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Bridging Educational Gaps through Digital Competency: A Systematic Literature Review on Teacher Readiness and Student Self-Concept in Rural Education

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Abstract

This systematic literature review (SLR) examines the effect of digital competency on narrowing the educational gaps in rural schools, with an emphasis on teacher readiness and student self-concept. The use of information and communication technology (ICT) in rural education can help bridge the gap left by inadequate infrastructure and resources. However, digital tools are rarely well integrated, as teachers lack digital competency and students are not motivated to use these tools in their learning. This study is based on research from developed and developing countries, exploring the impact of teacher digital readiness on ICT integration and the relationship between students' self-concept and their technology use. It outlines key pedagogical methods related to teacher digital competency and students' self-concept necessary to achieve the full potential of digital technology in rural education. The results highlight the importance of professional development, improved access to digital resources, and policies that foster digital competency, thereby increasing teacher and student confidence in utilizing technology in learning. Overcoming those challenges, rural schools can offer equitable opportunities for all students to thrive in the digital realm.

Keywords: Digital Competency, Teacher Readiness, Student Self-Concept, Rural Education, ICT Integration, Digital Divide

Introduction

The integration of digital technology helps narrow the wide gap, especially in rural areas or suburbs with limited resources, infrastructure, and digitally competent teachers. In rural regions, the effective use of ICT in teaching and learning is often not realised, resulting in poor educational outcomes as teachers and students struggle to use ICT efficiently. The COVID-19 pandemic has accelerated the integration of digital resources in education, underscoring the need to address these challenges in rural schools (Hurtado-Mazeyra et al., 2022). Teachers' digital competence and attitudes, as well as students' self-assessment of

their digital skills, appear to play a vitally important role in addressing these challenges (Ghalia & Karra, 2023). In addition, technology has been found to promote student learning and academic success, creating a more interactive and personalised learning milieu (Jita & Sintema, 2022). However, rural areas continue to face a range of challenges, including the digital divide and limited access to technology and digital skills necessary for effective learning (Kundu, 2022; Nur Hasmawati Junaidi & Khairul Azhar Jamaludin, 2024).

Although digital learning tools have improved, rural teachers often lag behind their urban peers in their understanding of digital tools. Additionally, students' self-concept (i.e., how they perceive their abilities in digital settings) significantly impacts their motivation and academic performance (Zalik et al., 2023). Research into teacher readiness and digital competence exists; however, in the rural context, where challenges are more pronounced, studies are scarce (Diethelm et al., 2020). Most rural teachers experience a significant lack of digital competencies, which limits their use of ICT (Hurtado-Mazeyra et al., 2022). This SLR seeks to fill this gap by synthesising the research on rural teachers' readiness to use ICT and its influence on students' self-concept. It provides suggestions for enhancing digital education in rural schools (Kundu, 2022). Addressing these issues is crucial for ensuring equitable educational opportunities in rural areas.

In Malaysia, digital divide issues are more pronounced in rural areas, where only 50.1% of rural homes possessed Internet access, resulting in rural teachers relying heavily on unstable mobile data for online teaching (Norhuda Salleh et al., 2023). According to a report from the Ministry of Education, 57.9% of the teachers in Malaysia had basic digital skills, which limits the quality of the online learning offer (MOE, 2024). Many obstacles underscore the urgent need for digital access and teacher training. Attention to digital divides is crucial for achieving equitable access to education, particularly for students in rural communities. Socioeconomic status, a lack of technology resources, and digital skills are significant challenges for students and teachers, contributing to educational disparities in rural education.

This study emphasises the importance of policies and infrastructure, as well as the readiness of teachers and students, as key factors in closing the educational inequalities gap and improving the quality of education (Samane-Cutipa et al., 2022). This study also demonstrates the significance of digital literacies in attaining learning outcomes through the provision of dependable internet and digital curricular resources in rural areas. This reinforces the need for teachers to have digital skills and for students to be sure that learning is possible. The promotion of ICT use in teaching must be linked to professional development for teachers, and equality of opportunity in ICT use is essential to provide an inclusive learning environment (UNESCO, 2025).

The global trends in digital education were accelerated by the COVID-19 pandemic, which has brought about significant changes in the field of higher education, where forces such as big data and artificial intelligence (AI) have emerged as key players. However, rural communities are not without challenges regarding inequality. Although various countries, such as Germany, the USA, or China, have initiated international programs to implement digital education reforms, a lack of infrastructure and resources remains a hindrance for rural communities. Efficient leadership, digital literacy, and tailored policies will need to be

implemented to address these issues and ensure equitable digital access to education (Prabowo & Bandur, 2022; Yang et al., 2022).

Rural students need to develop digital skills to bridge the digital divide and enter the digital economy and the future workforce. Rural students, however, are significantly disadvantaged in terms of resources and training compared to their urban counterparts. Hence, they are limited in their potential (Maniram, 2023). Digital competencies among rural students are commonly distributed, with rudimentary competencies in managing information and communication, but lacking more complex digital competencies, such as creating digital content and solving complex problems with the aid of digital skills. Teachers' use of technology is crucial in facilitating effective teaching and enhancing opportunities for students in the future, particularly in rural areas. Enhanced digital skills can also enable teachers to communicate more effectively with students, parents, and colleagues, ultimately enhancing the learning ecosystem.

The integration of digital tools, such as blogs, social networks, and online learning platforms, facilitates communication, engagement, and student learning, thereby preparing them for a technology-led world (Guillén-Gámez & Mayorga-Fernández, 2022). This highlights the urgent need for mastery of new digital skills, particularly in remote regions where access to conventional education is a significant challenge. Improving the digital skills of rural students would equip them with the capability to participate in the current digital economy fully and in their future employment (Siti Noorsuriani Maon et al., 2018).

This study emphasises the importance of developing a targeted professional development program to enhance digital skills among rural teachers, with implications for curriculum design and technology policy that involve integrating digital tools into the learning process (Kalonde, 2017). Therefore, it is imperative to provide infrastructure and resources for digital learning in rural schools, as closing the digital competence gap could support rural students in having similar prospects of immediate and future success, in terms of access to digital resources and digitisation, as their urban counterparts (Bi & Nadiah Ishak, 2025). Therefore, strengthening teachers' and students' digital competency will be of high significance for teacher readiness, curriculum development, and technology policy-making, as well as ensuring rural education equity and quality in the digital era.

The review will examine research from several geographical contexts, including rural schools in developed and developing countries. The subsequent research questions guide this review: 1. How do rural educators' approaches and use of ICT in the classroom change their level of digital readiness? 2. What is the relationship between student self-concept and the use of digital technologies in rural educational environments? 3. What measures have been developed to enhance teachers' readiness and students' self-concept in rural education, particularly with digital technologies? The responses to these inquiries will help inform the formulation of policies and practices aimed at reducing the digital divide in rural education.

Methods

This systematic literature review adhered to the PRISMA guidelines to ensure transparency, reproducibility, and rigour in selecting, screening, and synthesising studies on teacher digital competency and student self-concept in rural educational contexts. The

PRISMA framework is crucial for enhancing methodological transparency and increasing the reliability of the review (Moher et al., 2009; Page et al., 2021). This review focused on publications from 2015 to 2024, including the most recent research. A comprehensive PRISMA flowchart will illustrate the inclusion and exclusion process, clearly summarising the studies reviewed, assessed for eligibility, and included in the final review (Page et al., 2021). This SLR contributes to transparency, replicability, and an evidence-based synthesis of literature by following such guidelines and applying the flowchart.

The Search Terms

Table 1

The Search Strings

Database	Keywords Used	Findings
Scopus	"teacher digital competency" AND "rural education" AND "student self-concept"	1206
Web of Science	"digital tools" OR "technology integration" AND "teacher readiness" AND "student engagement"	9091

PRISMA conducted the systematic literature review (SLR) to enhance the rigour and transparency of the process. Two databases – Scopus and Web of Science – were utilised in this study to search for relevant articles. The strategies used to search included the use of keywords such as “teacher digital competence,” “student self-concept,” and “rural education,” along with Boolean operators (AND, OR), to enhance the search results. The eligibility criteria included academic papers published between 2015 and 2024 in the English language, in peer-reviewed journals, and research conducted in rural primary or secondary education settings. Articles were excluded if they focused on higher education, were not set in an educational setting, or were non-empirical (review articles, editorials, etc.).

The results indicate that teacher digital competencies, student self-concept, and rural education are significant research themes, as evidenced by Scopus and Web of Science. A search of “teacher digital competency,” “rural education,” and “student self-concept” resulted in 1,206 studies, thus reflecting a considerable amount of research conducted in this field of rural education. The Web of Science search using the terms "digital tools" or "technology integration" and "teacher readiness" and "student engagement" yielded a substantial total of 9,091 studies, highlighting a greater focus on the impact of technology and teacher readiness in enhancing student engagement. The larger volume of results from Web of Science indicates a broader array of studies than Scopus. Nonetheless, Scopus mainly offers focused perspectives on rural education.

The Criteria for Eligibility

Table 2

Criteria for Inclusion and Exclusion

Database	Setting	Inclusion	Exclusion
Scopus Web of Science	Year	Published between 2015 and 2024	Published before 2015
	Language	English	Non-English
	Article Type	Peer-reviewed journal articles	Non-empirical studies (e.g., reviews, opinion papers)
	Subject Area	Focus on primary or secondary education in rural contexts	Higher education or non-educational settings

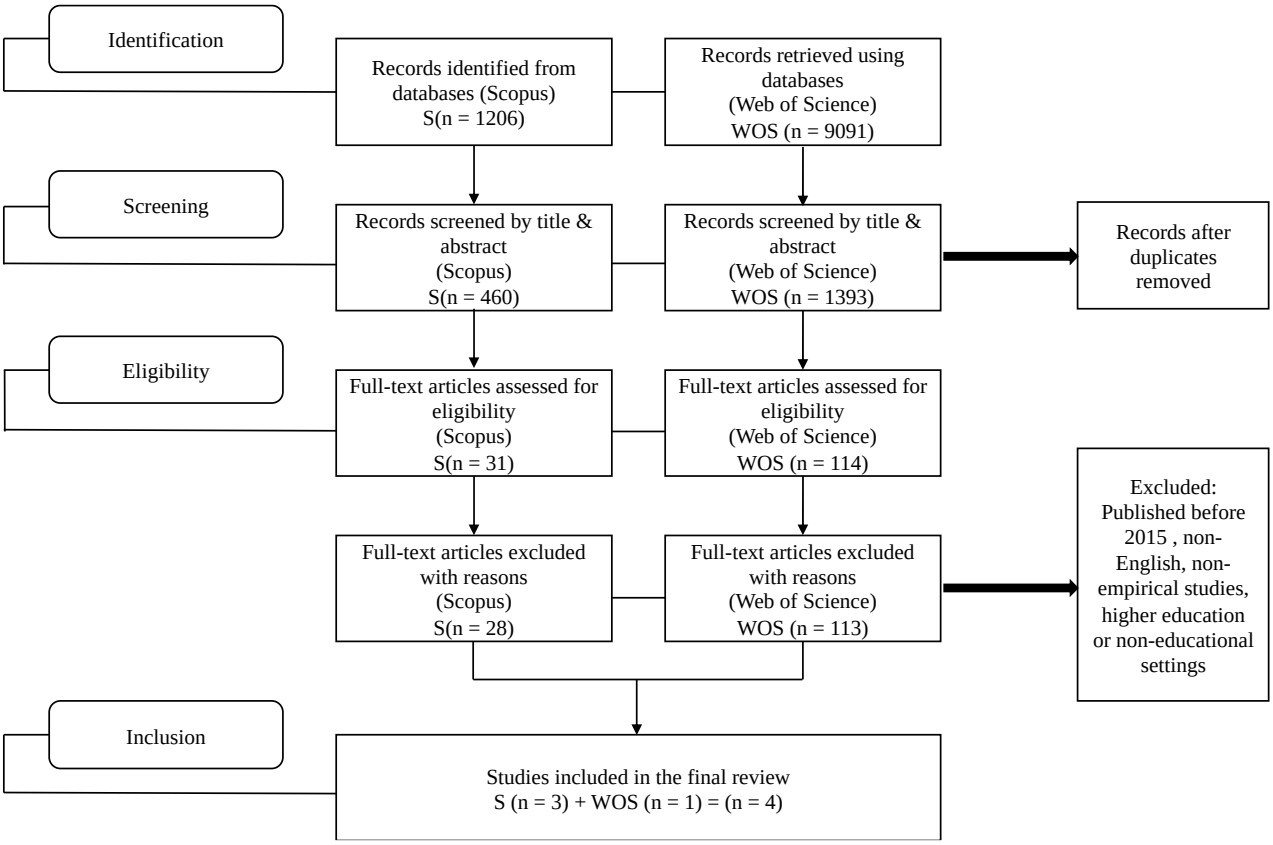
The inclusion criteria for this systematic literature review (SLR) are specifically established to ensure the relevance and quality of the selected studies. Studies published between 2015 and 2024 were selected to encompass the most recent research findings. Only English-language publications were assessed to remove potential language barriers in accessing full-text articles. Additionally, only peer-reviewed journal publications ensured the academic rigor of the studies, excluding non-empirical works such as reviews or opinion pieces. The study must focus on primary or secondary education in rural contexts to align with the review's focus on teacher digital competency and student self-concept in rural education. Research about higher education or non-educational contexts was excluded.

The exclusion criteria ensured the review remained focused and relevant to the research topic. Studies published before 2015 were excluded to focus on the most recent developments in teacher digital competency and its effects on rural education. Research conducted in languages other than English was excluded to avoid potential difficulties in translation and complete comprehension of the findings. Additionally, non-empirical works, such as theoretical papers, reviews, and opinion-based articles, were excluded, as this review emphasizes empirical research that provides evidence-based findings. Studies focusing on higher education or conducted in non-educational contexts were excluded, as the survey explicitly addresses primary and secondary education in rural settings.

Screening Process

This study's screening process adhered to the PRISMA 2020 principles to ensure a systematic and transparent selection process. The initial search results from two databases, Scopus and Web of Science, were transferred to Excel for organisation. Duplicate entries were removed before titles and abstracts were evaluated for relevance based on the established inclusion and exclusion criteria. Subsequently, relevant research was subjected to a thorough full-text evaluation to assess eligibility. Studies that did not meet the criteria were excluded, and the reasons for exclusion were recorded. The final selection of research was documented using the PRISMA flowchart, which details the number of records identified, screened, excluded, and included in the review.

Table 3
Screening Process



This study employed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) standards for data screening to ensure transparency and rigour in selecting relevant studies. A total of 1,206 records were identified from Scopus, and 9,091 from Web of Science. The screening of titles and abstracts yielded 460 entries from Scopus and 1,393 from Web of Science. After removing duplicates, the eligibility phase commenced, during which 31 full-text publications from Scopus and 114 full-text articles from Web of Science were assessed for relevance. Twenty-six full-text publications from Scopus and 108 from Web of Science were excluded based on criteria such as publication date before 2015, non-empirical research, non-English language papers, or studies focused on higher education or non-educational contexts. Four papers were included in the final evaluation, comprising three from Scopus and one from Web of Science. These papers provided the basis for analysing teacher digital competency and student self-concept in rural educational contexts.

Results Literature Review

The literature review emphasises the critical importance of digital competence in addressing educational inequalities in rural schools. Studies conducted in China, Nepal, Indonesia, and Vietnam consistently show that the digital readiness of teachers is crucial for the effective integration of digital resources in educational settings. The challenges of maintaining a teaching presence and creating supportive learning environments hindered the transition to online learning in rural China. In Nepal, the teachers' insufficient digital competencies negatively impacted student communication and engagement during online classes. Pre-service teachers in Indonesia faced challenges due to inadequate internet connectivity and limited access to resources, which hindered their ability to create effective

digital instructional materials. In Vietnam, various factors, including institutional policies and infrastructure, have influenced teachers' digital competencies. The findings underscore the need to enhance teacher digital readiness, improve access to resources, and implement supportive policies to bridge the digital divide and enhance educational outcomes in remote areas.

Data Extraction

Data extraction was conducted systematically through Microsoft Excel to categorise and encode critical information from the selected studies. The collected data included authors, publication year, country, research objectives, methodologies, sample characteristics, key findings, and topics related to teacher digital competency and student self-concept in rural education. The coding method enabled the classification of trends and key findings, supporting a systematic literature synthesis.

Author	Problem and Objective	Methodology	Key Findings
Wang et al., 2021	**Problem:** The restricted access to online education in rural China during the COVID-19 pandemic highlighted substantial digital disparities. **Objective:** To analyse the response of rural educational systems in China to COVID-19 school closures and identify the factors influencing the quality of students' online learning.	**Study Design:** A mixed-methods approach utilising both interviews and surveys. **Data Collection:** Study 1: Conducted interviews with three curriculum officers, seven principals, and thirty teachers. Study 2: A survey conducted with 1,409 primary students across three rural schools. **Subject:** Educators and 1,409 students in rural Shandong province. **Location:** Rural Shandong, China.	Educational institutions provided devices, television access, and municipal-level courses. Educators utilised individualised online instruction and collaborative peer assistance. Teaching presence and facilitating conditions were found to predict learning quality and to indirectly influence student happiness and social/cognitive presence via perceived usefulness and technology self-efficacy.
Joshi et al., 2023	**Problem:** Limited understanding of how math teachers' digital competencies influence student communication in online learning environments. **Objective:** To assess how the digital, collaborative, and software competencies of math teachers influence students' communication behaviours in virtual classrooms.	**Study Design:** A cross-sectional online survey **Data Collection:** A survey conducted with 466 secondary school mathematics teachers in Nepal. **Subject:** Mathematics educators who underwent technology-related training during the COVID-19 pandemic. **Location:** Nepal.	Teachers exhibited limited development in communication, collaboration, digital pedagogy, and software skills. The development of digital skills and the utilisation of communication tools are predictors of student communication outcomes. Training improved teachers' digital competencies; however, disparities persist between public institutions and female educators.
Effendi & Ben, 2024)	**Problem:** To examine the digital proficiency of	**Study Design:** A qualitative descriptive research	Pre-service teachers effectively utilised PACIFIC

	pre-service English teachers in creating interactive teaching materials utilising PACIFIC tools. **Objective:** To analyse the self-reported digital competencies of pre-service English educators, identify obstacles, and evaluate improvements in their digital skills.	approach employing focus group discussions. **Data Collection:** Six focus group interviews with 30 participants, specifically pre-service English teachers, who were enrolled in digital **Subject:** 30 pre-service English teachers, comprising 21 females and 9 males, are enrolled in courses on Digital Literacy and Technology in Education. **Location:** Universitas Mulawarman, Samarinda, Indonesia.	technologies to create interactive instructional materials. Digital competencies have enhanced, particularly in the areas of digital resources, teaching methodologies, assessment practices, and the advancement of learners' digital skills. Their challenges included restricted access to paid software, inadequate internet connectivity, and a lack of time for product development.
Nguyen et al., 2024)	**Problem:** Inadequate digital proficiency among primary school teachers in the mountainous areas of Northern Vietnam. **Objective:** To identify and assess the factors that affect the digital competency of primary school teachers in this region.	**Study Design:** A quantitative approach utilising surveys. **Data Collection:** A survey was conducted involving 260 primary school **Subject:** 260 primary school teachers. **Location:** Northern mountainous regions of Vietnam.	The study identified seven primary factors affecting teachers' digital competencies, including technology integration, material selection, and institutional policy. Major challenges included insufficient infrastructure and limited training opportunities.

Studying digital readiness and its impact on rural education provides essential insights into the challenges and opportunities that educators and learners face in these areas. This review encompasses research from both developed and developing countries, as well as studies from diverse geographic contexts. Wang et al. (2021) highlight that rural schools in China faced considerable challenges during the COVID-19 pandemic, particularly in terms of providing adequate resources and support for teachers and students. The study revealed that the quality of online learning experiences for students was significantly influenced by teachers' course design, as well as their ability to facilitate social presence. Key discoveries demonstrated that instructional presence and teacher support were the most important aspects for enhancing students' satisfaction and engagement in online learning settings.

Joshi et al. (2023) examined the digital readiness of mathematics teachers in Nepal and showed the relationship between teachers' digital competencies and students' engagement in online learning. The results suggest that the digital tools and communication used by teachers were strong predictors of student engagement, but at the same time, they were underutilized in teaching practices. This also emphasizes the need for teachers to participate in continuous professional development that can enhance their use of digital resources in a way that makes student learning more interactive and engaging.

A similar result was reported by Effendi and Ben (2024) in Indonesia. Preservice teachers engaged in a basic level of competence in developing digital learning resources utilising PACIFIC tools. However, the availability and use of paid software, as well as the lack of a stable internet connection, hindered the effective utilisation of digital tools. The study highlights the need for enhanced access to resources and support for pre-service teachers to improve teacher preparation and teaching quality in rural schools.

Nguyen et al. (2024) examined the digital competencies among primary school teachers in the remote mountainous areas of Vietnam. Among other factors influencing teachers' digital competence are the integration of technology, access to digital resources, and institutional policy. During the investigation for this study, it was found that a lack of infrastructure and limited opportunities for career advancement were significant hindrances to the development of digital skills. The study's results indicate a strong need for specific actions within legislative terms and for increased support for rural teachers to enhance their digital skills and integrate technology into teaching practices.

These findings underscore the importance of enhancing teachers' digital competencies and reducing the digital divide in rural areas to enhance academic performance. The combination of digital technology with pedagogy significantly improves students' engagement and develops their critical thinking skills. This requires the development and implementation of policies that are more efficiently focused on these elements through teacher training, infrastructure enhancements, and the availability of digital resources. Addressing the "digital divide" and promoting digital literacy among teachers will enhance rural schools' capacity to prepare students for the digital world.

Discussions

Digital skills among rural teachers have a strong bearing on their teaching strategies and the integration of ICT in schools. Teachers with higher digital readiness have a greater ability to innovate with technology. They can experiment with new ways of cultivating an engaging learning environment by using digital learning devices that provide prompt feedback. This is particularly relevant in rural areas, where available technological infrastructure and equipment may be limited. In the absence of digitally competent teachers in rural areas, the actual use of ICT is expected to be hindered, leading to traditional and less interactive teaching methods that may not captivate students or help them overcome learning difficulties.

In contrast, however, rural teachers with digital skills are more capable of overcoming barriers in the form of infrastructure and creatively utilizing digital technology to create a learning environment that supports students in practicing their digital skills. This enhances the digital readiness of teachers, thereby reducing the educational gap between rural and urban schools and providing better access to excellence through digital means.

The relationship between student self-concept and the use of digital resources in a rural educational context plays a crucial role in shaping learning experiences and academic performance. Students' self-concept refers to how they perceive their abilities. Digital tools competency in rural areas increases students' confidence, which in turn translates into enhanced engagement and improved academic performance. Meanwhile, students who lack

confidence in their digital ability, possibly due to limited exposure or insufficient learning, may be reluctant to utilise digital resources in learning, hindering their academic progress effectively.

Students tend to utilize online learning materials more frequently, thereby enhancing their academic performance and self-concept as they develop a sense of competence in a digital environment. Rural students who perceive that technology is accessible and beneficial are more apt to use technology in the form of digital learning tools. Students may have a negative self-concept, low motivational levels, and poor academic performance. This can be due to the lack of integration of digital resources or insufficient support in developing digital skills. Consequently, rural schools must ensure the development of their students' self-concept and digital skills to mitigate the possible adverse outcomes of technology use in learning.

Several strategies have been developed in rural education to enhance teachers' readiness and students' self-concept, particularly in the use of digital technologies. One approach is to target the professional skills development of teachers, enhancing their digital skills and preparing them to integrate technology into teaching effectively. This includes providing opportunities for teachers to collaborate, share best practices, and a medium for teachers to develop their professional capabilities in the digital and pedagogical context. Fostering a positive learning environment to empower students to explore and engage with digital tools in a conducive environment to enrich their self-concept. This is another important aspect of establishing a conducive learning environment. For students to gain confidence in using digital tools, they need to be able to access digital competencies and continue to develop their digital skills.

An adequate infrastructure, including reliable internet and access to devices, ensures that teachers and students can engage with digital resources, which is another way to achieve this goal. The socio-cultural acceptance of digital learning can be enhanced, and the training of teachers and students in rural areas can be facilitated by involving the local community in the promotion of educational technology. Integrating such activities may strengthen the effectiveness of teachers and enhance the self-concept of students, enhancing the meaningful use of digital technology in rural educational settings.

Conclusion

In conclusion, digital technology in rural education faces both challenges and opportunities. This SLR highlights the importance of digital skills for teachers and students in narrowing the educational divide between rural and urban students. This is primarily due to a lack of resources, inadequate infrastructure, and a lack of awareness on how to integrate technology efficiently in the classroom, posing the most significant challenge to rural teachers. By offering teachers opportunities to develop professionally and receive support, they can enhance their digital skills, ultimately creating environments that promote more engaging and effective learning.

Moreover, students' self-concept has a tremendous impact on the technologies they use. Rural students who feel competent to use technology are more likely to engage with digital resources and have higher levels of academic success. Due to their lack of digital skills,

students may feel discouraged and experience a negative impact on their academic performance. Hence, it is essential to foster a positive self-concept among rural students by providing them with access to digital resources, thereby enhancing their academic performance.

Results suggest that focused teacher professional development, digital resources, and supportive teaching and learning environments are among the efforts that can address challenges in rural education. Finally, infrastructural shortcomings and community participation are additional factors that may contribute to the success of digital learning. Rural education, with its emphasis on teacher readiness and student self-concept, can better equip students with the skills necessary for a technology-driven future.

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