Research Article

Digital Competencies and the Lifelong Learning Paradigm: Insights from a Connectivist Approach in Higher Education Using the PRISMA Framework

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Abstract: This meta-analysis explores the intersection of digital competencies and lifelong learning within higher education, framed through the connectivist approach. Utilizing the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology, the study analyzes existing literature to understand how digital skills facilitate continuous learning among higher education students globally. Findings indicate that digital competencies enable students to effectively navigate complex learning environments, aligning with connectivist principles that emphasize the importance of forming networks and leveraging digital tools for knowledge acquisition. The study also identifies challenges such as disparities in access to digital resources and varying levels of digital literacy. To counter these challenges, mitigating strategies are also highlighted for enhancing digital competencies for lifelong learning. Additionally, implications for policy and practice include integrating digital competency training into curricula, transforming infrastructure and institutions to fully utilization in addressing issues of access and equity. Future research should explore the long-term impact of digital competencies on lifelong learning outcomes and investigate the role of emerging technologies in enhancing these skills.

Keywords: lifelong learning, connectivism, digital competencies, information technology and higher education

1. Introduction

The fast growing adoption of information technologies has impacted the education area, uplifting the culture of proficient use of digital skills and competencies into lifelong learning. Higher education, especially, is a force that prepares students to embrace digital competencies for sustaining in the modern, closely interconnected and interdependent society. Lifelong learning incorporates the process of learning with knowledge enhancement and flexibility of learning for learning across the life span. In this regard, digital competency appears as a key to enabling students to quickly adapt to the changing professional and social requirements. The concept of connectivism theory supports the Connectivist approach in terms of forming connections and using technology to manage knowledge; connectivism is different from all other learning theories because it concentrates on the learners, the technologies used and the real world. Thus, this view can be considered to represent the concept of learners who engage in various learning systems, and develop their skills to filter and adopt the information from various sources. In the context of higher learning education, the promotion of Integrative Digital Competencies in line with the connectivism approach

is indicative of a promising development that may improve the paths and ways that learners engage and perform. However, as pointed out, the role and input of the digital competency towards lifelong learning still remains a topic for future research in this context. In conducting this literature review, the study adopts the PRISMA framework to comprehensively review previous literature related to digital competency and continuous learning among higher learning institution students (see Figure 1). In considering the Connectivist approach the goal of this review is to provide clarity on the strengths, limitations and future of developing digital competence in the higher education environment. Hence, the following research objective and research question have been developed.
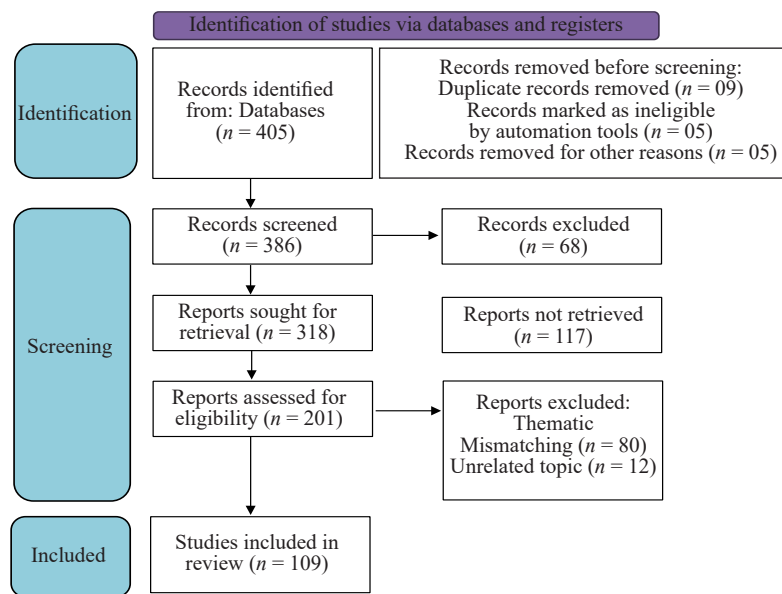
Figure 1. Showing the PRISMA flow diagram
Source: Authors own work

1.1 *Objectives*

• To systematically analyze contemporary research on the association between digital competencies and lifelong learning among higher education students globally.
• To explore the connectivist approach and how it informs the development and application of digital competencies in higher educational contexts.
• To identify key challenges and barriers faced by higher education students in acquiring and applying digital competencies for lifelong learning.
• To identify mitigating strategies for fostering digital competencies through connectivist principles within higher education.

1.2 *Research questions*

This study seeks to address the following research questions:
(1) What is the role of digital competencies in supporting lifelong learning among higher education students?
(2) How does the connectivist approach influence the development and application of digital competencies in higher education?
(3) What are the primary challenges and barriers that students encounter in acquiring digital competencies for lifelong learning?
(4) What mitigating strategies have proven effective in enhancing digital competencies within the framework of connectivism?

2. Methodology

Following the current emphasis placed on the use of systematic reviews in providing comprehensive overviews of the state of knowledge, this study adopts the Narrative Review of Literature (NRL) and scoping review approach to systematically review the available existing literature on digital competency and its connection with lifelong learning, while highlighting the prospects espoused by connectivism in the context of higher learning. A literature review approach is considered as most suitable when the aim of studying the literature is to identify trends and patterns as well as to establish the existing gaps, or contradictions in the literature reviewed. It is thus to give an account of the state of the art or state of the science of the previously published and empirical studies. A narrative literature review is particularly useful to present diverse findings in a coherent fashion and in an easy-to-read format. This review seeks to synthesize bulky amounts of information about digital competency and Connectivist learning in higher education into a manageable form. The narrative approach's activity prescription allows the subject to be discussed from a wide perspective, encompassing history, development, problems, and possible solutions.

The review process involved several stages, including a Preliminary Literature Search: A preliminary literature review was undertaken to examine literature on digital competency and its application to lifelong learning in the context of higher education. This phase identified the scope of already examined areas and the number of studies pertaining to it. Database Selection: The current research used Google Scholar, Scopus, Web of Science, Science Direct, ERIC, SpringerLink, SAGE, Emerald, and Taylor & Francis for the literature search. These databases were chosen to include the most resources associated with education and inter- and multi-disciplinary studies.

Search Strategy: The keywords were constructed from the themes that arose from the research objectives and questions. The literature search included terms like "digital competency", "connectivist learning theory", "lifelong learning", "higher education", "collaborative learning" within the titles and abstracts from the year 2011 to 2024 from peer-reviewed articles, meta-analysis and reframed conference proceedings.

Inclusion and Exclusion Criteria: Articles were included on the basis of the research objectives and the context of higher education specifically. Any work that expanded the framework but did not involve the two concepts of digital competency or Connectivist learning was excluded (see Table 1).

Table 1. Frequency of themes with percentage and year range

Theme	Frequency	Percentage (%)	2011-2015	2016-2020	2021-2022	2023-2024
Importance of digital competencies for lifelong learning	13	19.40	2	3	1	7
Role of technology in connectivism	13	19.40	2	3	4	4
Competencies on academic and career success	9	13.43	2	1	4	2
Feedback mechanisms for continuous improvement for digital competencies in connectivist approach	8	11.94	2	1	2	3
Digital competencies for 21st century	7	10.45	0	3	2	2
Barriers to digital competency and connectivist learning	7	10.45	1	1	2	3
Connectivist and lifelong learning paradigm	6	8.96	0	3	0	3
Strategies for enhancing digital competency and connectivist learning in higher education	4	5.97	1	1	1	1

Screening and Eligibility Assessment: Indeed, the preliminary search produced 405 scientific records initially, 386 records passed through screening after elimination of duplicate records, using the title and abstract for initial elimination. Next, 318 citations were screened further and 201 were requested for full-text assessment, 109 of which were included in this review.

Thematic Analysis: Seven emergent themes were derived from the findings of the selected studies: Theme 1: Identified Digital Competency, Theme 2: Connective Learning Theory/Lifelong Learning Paradigm, Theme 3: Depiction of the Outlook of Digital Competency on the scholastic and Vocational Horizon, Theme 4: Methods of Measuring/Assessing the Digital Competency of the HE Students, Theme 5: Feedback Mechanisms for Promotion of Digital Competencies.

Hence, the systematic and narrative synthesis and scoping review offer a comprehensive map of what can be known in the field in order to recognise what is still unknown and potentially transformative.

3. Literature review

3.1 *Digital competencies for the 21ˢᵗ century*

A definition of digital competency is about a set of skills that allows a person to master and interact with technology. These are information and data literacy; Information Technology (IT) based problem solving, safety of data and resources, digital content creation and communication and collaboration (Self, 2001; Kalajdžisalihović et al., 2023). Technical skills concern the ability to make effective use of the modern instruments and resources of the digital environment and which are relevant in both academic and professional contexts (Omirbayev et al., 2022). Computer literacy thus entails online interpersonal communication competence as student ability to collaborate and interact with peers and teachers in cyberspace (Šliogerienė & Oleškevičienė, 2014). Other activities, such as content generation, which entails creation of original content to be shared online, are more important with students expected to contribute to knowledge production in the fields they are in (Zavyalova & Galvin, 2023). In addition, this study also points out that these components are connected and all of them form a part of a students' digital competencies. For instance, synchronous and asynchronous communication skills are a prerequisite of online communication skills, and content generation and management skills require an understanding of new technologies applications (Botha & Steyn, 2020; Kalajdžisalihović et al., 2023). As more technology is incorporated in the higher learning institutions, so is the need to enhance the skills required in the development of the competencies.

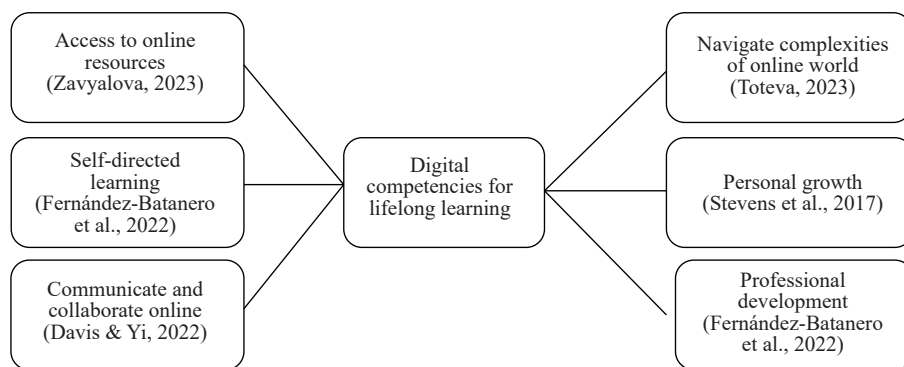### 3.2 *Importance of digital competencies for lifelong learning*

Digital competence is not only important during educational years but also during continued professional development as well. Since personal and professional growth are inevitable in today's world. Digital competencies allow individuals to be flexible in regard to changing employment situations as well as education (Zavyalova & Galvin, 2023). Digital competence enables students and any learner to access numerous digital tools and platforms; therefore, it can help learners to use web resources for independent learning and professional development (Fernández-Batanero et al., 2022). However, the maintenance of communication and openness for cooperation through the internet provides networking and professionalism which are critical for change in this Connectivist times (Davis & Yi, 2022).

Research confirms that there is a positive correlation between digital skills and the ability of people to work effectively in today's complex work setting since most tasks involve the use of digital technologies (Toteva, 2023). This flexibility not only promotes employability but also promotes the development of the individual, especially through the development of interests through online learning and community involvement (Stevens et al., 2017).

3.2.1 *Digital competency gaps*

On that basis, although digital competency has been recognized as a critically important factor, current gaps remain considerable among higher education students. The analysis of the existing literature in the field reveals that despite the fact that most learners possess fundamental digital competencies their advanced skills, including data analytics, content production, and online cooperation remain inessential (Haneberg & Aadland, 2020; Diachenko-Bohun et al.,

2019). These gaps could be due to early and older age differences where students only had access to a computer in the classroom, the advanced educational backgrounds of the students, and the lack of structure in supporting students for digital skill development (Potapchuk et al., 2022; Toh, 2016). For instance, despite being conversant with social media for interpersonal communication, the students will be found to possess little professional Digital Content Creation or Data Management skills (Mercier & Higgins, 2013; Chauhan & Pillai, 2013). Moreover, pandemic conditions may exacerbate postsecondary students' difficulties in developing these competencies because members of marginalized groups often lack resources and assistance (Omirbayev et al., 2022; Bovill & Felten, 2016). Filling these gaps is paramount for imparting to all students what may be necessary for competence in the current digital economic environment (see Figure 2).

Figure 2. Showing framework of digital competencies for lifelong learning
Source: Authors own work

3.3 *Connectivist and lifelong learning paradigm*

Basically, connectivism is a learning theory that has identified a learning process based on the connections between them, and especially of social and digital networks. This theory developed by George Siemens and Stephen Downes specifies that knowledge is not the process of gathering but the formation of knowledge as a result of a web of connections between knowledge information sources and other individuals (Pangrazio et al., 2020). Concisely, in this respect, learning is considered as an active process through which individuals transform their knowledge in relation to others and within the information environment (Guri-Rosenblit, 2018; Goodfellow, 2011) (see Figure 3).
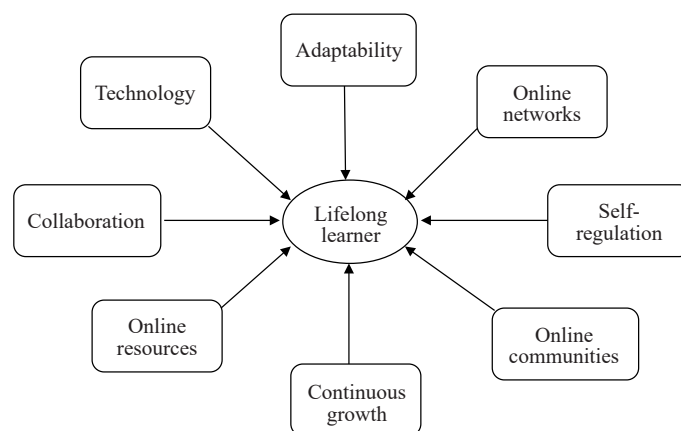

Figure 3. Showing framework of connectivism and lifelong learning
Source: Authors own work

This theory encourages students to continue learning because digital environments seek to enable self-learners. The theory underlines learners' autonomy concerning the processes taking place in their learning paths, and in applying different technological devices to search for needed information, share the results, and construct new knowledge (Klochko & Prokopenko, 2023). In this process, the digital competencies of learners seem to be important, as these competencies help learners to manage the vast amount of information available on the internet and determine the relevance and credibility of information (Santos & Serpa, 2017; Cabero-Almenara et al., 2022). At the same time, connectivism promotes lifelong learning by embracing constant acceptance of new ideas and information processing technologies to improve one's personal and professional development (Suryadi, 2024; Tian et al., 2023). Besides, the use of various instruments in learning helps learners develop knowledge connections for building an effective learning network. These tools enable interaction, cooperation, and sharing of content which enable learners to interact with fellow learners, educators, and specialists from all over the world (Quraishi et al., 2024; Suwanroj et al., 2019).

Thus, social networks and community forums act as the discussion areas and a platform for sharing knowledge; like repositories and LMS−as the sources of a large amount of educational material (Martínez-Bravo et al., 2020; Dadaczynski et al., 2021). This interconnectivity also enhances the learning process and makes learners more self-reliant and own their learning journey, something that in, line with the cultural shift in lifelong learning where the learner is in charge of his/her learning process (Verdugo-Perona et al., 2015; Tsvetkova et al., 2021).

3.4 *Role of technology in connectivism*

One major avenue that technology contributes towards connectivist learning mode is through the construction and sustenance of knowledge networks. Online forms of leverage like blogs, wikis, and social media enhance the dissemination of knowledge and Learning resources and development of effective learning communities (Manggopa & Kumampung, 2023). These technologies enable learners to interface with different worldviews and to co-construction knowledge, which is a key characteristic of Connectionism (Tabieh et al., 2021). Moreover, the media literacy and textual data mining skills foster the development of critical appraisal which is a necessary condition in the present-day global society (Mujiyanto & Suherman, 2021). The COVID-19 viral threat has also contributed to the integration of information and communication technologies for developing learning processes, especially, in terms of distance education. It also highlighted the need for teachers and learners to acquire literacies necessary for working in digital environments to support remote learning (Kasimoğlu et al., 2022). Thus, innovation in the learning environment has gradually moved to the foreground as an element necessary to implement in education in order to prepare learners for the demands of the digital society (Hasibuan & Hasibuan, 2022; Gündüzalp, 2021) (see Figure 4).
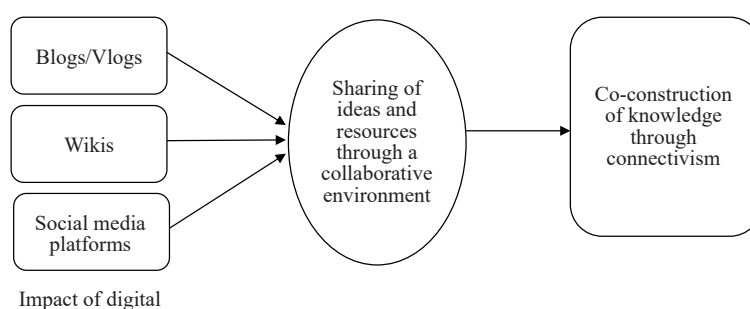
Figure 4. Showing the role of technology in connectivist learning
Source: Authors own work

3.5 *Competencies on academic and career success*

Techno-literacy is a significant factor that determines both content and vocational outcomes of students. Digital competencies can help build better educational structures that enhance research elements and teach techniques, crucial in current complex systems. This suggests that skills, particularly in the digital arena, greatly benefit students in

operational knowledge, data proficiency, and even cognitive abilities. For example, a systematic literature review found that digital-based modules support the development of independent learning among prospective teachers, as the studies indicated that these modules enhance both digital literacy skills and students' operational competencies. This growing sophistication in students' digital skills is crucial because it prepares them to work within information-rich contexts, enabling them to interpret data and engage in analysis (Ussarn et al., 2022). Additionally, the capability needed to search for information on the internet is placed among core competencies since applying information from different sources is one of the essential outcomes of studying (Irwandi et al., 2023) (see Figure 5).
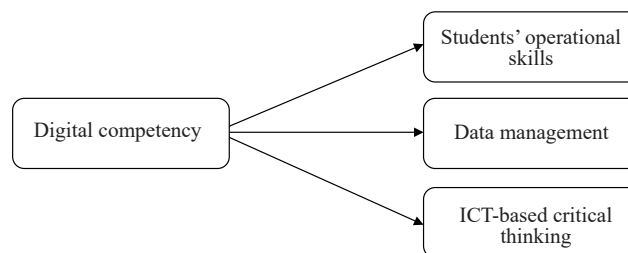
Figure 5. Showing digital competencies for academic and career advancement
Source: Authors own work

In addition, digital competency is inextricably bound up with employability. The capacity to work with and on digital information is not only an essential condition for learning and success in educational contexts but for success in the workplace as well. Research also indicates that students with higher levels of digital literacy demonstrate higher levels of organizational commitment and professionalism at the workplace that bring a positive impact on career advancement (Khammarnia et al., 2022). Firstly, the development of digital competence is crucial for engaging with new requirements as a critical success factor in the labor market (Mujiyanto & Suherman, 2021). Therefore, current education systems are shifting towards the inclusion of teaching and training in the effective usage of virtual processes as a part of giving students the necessary competitive advantage in the labor market (Child & Song, 2023).

Moreover, regarding digital literacy it is important to understand not only technical competence of the social subject but his or her ability to reflect and act responsibly when interacting with digital content. This is especially important given the rising tide of fake news and propaganda and the need to mold the students into good citizens. With promotion of integrated digital literacy, such educational programs will enable students to master ways of handling difficulties that characterize digital milieu as well as improve their academic achievements and employment opportunities (Chetty, 2023). Thus, the role of digital competency in academic and career success is exceptional. In this way, the ideas of digital literacy envision the necessity of developing students' research skills, problem-solving abilities, and skills for the synthesis of information in the process of their study. With educational institutions embracing technological advancement, the development of these skills shall remain paramount when getting ready for class work and later for the job market.

Techno-literacy is now commonly regarded as a unique parameter that user communities can leverage to improve their employment opportunities, flexibility, and ability to operate in technologically advanced environments. Due to digital change in organizations, there is pressure in the market for skilled employees' digitization, thus calling for reconsideration of education and training courses for an appropriate outcome. In this case, digital competency can be seen to play a number of functions where improving employability is concerned. Research highlighted that people with digital skills have a higher chance of finding jobs and performing well in their occupations. For example, a study highlighted that graduates must require digital competency in order to improve their understanding of the new challenge work environment where use of technology is critical in working and communicating (Dobson et al., 2022). Moreover, the incorporation of digital competencies into higher learning systems has been found to make a tremendously positive impact on the employability potential of the learners because their skills are matched with employers' expectations within a digital platform (Abelha et al., 2020). Such an approach is essential since employers are today more focused on hiring employees who can show he or she can use technology tools and applications (Attaran et al., 2019).

Another domain that concerns flexibility as an essential part of digital competency is adaptability. In today's increasingly complex work setting flexibility and willingness to develop technical skills are vital. Knowledge of digital technologies positively impacts organizational behavior by encouraging work-related learning and the ability to adapt to changes (Lee & Tan, 2023). For instance, due to COVID-19 the sudden shift of working from physical environment to the digital one resulted in amplifying the demand for the aspects of the digital competencies and adaptability towards digital work (Kalogiannakis et al., 2023). Those employees who adopt effective digital skills can effectively cope with these changes, which in turn increases their ability to cope with the prevailing volatile environment (Coldwell, 2019).

Furthermore, digital competency contributes to the development of individuals of other personal attributes or character strengths. Application of digital tools thus improves the skills in human professional practices. A study aiming to provide an insight into how technological competence influences one's self efficacy, problem-solving ability and creativity is presented herein. Such personal development is needed for a person in an era of constant intense competition and starting challenges which one has to encounter (Lee & Tan, 2023). Thus, digital competency is seen as an essential determinant of employability and capability, as well as the individual's development in existing and emerging workplaces characterized by the use of advanced technologies. Education sector and organizations should promote development of digital skills so that learners can address the challenges of the current labor market and be equipped to adapt to new changes.

3.6 *Feedback mechanisms for continuous improvement for digital competencies in connectivist approach*

Authentic feedback processes as well as self-reflection are important elements that should support further professional digital competencies' development and learning within networks during educational processes. These strategies not only improve students' learning experiences, but also reinforce self-organizing learning and a culture of continuous improvement. This theme of the paper incorporates diverse ways of writing the feedback as well as the self-assessment successfully. Feedback is an essential component in the teaching and learning process since it encourages the learner and gives him or her some other information about the performance. Eather et al. (2019) note that dialogical feedback approaches can increase pre-service teachers' perceived self-efficacy; moreover, the study discussed that interactive responses could be more effective (Eather et al., 2019). This highlights the freewheeling concept of feedback, particularly constructive, timely and specific feedback so that the students can know where they stand.

Additionally, peer feedback is another valuable means that allows the continuous enhancement of the process. Studies conducted by Van Ginkel et al. (2017) show that feedback standards can differ in teacher-given feedback, peer feedback and feedback given by fellow peers under the direction of tutors. This study aims to stress the prospect of developing a learner's ability to 'receive' and 'offer' feedback as a way of helping students improve their learning performance. Also, Lerchenfeldt et al. (2019) identified that peer feedback in collaborative learning environments proved effective for the training of core competencies in feedback giving, which is crucial in medical education. It establishes peer, or interconnection, which is essential for students' sense of belonging and promotes their participation in the learning processes. Another aspect of feedback processes is the ability of the recipient to evaluate him or herself. In Oni et al.'s (2023) study, it was shown that when students construct concept maps while receiving peer feedback, their learning achievements improve, as concept mapping requires less cognitive load and helps learners structure their knowledge more effectively. This work helps students take personal control of the learning process and to think and possibly write about or discuss the meaning of the lessons and modules in relation to their own progressive expertise for the use of technologies in education.

Enhancing this process, it is worthwhile such digital tools for the assessment of the learners as self-assessment tools. For example, peer feedback via online tools can offer students an opportunity to gain feedback from many teachers and peers in a short time and create more democratic conditions for students. Similar to Van Popta et al. (2017), this study found that online peer feedback can greatly improve learning and social integration among learners. Furthermore, the second component crucial for successful feedback practices consists of the development of feedback literacy for students. Carless and Boud (2018) highlight that in order to really benefit from feedback, learners should be more involved in feedback processes. This entails knowing how to assess feedback, make decisions on a person's output and how to effect change. Thus, developing feedback literacy in learners enables educators to prepare the clients for

independent school experiences which they would manage on their own (see Figure 6).
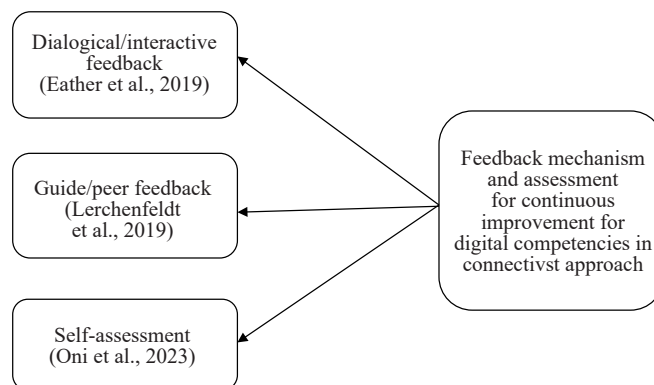
Figure 6. Showing feedback mechanism and assessment for digital competencies
Source: Authors own work

3.7 *Barriers to digital competency and connectivist learning*

The challenges to this approach of digital competence and Connectivist learning are complex, and include the use and ownership of digital technologies, competence and performance that needs to go beyond the mere technical and institutional. Awareness of these limitations will be adjudicative in the formulation of intervention measures to improve digital literacy and increase access to digital learning.

### 3.7.1 *Digital divide and accessibility issues*

The digital divide is still a critical issue, especially when it comes to digital means and fast broadband connections. This split is not just about physical mobility towards/with technology, but also the tariff of internet for such services. Studies have shown that, in terms of learning alone, most students possess physical access to the devices but factors such as; high data costs, network coverage greatly hamper the ability of the students to participate in online learning (Badiuzzaman et al., 2021). This situation is especially dangerous in developing states when students do not have a stable internet connection; it can limit their learning experience and deepen existing disparities (Alam et al., 2023). In addition, the byproduct of digital divides is again Socio-economic such that there are some groups of people who are disadvantaged, and they will be the most affected (Van Deursen & Van Dijk, 2014). It has important consequences as not only access to information is limited but also numerous aspects of people's lives are denied, denying active participation in the digital economy and society (Piatak et al., 2019).

3.7.2 *Skill gaps and knowledge barriers*

Apart from challenges arising from access, skill and knowledge gaps appear to be a major challenge towards the development of digital competency. Today, it is vital to admit that a significant number of people never received proper training or, at least, did not have enough knowledge to use such forms of media and technologies as learning ones. Pearce and Rice (2013) explained that a group study found that even those who own technology have poor digital literacy which makes it challenging to interact with teaching content. This gap is especially worrying in areas where European Union (EU) pupils require digital literacy for success in school and in the labor market. The problem is further compounded by the absence of suitable training schemes aimed at improving digital literacy added to which many people find themselves ill-equipped to deal with the challenges posed by digital space (Afzal et al., 2023). Furthermore, Wei et al. (2011) pointed out the fast-paced technological environment that then requires consequent learning, making staying technologically literate difficult especially for people without a fundamental grounding in what it means to be 'digital'.

3.7.3 *Institutional and structural barriers*

Institutional and structural factors are also defining influential aspects regarding students' digital competence construction. Teachers have criticized the existing curricula as being outdated, schools and colleges have attributed limited resources, and inadequate institutional support to hamper the integration of digital technologies into teaching practices. For instance, most learning institutions lag in the adoption of technology, and hence most curriculum are replicas of a formal workplace but inefficient in handling technology (Mathrani et al., 2022). However, lack of provision in the development of digital support systems alongside inadequate training of e-educators can deepen the digital divide among learners (Liebenberg et al., 2012). This situation is made worse by the fact that the levels of institutional support differ from one institution to another with regards to the promotion of digital literacy resulting in differences in performance (Brown, 2015) (see Figure 7).
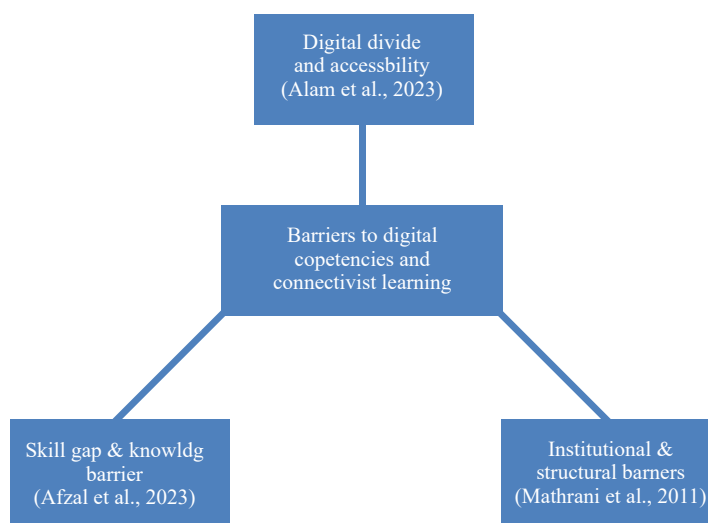
Figure 7. Showing barriers to digital competencies and connectivist learning
Source: Authors own work

To summarize, the challenges related to digital competency and connectivist learning should be solved by taking into account the lack of opportunities to access technologies, the necessity to develop necessary competencies and the lack of organizational support for relevant students. The presentation clarifies how these barriers can be addressed in order to help educational institutions facilitate students for the modern world and create equal opportunities for the use of technologies in learning.

3.8 *Strategies for enhancing digital competency and connectivist learning in higher education*

Supporting skills that encompass and engaging skills with digital media and pursue of Connectivist stance in learning environments for higher education constitutes for approaches towards readiness of students for a technologically inclined world. Plausible educational treatment and curriculum development can also help with such a goal. This response combines different approaches, such as digital literacy programmes, project-based education and cyber competence inclusion in teachers' training.

3.8.1 *Educational interventions and curriculum design*

This paper aimed to understand various approaches to improving the digital competency of students. Based on the reviewed literature, the author concluded that one of the most impactful ways to address the challenge identified above is through specific digital literacy programs. Such programs are meant to teach learners how to be suitable for positions

within the digital world. For example, Cabaron (2023) underscores the need to apply the DigComp 2.0 framework in educational practice and highlights the necessity of developing competencies, including information search and data literacy, for both faculty and students. It can best be described as a framework that provides guidance on designing specific interventions to boost the use of digital skills in various disciplines.

Another effective approach that enhances development of discrete digital competencies is Project Based Learning (PBL). If students are included in authentic activities that allow integrating IT, instructional designers can support the development of both utilitarian and questioning kinds of learning at once. Studies show that PBL enhances students' technological literacy, as well as fosters their interpersonal, and problem-solving competencies which are valuable in the global context (De Soriano et al., 2024). Further, the incorporation of other digital applications into PBL enables the learners to have an appreciation of how such applications can be applied practically in other contexts thus enhancing the theory-practice divide (Abubakari et al., 2023).

3.8.2 *Teacher training and professional development*

It is to the educators' credit that they have to equip learners with a digital competency level that is acceptable. It is now important to work in developing the teachers in matters of information communication technology as a way of improving their Information and Communication Technology (ICT) knowledge. Kapasheva also highlights the need of the effective use of technologies in training teachers, recommending that training institutions equip future teachers with efficient approaches to the use of those technologies (Kapasheva et al., 2024). This way not only helps prepare teachers for integrating Information Technologies (IT) in their own instruction, but also enables them to demonstrate appropriate uses of IT technologies to learners.

However, professional development programs must continue so that educators meet the technological demand. Santos and Serpa note that present an argument urging higher education institutions to provide students and faculty members with clear and intentional strategies for developing digital literacy and competencies (Santos & Serpa, 2017). This way, we are learning can help teachers embrace new technologies and keep on improving teaching and learning practices in the benefit of the students.

3.8.3 *Addressing digital competency gaps*

In order to improve the mode of developing digital competence it is necessary to identify the current areas of its deficiency among the students and teachers. According to Dias-Trindade et al. (2021), self-rating on digital competencies completed by teachers pointed the directions for the development and implementation of training programs that could be tailored to meet the deficiencies assessed. With the knowledge of the current level of digital skills that educators possess, the institutions can now be in a position to train and prepare the teachers to use technology in the learning and teaching process.
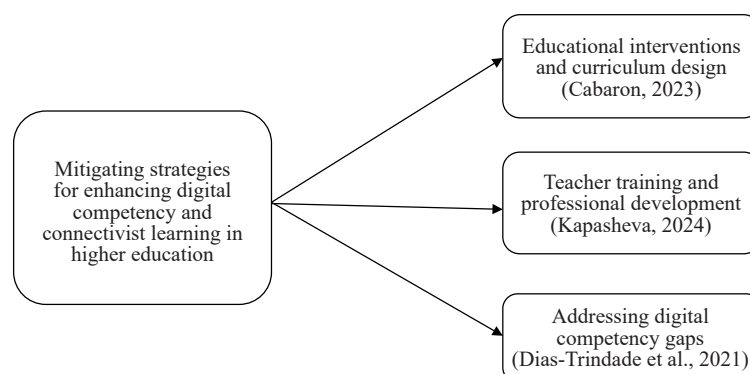
Figure 8. Showing mitigating strategies for enhancing digital competency and connectivist learning in higher education
Source: Authors own work

Additionally, the emergence of frameworks like the HeDiCom framework is helpful to develop a guideline to determine and facilitate the existing and preferred competencies for higher education teachers (Tondeur et al., 2023). This framework can be used by institutions in defining the competencies that should be targeted in teacher training and professional development so that the educators are prepared to cultivate digital literacy among their students.

Therefore, increasing digital competence and consequent spreading of the Connectivist approach in higher education needs an integrated approach that includes efficient educational initiatives, the proper preparation of teachers, and their subsequent education. In this case, it is desirable to provide structured programs for reading in digital environments, including project-based education and compulsory remedial education for educators, which will help to adapt students to the new conditions in the context of the rapidly developing digital environment (see Figure 8).

4. Discussion

This meta-synthesis was focused on the identification of the relationship between digital competencies and the continuity of learning, adopting the Connectivist perspective in higher learning education based on the PRISMA approach. This study provides a complex understanding of how digital competencies are posited as key enablers of the lifelong learning framework for students within Higher Education Institutions (HEIs).

4.1 *Digital competency*

Incorporated technical cognition as well as ethical aspects can be called digital competency, which has become a complex concept. The reviewed literature, again and again, emphasizes that the students with higher levels of digital literacy can successfully perform in complex and agile learning contexts. Particularly, the competencies to select, assess and use technologies are viewed as crucial for constructing learning processes as continuing education practices. This is in line with the ideas of connectivism whereby one has to form networks and use technological tools for the purpose of information gathering and sharing.

4.2 *Lifelong learning paradigm*

There is a synthesis within the lifelong learning perspective concerning continuous personal development as an emergent, socio-technical process increasingly shaped by technology. A habit of continuous learning embraced by higher education students via the digital platforms enables them to enhance their adaptability, creative problem solving and innovation. In the synthesis of several such research studies in the synthesis, we highlighted how digital competencies supported student progression to be continually up-to-date in respect of the development of new trends – a manifestation of the iterative and lifelong nature of learning.

4.3 *Connectivist approach: Bridging theory and practice*

The Connectivist approach affords the researcher a promising theoretical framework with which to theorize the place and use of digital competencies in lifelong learning. This approach lies in the capability of the fact that knowledge is associative and exists within the context of relationships: learning is one's ability to tap into networks. Thus in the literature it is established that digital competence are essential for students of higher learning institutions in their interaction with these networks. For example, action concerning online communities, open education resources and outreach projects corresponds to connectivism paradigm and promotes lifelong education objectives.

4.4 *Challenges and gaps*

However, in the course of the review of this study, it was established that there were several challenges that limited the integration of digital competencies into the lifelong learning paradigm. These are such things as, inequality in accessing digital tools, differences in the degree of digital literacy, and the absence of organizational conditions that will ensure the performance of development of the digital competencies. Further, there were also calls for the recognition of

the complexity of ethics and, in specific concerns for data privacy, as well as reflecting on the digital divide.

4.5 *Implications for policy and practice*

This meta-synthesis yields actionable insights for multiple stakeholders in higher education, particularly in enhancing digital competencies through a Connectivist lens.

(1) University Administrators:

The process of training on digital competency needs to be institutionalized by government and government and businesses by integrating compulsory modules in undergraduate and post-graduate programs. In accordance with connectivism, administrators are also expected to support the idea of introducing the culture of digital innovation, peer-to-peer collaboration, and independent learning.

(2) Curriculum Developers:

The redesign of academic programs should be undertaken by curriculum developers who emphasize Connectivist pedagogy that provides an opportunity to go in real-life application, networked learning, and digital involvement. Blended learning models, online learning ecologies and project-based assessments will enable the learners to co-create knowledge through digital networks.

(3) Faculty and Teacher Educators:

Professional development initiatives should be structured around faculty immersion in digital environments. Workshops and training must prioritize tool integration, learning design, and network facilitation, enabling educators to shift from content delivery to learning facilitation in digital spaces.

(4) Policymakers:

Policymakers need to address issues of digital equity and access, especially in under-resourced or marginalized contexts. Resource allocation should focus on ensuring infrastructure readiness, device accessibility, and connectivity, thereby creating inclusive digital learning environments that foster equitable learning outcomes.

4.6 *Future research directions*

While this meta-synthesis offers valuable conceptual and thematic insights, there remain key areas for empirical exploration:

• Longitudinal Studies:

Future research should explore how digital competencies evolve over time and their long-term impact on lifelong learning outcomes. This would require sustained, multi-phase studies tracking learner growth.

• Experimental and Quasi-Experimental Designs:

Empirical studies should test the effectiveness of specific digital tools and strategies—such as AI-driven platforms, adaptive learning systems, and collaborative tools—in cultivating digital competencies in diverse higher education settings.

• Cross-Cultural and Contextual Research:

Further studies are needed to compare regional or cultural differences in the adoption of digital competency frameworks and Connectivist models, particularly in developing countries.

• Connectivist Model Implementation:

There is a need for research on best practices in implementing the connectivist learning paradigm, focusing on its adaptability, scalability, and integration with current teaching models in higher education.

4.7 *Conclusion*

Therefore, this meta-synthesis emphasizes the ease, on which digital competencies influence the modern concept of lifelong learning in higher education. In this case, the findings are well anchored in the connectivist learning approach in order to establish how digital media skills, networked learning, and lifelong learning intersect. Mitigating the challenges and capitalizing on the opportunities highlighted in this review will be very important for creating a digitally literate student keystrokes that advance their lifelong learning experiences (see Table 2).

Table 2. Summary of themes and their characteristics

Theme	Core characteristics
1. Digital competencies for the 21st century	Emphasizes digital literacy, critical thinking, collaboration, and creativity essential for navigating the digital age.
2. Importance of digital competencies for lifelong learning	Focuses on self-directed, continuous skill acquisition enabled through digital platforms and online learning ecosystems.
3. Connectivist and lifelong learning paradigm	Centers on learning as a network-building process, where knowledge emerges through connections among people and digital resources.
4. Role of technology in connectivism	Highlights how ICT tools enable decentralized, learner-centered environments that foster connectivity, autonomy, and personalization.
5. Competencies on academic and career success	Links digital skills with improved academic performance and employability, emphasizing their value in both educational and professional contexts.
6. Feedback mechanisms for continuous improvement	Reflects the importance of dialogic and peer feedback mechanisms for iterative learning and skill refinement in digital learning settings.
7. Barriers to digital competency and connectivist learning	Identifies digital divide, lack of access, insufficient training, and resistance to change as major obstacles to effective digital learning.
8. Strategies for enhancing digital competency	Includes teacher training, curriculum redesign, blended learning models, and institutional policies aimed at fostering digital capacity in higher education.

Conflict of interest

The authors declare no competing financial interest.

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