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## Strategies for Overcoming the Digital Divide in Higher Education Institutions: A Systematic Literature Review<sup>1</sup>

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**Abstract:** This study explores strategies employed by higher education institutions (HEIs) to address the digital divide, focusing on improving access, developing digital skills and integrating advanced technologies. Using a systematic literature review guided by the PRISMA framework, it analyzes research published between 2005 and 2023 to examine institutional efforts in mitigating digital inequalities. The findings highlight persistent challenges at three levels. At the first level, despite progress in connectivity and resource distribution, disparities remain in access to infrastructure and devices, particularly among remote learners and low-income students. The second level emphasizes the need for targeted digital literacy programs through collaborative efforts involving HEIs, governments and private partners. At the third level, the study stresses the importance of adopting advanced technologies, such as artificial intelligence and establishing centers of excellence to equip graduates for future challenges. The study concludes that bridging the digital divide requires more than technological investments. It calls for continuous professional development, alignment of pedagogy with digital tools, and robust multi-stakeholder partnerships. These insights provide practical guidance for policymakers and education leaders to foster inclusive and sustainable digital transformation in higher education.

**Keywords:** digital divide; higher education institutions; systematic literature review; digital technologies; technology integration

### **Estrategias para superar la brecha digital en las instituciones de educación superior: Una revisión sistemática de la literatura**

**Resumen:** Este estudio examina las estrategias empleadas por las instituciones de educación superior (IES) para abordar la brecha digital, con un enfoque en mejorar el acceso, desarrollar habilidades digitales e integrar tecnologías avanzadas. A través de una revisión sistemática de la literatura guiada por el marco PRISMA, se analizan investigaciones publicadas entre 2005 y 2023 para evaluar los esfuerzos institucionales destinados a mitigar las desigualdades digitales. Los hallazgos destacan desafíos persistentes en tres niveles. En el primer nivel, a pesar de los avances en conectividad y distribución de recursos, persisten disparidades en el acceso a la infraestructura y a los dispositivos, especialmente entre estudiantes de zonas remotas y de bajos ingresos. El segundo nivel enfatiza la necesidad de programas específicos de alfabetización digital mediante iniciativas colaborativas entre IES, gobiernos y socios del sector privado. En el tercer nivel, el estudio subraya la importancia de adoptar tecnologías avanzadas, como la inteligencia artificial, y de establecer centros de excelencia para preparar a los graduados frente a los retos futuros. El estudio concluye que superar la brecha digital requiere más que inversiones tecnológicas. Se necesita un desarrollo profesional continuo, la alineación de la pedagogía con las herramientas digitales, y alianzas sólidas entre múltiples actores. Estos hallazgos ofrecen orientaciones prácticas para responsables de políticas públicas y líderes educativos a fin de promover una transformación digital inclusiva y sostenible en la educación superior.

**Palabras-clave:** brecha digital; instituciones de educación superior; revisión sistemática de la literatura; tecnologías digitales; integración tecnológica

### **Estratégias para superar a exclusão digital nas instituições de ensino superior: Uma revisão sistemática da literatura**

**Resumo:** Este estudo investiga as estratégias adotadas pelas instituições de ensino superior (IES) para enfrentar a exclusão digital, com foco na melhoria do acesso, no desenvolvimento de competências digitais e na integração de tecnologias avançadas. Utilizando uma revisão sistemática da literatura orientada pelo protocolo PRISMA, são analisadas pesquisas publicadas entre 2005 e 2023 para examinar os esforços institucionais destinados a reduzir as desigualdades

digitais. Os resultados evidenciam desafios persistentes em três níveis. No primeiro nível, apesar dos progressos na conectividade e na distribuição de recursos, permanecem desigualdades no acesso à infraestrutura e aos dispositivos, sobretudo entre estudantes de áreas remotas e de baixa renda. O segundo nível ressalta a necessidade de programas direcionados de literacia digital por meio de iniciativas colaborativas envolvendo IES, governos e parceiros privados. No terceiro nível, o estudo destaca a importância de adotar tecnologias avançadas, como a inteligência artificial, e de criar centros de excelência para preparar os graduados para desafios futuros. O estudo conclui que superar a exclusão digital exige mais do que investimentos tecnológicos. Requer desenvolvimento profissional contínuo, alinhamento da pedagogia com ferramentas digitais, e parcerias robustas entre múltiplos atores. Esses insights oferecem orientações práticas para formuladores de políticas e gestores educacionais promoverem uma transformação digital inclusiva e sustentável no ensino superior.

**Palavras-chave:** exclusão digital; instituições de ensino superior; revisão sistemática da literatura; tecnologias digitais; integração tecnológica

## **Strategies for Overcoming the Digital Divide in Higher Education Institutions**

The widespread integration of internet technologies has fundamentally reshaped how digital tools are used, leading to greater productivity and broader access to innovative information. This progress is closely linked to advancements in artificial intelligence, marked by the rapid emergence of various new technologies (van Veldhoven & Vanthienen, 2022). However, the benefits of these advancements are not evenly distributed. From a socioeconomic perspective, a growing digital divide continues to hinder equitable access to technology, particularly in the context of enhancing productivity (Ayob et al., 2022). The digital divide is generally defined as the gap between individuals who have and do not have access to information and communication technologies (van Dijk, 2017), and more specifically as the inequality in access that arises across communities due to regional, demographic and socio-economic differences (Kormos & Wisdom, 2021). These disparities are particularly evident in the education sector, where the gap can be observed at all levels of education, including primary, secondary and tertiary institutions (Soomro et al., 2020). Before the COVID-19 pandemic, higher education institutions (HEIs) paid limited attention to addressing this divide and strategies or curricula aimed at bridging these gaps were notably lacking (Kumi-Yeboah et al., 2023).

The onset of the pandemic forced HEIs, particularly in developing countries, to abruptly transition to digital teaching methods due to social distancing measures (Bygstad et al., 2022). While this shift was necessary to maintain educational continuity, it exposed critical challenges, such as a lack of digital devices, unreliable internet connectivity and insufficient digital literacy. These issues underscored the severity of the digital divide, which became a central concern during the pandemic (Kumi-Yeboah et al., 2023). As a result, addressing these disparities emerged as a priority, prompting the adoption of comprehensive strategies to improve access to digital tools, enhance internet infrastructure and build digital literacy skills.

In the post-pandemic period, the momentum for digital teaching and learning has slowed. Some HEIs have embraced this period as an opportunity to strengthen their digital infrastructure and capacities to prepare for future challenges. In contrast, others have opted for a more cautious approach, maintaining traditional teaching methods while gradually enhancing their digital capabilities, particularly in fields like management education (Ratten, 2023).

This paper aims to contribute to the scholarly discussion on the digital divide in HEIs by analyzing the strategies employed to address these challenges. Focusing on the period from 2005 to 2023, it explores initiatives implemented by HEIs to reduce digital inequalities among students. By

synthesizing insights from existing studies, this research provides a comprehensive overview of these efforts. The findings aim to enhance understanding of how to bridge the gap between those with and without access to digital technologies, offering practical guidance for HEIs seeking to adopt similar measures.

### **Gap of Studies and Research Question**

The integration of technology in education is a growing trend that has garnered significant attention from scholars, leading to numerous findings about its role in educational environments. One major issue under examination is the digital divide, which is shaped by geographical and socio-economic factors. The complexities surrounding the digital divide, along with the increasing use of digital technology in education, emphasize the need for a more systematic investigation. This paper aims to systematically review and reorganize the existing research to develop a structured framework that better captures these studies. Ultimately, the goal is to use these findings to enhance our understanding and application of technology in educational settings.

The systematic literature review for this study begins by formulating a central research question using the PICo methodology, which includes three key elements: Problem (P), Interest (I), and Context (Co). The research question is: "What strategies or methods do Higher Education Institutions (HEIs) use to address the digital divide?" In this framework, the Problem (P) represents the digital divide, the Interest (I) focuses on the strategies or methods employed and the Context (Co) relates to HEIs. Because the studies reviewed involve students from diverse geographical backgrounds across different regions and countries, the synthesis presented here should be understood as reflecting a broad international perspective on students in higher education institutions rather than being limited to one specific context. Using the PICo framework helps guide the literature search to focus on three main aspects: (1) the strategies implemented to address (2) the digital divide within (3) the context of HEIs.

## **Literature Review**

This section of the literature review aims to clarify the concept of the digital divide, focusing on its different levels and categories. Before conducting the systematic literature review, it is important to set the context within these specific aspects. This initial review helps establish a foundation for a more focused exploration of strategic themes in the systematic literature review.

### **The Digital Divide**

The concept of the digital divide first emerged in 1995, highlighting the disparities between individuals who have access to technological media and those who do not. This term gained prominence as advancements in digital technology fueled debates about accessibility, clearly distinguishing between those with and without access (van Dijk, 2020).

Over time, discussions on the digital divide expanded to include systematic categorizations based on levels and types, helping to better understand its different dimensions. Scheerder et al. (2017) argue that having a consistent framework for categorizing the digital divide is essential for meaningful discussions and effective strategies to close these gaps. Figure 1 provides a visual representation of this categorization, illustrating the digital divide across different levels and types.

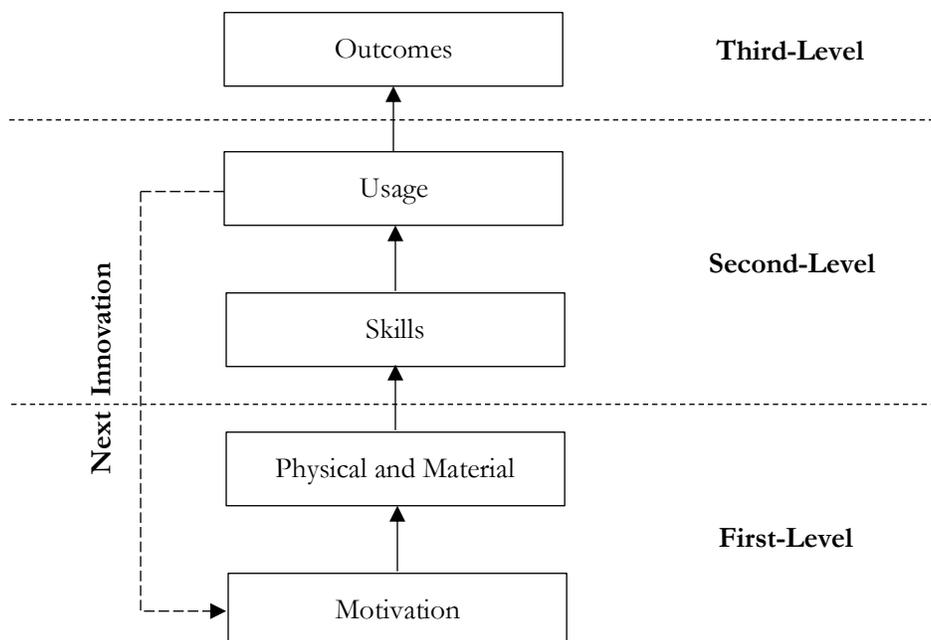
#### ***First-Level Digital Divide***

In the early stages of the digital divide, two main barriers can be identified. The first is a lack of motivation to engage with digital technologies, while the second involves issues of affordability or the ability to physically and materially access these technologies. When considering physical and

material access, it is also important to address motivational engagement. According to van Dijk (2017), a lack of motivation is a key factor that prevents many people from using digital technology. This reluctance is often linked to psychological factors, such as a fear of technology or technophobia, which leads to negative perceptions of technological advancements. As a result, those affected by these views tend to favor the status quo, adhering to established norms and traditional methods.

**Figure 1**

*The Level of Digital Divide*



In the field of education, Ghasem and Ghannam (2021) reported that the appeal of digital or online learning is somewhat diminished due to the difficulties educators face in engaging students and the challenges students encounter in maintaining focus, primarily due to limited interaction. As a result, teaching and learning in online environments often become one-directional, leading many teachers and students to believe that online learning is less effective than traditional classroom settings.

However, Müller and Mildemberger (2021) challenge this belief, noting that the difference in effectiveness between traditional and online learning is not as significant as often assumed. It has been suggested that the effectiveness of online learning varies among individual students, with some finding it more suitable and beneficial for their learning (Abd Aziz et al., 2024). This suitability is influenced by students' comfort with digital platforms, which often depends on their digital skills and the way online learning sessions are conducted by the instructor (Butnaru et al., 2021). Therefore, despite many studies showing minimal differences in learning outcomes with or without the integration of technology, challenges related to 'motivational access' for adopting technological tools persist, driven by psychological factors such as skepticism and lack of user competence.

The second aspect of the first level of the digital divide relates to access to physical and material digital technologies, such as owning digital devices and having internet access. This divide is

largely influenced by socio-economic factors and geographic location. Without sufficient income, individuals cannot afford to purchase digital devices or pay for internet access, both of which are essential for utilizing technology (van Deursen & van Dijk, 2019). In contrast, those with adequate financial resources can afford quality digital devices, reliable internet connections, and additional peripherals like webcams, speakers and printers, along with digital applications that enhance their use of technology.

However, technology has become increasingly affordable, diverse and accessible. The availability of free WiFi in many locations and the introduction of more affordable internet plans have also contributed to greater accessibility. As a result, many argue that this first-level digital divide has been effectively addressed. Policymakers also believe that extending internet coverage to all populated areas and improving internet speeds will help fully bridge this first-level digital divide (Quaglione et al., 2020; Reddick et al., 2020).

However, this perspective is only partially accurate. According to van Deursen et al. (2021), although internet availability has increased and more affordable digital devices are available, the issue of the digital divide, particularly in terms of physical and material access, continues to evolve. This is due to advancements in digital technology, including artificial intelligence, which require more sophisticated digital applications and greater storage capacity, leading to the need for frequent device updates or replacements with more advanced models. Additionally, maintaining digital devices, such as repairing them when damaged, is necessary but can be costly. The introduction of technologies like artificial intelligence also tends to increase the cost of devices, making them unaffordable for many people. Therefore, it is argued that the digital divide at this level will persist if fundamental issues, such as income levels and community capabilities, do not keep pace with technological advancements.

### ***Second-Level Digital Divide***

At the second level of the digital divide, attention is given to two key areas, which are digital skills and digital usage. The gap in digital skills can be seen in the differences in people's ability to use technology effectively. Even when individuals have digital devices, internet access, and the motivation to engage with technology, lacking the necessary skills can make technology burdensome. According to van Laar et al. (2020), traditional 21st-century skills need to evolve into digital forms, including digital information literacy, communication, collaboration, critical thinking, creativity and problem-solving skills, to stay relevant in the digital era. This evolution is seen as essential for integrating these skills with modern technologies. Digital communication and collaboration skills are particularly important for making online interactions and teamwork more efficient and effective. Additionally, digital problem-solving skills are vital for improving agility in management and administrative tasks, enabling faster and more efficient solutions through technology. Without digital skills, problem-solving often depends on traditional approaches (van Laar et al., 2019). However, effectively implementing these skills also requires having basic technical digital skills.

Cai and Gut (2020) investigated differences in problem-solving skills using digital technology among educators in four countries, including the United States, Canada, Finland and Japan. Their findings showed that educators in the United States ranked the lowest in these skills compared to those in other countries, indicating that even among Organization for Economic Co-operation and Development (OECD) countries, there is still a digital skills gap. Despite rapid advancements in digital technology and widespread internet access, developed countries continue to face challenges related to the digital divide. These challenges lead some educators to prefer traditional teaching methods because they find digital technology burdensome due to weaknesses in communication, collaboration and problem-solving skills. As a result, these educators believe that using digital

technology limits their interaction with students (Ghasem & Ghannam, 2021). In addition, digital skills influence a person's level of satisfaction with digital services. According to Ebbers et al. (2016), individuals with stronger digital skills are generally more satisfied with government digital services (eGovernment) compared to those with lower skills. A lack of digital skills makes it difficult for individuals to access these services, which results in lower satisfaction. In contrast, those proficient in digital skills find that eGovernment services simplify their tasks and improve their satisfaction.

In addition to digital skills, digital usage is also a key aspect of the second-level digital divide. The way different groups engage with digital technology creates a division within society based on how technology is used. This divide can be seen in how people with digital devices and internet access utilize these resources. According to van Dijk (2020), the gap in digital usage primarily concerns the types of internet activities people engage in, which leads to varying levels of knowledge within society. There is a clear contrast between groups that use digital technology for information and learning in various areas and those who primarily use it for entertainment and social media. Tsetsi and Rains (2017) examined internet usage on smartphones across different groups and found disparities in digital usage between high-income and low-income groups. High-income individuals are more likely to use digital technology for information gathering, while low-income individuals tend to focus more on entertainment and social activities. This suggests that socio-economic and demographic factors play a significant role in shaping how digital technology is utilized in society.

From the perspective of social media use as a networking platform, where most individuals now have their own social media accounts, it has been observed that using social media does not necessarily lead to an increase in digital literacy within society. Radovanović et al. (2015) argued that digital literacy should involve more than just the ability to use social media platforms like Facebook. Simply using social media does not indicate strong digital literacy skills, as social media use often focuses more on entertainment rather than utilizing digital technology for gaining information and knowledge, which can lead to a knowledge gap. Additionally, social media platforms use machine learning algorithms to tailor the content users see according to their interests. This practice has been identified as a contributor to data inequalities, further widening knowledge gaps in society, especially when users' focus shifts between informative content and entertainment as influenced by these algorithms (Lythreatis et al., 2022).

### ***Third-Level Digital Divide***

The third-level digital divide focuses on the differences in outcomes that arise from using digital technology, where the gap is evident in the results of digital skills and usage (Lythreatis et al., 2022). At this level, the digital divide is defined by the disparity in the benefits gained from digital skills and usage, with some individuals gaining significant advantages while others do not (van Deursen et al., 2016). This distinction between those who are able to derive benefits and those who cannot, forms the basis of the third-level digital divide.

Furthermore, van Deursen and Helsper (2015) found that educated individuals are more likely to use digital technology effectively to enhance their knowledge, while less educated individuals do not use it as efficiently, which further widens the digital divide. The absence of benefits is also aggravated by negative consequences such as the spread of fake news and misinformation (Meel & Vishwakarma, 2020), instances of fraud and digital scams (Evans, 2019), harmful cultural trends (Mihelj et al., 2019) and increased political conflicts (van Bavel et al., 2021), among other adverse outcomes of digital misuse.

Without proper integrity and ethical use of digital skills and technology, these negative effects will continue to occur, further deepening the third-level digital divide between countries that benefit from digital technology and those struggling to manage its misuse.

## Methodology

To ensure transparency and thoroughness in the systematic literature review (SLR) process, this paper clearly outlines several key elements, including the adoption of the review protocol and the procedures for data extraction and analysis. This detailed approach ensures that every stage of the SLR is well-defined and rigorously conducted, thereby maintaining the integrity and validity of the review.

### The Review Protocol – PRISMA

This study follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol to conduct a systematic literature review on strategies to reduce the digital divide in HEIs. PRISMA was chosen for its rigorous methodology and emphasis on high-quality reporting in systematic reviews. The study strictly adheres to PRISMA's 27-item checklist and uses its flow diagram methodology to ensure a systematic review process (Page et al., 2021). This adherence guarantees a robust methodology and thorough reporting, with each checklist item carefully addressed to guide the entire research process.

### Information Sources, Searching Strategy and Identification

To obtain reliable information sources for the literature review, this study accessed three reputable databases, namely Web of Science (WoS), Scopus, and Google Scholar. These databases are recognized as leading academic resources, providing high-quality literature. Relevant publications were identified through these databases using a search string that combined specific keywords. The primary keywords used were "Digital Divide" AND "Higher Education." Table 1 presents the detailed search strings applied in this literature search.

**Table 1**

*Search Strings*

Database	Search Strings
Web of Science	(TI=(Digital Divide; Higher education)) NOT (DT=("PROCEEDINGS PAPER" OR "BOOK CHAPTER" OR "EARLY ACCESS"))
Scopus	TITLE ( digital AND divide; AND higher AND education ) AND ( EXCLUDE ( DOCTYPE , "cp" ) OR EXCLUDE ( DOCTYPE , "ch" ) OR EXCLUDE ( DOCTYPE , "ed" ) )
Google Scholar	allintitle: Digital Divide; Higher Education

To enhance search precision and focus specifically on journal articles, the search strategy excluded documents such as book chapters, conference proceedings, editorials and early access publications. The search across the Web of Science, Scopus and Google Scholar resulted in a total of 118 relevant articles. Among these, 11 were sourced from Web of Science, 17 from Scopus and 90 from Google Scholar. This selective approach was crucial in ensuring the accuracy and relevance of the search results to the central theme of the study.

### Screening

At this stage, the 118 gathered articles were screened based on specific selection criteria. The criteria required that the articles align with the research question, focusing on strategies to address

the digital divide in HEIs. Establishing these criteria, which were directly related to the research question, was essential to ensure the inclusion of only relevant articles, considering the impracticality of reviewing all articles if the topic was too broad (Mohamed Shaffril et al., 2021).

The selection was conducted in a hierarchical manner. Titles and keywords were first reviewed to provide a quick filter that removed clearly irrelevant studies. Abstracts were then examined to check whether the studies aligned with the research question and scope. Finally, the full texts were evaluated in detail to confirm that the articles met all eligibility requirements. This step-by-step approach ensured efficiency while also maintaining rigor. Two researchers screened the articles independently and in parallel and a third researcher joined collaboratively to resolve any disagreements, which guaranteed both independence and consensus throughout the process.

The selection process also considered the publication period, noting that while research on the digital divide began around 2000 or earlier, discussions specifically on technology use and the digital divide in HEIs started around 2005. Therefore, articles from approximately 2005 to 2023 were chosen for the review.

To ensure the quality of the review, various factors were examined to establish the inclusion and exclusion criteria. Only journal articles were included, while book chapters, conference proceedings, theses and reports were excluded. Additionally, articles had to be published in English and fully accessible, meaning they were either open access or retrievable through our university's subscriptions. Articles that could not be accessed, such as those behind a paywall without institutional subscription, were excluded. Articles that were duplicated across different databases were removed to avoid repetition. As a result, 29 articles were found to be redundant, 13 were not journal articles, 2 were not fully accessible for the reasons noted above and 1 was not in English, leaving 73 articles to be evaluated in the next stage.

### **Eligibility**

Next, an assessment was conducted to determine the eligibility of the journal articles. Out of the 73 articles reviewed, each was examined to verify whether it included discussions on strategies for overcoming the digital divide in HEIs. The review results revealed that 54 of these articles did not address strategies for bridging the digital divide in HEIs. Instead, most of these articles focused on issues related to the digital divide, such as challenges in online learning, socio-economic factors and the impact of the digital divide on performance in HEIs, without offering detailed methods or strategies for addressing these problems. As a result, these articles were excluded from further analysis. Based on this evaluation, only 19 articles were deemed suitable for further analysis to address the research questions.

### **Quality Appraisal**

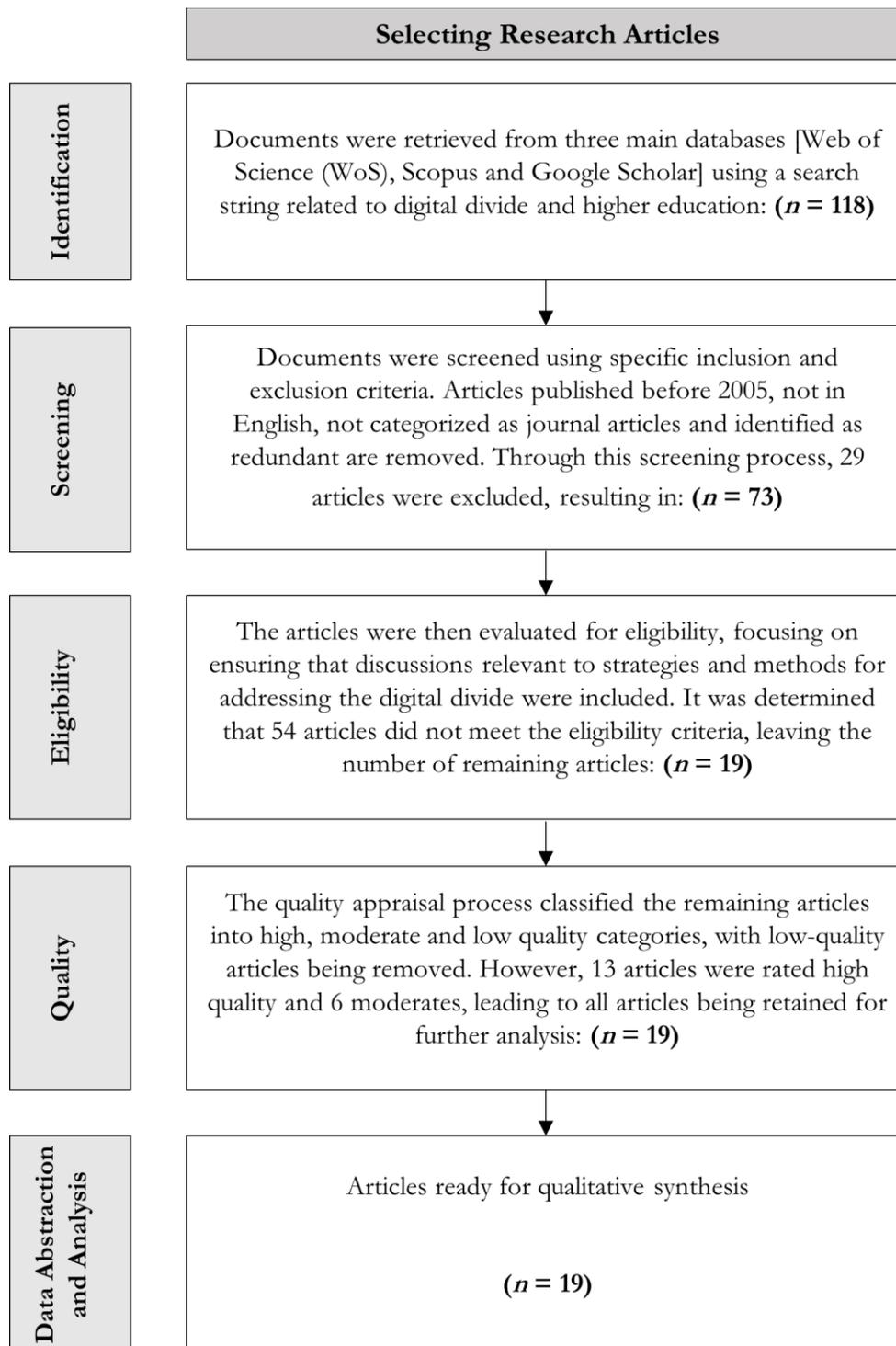
The quality appraisal stage was conducted after the eligibility screening to ensure that the selected articles not only met the inclusion criteria but also demonstrated sufficient methodological rigor. At this stage, three expert assessors independently evaluated each article using predefined criteria adapted from established SLR guidelines (Azarian et al., 2023; Mohamed Shaffril et al., 2021). The assessment focused on clarity of research objectives, methodological rigor, adequacy of sample size, appropriateness of data analysis and transparency of reporting. Each criterion was scored using a three-level rubric (high, moderate, low) and the cumulative score determined the overall quality classification.

To minimize subjectivity, the assessors worked independently and then discussed discrepancies until consensus was reached. Articles rated as high or moderate quality are selected for further review, while those deemed low quality are excluded. Out of the 19 articles assessed, 13 were

rated as high quality and 6 as moderate. Based on this quality appraisal, all 19 articles were deemed eligible for further review. Figure 2 illustrates the systematic search strategy used for selecting articles.

**Figure 2**

*Diagram in Selecting Research Articles*



## **Data Abstraction and Analysis**

In this study, data abstraction used a descriptive approach to summarize author information, publication year and the level of the digital divide addressed in each article. This process was applied only to the 19 eligible articles that had passed the screening, eligibility and quality appraisal stages. For article analysis, an integrative review method was applied to gather information relevant to the research questions. Different analytical methods can be used for reviewing articles, including quantitative, qualitative and mixed methods approaches (El-Masri et al., 2020).

Since the research questions in this study are qualitative in nature, a qualitative approach using thematic analysis was chosen to ensure the findings effectively address the research questions, without focusing heavily on quantitative measures like bibliometric analysis. The identification of themes was facilitated by a hybrid coding technique (Calvo & Cova, 2023). Selective coding, which represented the main themes, was determined using deductive coding techniques and focused on the levels of the digital divide discussed in the literature review. Axial and open coding were then performed using inductive coding techniques (Williams & Moser, 2019). The analysis of the articles identified themes related to strategies for overcoming the digital divide in HEIs, with these themes designed to answer the research questions.

## **Results**

### **Background of the Selected Articles**

Following the screening, eligibility and quality appraisal processes, 19 articles published between 2005 and 2024 were selected for synthesis to address the research questions. Although 6 of these articles are more than 10 years old and may reflect technological contexts prior to 2014, they were still included in the analysis. This inclusion is justified because these articles, despite their age, focus on strategies for overcoming the digital divide, particularly emphasizing skills and usage, similar to the studies conducted after 2014. Including these articles allows for a comprehensive understanding of how efforts to address the digital divide in HEIs have evolved over time, from the initial stages to the present.

Among the collected articles, 7 were found exclusively in the Google Scholar database, while the others were also available in Scopus and Web of Science (WoS) databases. The analysis revealed that most discussions on the digital divide focus on the second level, particularly on digital skills, which accounted for 35.9% of the articles. Following this, issues related to digital usage were covered in 30.7% of the articles. The first-level digital divide, which primarily addresses physical access, was discussed in 28.2% of the articles and only one article, or 2.6%, explored motivations for using digital technology. The third-level digital divide also received minimal attention, with only one article, or 2.6%, examining the role of HEIs in addressing this aspect (see Table 2). These findings are consistent with Scheerder et al. (2017), who noted that the third-level digital divide is underrepresented and less thoroughly discussed. Therefore, the results clearly indicate that, in the context of HEIs, the third-level digital divide remains underexplored.

Next, the synthesis and review process of the selected articles was carried out to address the research question. To ensure that the findings could be presented in an organized and systematic manner, the answers were structured based on the levels of the digital divide discussed in the literature review. Themes for each level of the digital divide were also developed, which helped provide a more structured explanation of the strategies for overcoming the digital divide in HEIs.

**Table 2***The Selected Research Articles*

No.	Author(s)	Year	Database	Overcoming Digital Divide				
				First-Level		Second-Level		Third-Level
				Motivation	Physical	Skills	Usage	Outcomes
1.	Juniu	2005	Google Scholar			/	/	
2.	Zaitun & Crump	2005	Google Scholar			/	/	
3.	Rye	2008	WoS / Scopus		/	/		
4.	Sims, et al.	2008	WoS / Scopus		/	/		
5.	Naidoo & Raju	2012	WoS			/	/	
6.	Radovanović, et al.	2015	WoS / Scopus	/		/	/	
7.	Buzzetto-Hollywood, et al.	2018	Google Scholar			/	/	
8.	Asher	2021	WoS / Scopus		/	/		
9.	Azionya & Nhedzi	2021	WoS / Scopus		/			
10.	Dahmani	2021	Google Scholar			/	/	
11.	Goin Kono & Taylor	2021	WoS / Scopus		/			
12.	Roy & Srivastava	2021	Google Scholar		/	/	/	
13.	Aissaoui	2022	WoS / Scopus					/
14.	Benerjee	2022	Google Scholar		/			
15.	Woldegiorgis	2022	Scopus		/	/	/	
16.	Agarwal & Jaiswal	2023	Google Scholar		/		/	
17.	AlShawabkeh, et al.	2023	WoS / Scopus		/	/		
18.	Kumi-Yeboah, et al.	2023	WoS / Scopus		/	/	/	
19.	Devisakti, et al.	2024	WoS / Scopus		/	/	/	
<b>Frequency</b>				1	11	14	12	1
<b>Percentage (%)</b>				2.6	28.2	35.9	30.7	2.6

## **Overcoming the First-Level Digital Divide in HEIs**

### ***Stratification-Sensitive Approaches to Technology***

To encourage the adoption of digital technology among senior university professors, Radovanović et al. (2015) recommended using stratification-sensitive approaches. These strategies involve thoroughly examining the training needs and attitudes of those who are hesitant to adopt digital tools, particularly experienced academics. This group often prefers traditional teaching methods over integrating technology into their instruction, which can hinder the ability of younger students to benefit from technological resources in their learning, despite the professors' deep subject expertise. To effectively improve technology use among senior faculty, it is essential to employ approaches that specifically identify and address their unique needs. Additionally, as shown in Figure 1, bridging the digital usage gap is key to fostering technological motivation and supporting the development of innovative teaching solutions.

### ***Digital Infrastructure Support for e-Learning***

Rye (2008) highlighted the digital divide in terms of internet infrastructure, particularly affecting students in remote areas who lack adequate internet connectivity compared to their urban counterparts. This disparity hinders the effective implementation of remote or e-learning due to geographical limitations caused by insufficient internet access. As a solution, Rye broadly recommended that governments improve internet infrastructure in remote regions to provide equitable digital access and e-learning opportunities for all students.

In contrast, the study by Sims et al. (2008), conducted in the United Kingdom, a developed country, focused on a different aspect of digital infrastructure. While Rye emphasized internet connectivity, Sims et al. concentrated on university-provided digital platforms. Their recommendations aimed to address the material digital divide by advocating for comprehensive information and communication technology (ICT) platforms that serve diverse student needs, including distance learners who are employed. These platforms were designed to offer digital content, learning materials, storage solutions and email services specifically tailored for student use. Although Sims et al. acknowledged challenges related to internet access and digital devices, their primary focus was ensuring access to learning materials through digital platforms, enabling students to benefit from free digital services provided by the university.

### ***Collaborating with Private Sectors and NGOs***

Roy and Srivastava (2021) highlighted the importance of a collaborative effort between the government and private companies, through the National Mission of Education (NME), to make digital devices and internet data more affordable for students. They argue that partnerships with technology companies like Microsoft and Hewlett-Packard (HP) are essential to provide students with the necessary digital tools for learning. Asher (2021) supports this perspective, emphasizing that collaborations with private sectors or NGOs can help ensure that students, particularly those from disadvantaged backgrounds, can acquire devices either for free or at a reduced cost. HEIs play a crucial role in identifying students in need and facilitating the distribution of these resources.

Kumi-Yeboah et al. (2023) further suggest that the government should work with internet service providers to offer affordable or free internet packages for students. This initiative aims to address the digital divide by ensuring that students have reliable internet access, which is essential for remote learning. To fully bridge this gap, efforts must go beyond providing devices and include improving digital infrastructure and establishing Wi-Fi hotspots, especially in underserved areas. This comprehensive approach is crucial to ensure equal access to learning opportunities for all students.

### ***Subsidies and Financial Aid for Device and Internet Access***

To address the issue of insufficient digital devices for learning, Woldegiorgis (2022) proposed that the government expand the National Student Financial Aid Scheme (NSFAS) to provide not only living allowances but also free laptops to students from disadvantaged backgrounds. Woldegiorgis argued that living allowances alone are not enough for students to afford quality laptops needed for their education. Banerjee (2022) supports this perspective, noting that students from low socio-economic backgrounds tend to rely on smartphones for learning, while those from wealthier families have access to more suitable devices such as laptops and computers. The use of less effective devices, like smartphones, negatively impacts students' academic performance, particularly their grade point average (GPA).

Agarwal and Jaiswal (2023) also emphasized the need for government intervention, recommending that ICT infrastructure in rural areas be developed more rapidly, along with offering low-cost internet packages and affordable digital devices, such as laptops. These recommendations collectively stress the importance of providing suitable devices for learning and ensuring affordable internet access for students from low socio-economic backgrounds, especially those in rural areas.

### **Overcoming the Second-Level Digital Divide in HEIs**

#### ***Development of Digital Facilities and Infrastructure***

In addition to training programs aimed at enhancing digital skills among teaching staff and students, it is crucial to prioritize the strengthening of digital infrastructure and facilities. This foundational development is necessary to support skill application and promote greater digital integration within the teaching and learning process. Agarwal and Jaiswal (2023) emphasized the need for HEIs to increase the number of smart classrooms, thereby exposing students and lecturers to digital technology in educational settings and enhancing digital usage. Furthermore, providing computers with learning applications can encourage lecturers to incorporate technology more effectively into their teaching practices (Dahmani, 2021).

Platforms like learning management systems (LMSs) facilitate digital interactions between lecturers and students, enabling blended learning approaches, massive open online courses (MOOCs) and micro-credentialing. These elements collectively contribute to increased digital engagement in learning (Roy & Srivastava, 2021; Woldegiorgis, 2022). Strengthening digital infrastructure and facilities is therefore essential for expanding the use of digital technology in education and addressing the second-level digital divide by ensuring more equitable access to these resources.

#### ***Enhancing Digital Skills for Increased Usage in HEIs***

Asher (2021) highlighted significant differences in the readiness of universities in Pakistan compared to those in the United States for transitioning to digital-based learning. He suggests that universities in Pakistan and other developing countries should make greater efforts to prepare for this transition. To ensure a structured and effective implementation, Naidoo and Raju (2012) recommend that teachers and lecturers first enhance their digital skills, progressing from basic to advanced levels. This foundational step is essential for successfully integrating digital learning in higher education.

Dahmani (2021) echoed this view, emphasizing the need to enhance digital competence among educators using a teacher-centered approach. Teachers and lecturers must lead by example in using digital tools, thereby helping students improve their digital skills more efficiently. Similar challenges were evident during the COVID-19 lockdown, where limited digital skills and weak institutional preparedness constrained effective engagement with emergency online learning,

highlighting the need for foundational digital guidance and coordinated institutional support (Azionya & Nhedzi, 2021). Woldegiorgis (2022) and Kumi-Yeboah et al. (2023) further emphasized the importance of developing technology-based digital learning pedagogies and promoting digital literacy training for both lecturers and students. AlShawabkeh et al. (2023) added that pedagogical development should incorporate the Universal Design for Learning (UDL) approach to accommodate students with disabilities, ensuring inclusive access to learning technologies. To achieve this, lecturers should be trained in UDL to ensure that no student group is excluded from the benefits of digital learning.

However, internal efforts alone may not be enough to develop the necessary digital skills and training. Roy and Srivastava (2021) suggested that more advanced industries, such as multinational digital companies or NGOs, could provide free training for lecturers and students to improve their proficiency with the latest digital technologies. Additionally, Buzzetto-Hollywood et al. (2018) recommended that students complete a digital literacy certification before enrolling in university to reduce the digital divide among students. Such pre-university training could ensure that students are equipped with basic digital skills, preventing those with greater digital proficiency from dominating the learning environment.

### ***Fostering Digital Proficiency and Media Literacy for Students and Lecturers***

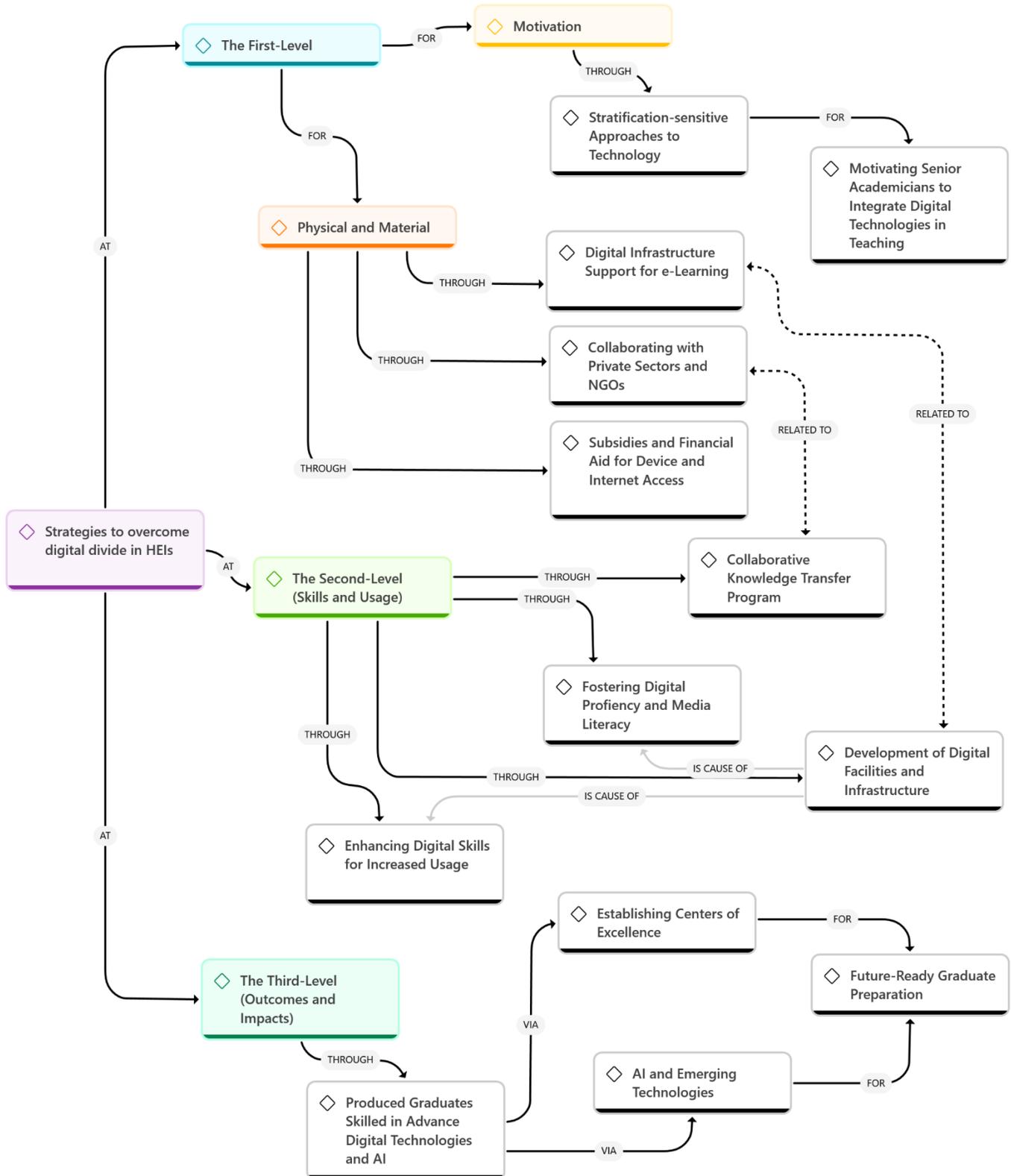
Reducing the second-level digital divide requires targeted improvements in both digital proficiency and media literacy, as these are critical for advancing digital skills and promoting responsible usage. Juniu (2005) argued for this approach through his Teaching and Learning for Educational Needs with Technology (TALENT) model, which emphasizes integrating modern technology into pedagogy and curricula to enhance student proficiency with digital tools. This model aims to go beyond simple information retrieval by fostering skills in problem-solving and technology-based solutions, creating a distinction from passive information consumption.

Similarly, Huang et al. (2022) advocated for promoting proficiency in information technology and information systems, suggesting that effective handling of digital information helps users discern accurate data amidst infodemic challenges, highlighting the need for a nuanced approach to digital literacy. Faculty narratives further suggest that the second-level digital divide is shaped not only by technical skills but also by how lecturers intentionally and empathetically employ digital tools to support student learning (Goin Kono & Taylor, 2021). Figure 3 illustrates the strategies to overcome the digital divide in Higher Education Institutions, presented through a visual analysis conducted using Atlas.ti.

Radovanović et al. (2015) identified an age-based divergence in digital technology use, noting that millennials, who were exposed to digital environments from an early age, generally find it easier to use technology compared to older generations. However, this familiarity is often focused on entertainment, with much of their digital engagement revolving around social media and media downloads rather than information gathering or knowledge development. Despite this, the authors observed that millennials can adapt quickly to more purposeful uses, such as digital problem-solving or entrepreneurial activities, when given adequate exposure.

In contrast, older generations tend to approach technology with more caution. For example, Wikipedia is often viewed by this group as an unreliable source of information. However, individuals with advanced digital literacy understand Wikipedia's role as a dynamic, open-source platform and encourage students to use and contribute to it responsibly. To address these differences, the authors suggest that senior academic figures, who often shape institutional policies, receive targeted support to improve their digital literacy. This support would help them view technology as a valuable tool for knowledge creation and misinformation prevention.

**Figure 3**  
*Strategies to Overcome Digital Divide in HEIs: A Visual Analysis using Atlas.ti*



Furthermore, Devisakti et al. (2024) recommended using the Social Integrative Gratification method to enhance digital literacy in higher education settings. This approach leverages social interaction through digital tools, allowing students to develop skills by directly engaging with instructors in real-time use of technology. By positioning digital tools as facilitators of communication and learning, this method not only enhances technical skills but also promotes more productive use of technology in educational environments. Through this approach, digital platforms evolve beyond mere information retrieval, fostering productivity and problem-solving capabilities among students, which are essential for their academic and professional success.

### ***Collaborative Knowledge Transfer Program***

Addressing the second-level digital divide, particularly regarding digital usage and skills, requires a foundational approach. Zaitun and Crump (2005) suggest that initial efforts should involve fostering community engagement through knowledge transfer from HEIs, government, and industry to local communities. This approach requires collaboration among these agencies to build digital literacy at an earlier stage, before individuals enter HEIs. The role of HEIs should focus on structured knowledge transfer programs, where students, particularly those from computer science or ICT disciplines, work with community groups to raise awareness, teach foundational digital skills and promote technology use. However, before extending such initiatives to broader community groups, institutions must first establish a strong digital infrastructure within HEIs. This preparatory stage allows students to refine their digital skills and empowers them to apply and further develop these skills by educating and supporting community members, especially children in rural areas, to improve their digital competencies before entering higher education.

To enhance the effectiveness of this knowledge transfer model, collaboration with government and industry is crucial, particularly in providing necessary resources or financial support, which can make the process more efficient and impactful. This approach aligns with Rye (2008) and Sims et al. (2008), who argued that digital literacy programs should connect with everyday practices and community structures at the regional level. Such targeted efforts can effectively support rural communities with limited access to technology, thereby enhancing their digital skills and enabling more equitable digital engagement.

### **Overcoming the Third-Level Digital Divide**

#### ***HEIs' Capacity to Produce Graduates Skilled in Advanced Digital Technologies and AI***

This systematic literature review supports the assertion by Scheerder et al. (2017) that discussions about the third-level digital divide are notably scarce in academic literature, particularly in the context of HEIs. The analysis identified only one relevant article by Aissaoui (2022), which specifically addresses this issue within HEIs. Aissaoui argued that the third-level digital divide became especially evident during the Covid-19 pandemic, as some countries struggled to effectively utilize information and communication technology (ICT), while others were more successful. This disparity is particularly pronounced in nations that leverage digital technology to enhance productivity and quality across sectors such as education, the economy, and manufacturing.

As a result, it is crucial for HEIs to integrate technology into their teaching and learning practices while staying informed about emerging technologies, such as artificial intelligence (AI), to avoid falling further behind in the global digital divide. Aziz et al. (2024) emphasized that institutions play a vital role in fostering confidence and guiding individuals and communities toward technology adoption. Establishing centers of excellence or dedicated faculties focused on advancing digital technology and AI within HEIs is essential to equip graduates with the advanced skills needed to succeed in this evolving landscape.

## Discussion

The findings of this review highlight that higher education institutions play a central role in shaping responses to the digital divide, yet their approaches remain uneven. At the first level, which concerns access, HEIs have taken steps to expand digital infrastructure and provide students with devices or online platforms. Studies show that universities in developed contexts have invested heavily in comprehensive ICT platforms to support diverse learners (Sims et al., 2008), while in developing contexts the focus has been on expanding internet connectivity and providing devices at reduced cost (Asher, 2021; Roy & Srivastava, 2021). Despite these efforts, the review confirms that access inequalities persist, particularly for students from low-income families and those in rural areas (Agarwal & Jaiswal, 2023; Rye, 2008). This reflects the argument of van Deursen and van Dijk (2019) that access is not a problem solved once and for all, but one that evolves with new technologies and rising costs. For HEIs, the challenge is to balance investment in digital infrastructure with strategies that anticipate ongoing technological changes, such as artificial intelligence, which demand frequent updates and create new barriers (van Deursen et al., 2021).

At the second level, which focuses on skills and usage, HEIs are expected to be at the forefront of building digital competence among both students and lecturers. Many of the reviewed studies emphasized the importance of training programs and structured approaches to develop skills in digital literacy, collaboration, and problem-solving (Dahmani, 2021; Kumi-Yeboah et al., 2023; Naidoo & Raju, 2012). However, there is debate over whether HEIs should carry this responsibility alone. Some scholars stress that governments and private actors must support universities through partnerships and funding to ensure effective training (Asher, 2021; Roy & Srivastava, 2021), while others argue that digital literacy must be fully embedded into curricula and pedagogy within universities themselves (Buzzetto-Hollywood et al., 2018; Juniu, 2005). This debate reflects the wider question of whether HEIs are equipped to act independently or whether systemic support is required for sustainable capacity building.

The third level, which concerns outcomes, remains the least developed in HEI-focused research. Only one of the reviewed studies examined the role of institutions in influencing outcomes such as employability and equitable learning benefits (Aissaoui, 2022). This lack of attention is concerning, since universities are expected not only to provide access and training but also to ensure that digital adoption translates into meaningful academic and social results. As Scheerder et al. (2017) argue, neglecting outcomes risks creating a divide where technology is available but does not improve learning or future opportunities. For HEIs, this represents an urgent area where evidence is still limited and where further work is needed to evaluate whether current initiatives truly achieve inclusive and long-term impacts.

Taken together, these findings show that HEIs have been proactive in addressing the digital divide but that their strategies are uneven and often constrained by structural and economic factors. The review contributes to ongoing debates by showing that while universities have a responsibility to strengthen infrastructure and embed digital skills into curricula, their capacity to do so is influenced by external forces such as public policy, market costs and rapid technological change. Therefore, bridging the divide in higher education requires not only institutional innovation but also multi-stakeholder collaboration and forward-looking strategies that position HEIs as leaders of inclusive digital transformation.

### Study Limitations

This review has several limitations that should be acknowledged. First, restricting the inclusion criteria to English-language articles may have introduced language bias. Perspectives and

strategies developed in non-English-speaking contexts might not be fully represented in this review. Second, the scope of this study was limited to articles that were either open access or retrievable through institutional subscriptions. Articles behind paywalls and not covered by the university's access were excluded, which may have narrowed the diversity of sources included. Third, the review relied exclusively on peer-reviewed journal articles. While this ensures a focus on high-quality academic sources, it may have introduced publication bias, as studies with non-significant or negative results are less likely to appear in peer-reviewed journals. Grey literature such as reports, theses, or policy documents was excluded, even though these sources could provide practical perspectives on how higher education institutions tackle the digital divide. Finally, the digital divide is shaped by rapidly evolving technologies, driven by new tools such as artificial intelligence, 5G connectivity and advanced digital learning platforms. Although this review covered studies published between 2005 and 2023, some findings may already be outdated given the fast pace of innovation. This highlights the need for ongoing reviews to keep pace with the dynamic nature of technology and its implications for higher education.

## **Conclusion**

This review examined strategies used by higher education institutions to reduce the digital divide, synthesizing evidence from 19 peer-reviewed studies published between 2005 and 2023. The results show that most institutional efforts concentrate on improving digital skills and usage, followed by measures to provide access to devices and connectivity. However, very few studies considered outcomes, which leaves a gap in understanding how digital adoption within universities translates into long-term academic success, employability and equity.

For HEIs, the findings point to three important directions. First, investments in infrastructure and access must be continuous and responsive to rapid technological developments, since the digital divide evolves as new technologies emerge. Second, digital literacy and competence must be embedded into teaching, curricula and staff training so that skills are developed in a systematic way rather than through short-term interventions. Third, HEIs must move beyond access and skills to evaluate whether digital initiatives are producing equitable benefits for all students, particularly those from disadvantaged backgrounds.

The findings also show clear policy actions that are required. Governments should establish long-term funding models to secure reliable digital infrastructure in higher education and provide targeted subsidies that support disadvantaged groups. Policymakers should encourage partnerships with private actors to reduce the cost of devices and internet services, while also promoting national frameworks that strengthen digital literacy across universities. HEIs must align their strategies with these policies by ensuring that investments in technology are accompanied by inclusive teaching and support systems. As technologies such as artificial intelligence, 5G and advanced digital learning platforms continue to reshape education, governments and HEIs alike must adopt adaptive strategies that respond quickly to emerging challenges.

By working together through these actions, HEIs and policymakers can ensure that digital transformation in higher education is inclusive, sustainable, and capable of preparing students for academic, professional and societal challenges in the digital age.

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