university, she encountered distinct issues with digital technology use compared to her peers. At that time, she found it difficult to adjust to the new technologies she had to use during the initial stages of university life. It was these experiences that motivated her to research this topic.

According to statistical data from the Ministry of Religious Affairs Indonesia, by 2022, there were around 36,600 Islamic boarding schools spread out in Indonesia with approximately 3.4 million students (Kemenag, 2022). Many of these schools have secondary school status. According to BPS-Statistic (2020), there were about 20 million young Indonesian people in formal school aged 15 to 19. The number of schools at the senior level (secondary school) based on statistical data was around 30,000, with approximately 10 million students (BPS-Statistic, 2023). Although Islamic boarding school students comprise a lower proportion of all those attending Indonesian secondary school education, it can be seen from these figures these schools still potentially have a significant impact on the education of young people in Indonesia. Even though alumni from formal schools are more numerous in universities, the proportion of alumni from Islamic boarding schools is also significant. Alumni from both types of schools are recorded as continuing further studies at about 47% and 35% respectively. Thus, nearly half of the formal school alumni may pursue further education while over one-third of Islamic boarding school alumni also enter higher education.

Given this context, therefore, the phenomenon of the digital experience of these alumni entering university education is worth exploring further. This study thus aims to explore the digital experience, in both social and academic terms, of Al-Ishlah Islamic boarding alumni attending universities in Indonesia, using a postphenomenological lens. It is the first study to examine human-technology interaction in students from Islamic boarding school backgrounds. Utilising postphenomenology as a methodology enables the researcher to deeply explore their present and prior experience with digital technologies.

2 Literature review

2.1 Digital literacy

With the rise of new digital technologies, it is clear that digital literacy is a vital and important skill for living in today's demanding and competitive world (Bawden, 2008; Phuapan et al., 2016; Shopova, 2014). The

term digital literacy was first introduced by Gilster (1997), referring to how individuals utilise various digital artefacts. Gibson and Smith (2018) further defined the term digital literacy as the ability of individuals to read and write using online resources and to integrate information into coherent messages and communication. Research on digital literacy has generated various definitions and frameworks. Martin and Grudziecki (2006), for example, categorised digital literacy into three distinct types: digital competence, digital usage, and digital transformation. Nelson et al.'s (2011) study constructed an umbrella framework for investigating digital competence into twenty distinct aspects of digital literacy. Therefore, the concept of digital literacy can encompass a variety of aspects, including technology usage, multimedia, and communication. It emphasises how individuals can utilise information technology to support their lives, including education, employment, and recreation. It also refers to organising information coherently and conveying it to others.

Research on the digital literacy of university students has recently become of topical interest (Zalite & Zvirbule, 2020). Tejedor et al. (2020) and Rafi et al. (2019), for example, examine the level of digital competence among students in full digital inclusion, confirming that digital skills are considerably affected by digital exposure and constant interaction. Moreover, many studies also confirmed that not all students are equally equipped or exposed to the same technologies and have the same technological readiness (Egan, 2020; Van de Werfhorst et al., 2022). Even students with full digital inclusion cannot be guaranteed to have equal digital literacy and digital readiness (Tejedor et al., 2020). Additionally, those who study in formal educational settings and regularly engage with technological artefacts cannot be assumed to possess enhanced competencies and a heightened level of digital preparedness. However, intensive interactions and exposure to digital technologies could influence an individual's ability to acquire digital skills, and conversely, it would be difficult for individuals who have only limited access to technology to do so. Hence, students with less digital inclusion or influenced by other digital disparities are likely to be more unfamiliar with technological environments and therefore may not have acquired adequate digital skills.

An Islamic boarding school is an educational institution that aims to develop good moral character in students so that they can lead moral lives independently (Al Anshori et al., 2022). It is a type of educational institution with a curriculum that combines Islamic educational values with those of formal schools (Abidin et al., 2020; Salim et al., 2021). To preserve a conservative educational culture and turn out excellent students, Islamic institutions persistently restrict their students' engagement with digital technology and digital environments. They strongly assume that digital technology has a detrimental effect on teenagers and students. Therefore, rules restricting technology use in Islamic boarding schools are presumed to be appropriate and part of their curriculum and educational values. Meanwhile, formal school may actually integrate digital technology use into their formal curriculum, recommending it as a way to facilitate their academic performance. Informatics of ICTs is taught by the majority of secondary schools in Indonesia as part of a formal curriculum but is not currently included in national competency tests for enrolling into university education. The informal use of technology by non-Islamic boarding school students is also more widespread and varied. These students are not always controlled 24-7 by their schools and might gain more digital exposure by utilising gadgets or even visiting internet cafés.

According to a study conducted by Putra et al. (2019), the implementation of stringent regulations in Islamic boarding schools leads to varying degrees of digital literacy among students. These regulations restrict students' access to digital technologies. For example, students engage with technology at least once a week in informatics classes under the guidance and oversight of their instructor. They only have a limited time to independently explore the technology and may only just follow the teacher's instructions or handouts in order to complete their assignment. Thus, these students are unlikely to benefit much from these limited opportunities for utilising and familiarising themselves with technology. Therefore, their digital skills are presumably weak. In a seminal study conducted by Mantyastuti (2017), it was discovered that communication devices, such as telephones, may be utilised as a means of contact between Islamic boarding school students and their families, mostly for urgent matters. In addition, throughout students' holiday periods spanning around two weeks, and during brief parental visits lasting only a few hours, there is a prescribed frequency restriction on technology usage. According to Putra et al. (2019), Islamic boarding school students apparently have adequate digital skills in accessing particular social media content and gaining information. However, their ability is limited to social media activities only and not using technology to support their education. Hence, one can assume that these alumni may only have limited digital readiness when starting university.

Relevant studies of digital literacy in Islamic boarding schools were conducted by Putra et al. (2019) and Mantyastuti (2017), focusing on examining digital literacy among students at an Islamic boarding school.

These two studies measure the level of digital literacy among students in these settings seeking to establish the digital disparities present in Islamic boarding school settings. Their uniqueness may be attributed to the exploration of the specific cases within this unique digital environment that differ from other social groups. Our current study, however, moves beyond measures of digital literacy in those environments towards exploring the alumni's digital experience once they begin their university lives. It is even more relevant since digital migration and transformation from school to university level can be key to students transitioning from secondary to higher education. Their digital experience becomes a focal point in determining how their interaction with technology shapes this transition.

2.2 Digital experience

Digital experience can be defined as the emotional responses engendered through the interaction between users and diverse technological systems (Chang & Gomes, 2017). It focuses on the investigation and assessment of how technology enhances human activities and is related to the research on human-computer interaction (HCI). The study of digital experience in education traditionally evaluates students' and teachers' technological proficiency and is also related to the impact of technology on learning outcomes (Vindenes & Wasson, 2021). Various studies have been conducted to examine technological experiences within the field of educational research including the interaction between humans and technologies in teaching practices and psychosocial encounters (Cilesiz, 2011; Wood et al., 2003). The study of digital experience within the educational sector thus provides valuable insights into a variety of implications resulting from the use of digital technologies.

Digital experience has become more of a phenomenon of interest due to the continuing digitalisation of education and learning evidenced by online courses, interactive simulations, and virtual classrooms. Those offer learners diverse and engaging ways to acquire knowledge and skills (Haleem et al., 2022; Schindler et al., 2017). Considering the phenomenon of interest, Islamic boarding school alumni with previous low digital exposure may encounter a significantly different learning environment compared to learning mostly based on textbooks. However, problems may arise for such individuals from information overload, addiction to technology, and social isolation. Technological addiction may occur due to their level of curiosity about the new technological environment. An exploration of their digital experience both before and in their current university life can uncover how these new encounters affect many aspects such as digital skills, lifelong learning, creativity and mental health.

In relation to their transition from school to university life, the concepts of digital migration and digital journeys may help in further understanding these alumni's digital experience from before the present digital environment. Even though this study does not focus on migrants, the theoretical framework of digital migration is useful in conceptualising the transitioning aspect of the digital experience of these alumni. In a broad sense, digital migration is detailed into three paradigms: (1) migrants in cyberspace, (2) everyday digital migrant life, and (3) migrants as data (Candidatu et al., 2019; Leurs & Prabhakar, 2018). The first paradigm focuses on the ways in which migrants utilise digital technologies and cyberspace to navigate and negotiate their migration experiences. Many studies explore how migrants use digital platforms such as social media, messaging apps and online forums to connect with their communities and seek information through the migration process (Dekker & Engbersen Themis, 2012). The second paradigm diverges from a digital-media-centric approach by prioritising the examination of online-offline interactions as its primary analytical framework (Leurs & Prabhakar, 2018). Contrary to emphasising digital activities as the starting point, scholars within this paradigm integrate traditional fieldwork conducted in physical environments with the observation and analysis of digitally mediated behaviours. It explores how digital technologies have become more integrated into migrants' everyday lives and routines. The last paradigm redirects attention away from migrants' specific digital behaviours to their portrayal and management as data entities within digital infrastructures. It investigates the processes involved in the collection, storage, analysis, and utilisation of migrants' data by various entities, including governmental bodies, private enterprises, and other stakeholders.

Of relevance to this study is the second digital migration concept of everyday digital migrant life, in which Islamic boarding students migrate from less digital inclusion to a more fully digital environment. In this situation, even though Islamic boarding school alumni are not physically migrating from one place to the other, they are encountering new digital settings during their transition to university which potentially mediate and transform their new academic and social lives. Hence, the second paradigm may be adopted to explore the transitional aspect of their new developing digital experience. In addition, the second

paradigm promotes the study of online-offline interactions of digital migrants which may influence methodological choices such as contrasting online and offline experiences of the target research subjects.

The foregoing review of literature relevant to the phenomenon of the digital experience of Islamic boarding school graduates transitioning to university leads to the following three research questions:

Research Questions:

Q1. How does the Islamic boarding school graduate's individual digital experience at university compare with that of their prior secondary school settings?
Q2. How does the prior digital literacy of Islamic boarding school graduates influence their digital migration to university?
Q3. How does the current use of digital technologies shape the graduates' digital experience at university?

2.3 Postphenomenology as a Research Approach

Phenomenology is a form of qualitative research defined as the study of lived experience patterns to gain a deeper understanding of actual phenomena (Converse, 2012; Fowler et al., 2008; Moustakas, 2011; Neubauer et al., 2019). As a research approach, according to Teherani et al. (2015), phenomenology attempts to describe the essence of the phenomenon by exploring it from the perspective of those experiencing it. It aims to describe the meaning of the experience both in terms of what was experienced and how it was experienced (Neubauer et al., 2019). In simple terms, the study of phenomenology is the exploratory detail of how humans experience their real world directly.

A closer investigation into the interaction between humans and technology, i.e., digital experience, seems somewhat inadequately addressed by phenomenology but is highly appropriate in lived experience research. Both descriptive and hermeneutic phenomenology are critiqued as failing to highlight the importance of the technological mediation of experience (Aagaard, 2017). Descriptive phenomenology emphasises the purity of people's experiences, while hermeneutic phenomenology, on the other hand, involves the interpretation of the experience (Matua & Van Der Wal, 2015). As noted, experience with technology can denote the way users engage with the real world, mediated by technology. Technology is seen to transform people's perceptions and actions (Jensen & Aagaard, 2018). Consequently, it is argued that how humans and technology interact necessitates the development of a specific exploratory strategy from the perspective of the philosophy of technology (Verbeek, 2005).

The philosopher Don Ihde introduced postphenomenology to respond to these criticisms of phenomenology. Postphenomenology was designed as a philosophy of technology to explore the technologies of science (Jensen & Aagaard, 2018; King, 2019). The prefix 'post-' is developed in depth from classical phenomenology in order to investigate the interaction between humans and technology. It is concerned with comprehending the various functions that technologies play in the human-world relationship (Jensen & Aagaard, 2018; Rosenberger & Verbeek, 2015) and inherits aspects of phenomenology's subject-object relationship (Rosenberger & Verbeek, 2015). Thus, the human-world relationship is seen as a human-technology relationship. Don Ihde divided the roles of technologies into four types of human-world relations (Jensen & Aagaard, 2018; Voordijk, 2019), namely the embodiment relation, the hermeneutic relation, the alterity relation, and the background relation.

2.3.1 Embodiment Relation

The embodiment relation represents the situation where humans engage/interact with their environments through technology where it is seen as part of their physical bodies. Ihde used the example of eyeglasses to describe this kind of relation (Ihde, 2009). An individual who is wearing eyeglasses perceives and experiences the world through them. She/He does not perceive the eyeglasses themselves because the eyeglasses have become part of their body which they no longer notice as being different to themselves. Using Ihde's notation, this becomes (human/eyeglasses) → world. In the embodiment relation, the human's relationship with the technology is transparent, such that technology is simply viewed as part of their own being. This relationship is essential for demonstrating how humans interpret a world influenced by technology. In Figure 1, this is depicted as technology playing a central role as a mediator for the human to experience the world. The direction of the relationship (through the arrow) is from the human passing through the technology to the human's experience the world. Another example related to ICTs would be when people talk to others through their mobile phones using hands-free devices such that the

phone becomes part of their body and therefore unnoticeable to them as they converse with other person. Using Ihde's notation, this becomes (human/mobile phone) → world.

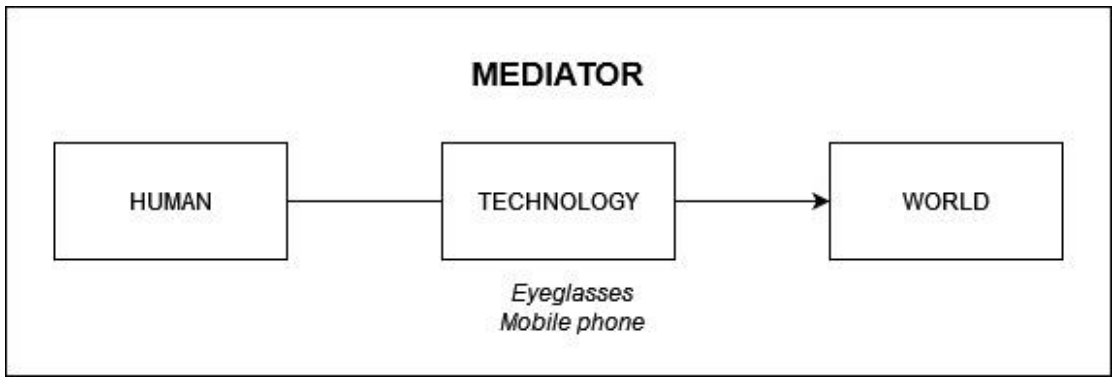

Figure 1 The Embodiment Relation adapted from (Vindenes & Wasson, 2021)

2.3.2 Hermeneutics Relation

The hermeneutics relation depicts how technology may be used to represent the real world to a human user. In this relation, the user interprets the world aided by technology (Voordijk, 2019). In Ihde's notation, this is human → (technology world). The relation is referred to as "hermeneutic" because it involves a process of reading and interpretation (Verbeek, 2008, p. 389). In a hermeneutics relation, unlike the embodiment relation, technology stays in focus, i.e., people pay attention to the technology when trying to understand and interpret its portrayal of the world.

Figure 2 demonstrates how humans interact directly with technology to interpret information about the world. Three arrows in the diagram depict these relationships. First, the human interprets the world through technology, which is shown as a directed arrow from the human to the technology and then through it to the world. The second arrow illustrates the human's perceptions and experience of the world, while the third shows their response to the world. The third arrow demonstrates how the human then acts in the world depending on their interpretation. As an illustration, a doctor could examine brain activity through MRI technology. In this situation, the scanned image depicts some information about the patient's case. The interpretation made by the doctor is further mediated by their experience with such cases, which they then use to determine what action to take in diagnosing and treating the patient. Their interpretations either inhibit or invite particular actions or practices related to treating the patient. Hence, the hermeneutic relationship holds significant value in demonstrating how individuals interpret and act in the world through the mediation of technological artefacts.

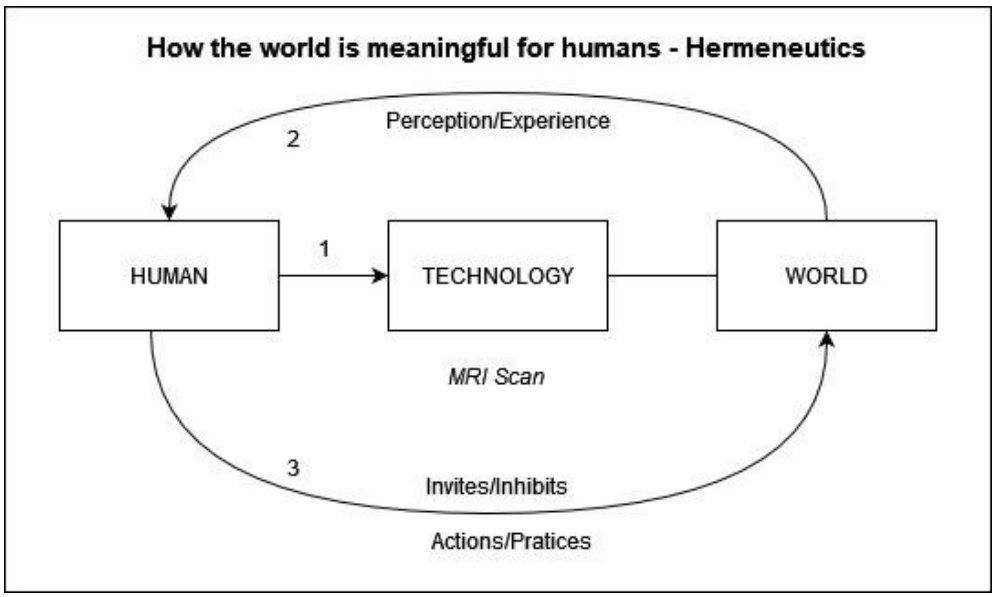

Figure 2 Hermeneutics Relation adapted from (Vindenes & Wasson, 2021)

2.3.3 Alterity Relation

The alterity relation places technology at the centre of how humans experience their world (Afyounian, 2014; Verbeek, 2015). In Ihde's notation, this is human → technology (the world). The human interacts not directly with an entity in the world but indirectly through a technological artefact in place of that entity. This can be illustrated through Verbeek's (2005) example of a person purchasing a train ticket from a machine. In this example, the person interacts with the world through the machine's screen. The person's attention is directed toward the screen presenting relevant information about the transaction and the transaction is completed by the technology. This kind of relationship could be useful when analysing systems design since it calls attention to the interaction with the technology. Hence, the way the screen performs its interaction with the human becomes a key focus of the design.

Figure 3 depicts the alterity relation by showing humans interacting directly with the technology, as a placeholder, but not as a mediator to the world. The first arrow is directed to the technology and the human's action/response is also directed toward technology through the second arrow. Unlike both the embodiment and hermeneutic relations, there is no direct interaction between the human and the world. Another example would be humans interacting with an eCommerce website to purchase goods; in this case the shopping experience is completely online with no direct interaction with a real-world store.

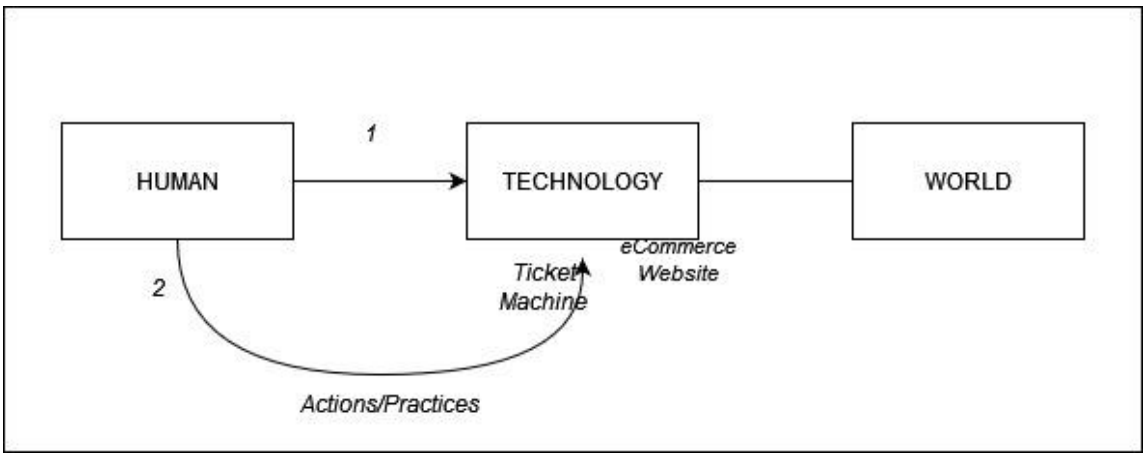

Figure 3 Alterity Relation (researcher's own interpretation)

2.3.4 Background Relation

The background relation depicts technology as an external component which may not play a central role in how people experience the world, either through mediation, interpretation or substitution (Rosenberger & Verbeek, 2015). In Ihde's notation, this would be human (technology/world). In contrast to the embodiment relation, there is no mediation by technology between the human and the world (Youngjin, 2010). This final relation is depicted in Figure 4 showing no arrows between the human and the technology, only a connection through a straight line. The figure depicts humans as individuals being passively impacted by technology in the world. As an illustration, we can consider the noise caused by mobile phone notifications in the middle of a conversation. This represents an audible signal that something is happening in the human world but the exact nature of this occurrence is not obvious at the point in time when the notification is heard. It is in the human's background environment. This relationship proves crucial for demonstrating how technological objects may mediate human-environment interactions.

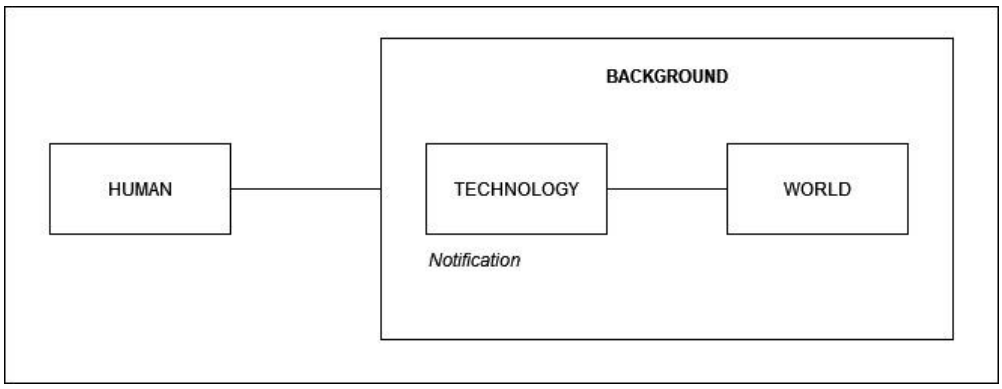

Figure 4 Background Relation (researcher's own Interpretation)

Postphenomenology, as a research method, provides two main investigative approaches: (1) in-depth analyses of a specific technology and (2) comparisons of multiple technology variants (Aagaard, 2017). The first approach is derived from Adams & Thompson's (2011) qualitative study. It provides eight heuristics for conducting a thorough investigation of technological mediation, which involves the recognition of the amplification/reduction structure of human-technology relations and ensures the quality of interactions focusing on the technological material (Aagaard, 2015, 2017). The second approach is exemplified by Rosenberger's (2014, 2020) research, which contrasts the variability of technological use in order to investigate what is most stable. It allows researchers to explore human experience mediated by technology, fully considering neglected crucial aspects of many education practices (Aagaard, 2015, 2017). Either an in-depth examination of human-technology interaction or a comparison of multiple versions of technologies can constitute a postphenomenological study in educational settings. Regardless of data collection and analysis techniques, a postphenomenological investigation could aid the researcher in gaining a nuanced understanding of educational technologies (Aagaard, 2017; Arzroomchilar, 2022).

In short, postphenomenology stands out as an appropriate approach for studying the complex relationship between humans and technology in the world. Its capacity to explore the multifaceted nature of technology, its roots in phenomenology, its focus on mediation, and its ethical and ontological considerations make it a versatile and powerful framework. Even though phenomenology is widely recognised in most research to explore the human's lived experience, this approach has certain limitations when it comes to addressing the intricate dynamics between technology and individuals. In this study, therefore, postphenomenology has been embraced as a framework derived from phenomenological methods tailored to examine the interplay between humans and technology.

3 Research methodology

In-depth semi-structured interviews are among the qualitative research methods commonly used to study lived experience in research (Byrene, 2001; Creswell, 2018). According to the second digital migration paradigm, discussed in section 2.2, approaches to studying digital life experience can adopt both interview and observation methods. This study collects data through semi-structured interviews, with a pilot interview conducted with the first participant. This is because data collection through interviews could investigate the phenomenon in depth and also provide an opportunity to stimulate additional unstructured discussion with participants. In addition, the pilot interview helped to evaluate the research instrument and identified practical issues. The research instrument was an interview protocol designed to address the research objectives and questions. The pilot interview changed a small proportion of the questions, especially the current digital experience and also changed the order of questions to let the interviewee manage their story. It also was also used to test the duration of the interview. According to Jacob and Furgerson (2012), the interview should not exceed more than 90 minutes in order to maintain the commitment of the participants. The final instrument took around 60-90 minutes to administer and contained about 30 main and probing questions.

The interview questions were categorised according to students' past and current experiences with technology. The perspectives and attitudes of the students who have encountered restricted technological access in boarding institutions can be gleaned from these prior experiences. The present experience questions investigated how digital literacy and readiness impacted the university life of respondents. With reference to postphenomenology, the interview questions were designed to elicit a comprehensive

understanding of students' experiences with their new technological environment. In addition, the investigation also compared and contrasted academic learning systems with other platforms, such as e-learning, distance learning, and social media.

A postphenomenological study focuses on the detailed nature of the selected case; hence, the sample size is relatively small (Rosenberger & Verbeek, 2015). According to Creswell (2007) and Moustakas (2011), the recommended sample size for a phenomenological study is between three and ten participants. Therefore, this study consisted of interviews with approximately eight first- and second-year undergraduates who were alumni of a pre-selected Islamic boarding school. They were over the age of 18 and voluntarily consented to participate in the interview without coercion. To recruit participants for this the alumni database of the Al-Ishlah Islamic Boarding School, Paciran Lamongan was used. This is one of the Islamic boarding schools which restrict their students from accessing technology. The facilities such as computer laboratories have been provided to facilitate only informatics classes. Potential participants were contacted by the school and provided with comprehensive details about the project. Additionally, voluntary participants were encouraged to share the research information with other alumni, thereby facilitating recruitment. Those interested in volunteering were requested to reach out to the researcher for further clarification and to consent to participation through a formal letter of consent.

As postphenomenology has not yet developed specific data analysis techniques (Rosenberger, 2014), the data analysis in this study adheres to the general procedure outlined by Creswell (2007), consisting of six procedures for analysing and interpreting. The preliminary step in this analysis is organising and preparing data involving transcribing the interview record. In this step, the interview audio recording is transcribed into text and categorised depending on the type of information, for example, demographics. The transcription technique used in this study is known as intelligent verbatim, which entails meticulous editing and rephrasing to produce a concise and precise transcript (Bucholtz, 2000). Then, the second step involves reading the whole data to obtain general information about the data and the overall meaning. The procedure may be undertaken several times in the scanning reading method. The third step starts to codify the data and use specific words to represent the category of information (Rosman & Rallis, 2012). In the following step, the codification is used to generate a description for categorical analysis. In this step, each participant is analysed individually regarding their perceptions and attitudes toward technologies, which are interpreted through the postphenomenology lens. Each case is an in-depth and unique investigation, hence, each participant's perceptions and attitudes towards technologies are analysed separately. The narrative highlighting the essence of the student's experience is presented in this descriptive analysis (Magilvy & Thomas, 2009; Moser & Korstjens, 2018). Afterwards, the whole documentation and analysis are read to ensure that it becomes detailed and advanced, as well as ensuring that nothing is missed. Finally, the analysis results and new study findings are discussed and recommendations for future research made.

In addition, participant verification was used to ensure the data were validated. The participants were contacted again if data was missing or to clarify information. The purpose of this method is to gain a thorough comprehension of the participant's experience (Merriam, 2002). Furthermore, to maintain the reliability and consistency of the researchers, each step of the study was documented so that it could be compared to other similar research projects.

4 Findings

The findings are presented in two sub-sections comparing the past and present digital experiences of Islamic boarding school alumni. Table 1 summarises these experiences under three themes exposure, adaptation and experience.

Table 1 comparison of past and present digital experience

Theme/ Category	Past digital experience	Present digital experience
Exposure	• limited exposure • more access to technology during holidays • different opportunities to access technology • access to limited apps and technology	• full digital integration into their lives • own personal mobile phone and laptop • more varied apps and information systems
Adaptation	• feeling isolated and different from their peers	• shocked and frustrated at the beginning • distance learning leads to tension and

Theme/ Category	Past digital experience	Present digital experience
		frustration at the beginning of adaptation
Experience	• technology not facilitating academic work • not much technology facilitating their social activities • computer use based on informatics handouts in class • use of mobile phones only during school breaks • social media limited only to content and communication • technology does not mediate their activities (pen-based learning)	• academic progress fully relies on technology • their entire lives are mediated by technology • increased independent learning and more creativity • utilising technology during class sessions to take notes • utilising different kinds of technology to communicate and support their daily activities • using social media more comprehensively for various purposes • familiarising with technology more independently

4.1 Past digital experience

The empirical data shows that the participants' level of digital exposure while studying at the Islamic boarding school was limited but variable because of disparities in opportunities for digital technology use. Due to the implementation of strict rules at the Islamic boarding school, the participants' exposure to various technological artefacts was limited. Most of them indicated that formal sessions during Informatics classes were the times when they could actively utilise a computer. Meanwhile, when on vacation, they may have had greater access to technology but this was highly dependent on parental and environmental controls. It is interesting to note also that other opportunities also affect the variability among students in accessing digital technology. For example, the majority had better opportunities when they were part of a student organisation's administration team, especially as a secretary. They indicated that they had more opportunities to access technology such as a laptop to do their organisational administration. They had more time to get familiarised with technology and interpret and interact directly with the technology.

Participant 1# *"As far as I remember, I rarely used technology. I only encountered technology in formal school during the informatics lecture. According to the schedule, I only had one hour weekly during informatics class. It was different during the holidays. I had more access to my computer and smartphone a lot."*

Limited technological exposure was compounded by the fact that the technologies they used were also limited and based on the informatics curriculum. Most respondents, P1, P2, P3, P4, P6 and P7, pointed out that MS Word was the main application they remembered the most when they used technology in the Islamic boarding school. P2, P3, and P4 typically only followed the teacher's instructions, and if they had a problem with the computer or program in front of them, they might have asked the teacher for help. P4 and P6 explained that there was no access to technology during other classes, and the one-hour session of the Informatics class was only for learning based on the in-class material. They also did not utilise technology to support other academic subjects. Technology was not provided during in-class sessions and most relied on a textbook and whiteboard to interpret taught information.

Participant #4: *"No digitalisation was facilitated during formal classes, except in Informatics class sessions. I didn't use technology to support my academics since I relied on my textbooks. I could explore or follow the teacher's instructions in a one-hour session. […]."*

Interestingly, Participant 1 reported different experiences in utilising technology; he explained that he sometimes made the most of his lab session by exploring the Internet and finding information relevant to his future education.

Participant #1: *"I didn't use the computer much […]. I only execute the activity to respond to a teacher's command and instruction […]. Then, during my final year, I intended to use the internet to research much information such as suitable studies and campuses for my next degree."*

The interviews also addressed how technology influences individuals in terms of note-taking, using pen and paper or technology. All respondents reported using pen and paper for note-taking, but their reasons

varied. Participant 1 stated that he did not know how to effectively use technology to take notes because there were no opportunities to use the appropriate technology in class. Participants 1 and 4 intended to take notes using technology, but it appeared impossible at the time. Their access to technology was limited and it was impossible for them to utilise the note tools during the class or after. Participants 1 and 4 had opportunities to act as a secretary to student organisations, but it was impossible to use these to support their learning process. Both had thought about using technology to help their studies but the rules prohibited them from accessing it in everyday life. Other participants also mentioned that they found it more convenient to use textbooks rather than technology due to force of habit.

Participant #1: *"I preferred pen-and-paper throughout the lecture because I found it difficult to carry devices to class. Another reason was that I didn't know how to use note-taking devices, particularly Arabic notes. I was not sure what the note-taking tool was all about".*

When technology was more available, they utilised it for social activities, mostly during holidays. Six participants, P1, P2, P3, P4, P6 and P8, had social media accounts, but they were not active users who always made an update or accessed the social media content. Participant 5 indicated that he barely used social media while in boarding school. However, during holidays he was able to contact, communicate and further engage with other people. During this period, interestingly, most of the students were more likely to interact socially through social media communication apps. They changed the way they communicated from direct offline in-person to online using technology either in group chats or through phone calls.

Participant 5# "[…] *During the holiday, my group chats in WhatsApp were always busy with notifications since the interaction, which usually was directly in the boarding school, migrated to social media." […]*

It is fascinating to note that technology may only facilitate them in a limited way to interact with other social groups outside their school. Participant 8 stated that he benefited from the lab sessions when engaging in social media-related activities. Participant 1 also stated that he could interact socially with others outside the boarding school. In other words, it could assist him in perceiving and experiencing the world beyond the boundaries of the boarding school.

Participant 1# *"I utilised a few minutes of my informatics break to check my social media and read a few posts. Because I felt isolated from the rest of the world, I was only interested in what happened. Not because of FOMO, but because I was curious about other people's social media posts."*

In short, the majority relied on formal lessons to gain access to digital technology and gain some form of experience through it but it was seen as a tool to facilitate their academic work.

4.2 Current digital experience

The participants indicated that as university students, they had greater access and exposure to different forms of technology. They reported using technologies such as laptops and smartphones almost every day to support their academic and daily lives, such as communication. The technologies utilised varied as well. P2, P3, P4, P6, and P7 reported that they were not required to use any mandated applications. Participant 4 and Participant 8 reported adding more academic and social applications to their mobile devices. They were eager to use applications that would support their studies more effectively. Participant 1 and Participant 5, who were enrolled in a computer science program, reported having to manage numerous additional applications to support their academic process. Participant 1 emphasised that, at least for each semester, he was required to adapt to multiple applications for his studies. During university, they utilised technology frequently to support their academic as well as social activities. They integrated technology as part of their life.

Participant 3# "*I can access my laptop to learn and do my assignments for almost 4 hours daily. Even though there are no rules for accessing technologies, events such as morning and evening lectures may hinder me from using my phone. […]."*

Participant 1# "*As a computer science student, I need to explore many applications and software. Those are code editor, Visual Studio code, GitHub, power BI, […]. I begin to learn new applications at least once per semester based on the module I attend.*"

With more technological exposure, the way they were learning was different compared to their past experience. All participants agreed that technology was facilitating learning and supporting their academic endeavours effectively. They frequently utilised the Internet for study, research, and assignment support. In addition, they utilised distance learning technologies such as e-learning, student information systems,

and other education information systems. They used information technology nearly every day for their studies, including accessing materials, uploading assignments, and reviewing due dates, feedback, and grades.

Most participants also noted that they now relied on Internet searches to study and obtain references for their assignments. Participants 1, 4, and 5 pointed out that the way they learned varied according to the characteristics of the modules they attended. They were also using YouTube searches in order to access video tutorials supporting their studies. Participants 3, 5 and 8 also noted that they use artificial intelligence, such as GAI, to find another version of the answer as they assume that the GAI could generate the result more efficiently. Participant 8 stated that he frequently used his smartphone to support his studies by installing applications that helped him learn more effectively.

Participant 3# "*I follow social media channels that help me to learn. […]. I also follow the content that shows me how to be a good student, such as informing kinds of applications to do better writing like Chat GPT, writing tools, and grammatical checking*."

The participants also indicated different preferences in using technology as a tool. Four out of the eight participants, specifically P1, P4, P5, and P7, expressed a preference for utilising technology as a means of note-taking due to its perceived ease and effectiveness. The remaining participants, namely P2, P3, P6, and P8, continued to use paper-based note-taking as their preferred method, citing its convenience and ability to facilitate better retention of information.

Participant 1#: *"For now, I prefer to use technology because I can make and access my notes more effectively, especially attaching the link and other sources of information. I record most of the lectures during distance learning using the Zoom feature".*

Participant 6#: *"I still prefer to use pen-paper because it is comfortable. In contrast if needed, I also use my phone to take a note or capture the class whiteboard".*

This result may suggest that full technological inclusion completely alters the student's attitude toward technology and their preferences as they learn to take advantage of its benefits while facilitating their activities. Despite half of them still preferring pen and paper as a convenience, others had adopted new attitudes toward technology, using their smartphone cameras to capture and formulate lecture notes. Technology, such as a camera, helped them to capture and interpret information.

A further observation was that the use of social media was also considered important for supporting their studies. Participant 6 explained that using WhatsApp groups could facilitate discussion among students and sharing documents. In addition, most of them, P1, P3, P4, P5, P7, and P8, used social media content to enrich their knowledge and capacities. For example, they subscribed to certain accounts which provided educational and motivational content. In their daily social interaction, most of the participants reported that they were now habitual social media users. Their use of social media was not significantly different from the past, however, social media served a greater variety of purposes, including entertainment, educational support and communication tools.

Participant 7 and Participant 8 also pointed to the use of technology for many purposes, not only communication but also for their daily life. They stated that they utilise various applications such as online shopping, online payment, hiring drivers, and online food delivery services.

Participant 7#: *"I also install much software that helps me in my daily life, such as internet shopping, cab services, and online food ordering."*

As they transitioned from Islamic boarding school students to university students, they encountered significant technological differences. Each of them was initially astonished and dissatisfied by their lack of knowledge and expertise; collectively, they were initially surprised and frustrated. Participants 1 and 4, who were in their second year in university this year, explained that they encountered great difficulties conducting long-distance learning. Participant 4 argued that she faced difficulties since she was not familiar with the technology and also none of her peers were able to help during the remote learning caused by the COVID-19 pandemic. Surprisingly, the third participant, who was in the first year, noted that she was initially and frequently confused when attempting to access the university portal, as well as when making a post on her social media TikTok, as part of an introductory assignment for new students.

Participant 4# *"My first year was so challenging because I had to overcome different conditions in attending long-distance learning. I had no clue about using Zoom and Google Classroom; I needed to*

adapt to how to interact with other people using technology. Sometimes, I panicked because of an error and other problems. […]."

The majority attempted to overcome their difficulties from the outset and tried to adapt to the new technological environment. Participant 1 asserted that he required nearly a semester or six months to adjust to the new environment and academic demands. It took several attempts at individual exploration of the technology to affect their perceptions and attitudes and to change their habits too. All the students' experiences with learning new technologies began with self-exploration, allowing further examination of how they became accustomed to the technology. When confronted with difficulties, they looked for potential solutions by exploring the technology itself via Google search or watching YouTube video tutorials. P1, P2, and P4 relied almost entirely on the Internet to find solutions to their digital barriers. They also sought help from their peers if they could not resolve their individual issues.

Participant *1# "Overall, I can handle any situation and technical issues of the new technology since the beginning. I always try to solve by myself by Googling to fix the problems. Unfortunately, when I am stuck in the same situation for a long time, I ask my friend to give me a hand."*

4.3 Applying the postphenomenological lens

Table 2 comparison of past and present digital experience

Human-Technology Relations	Past Experience (Islamic Boarding School)	Current Experience (Post-Islamic Boarding School)
Embodiment Relation (human/technology) → world	Externalising knowledge through pen/paper	Some externalising of knowledge through pen/paper and through apps Formulating ideas through GAI Capturing written notes through smartphone camera apps
Hermeneutics Relation human → (technology world)	Information processing through textbooks	Information processing through multiple applications Internalising knowledge through e-learning platforms Engaging with their learning through various virtual learning platforms and apps Problem-solving through Google
Alterity Relation human → technology (the world)	Information seeking/retrieval through textbooks Limited information seeking/retrieval through the Internet Limited socialisation through social media/the Internet	More varied information seeking/retrieval through the Internet and various applications (student information systems, education information systems, YouTube, social media) Completing academic tasks through various applications/systems More socialisation and engagement with the social world (entertainment, food services) through social media
Background Relation human (technology/world)	N/A	Technology is now part of the context in which they live and work, ever-present and intertwined with their lives

In the student's past experience, there was little evidence of technologies in general, and digital technologies specifically, playing a part in their academic and social lives. There is a noticeable contrast between their past experiences and how they interact with technology in their university life. Digital technologies, particularly computers and smartphones, are now embedded in their day-to-day life

exhibiting various new human-technology relations. There is evidence of the four human-technology relations in the way in which students engage with the new technological environment (as seen in Table 2). It influences their attitudes and presumptions. Whereas in the past, they may have been unaware of how technology facilitated their lives, they are now more interdependent and assisted by technology in their academic pursuits. Their perceptions of, and attitudes toward technologies have changed. In the past, they used basic technologies like pen/paper to represent the knowledge they were gaining from their studies, a form of embodiment relation, if you consider the pen/paper to be a type of technology. However, now they are thinking through technology (using GAI) and capturing notes through smartphone cameras, forms of embodiment relations that depend more on technology mediating the world. They are using technology more to interpret and understand their new world, from e-learning to problem-solving through 'Googling'. These examples of hermeneutic relations are in stark contrast to previously interpreting their world mainly through textbooks. Their online information-seeking behaviour has increased in the new university setting. Furthermore, they are engaging in a host of interactions with a variety of technologies and applications demonstrating a significant increase in alterity relations compared to their past experience. They now rely more on doing activities in the real world through technology such as online payments or online shopping.

The evidence of the background human-technology relation is more subtle. The effect of the increased usage and reliance on digital technologies in their everyday academic and social lives demonstrated how digital technologies are becoming more integrated into the context of their everyday life. It is not often consciously visible to the user and therefore often goes unnoticed and unexplored unless the technology suddenly becomes unavailable or breaks down. There was no opportunity to observe this in this study, however, we could infer the background relations simply through the increasingly embedded nature of the technologies in their everyday life. Were the technologies to break down or become unusable, the students would not be able to function effectively in daily life. The human-technology relations explored in this study allow us to conceptualise the digital experience of the students. Focusing on embodiment, hermeneutics, alterity and background relations can provide a more comprehensive and profound understanding of the digital experience and a means of comparing the past with the present as well.

5 Discussion

Table 3 Discussion Summaries Table

Theme/ Category	Past Experience	Current Experience
Exposure	• technology does not fully facilitate the students in the boarding school • technology in boarding schools is not optimised for enhancing education and digital skills which is relevant to previous studies by Al Anshori et al. (2022) and Heryatun, Y. & Septiana (2023) • students' use of technology, such as social media limited to during holidays • limited evidence of human-technology relations	• university settings can have a substantial impact on using various technologies • more evidence of human-technology relations, especially alterity relations
Adaptation	• findings support a study by Putra et al. (2019) that the alumni lack digital competency and are limited to only utilising social media • less experience in exploring digital technologies resulted in a lack of confidence	• each participant expressed surprise and frustration when they began their university journey • gain access to technology and be active online impromptu self-learning through technology • engaging with the digital world led to heightened confidence in their digital skills and a more positive self-perception. • more evidence of human-technology relations in how students interact with technology to get familiarised
Experience	• limited only embodiment relation in how they use technology to facilitate	• the use of social media is more comprehensive – the human-technology

Theme/ Category	Past Experience	Current Experience
	communication such as utilising smartphones and social media • limited examples of human-technology relations in how sometimes they surf their social media and seek information from social media content • academic journey relied on textbooks, and material forms of technology for mediating the world;	relations in engaging with the social world can be clearly seen • alterity relation is more obvious in how they transform their daily activities for example using e-commerce and online banking • the academic journey is richer and varied. Engaging within technology and interpreting the information through digital materials such as e-books, google searches, YouTube, generative AI etc. • the experience toward technology alters the way they study such as using technology to make notes instead of handwriting

5.1 Digital Exposure

The study revealed that students experienced significantly fewer opportunities to utilise technology while staying at Islamic boarding schools compared to when they were on school breaks within only around two weeks. They predominantly rely on technologies, mostly smartphones, throughout the day. What is noteworthy is that each participant may have a varying level of access to technology during their time in the boarding school. A few of them have slightly more opportunities to use technology for student organisational purposes. The contrast becomes evident when they transition into university life, where technology becomes an integral part of their daily routines. This aligns with the broader findings of other studies, such as those conducted by Gutiérrez-Ángel et al. (2022) and Kim et al. (2018).

The difference in exposure to technology while staying between boarding schools and universities reveals unique insights into how students engage with technology. In accordance with Ihde's (2009) concept of the hermeneutics of human technology relation, the study highlights that technology does not fully facilitate the students in boarding school. The evidence conveys that the use of technology is often limited to text-processing apps, with a focus solely on lesson material, thereby failing to incorporate technology into another aspect of their activities. This study is relevant to support evidence from previous observations by Al Anshori et al. (2022) and Heryatun, Y. & Septiana (2023), indicating that technology in boarding schools is not optimised for enhancing education and digital skills. Another finding concerns how students utilise technology, such as using social media during holidays, demonstrating that they utilise technology primarily for communication with others. This pattern of behaviour is largely consistent with the concept of alterity relation. In short, the students may utilise technology in their daily activities; however, it is regrettable that the range of applications they employed was quite impeded. Students have the ability to incorporate technology into their everyday routines.

Conversely, university settings can have a substantial impact on how students engage with a wide array of technological devices and software applications. The current study found that the majority of participants acquired personal laptops upon starting their university education. They initiated the use of various apps on both smartphones and other devices to enhance their educational pursuits and daily routines. This finding was also reported by Margaryan et al. (2011) in that the selection of applications utilised by students is diverse. Moreover, they tend to be related to their academic pursuits and their everyday necessities from social media, google apps, and generative AI to e-commerce apps and services apps such as banking, transportation and delivery services. In contrast to their prior digital experiences, technology in the university context is seamlessly integrated to facilitate a multitude of purposes for students (Rosenberger & Verbeek, 2015). This observation underscores the presence of two distinct human-technology relationships, namely embodiment and hermeneutics relations, indicating that students consistently interact with their real-world activities through the mediation of technologies.

The diverse technological landscape and fortuitous circumstances exert a profound impact on the digital experiences of graduate individuals. Each of them described their personal narratives concerning digital experiences across different time and situational contexts. These are influenced by a multitude of factors, including educational specialisation and parental regulations during holiday periods. In the past, the

graduates faced limited opportunities and restricted their exposure to and proficiency with technology and digital applications. Conversely, during their university, their digital experiences underwent a marked transformation and enrichment, encompassing extensive engagement with digitalisation processes and technological artefacts.

5.2 Digital Adaptation

More than half of the individuals interviewed expressed a lack of confidence in their digital skills while they were students in an Islamic boarding school. A revealing study by Putra et al. (2019) showed that the digital skills of Islamic boarding students were primarily limited to accessing social media during that time. Their interaction with technology was mainly focused on facilitating communication, falling within the realm of an alterity relationship. On the other hand, three of the participants argued that they felt they were at the appropriate level as needed at that time. This is because of the different technological exposure they got such as more accessing technology for student organisational purposes and also an additional class in preparing for a competition as mentioned by Participant 1. Their experience in exploring digital technologies at that time resulted in them feeling confident enough to navigate and utilise technology as they needed as students. As per the digital migration framework proposed by Leurs and Prabhakar (2018)The participants in this study can be classified as the second paradigm, which is everyday digital migrants' lives. This phenomenon arises from their shift towards extensive use of technology, a transition driven by their prior experiences of being excluded from the digital realm. In the context of this investigation, the most significant outcome was that each participant expressed surprise and frustration when they began their university journey. The process of individuals adapting to new digital environments is a common occurrence, allowing them to acquire additional digital skills and self-fulfilment in a rapidly changing society.

The obvious finding to emerge from the analysis is that the ways participants familiarise themselves and adjust to the new digital environment are varied. The alterity and hermeneutic relation pertain to this discovery. Most participants commonly acquired familiarity with technology by engaging in a thorough process of trial and error without relying on manuals, guidebooks and handouts. They engaged with technology to acquire the experience that could help them to solve difficulties and problems. The participants in this study showed how they could interpret the world through the available technologies. Regarding the process of adaptation, it is important to gain access to technology and to be active online. Accordingly, this can enable individuals to solve their own problems much more independently than if they were to seek assistance either directly or through technology from others.

As an adaptation to the new technological environment after becoming university students, the findings revealed that most participants exhibited increased confidence in their digital abilities. It is relatively in line with other work asserting that educational technology enriches students' digital competency as they engage in technology more frequently (Haleem et al., 2022). This transformation can be attributed to the new technological environment, which effectively nurtured their competence in becoming more adept at adapting to and utilising technologies and applications on a daily basis, interpreted in the study as evidence of background relations. Consequently, as they fully embraced digital inclusion, technology played a pivotal role in enabling them to engage with the digital world for nearly all of their academic and social needs. This, in turn, led to heightened confidence in their digital skills and a more positive self-perception. To assess and measure self-reported digital skills more accurately, it is essential to consider established digital competency frameworks, such as those encompassing information literacy, communication, and digital creation (Bawden, 2008). It seems that these findings stem from the contrasting technological environments of Islamic boarding schools and universities. Participants experienced a significant boost in confidence because they transitioned from having little to no exposure to digital technologies to gaining substantial experience with them. However, it is worth noting that their self-assessment may not encompass all three aspects of the digital competency framework. In essence, they might assume they are proficient in using technology to enhance their academic and social lives, but this assumption might not be entirely accurate.

This research offers evidence supporting the idea that the level of exposure to technology significantly influences the development of digital skills. The limited availability of technology in Islamic boarding schools has consequences for students' digital preparedness before they enter university. These disparities relate to unequal access to and use of information and communication technology (ICT). In essence, this study's findings corroborate prior research (Van de Werfhorst et al., 2022), underscoring the importance of digital readiness in shaping students' readiness for their academics at the university level.

5.3 Use of Technology in Shaping Human's Experiences and Attitudes

The primary difference in their digital experience compared to the past lies in how they use social media applications upon entering university life. Their interaction with technology now differs significantly from their past experiences and is, in many aspects, much more enriched. Firstly, they utilise social media as a means to facilitate their communication, and this inclination can be elucidated by considering the intricate interplay between human-technology relationships. Essentially, this discovery affirms that the use of social media enables students to engage with other individuals in the digital realm, forging a connection that integrates humans and technology rather than treating them as separate entities or estranged tools (Rosenberger, 2020). In addition, they also turn to social media for information entertainment and to support their academic pursuits by accessing relevant content. In this context, social media serves as a window to the world, with students interpreting the information it presents, exemplifying the hermeneutic relationship through which students comprehend the world facilitated by social media. For instance, they can access updated news and entertainment content without directly immersing themselves in the real world.

An intriguing discovery revolves around how technology reshapes the way students engage with their daily routines. Notably, three participants highlighted that the adoption of e-commerce, e-banking, and online services simplifies their tasks, leading them to rely on these digital solutions. In this context, technology serves as a mediator that streamlines their activities, representing what can be termed an "alterity relation." This transformation in their daily routines can subsequently influence their perspectives and expectations. This finding illustrates how former students may now encounter new experiences through screen-mediated interactions, such as online shopping, as opposed to physically visiting traditional markets. It demonstrates that individuals engage in an indirect selection process, where they make choices and express their preferences through technology. This finding is also evidence of how they began to use technology to embed and mediate in their everyday life.

During their learning journey, students are empowered to substitute or enhance their previous bio-technological interaction. The integration of the internet and technologies like smartphones and laptops into their academic pursuits creates a new educational environment, supplanting their prior method of studying, which predominantly revolved around studying textual books. Using Google search, AI chatbots and YouTube video tutorials, for example, offers a faster and more convenient means to access a wide array of facts and expand one's knowledge base. The algorithms used in internet searches yield copious amounts of data and information, which can influence cognitive processes and interactive abilities. Rather than relying solely on lectures, this study underscores the potential of internet-based independent learning to complement students' comprehension and improve their capacity for knowledge acquisition and processing. Furthermore, their transformation also showed in how they used digital books more rather than textual books. Compared to the past that not any digital books in their study, digital books such as a PDF format the new form of source of information they used to study. Even though a few of them said that textbooks were still more convenient, but, using digital books can be more accessible from anywhere.

Changes may also be apparent in how technology supports academic endeavours, exemplified by its role in note-taking. Half of the participants stated that technology has significantly altered their way of doing note-taking during classes, contrasting their response in prior digital experiences that taking notes using pen and paper was the most preferred. Their level of exposure to and proficiency with digital tools influences their preference for using technological devices such as smartphones and computers, which directly enhance their comprehension of the subject matter. Some of them persistently using textbooks hold the strong reason that handwriting might help them to remember and digest the learning material. In contrast, those who have a strong preference for technology recognised that technology could streamline the note-taking process, making it more efficient. They fully appreciate how technology can facilitate their educational journey and provide accessible resources beyond traditional textbooks. In short, consistent and ongoing interaction with technology has the potential to shift their mindset and transition their experience from the traditional pen-and-paper method to digital computer usage in note-taking.

Another illustration, as indicated by the findings of this study, involves the implementation of long-distance learning systems. In such setups, technology is employed to supplant traditional classroom environments, enabling interactions between instructors and students that are facilitated and mediated through technology. However, from the postphenomenological standpoint, there is an underlying assumption that both students and teachers seamlessly adapt to and engage in online sessions. This is the process of how technology embodied the students and teachers interacting mediated by technology. Consequently, many individuals tend to lean toward and thus miss the direct, in-person classroom interaction (Sergeeva, 2023).

The participants showed an experience that was somehow stressful in involving online class sessions. This research discovered that participants who experienced distance learning often felt distressed and uncomfortable in online settings and the adaptation began which also shows human-technology relations through constant exploration.

6 Conclusion

The most apparent conclusion is that the increase in university students' exposure to technology has a significant impact on their academic and social support strategies, as evidenced by how technology changes the way they learn and interact with social entities. The first research question examines the disparity in application usage between students enrolled in boarding schools and those attending universities. The results illustrate the divergent levels of technological exposure among each participant. Although they encountered a number of digital discrepancies during their time in boarding school, the majority of them had limited and sporadic access to technology. The use of applications exhibited limitations as educational resources and were not integrated into their everyday experiences. In contrast, in universities, students are exposed to a much wider range of technologies and diverse applications that serve to enhance both their academic pursuits and daily lives.

The findings of the second research question indicate that prior digital literacy has a significant impact on the digital migration of former students of Islamic boarding schools. Based on research findings, it has been observed that students often experience feelings of shock, inadequacy, and frustration during their initial transition into university life. The confusion was basically not having a clue how to use technology and also how to fix the error that happened. This is the effect of less digital experience then it seems to need time to adapt and get the way in coping with the unfamiliar technical conditions. This phenomenon pertains to numerous prior empirical investigations that suggest that, as users of technology, individuals must engage in adaptation and adjustment processes to effectively navigate the technological landscape. The research also reveals the strategies employed by students to adapt and address the challenges. In addition to practical experience, individuals may also acquire knowledge through real-life scenarios, such as seeking assistance from others.

The primary focus of the third research question pertains to examining and interpreting the student's interaction within new technological milieus using postphenomenology. The dynamics of human-technology interactions can be effectively employed to fully understand how students encounter a diverse range of technologies, applications, and information systems. The discussion concludes that technology plays a significant role in shaping and influencing students' behaviours and beliefs. They engage technology in virtually all of their daily activities. Their activities are mediated, embodied, and influenced by technology. The study demonstrates well three frameworks within the field of human-technology relations, namely embodiment, hermeneutics and alterity in how students engage with technology. Regrettably, there was not a lot of empirical data to demonstrate background relations. This aspect appears to necessitate an in-depth exploration of personal experiences, especially when technology is not actively being used, but is influencing the user’s environment. Embodiment, hermeneutics, and alterity relations, nevertheless helped the study to achieve a comprehensive and profound understanding of digital experiences.

This general study's findings suggest that there may be digital skill disparities among students attending Islamic boarding institutions, which can be attributed to the digital skill research group. Postphenomenology can reveal the digital migration and journey of students and the transformation of their attitudes and experiences toward technology as a consequence of increased technological exposure in this study. This initiative represents the first exhaustive examination of the experiences of graduates of Islamic boarding schools who participated in full digital inclusion during their university years. In addition, it has been demonstrated that digital training programs in Islamic boarding schools do not adequately prepare graduates for their digital readiness for university enrolment.

This study acknowledges that not all Islamic boarding schools share the same culture. The cultural environment within each school can differ significantly, making it challenging to generalize across all Islamic boarding schools. Each institution may have varying levels of exposure to technology, influenced by factors such as cultural, religious, geographical, and political constraints or ideologies. These elements contribute to disparities in technology access. For instance, in the case of digital disparity, factors like poverty and geographic isolation can severely limit access to technology. The environment setting between Islamic boarding schools and isolated villages might be far different in their underlying potential

for digital disparity. Islamic boarding schools intentionally restrict access as part of their educational philosophy, while isolated villages often experience such limitations due to a lack of development or poverty. In both cases, individuals may share limited exposure to digitalisation, reduced opportunities for real-time global communication and networking, and might only rely on traditional non-digital systems. In general, the exploratory study of the two cases remains the same in examining how individuals from both environments navigate their experience as newcomers to the digital world.

6.1 Implications

This research highlights those students entering higher education, particularly from diverse backgrounds such as Islamic boarding schools, may have varied expectations regarding digital technology. Their previous exposure to technology creates significant differences in how they perceive and engage with digital environments. The responsibility of higher education systems both at the secondary and university levels is to provide better schemes that help the student in preparing for their university entry. Universities could offer tailored orientation programs that focus on building digital literacy skills, bridging the gap between students with varying levels of technological exposure. The target program should not be solely for Islamic boarding school alumni but also for any students who need digital preparation. Meanwhile, boarding schools could also integrate basic digital literacy into their curricula, preparing students for university life without compromising their educational philosophy.

Students also vary in their eagerness, effort and motivation which may fully affect their learning process. Acquiring digital skills is not solely about navigating the digital tools but it is more that individuals have to be able to learn independently using digital tools. This study underscores the importance of fostering independent learning skills among students with limited digital experience. Universities should offer tailored resources and training to help students navigate digital platforms, encouraging them to develop the autonomy required for successful learning in a digitally-driven academic world. Knowing students' unique motivations for learning might also assist in developing the right schemes to help them acquire digital skills effectively.

The heterogeneity of digital skills among university students suggests the need for flexible learning models that cater to varying skill levels, potentially supported by university policies that ensure equitable access to digital resources and training. Regardless of their background or prior digital experience, they should have equal access to resources that enhance their digital skills. Inclusion policies might advocate mandatory digital literacy courses, access to digital mentors, and infrastructure improvements, especially for students from underprivileged or isolated areas. These measures would create a more inclusive environment and help ease the transition for students from diverse educational backgrounds.

Students' transition from secondary education to university is a critical phase in their academic and personal development. Studies exploring this phenomenon can contribute to the growing discourse on how universities can better support students during this transition, focusing specifically on the role of digital literacy. By linking the findings of this research to broader studies on student transition, universities can gain insights into creating smoother pathways for students to adapt to the digital demands of higher education. Knowing and categorising the level of digital skills can also help universities develop more targeted educational strategies. It allows universities to design specific programs tailored to each group's needs, ultimately improving the digital competence of the entire student body.

6.2 Limitations and Recommendations

One of the drawbacks of this study was the paucity of researchers in undertaking postphenomenological interviews. Due to the researcher's dearth of experience, conducting interviews in postphenomenology is limited. Even if the researcher conducts a pilot interview in advance to test the interview instruments, obtaining abundant data from the participants may be difficult due to their tendency to provide vague responses. In addition, the most significant limitation of this study is that the postphenomenology analysis in this study can focus on only three human-technology relationships: embodiment, hermeneutics, and alterity. This is because the study focuses extensively on how students interact with technology. For future research, it would be beneficial to investigate how the experiences of Islamic boarding school students are centred on a variety of technologies and applications with the same functionalities. Additionally, experiences related to background relations analysis can be more explicitly incorporated.

Acknowledgement and ethics

The study is a low-risk undertaking for which the University of Sheffield has granted ethical approval. This study examines the level of sensitivity exhibited by religious schools towards educational culture.

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