

Learning without Limits: Exploring University Students' Experiences of Digital Technologies to Foster Lifelong Learning

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Abstract

Digital Technologies (DT) are pivotal in promoting Lifelong Learning (LLL) by providing students with access to a wealth of information. Technologies facilitate students' personalized learning experiences, enabling them to progress at their own pace and in line with their interests. DT has transformed higher education by expanding access to information and creating opportunities for independent and continuous learning. This study explored how university students use DT to enhance LLL. A qualitative research design guided by an interpretivist philosophical paradigm was employed to understand students' experiences and perspectives on a sample of purposively selected 10 M.Phil. and 10 Ph.D. students. Data were collected through semi-structured interviews using a protocol comprising 10 open-ended questions addressing DT and LLL. The interview responses were examined thematically to identify recurring patterns in participants' experiences and learning practices. The findings revealed that finding and evaluating reliable online information, creating and presenting learning materials, protecting personal information, learning beyond the classroom, setting learning goals, applying online learning in academic and everyday contexts, monitoring learning progress, adapting learning methods when facing difficulties, continuing to acquire new knowledge, and the overall contribution of digital technologies to SDL and LLL. Participants reported using academic databases, Google Scholar, educational videos, digital libraries, and productivity applications to support their learning. They also described evaluating information credibility, monitoring their progress, and modifying learning strategies according to their needs. These findings highlight the importance of strengthening digital competence to prepare students for LLL beyond formal educational settings.

Keywords: *digital technologies, lifelong learning, self-directed learning, digital literacy, postgraduate students, higher education*

Introduction

The closing years of the 20th century witnessed a significant surge in the advancement and integration of computer and communication technologies across various aspects of our daily lives. This era also saw the emergence of novel information technologies

and the continuous growth of existing ones. Global communications accelerated, and the interplay between education and socioeconomic factors intensified. There exists a causal relationship between information processing and education, wherein higher levels of information technology development necessitate a higher level of education. Education becomes a driving force behind further advancements in science and technology (Siemens & Tittenberger, 2009). Technology continues to play a pivotal role in extending education beyond the traditional classroom setting. Digital learning not only stimulates creativity but also instills a sense of achievement in students, encouraging further learning through unconventional methods. The global adoption of remote learning technologies, incorporating TV, radio, online platforms, and mobile devices, is commendable (Cendon et al., 2023).

The establishment of the global information space played a crucial role in driving a shift in the traditional educational paradigm. One of the central concerns in pedagogy was to devise educational models that would suit the new stage of civilization. The concept of Lifelong Learning (LLL) emerged, with a primary focus on continuous postgraduate studies aimed at enhancing knowledge, skills, and professional competence (Assefa et al., 2023). The impetus behind this shift was the need for economic progress, which brought forth new educational challenges, such as the transformation of traditional professions and the creation of new ones, necessitating professional education, advanced training, and employee retraining. Digital skills embody the synergy between cognition and technology, revolutionizing knowledge processes, particularly among aging populations. Younger generations display innate tech savviness, benefiting from advanced learning capacities. Adults and older individuals lack native technological competence. Nevertheless, they are proactively acquiring digital skills to enhance their lives and adapt gracefully to the digital era as they age. The rapid advancements in digital and technological innovations are profoundly reshaping people's daily lives and causing significant demographic changes. These advancements are creating new employment opportunities and revolutionizing the management of healthcare, education, and social environments. Preparing for this transformation necessitates substantial investments in acquiring new skills and a fundamental reevaluation of education and lifelong learning systems.

Digital Technologies is the Integration in Higher Education (HE) dates back to the 1990s, when IT developed quickly and marked the first time that digital tools were used in a HE environment (Leidner & Jarvanpaa, 1993). Since then, the use of DT in higher educational institutions has grown significantly because of its ability to offer unique options for both teaching and learning (Whitaker et al., 2016). However, there are pros and cons to using DT in higher education. Positively, many stories demonstrate how digital technology is used in higher education. According to these reports, digital tools promote peer and instructor connection, improve information seeking and sharing, improve problem-solving abilities, and raise student involvement (Henderson et al., 2017). On the other hand, some have suggested that children can learn just as well with or without technology and that using digital devices might actually cause pupils to behave badly (Whitaker et al., 2016). Researchers warn higher education institutions against getting too excited about technology-enabled learning in light of these conflicting viewpoints. They also stress the importance of conducting further research to fully understand how digital technologies affect HE outcomes (Henderson et al., 2017). HE uses a variety of digital technologies, one well-known example of which is the Virtual Learning Environment (VLE). The VLE, which was created expressly for educational purposes, is seen as a "teacher-centered" technology that has historically been utilized in higher education to enhance teaching and learning (Whitaker et al., 2016). Comprehensive

studies that shed light on how DT affects educational results are needed as the conversation surrounding them in higher education continues.

There is currently a lack of empirical studies on the use of VLE and how they affect students' experiences in HE. However, the majority of the research that has been done thus far indicates that using VLE in the HE setting has favorable effects. Research, such as that conducted by Dennen and Spector (2007), highlights how using VLEs improves students' learning capacities. Similarly, Lee and Tsai (2011) note that VLE has a favorable effect on students' entire learning experience, while Cho and Shen (2013) find a positive association between students' performance and the amount of time they spend using VLE. According to Mills et al. (2014), VLE has the benefit of combining formal and informal learning. The research (Sobaih et al., 2016) recognizes the restricted capability of VLE in terms of unidirectional information flow, despite these encouraging findings. To overcome these constraints, social media (SM) expands upon Web 2.0 concepts (Kaplan & Haenlein, 2010) and offers chances for reciprocal communication (Sobaih et al., 2016). Despite not having been created with education in mind, SM is easily accessible and is being embraced by HE institutions; it is thought to be a potent force for altering teaching and learning methodologies (Manca & Ranieri, 2013). Because SM is viewed as a tool that speaks to the interests and behaviors of modern students, its use enables HE institutions to reestablish a connection with digital natives (Junco, 2014).

Information is a measure of an individual's capacity to identify information needs and to find, store, retrieve, apply, synthesize, and assess information that is transmitted (Alexander & Galina, 2020). This factor attempts to gather data on an individual's level of media and information literacy. Four sub-dimensions make up this questionnaire dimension: 1) Information needs, access, location, and selection; 2) Information management, comprehension, and application; 3) Information assessment; and 4) Media access, comprehension, and assessment. *Communication and Collaboration* emphasizes the importance of sharing information with others (Vuorikari et al., 2016) and measures a person's ability to communicate in a range of contexts. It also assesses how involved and cooperative the aforementioned person is in communicating with others. This part aids in the process by which people learn to comprehend the significance of exercising critical thinking regarding media productions and messages, as well as the repercussions of those messages. The two sub-dimensions that make up this dimension are: collaboration with others and communication with others. *Digital Content Creation* aims to gather data about people's activities related to producing, sharing, and distributing online material (Vuorikari et al., 2016). When someone can produce and edit fresh content, creative creations, audio-visual products, and digital expressiveness while keeping in mind the moral and legal implications of their rights and intellectual property, they are considered competent in the field of creating digital content. Two sub-dimensions make up the dimension: The creation of digital content, followed by its integration and reorganization. *Digital Security* attempts to gauge an individual's capacity for self-defense as well as their level of safety and well-being in digital environments and when utilizing digital technology (Vuorikari et al., 2016). The dimension is made up of two sub-dimensions: 1) privacy settings and data protection, and 2) safeguarding an individual's health and well-being.

LLL entails individuals gaining relevant knowledge, values, and skills by embracing diverse learning opportunities offered by both the government and society (Kirby et al., 2010). These opportunities encompass both formal and informal education, spanning from early childhood to retirement (Uggla, 2008). UNESCO identifies four key dimensions within

the concept of LLL: *firstly*, "learning to know," which involves acquiring knowledge and understanding through various means. *Secondly*, "learning to do," which extends beyond acquiring vocational skills to encompass a range of competencies for effective engagement in one's work environment; *thirdly*, "learning to live together," emphasizing participation in collaborative activities and project implementation with others; and *finally*, "learning to be," which promotes greater autonomy, judgment, and personal responsibility in one's actions (Billett, 2010; Ceschi et al., 2021). These four dimensions are reflected in indices such as the ELLI and the Canadian CLI. In today's uncertain times, HE places a strong emphasis on the concept and significance of LLL. One of its objectives is to nurture the LLL abilities of college students (Field, 2011).

Goal setting is setting high goals for task performance rather than setting easy goals or vague, abstract goals such as the exhortation to "do one's best." So long as a person is committed to the goal, has the requisite ability to attain it, and does not have conflicting goals, there is a positive, linear relationship between goal difficulty and task performance. Goals refer to future valued outcomes; the setting of goals is first a discrepancy-creating process. It implies discontent with one's present condition and the desire to attain an object or outcome (Assefa et al., 2023). Goals link to affect in that those goals set the primary standard for self-satisfaction with performance. High, or hard, goals are motivating because they require one to attain more to be satisfied than do low, or easy, goals. Feelings of success in the workplace occur to the extent that people see that they can grow and meet job challenges by pursuing and attaining goals that are important and meaningful (Latham, 2013). *Application of knowledge and skills* is one of the most important components of lifelong learning is the application of information and skills, as it helps to close the gap between theory and practice. It comprises the capacity to apply learned skills and information in practical settings, thereby generating meaningful outcomes and solving practical problems. Individuals' adept at applying their knowledge and skills demonstrate a capacity for critical thinking, creativity, and innovation (Billett, 2010). They identify opportunities where they can use their skills and adjust their approach to different situations. Moreover, they exhibit a commitment to continuous improvement, seeking feedback and reflecting on their experiences to refine their capabilities further. Through the proactive application of knowledge and skills, individuals not only enhance their proficiency but also contribute positively to their communities and professions, driving progress and innovation forward (Lin et al. 2020). Focusing on the perspective of *Self-direction and evaluation*, there are three ways to define self-directed learning. "(1) to enhance the ability of adult learners to be self-directed in their learning, (2) to foster transformational learning as central to self-directed learning, and (3) to promote emancipatory learning and social action as an integral part of self-directed learning" are the goals of SDL that are examined in the first approach. According to its definition, SDL is a process where individuals plan, carry out, and evaluate their own learning experiences. SDL is a "personal attribute". Measures of the "internal state of psychological readiness to undertake self-directed learning" were developed by Oddi (1986). According to Guglielmino (1997), a person's curiosity, goal orientation, tenacity in learning, and enjoyment of learning are some of the characteristics linked to SDL readiness. The self-evaluation perspective holds that people are driven to reach a mutually acceptable self-evaluation. People are primarily concerned with the diagnosticity of self-relevant knowledge, that is, how much the information can clear up doubt about a particular feature of the self to achieve this goal. People look for diagnostic information, whether it confirms or contradicts their preexisting beliefs about themselves, or whether it has favorable or negative

effects on them. Overall, the purpose of self-evaluation is to raise the degree of confidence associated with self-knowledge (Higgins et al., 1986). *Adaptable learning strategies* refer to the ability to adapt one's learning strategies is paramount for success in both personal and professional endeavors. Adaptable learning strategies encompass the capacity to flexibly adjust one's approach to learning in response to evolving circumstances, challenges, and opportunities. Individuals proficient in adaptable learning recognize that learning is a dynamic process that requires continual refinement and adjustment. They demonstrate a willingness to experiment with different techniques, seek out diverse resources, and embrace new technologies to enhance their learning experiences. Adaptable learners exhibit resilience in the face of setbacks, viewing them as opportunities for growth rather than obstacles. By cultivating adaptable learning strategies, Individuals can effectively navigate the complexities of the modern world in their pursuit of LLL (Boekaerts, 1992).

Statement of the Problem

DT has become an integral part of contemporary education, providing university students with opportunities to access information, develop academic skills, and engage in independent learning beyond formal classroom settings. Their effective use can support LLL by enabling learners to acquire new knowledge, establish learning goals, evaluate their progress (Billett, 2010) and adapt their learning strategies to changing academic and professional needs. However, the educational value of digital technologies depends not only on their availability but also on how students use them to support continuous and self-directed learning. At the postgraduate level, students are expected to engage in independent study, conduct research, evaluate academic information critically, and continuously update their knowledge. Digital resources, including academic databases, online courses, digital libraries, educational videos, and collaborative platforms, facilitate these activities. Nevertheless, students may experience challenges in evaluating the reliability of online information, protecting personal data, selecting appropriate learning resources, and monitoring their own learning progress. Understanding these practices is important for determining how digital technologies contribute to the development of LLL (Assefa et al., 2023) competencies among postgraduate students. Although DT is increasingly integrated into higher education, further exploration is needed to understand students' experiences, learning practices, and perceptions regarding their use for self-directed and lifelong learning. Therefore, the present study explored the experiences of postgraduate students who used DT to find and evaluate information, create academic materials, ensure online safety, establish learning goals, apply knowledge, monitor learning progress, and adapt their learning strategies. The study sought to develop an in-depth understanding of how DT support LLL and continuous knowledge development beyond formal educational settings.

Research Objectives

The researchers planned the following research objectives

1. To explore how university students use DT to access, evaluate, create, and apply knowledge for independent academic learning.
2. To investigate how DT facilitates students' LLL by supporting continuous knowledge acquisition, skill development, and learning beyond formal educational settings.

Research Design and Methodology

A well-structured research design minimizes biases, enhances the credibility of the current research, and provides a clear roadmap for researchers to follow, ultimately contributing to the rigor and integrity of the research (Coe et al., 2021). The current research

employed a qualitative research design guided by an interpretivist philosophical paradigm to explore university students' experiences of using DT to foster LLL. The researchers adopted this approach to understand students' perspectives, interpretations, and experiences (DeMarrais et al., 2024) of DT use in LLL. The interpretivist paradigm enabled the researchers to explore how students constructed meanings from their learning experiences within their academic contexts (Yue & Xu, 2019). The qualitative design provided an opportunity to gain an in-depth understanding of students' learning practices (Leavy, 2022), motivations, and challenges (Lapan et al., 2011) associated with DT. The researchers focused on understanding how students used digital resources to establish learning goals, apply acquired knowledge and skills, monitor their learning progress, and adapt their learning strategies to changing needs. This methodological approach supported a context-sensitive interpretation of participants' experiences and provided insights into the role of DT in promoting independent, continuous, and LLL beyond formal educational settings.

Population and Sample

The population of the current study comprised postgraduate students enrolled in the Faculty of Social Sciences at the University of Lahore (UOL). The faculty includes four departments: Education, Sociology, Islamic Studies, and Lahore School of Behavioural Sciences. Students enrolled in M.Phil. and Ph.D. programs constituted the target population because their academic activities involve independent learning, research, and the use of digital technologies. The researchers focused on this population to explore students' experiences of using digital resources and platforms to support DL and LLL. The population was relevant to understanding how postgraduate students integrate digital technologies into their academic and continuous learning practices (Coe et al., 2021). The researchers selected a sample of 20 postgraduate students through purposive sampling. The sample comprised 10 M.Phil. students and 10 Ph.D. students enrolled at the University of Lahore. Participants were selected based on their experience of using digital technologies for academic and self-directed learning. This sampling technique enabled the researchers to recruit information-rich participants capable of providing relevant insights into the research topic. The inclusion of students from both postgraduate levels facilitated an exploration of varied learning experiences, practices, and perspectives (Leavy, 2022). Consistent with the qualitative research approach, the researchers prioritized the depth and richness of participants' responses rather than statistical generalizability (Coe et al., 2021; Yue & Xu, 2019).

Instrument

The researchers developed a semi-structured interview protocol after reviewing relevant literature on DT and LLL. The instrument consisted of 10 open-ended interview questions designed to explore university students' experiences of using DL to foster LLL. The questions were developed around two major dimensions: digital technologies and lifelong learning. The DT dimension covered four areas: information, communication and collaboration, digital content creation, and digital security. The LLL dimension focused on four areas: goal setting, application of knowledge and skills, self-direction and evaluation, and adaptable learning strategies. These dimensions provided a systematic framework for exploring students' digital learning practices, independent learning experiences, and approaches to continuous learning. To ensure the clarity, relevance, and appropriateness of the interview questions, the researchers submitted the initial protocol to language experts for evaluation (Chasokela, 2025). The experts reviewed the questions for grammatical accuracy, clarity of wording, coherence, and suitability for the target participants (Coe et al., 2021).

Based on their feedback, the researchers revised the questions to improve their comprehensibility and alignment with the study's objectives. The revised interview protocol was subsequently validated to establish its content relevance and ensure adequate coverage of the identified dimensions. This process helped strengthen the quality of the instrument and its suitability for qualitative data collection. The finalized protocol provided a consistent framework for conducting interviews while allowing follow-up questions to explore participants' responses in greater depth (Leavy, 2022).

Data Collection

The researchers obtained permission from the relevant university authorities before initiating the data collection process. Subsequently, the researchers contacted the selected M.Phil. and Ph.D. students and explained the purpose, objectives, and procedures of the study. Informed consent was obtained from all participants through a consent form, ensuring that their participation was voluntary and that their responses would remain confidential. The interviews were conducted individually in a normal classroom setting at the University of Lahore to provide a familiar and comfortable environment for participants. The researchers used a semi-structured interview protocol comprising 10 open-ended questions related to digital technologies and LLL. Participants were encouraged to share their experiences, perspectives, and practices regarding the use of DT for self-directed learning and LLL. Follow-up questions were asked when necessary to obtain further clarification and detailed responses (Leavy, 2022). The researchers carefully documented the participants' responses and maintained confidentiality throughout the data collection process. The collected data were subsequently organized for analysis to identify meaningful patterns and themes relevant to the research objectives (Coe et al., 2021; Yue & Xu, 2019).

Data Analysis

The researchers analyzed the qualitative data using thematic analysis to explore university students' experiences of using digital technologies to foster LLL. The interview responses were transcribed, organized, and reviewed repeatedly to develop familiarity with the collected data. The researchers assigned initial codes to meaningful statements and identified recurring patterns across participants' responses (Braun & Clarke, 2006). These codes were subsequently grouped into broader categories and themes aligned with the dimensions of DT and LLL. The analysis focused on information, communication and collaboration, digital content creation, digital security, goal setting, application of knowledge and skills, self-direction and evaluation, and adaptable learning strategies (Castleberry & Nolen, 2018). The researchers interpreted the emerging themes to understand students' experiences, perspectives, and practices (Braun & Clarke, 2023). Finally, the findings were organized thematically to address the research objectives and provide an in-depth understanding of DT in promoting LLL.

Research Question 1: How do you find and check reliable information online?

The interview responses indicated that DT played an important role in helping students locate and assess information for academic purposes and independent learning. M.Phil. and Ph.D. students reported using Google Scholar, academic databases, university websites, and search engines to find relevant materials. They also considered the reliability of sources by examining authorship, journal credibility, publication dates, and references before incorporating information into their work. One M.Phil. participant remarked, "*I use Google Scholar to find research articles related to my topic*" (P1). A Ph.D. participant similarly noted, "*I check the author and journal before trusting information from online sources*" (P11). These accounts reflect students' efforts to distinguish credible information from

potentially unreliable online content. Effective information searching and source evaluation are essential digital literacy skills that help students learn independently and continue developing their knowledge beyond formal education.

Research Question 3: How do you use digital tools to create learning materials or presentations?

The participants' responses highlighted the role of digital technologies in creating and presenting academic content. Students described using tools such as Microsoft PowerPoint, Canva, Microsoft Word, and other digital applications to prepare presentations, research documents, and learning materials. These tools helped them organize information, present ideas clearly, and improve the quality of their academic work. One M.Phil. participant stated, *"I use PowerPoint to prepare presentations and explain my research ideas clearly"* (P4). Similarly, one Ph.D. participant explained, *"Digital tools help me organize research findings and prepare academic presentations more effectively"* (P13). These excerpts illustrate how digital content creation supports students' academic communication and learning. Overall, the use of digital tools appeared to encourage creativity, improve knowledge presentation, and develop practical digital skills that contribute to independent and lifelong learning.

Research Question 4: How do you protect your personal information while learning online?

The participants' responses highlighted the importance of digital security when using online platforms for academic and independent learning. Students described practices such as using strong passwords, avoiding suspicious links, protecting personal information, and accessing trusted websites. These practices helped them reduce potential online risks while using digital learning resources. One M.Phil. participant stated, *"I use strong passwords and avoid sharing my personal information on unknown websites"* (P5). Similarly, one Ph.D. participant explained, *"I check website security before downloading research materials or sharing academic documents online"* (P14). These excerpts illustrate students' awareness of online safety and responsible technology use. Digital security appeared to be an important component of digital literacy, enabling students to use digital platforms more confidently and safely for continuous learning.

Research Question 5: How do your digital skills help you learn beyond the classroom?

The participants' responses highlighted how digital skills enabled university students to access learning opportunities beyond formal classroom settings. Students described using online courses, educational videos, digital libraries, and research websites to develop new knowledge and improve their academic skills. These resources allowed them to learn independently according to their interests, schedules, and learning needs. One M.Phil. participant stated, *"I watch educational videos online to understand topics that are not fully explained in class"* (P6). Similarly, one Ph.D. participant explained, *"Digital resources help me explore new research areas and update my knowledge beyond university lectures"* (P15). These excerpts illustrate how digital skills can support independent learning and knowledge development. Overall, digital technologies appeared to extend learning opportunities beyond traditional educational settings and encourage students to pursue continuous learning throughout their academic and professional lives.

Research Question 6: How do you set your learning goals using digital technologies?

The participants' responses highlighted the role of DT in setting learning goals and organizing independent learning activities. Students described identifying learning needs, searching for relevant online resources, and planning learning according to academic requirements and personal interests. Digital tools helped them access learning materials and

work toward specific objectives at their own pace. One M.Phil. participant stated, *“I set my learning goals by identifying the topics I need to understand and finding relevant videos and articles online”* (P7). One Ph.D. participant explained, *“I use digital resources to plan my research learning and identify the skills I need to develop”* (P16). These excerpts illustrate how DT support purposeful learning and personal responsibility.

Research Question 7: How do you apply what you learn online in daily life or academic work?

The participants’ responses highlighted how DT helped them apply acquired knowledge and skills to academic tasks and everyday situations. Students described using information from online courses, research articles, educational videos, and digital tutorials to improve assignments, prepare presentations, and strengthen research practices. Applying this knowledge enabled them to connect theoretical concepts with practical experiences. One M.Phil. participant stated, *“I apply what I learn from online tutorials when preparing assignments and presentations”* (P8). Similarly, one Ph.D. participant explained, *“I use knowledge from digital resources to improve my research methods and academic writing”* (P17). These excerpts illustrate the potential of digital learning to support practical skill development and knowledge transfer.

Research Question 8: How do you check your own learning progress?

The participants’ responses highlighted the importance of self-monitoring and evaluating learning progress when using digital technologies. Students described reviewing their understanding, completing online quizzes, checking assignment results, and comparing their progress with their learning goals. These practices helped them identify knowledge gaps and determine whether they needed additional learning resources. One M.Phil. participant stated, *“I check my learning progress by reviewing my notes and testing my understanding through online quizzes”* (P9). Similarly, one Ph.D. participant explained, *“I evaluate my progress by reviewing my research work and identifying areas that need improvement”* (P18). These excerpts illustrate how students can take responsibility for evaluating learning.

Research Question 9: How do you change your learning methods when you face difficulties?

The participants’ responses highlighted the importance of adapting learning strategies to overcome academic challenges when using digital technologies. Students described changing learning resources, watching alternative explanatory videos, consulting online tutorials, and seeking guidance from peers or teachers when they experienced difficulties. These strategies enabled them to approach complex topics from different perspectives and learn at their own pace. One M.Phil. participant stated, *“When I do not understand a topic, I watch another video or search for a simpler explanation online”* (P10). Similarly, one Ph.D. participant explained, *“I use different digital resources and online discussions when I face difficulties in understanding research concepts”* (P19). These excerpts illustrate the role of flexibility in digital learning.

Research Question 10: How do digital technologies help you continue learning new things?

The participants’ responses highlighted the role of digital technologies in encouraging continuous learning beyond formal education. Students described using online courses, educational videos, digital libraries, and research platforms to explore new topics, develop skills, and remain updated in their academic fields. These resources provided flexible learning opportunities that could be accessed according to individual interests and schedules. One M.Phil. participant stated, *“Digital technologies help me learn new skills and explore*

topics beyond my university courses” (P10). Similarly, one Ph.D. participant explained, “I use online courses and research platforms to update my knowledge and improve my academic skills” (P20). These excerpts illustrate how digital resources can support ongoing knowledge development. Overall, digital technologies appeared to encourage curiosity, independent learning, and continuous personal and professional development.

Figure 1. Themes and Subthemes Related to DT, and LLL among Students.

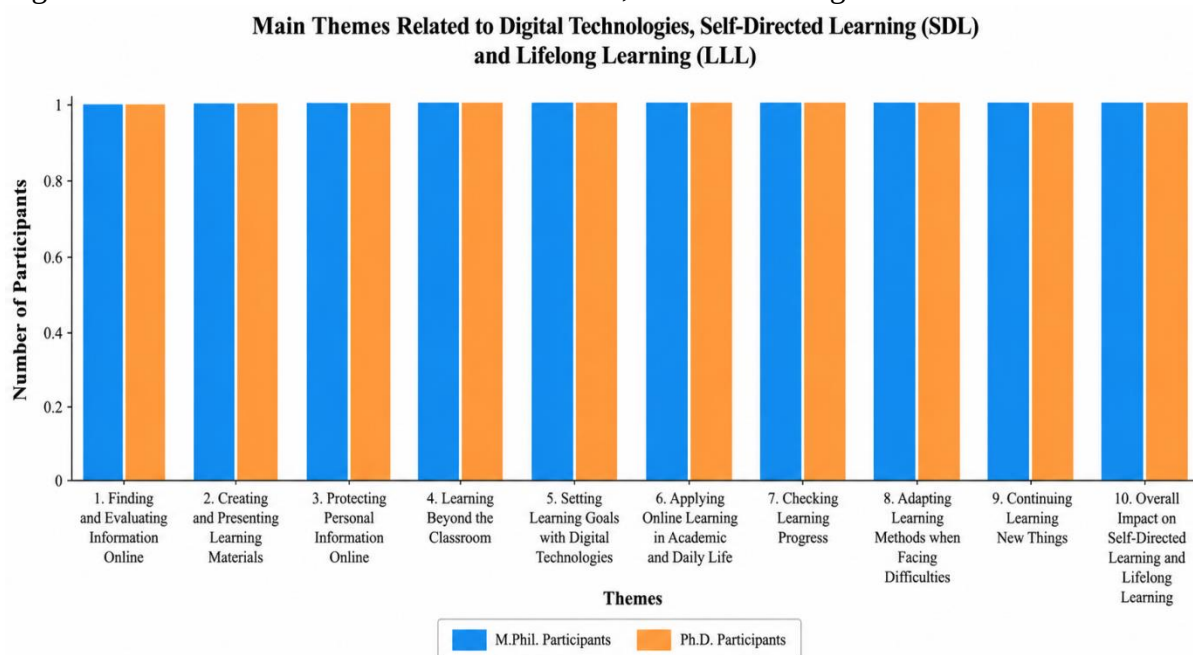


Figure 1 illustrates ten main themes identified from the interview responses concerning the role of digital technologies in promoting DL and LLL among M.Phil. and Ph.D. students. These themes include finding and evaluating online information, creating learning materials, protecting personal information, learning beyond the classroom, setting learning goals, applying online learning, checking learning progress, adapting learning methods, continuing to learn new things, and the overall impact of DT on SDL and LLL. The figure highlights the diverse ways students use digital resources to support independent learning, academic development, and continuous knowledge acquisition. The equal-height bars represent one quoted participant from each academic group for every theme, rather than the total frequency of themes across all interviews. Overall, the themes demonstrate the potential of DT to facilitate flexible, purposeful, and continuous learning.

Discussions

The development of computer and communication technologies has significantly transformed educational practices by expanding access to information and creating new opportunities for remote, flexible, and independent learning (Ceschi et al., 2021). Earlier developments in educational technology facilitated the integration of multimedia resources, online instruction, and digital learning materials into educational systems (Beller & Or, 1998). Building on this historical development, the findings of the present study demonstrate how digital technologies support LLL among M.Phil. and Ph.D. students. The interview findings revealed ten themes: finding and evaluating reliable information online, creating and presenting learning materials, protecting personal information, learning beyond the classroom, setting learning goals, applying online learning in academic and daily life, checking learning progress, when facing difficulties, continuing to learn new things, and the

overall contribution of DT in promoting LLL. Specifically, participants reported using Google Scholar, academic databases, and university websites to locate and evaluate information, while Microsoft PowerPoint, Canva, and Microsoft Word supported the creation and presentation of academic content. These findings highlight the importance of digital literacy, which extends beyond operating technological tools to include the critical evaluation, effective use, and responsible communication of information (Ng, 2012).

The findings further indicate that DT facilitate independent learning by enabling students to access educational videos, online courses, digital libraries, and research platforms beyond formal classroom settings. Participants described setting learning goals according to their academic requirements, applying knowledge acquired online to assignments and research activities, and monitoring their progress through note reviews, online quizzes, and the evaluation of their academic work. These practices are consistent with Garrison's (1997) model of self-directed learning, which emphasizes self-management, self-monitoring, and motivation. Similarly, Zimmerman (2002) explained that DL establish goals, monitor their performance, and reflect on their learning outcomes. Broadbent and Poon (2015) also identified self-regulated learning strategies as important considerations in online higher education. Furthermore, participants reported changing learning resources, consulting alternative explanations, and seeking assistance from teachers or peers when they encountered difficulties. Such practices suggest that DT provide flexible learning opportunities that students can use to address knowledge gaps and adapt their learning strategies. However, the educational value of these technologies depends on students' ability to select appropriate resources and use them purposefully.

An additional finding concerns the importance of digital safety and critical judgment in online learning environments. Participants reported using strong passwords, avoiding suspicious links, accessing trusted websites, and checking website security before downloading materials or sharing academic documents (Ceschi et al., 2021). These practices demonstrate that effective digital participation requires awareness of information security alongside the ability to locate and use online resources. The importance of technological understanding was also emphasized by Faure et al. (1972), who highlighted the role of education in enabling individuals to understand and exercise greater control over their environment. In the context of the present study, this perspective reinforces the need for students to engage with digital technologies critically and responsibly rather than relying on them without evaluating their limitations. The findings further show that participants used digital resources to explore unfamiliar subjects, develop new skills, and update their academic knowledge. This pattern reflects the LLL dimension of the study because learning continues beyond formal education and responds to changing academic and professional needs (Ceschi et al., 2021). Overall, the ten themes indicate that digital technologies can support SDL and LLL by promoting information literacy, academic communication, online safety, learner autonomy, self-monitoring, adaptive learning, and continuous knowledge development. Nevertheless, these findings represent participants' reported experiences and practices; they do not independently establish a causal relationship between technology use and improved learning outcomes.

The transition towards an information-oriented society has increased the importance of digital competence in academic, personal, and professional development. Toffler (1980) emphasized the transformative influence of information on modern society, while Masuda (1980) highlighted the significance of education in adapting to technological and societal changes. In the present study, M.Phil. and Ph.D. students reported using DT to evaluate

online information, create academic materials, protect personal information, and communicate research findings. These findings correspond with Ng's (2012) conceptualization of digital literacy, which encompasses the technical, cognitive, and social dimensions of technology use. Furthermore, students described accessing online courses, educational videos, and digital libraries to extend learning beyond formal educational settings. Their practices of setting learning goals, monitoring progress, applying acquired knowledge, and adapting strategies to overcome difficulties reflect the principles of self-directed learning (Garrison, 1997) and self-regulated learning (Zimmerman, 2002). Similarly, Broadbent and Poon (2015) highlighted the importance of self-regulated learning strategies in online higher education. These findings suggest that DT provide flexible opportunities for students to identify learning needs, address knowledge gaps, and pursue continuous academic development. However, effective digital learning also requires critical evaluation of information and responsible online engagement. Participants' reported practices, including using strong passwords, avoiding suspicious links, and checking website security, demonstrate the importance of digital safety alongside technological proficiency. Overall, the ten themes indicate that purposeful engagement with digital technologies can promote learner autonomy, information literacy, adaptive learning, and lifelong learning. Nevertheless, these findings reflect participants' reported experiences rather than establishing a direct causal relationship between technology use and improved learning outcomes.

Conclusions

LLL has become essential for individuals to continuously develop their knowledge and skills throughout their academic, professional, and personal lives. The findings of the present study demonstrate that DT play an important role in facilitating SDL and LLL among M.Phil. and Ph.D. students. The ten identified themes indicate that students use digital technologies to find and evaluate reliable information, create academic materials, protect personal information, access learning opportunities beyond the classroom, establish learning goals, apply acquired knowledge, monitor learning progress, adapt learning strategies, and explore new areas of knowledge. These practices highlight the potential of digital technologies to promote learner autonomy, independent decision-making, critical thinking, and continuous knowledge development. Furthermore, students' use of online courses, educational videos, digital libraries, and research platforms demonstrates how technology extends learning beyond formal educational settings and provides flexible opportunities to accommodate individual learning needs and interests. Importance of digital literacy, responsible online behavior, information evaluation, and digital safety play important role for effective participation in technology-supported learning environments. Enabling students to identify knowledge gaps, select appropriate resources, evaluate their progress, and modify their learning approaches, digital technologies can strengthen the skills required for continuous academic and professional development. Overall, the study concludes that purposeful integration of digital technologies into higher education can provide a valuable foundation for preparing students for lifelong learning. However, realizing this potential requires students to develop the critical, technical, and self-regulatory skills necessary to use digital resources effectively, responsibly, and independently throughout their lives.

Based on the results, it is recommended that Higher education institutions should integrate interactive digital platforms, provide ongoing digital literacy training for educators, and promote personalized and collaborative learning opportunities. Furthermore, digital assessment tools, continuous feedback, and progress-monitoring mechanisms should be

employed to strengthen students' self-directed learning, address individual learning needs, and encourage lifelong knowledge and skill development.

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