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Research Article

COVID-19 and its Impact on the Development of Digital Competencies at the Higher Level. A Systematic review of the Literature

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ABSTRACT

The COVID-19 pandemic generated an unparalleled change in higher education, driving a transition towards digital teaching. This transformation revealed significant gaps in the digital competencies of students and teachers, essential for adaptation to online learning environments. A systematic literature review was conducted following PRISMA guidelines, covering publications from January 2020 to April 2024. Databases indexed in Scopus were searched for empirical studies and journal articles, using combinations of keywords related to "COVID-19", "digital skills" and "post-pandemic education". The studies analyzed show considerable variability in the development of digital skills during the pandemic. In contexts such as Spain and Brazil, significant progress was observed, while in South Africa and Nigeria, inequalities in access to technology exacerbated educational gaps. Furthermore, the uneven implementation of educational policies in countries such as the United Kingdom and the United States resulted in disparities in educational quality. It is concluded that the pandemic promoted advances in digital skills, but also amplified existing inequalities, while the effectiveness of digital education depends largely on equitable access to technological resources and contextualized support.

Keywords: COVID-19, Digital Competencies, Online Education, Distance Education, Teaching-learning process, post-pandemic education

INTRODUCTION

The COVID-19 pandemic brought about a radical change in the global educational landscape, triggering an abrupt transition to digital and remote teaching-learning models. This accelerated shift revealed significant gaps in the digital competencies of students and teachers, creating critical challenges for their development.(1) The importance of addressing this issue is more than evident, given that digital competencies are essential for academic and professional success in the post-pandemic era. The lack of skills in this area can hinder students' adaptation and development in digital educational environments.(2) Several studies have demonstrated the magnitude of the problem, as UNESCO reported that more than 1.5 billion students were affected by the closure of educational institutions during the pandemic,(3) which propelled the adoption of educational technologies and exposed both students and teachers to intensive digital environments.(4) However, this rapid transition also revealed disparities in access to technological resources and the necessary digital skills.(5) Digital competencies are defined as a set of knowledge, skills, and attitudes for effectively and ethically using ICTs, which have gained fundamental importance in this new context.(6) Recent research suggests that students considered digital natives adapted better to distance education models, achieving better results and reducing the stress associated with technology use.(7-8)

Factors such as access to technological devices, prior digital literacy, the quality of digital educational resources, and the technical and pedagogical support provided by educational institutions significantly influenced the development of these competencies.(9-12) For example, Martínez-Alcalá et al.,(13) found a significant increase in university students' digital self-efficacy after a year of online education, although gaps persisted in advanced skills such as programming.(14) Furthermore, studies such as that of Sánchez-Cruzado et al.,(15) have highlighted the importance of

continuous teacher training to foster digital competencies among students, while the adoption of innovative pedagogies has shown additional benefits.[16-20]

OBJECTIVES

The motivations lie in the need to understand how the pandemic has influenced the development of digital competencies and how the identified gaps can be closed to better prepare students for a digitalized world. Additionally, it is crucial to explore how to capitalize on the progress made during the pandemic and strengthen equitable and accessible digital education for all students across different socioeconomic contexts.[21-29] Consequently, this study aims to conduct a comprehensive review of the state of the teaching-learning process in the post-pandemic era, focusing on the impact of COVID-19 on the development of digital competencies.

METHODS

To address the objectives of this study, a systematic literature review was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The search was carried out in Scopus-indexed journal databases, covering publications from January 2020 to April 2024. The following keywords were used: COVID-19, Digital Competencies, Online Education, Distance Education, Teaching-learning process, Post-pandemic Education, which resulted in combinations with Boolean operators applied to the search.[30] The proposed inclusion criteria encompassed empirical studies, systematic reviews, and meta-analyses of articles published in English and Spanish that focused on the impact of COVID-19 on the development of digital competencies in education. Editorials, letters to the editor, and non-peer-reviewed studies were excluded. In line with this, a synthesis approach was employed at the researcher's discretion for didactic purposes, identifying emerging themes and patterns in the data. Microsoft Excel was used for data reduction and/or identification of selection and refinement criteria.

Table 1. *Parameters Used in the Analyzed Studies*

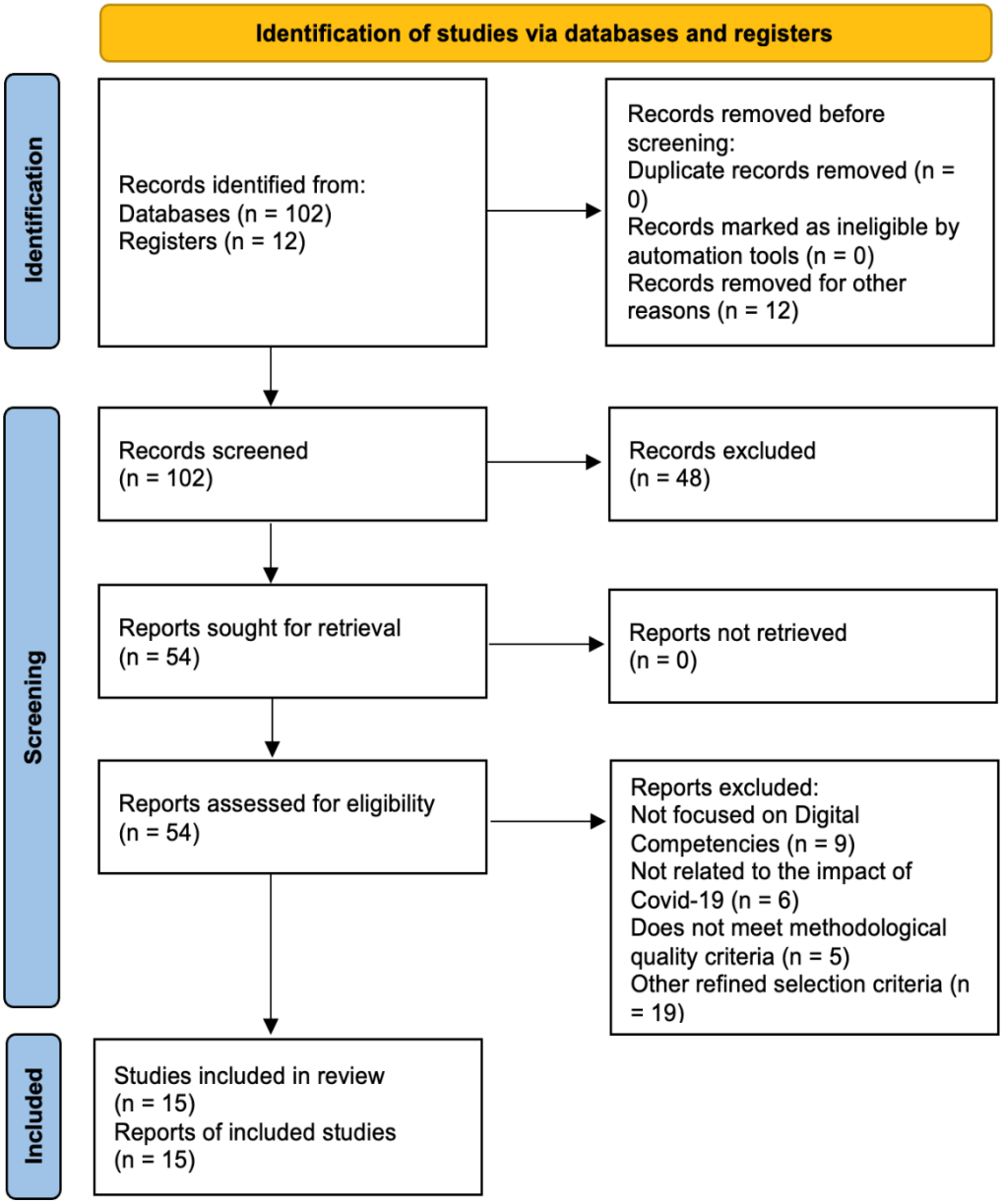
Analysis Parameter	Description
Author	Last name(s) of the author(s) and year of publication of the research, arranged alphabetically.
Country	Geographic location where the research on digital competencies was conducted during and after the COVID-19 pandemic.
Sample Size	Number of students or participants included in each analyzed study.
Analyzed Sample	Description of the participants in the study.
Study Design	Type of methodological design (Quantitative, Qualitative, Mixed).
Study Objective	General purpose of the study in relation to the development of digital competencies post-pandemic.
Applied Method	Describes the specific purpose of each research study on the development of digital competencies in the post-pandemic context.
Surveys	Use of structured questionnaires to collect information on digital competencies.
Interviews	Data collection through guided conversations with participants.
Policy Review	Analysis of regulations and guidelines related to digital education.
Document Analysis	Evaluation of reports, articles, and relevant academic documents.
Content Analysis	Systematic examination of written or audiovisual materials to identify patterns in the information.
Studied Variables	Digital competencies, adaptation to online learning, teaching-learning strategies, access to digital resources.
Instrument	Name of the instrument used, evaluated factors/dimensions and items, type of applied scale, validation, and psychometric properties.
Limitations	Factors affecting the validity of the study, such as small sample size, methodological biases, or lack of generalizability in findings.

Note. Developed based on the data reviewed in the research, 2024.

RESULTS

The following results are presented in the Prisma Flowchart for this review. This diagram outlines the selection process of the studies included in the analysis. It provides a clear visualization of the data screening and eligibility criteria applied.

Figure 1. *Prisma Flowchart*



Note. This table represents the study selection process following the PRISMA guidelines for systematic reviews.

Table 2. *Studies Included for Review and Meta-Analysis*

Author(s)	Country	Sample Size	Study Design	Applied Method	Study Objective	Studied Variables	Instrument	Limitations
Sánchez-Cruzado C, Santiago Campión R, Sánchez-Compaña MT	Spain	300 teachers	Quantitative	Survey	Assess teachers' digital competencies	Digital competencies, ICT usage	Structured questionnaire	Sample limited to one region in Spain
König J, Jäger-Biela DJ, Glutsch N	Germany	150 teachers	Mixed	Interviews and surveys	Analyze teachers' adaptation to online teaching	Adaptation, digital competencies	Semi-structured interviews, surveys	Contextual differences between education levels
Williamson B, Eynon R, Potter J	United Kingdom	Document analysis	Qualitative	Policy review	Examine educational policies during the pandemic	Educational policies, COVID-19 impact	Document analysis	Variability in policy implementation across institutions
Hodges C, Moore S, Lockee B, Trust T, Bond A	United States	50 universities	Case study	Content analysis	Assess the impact of COVID-19 on higher education	Teaching strategies, academic performance	Interviews and document review	Focus limited to specific universities
Zhang W, Wang Y, Yang L, Wang C	China	500 students	Quantitative	Surveys	Analyze the transition to online education	Satisfaction, access to resources, digital skills	Online questionnaire	Variations in students' connectivity
Burns D, Dagnall N, Holt M	Australia	400 students	Quantitative	Surveys	Investigate student well-being in remote learning	Psychological well-being, academic satisfaction	Well-being and satisfaction scales	Possible self-report bias
De Oliveira Fassbinder AG, Moreira GJ, Pinto GRP	Brazil	250 teachers	Mixed	Surveys and interviews	Assess teacher training in digital competencies	Digital competencies, continuous training	Surveys and interviews	Diversity in participants' training backgrounds
Czerniewicz L, Agherdien N, Badenhorst J, et al.	South Africa	300 students	Mixed	Surveys and interviews	Explore the digital divide in higher education	Access to technology, academic performance	Questionnaires, interviews	Significant socioeconomic inequality
Murakami H, Shimura T, Kasai H, Sato S	Japan	100 teachers	Quantitative	Surveys	Investigate the adoption of	Technology usage, teacher perception	Questionnaire	Sample limited to an urban context

					educational technologies			
Alonso Díaz L, Yuste Tosina R	France	50 institutions	Qualitative	Interviews and content analysis	Explore digital pedagogy in times of crisis	Pedagogical strategies, ICT usage	Interviews, document review	Variability in institutional responses
Teo T, Zhou M, Fan AC, Huang F	Singapore	150 teachers	Mixed	Surveys and observation	Investigate innovation in online teaching	Innovation, educational technologies	Surveys, observations	Focus on limited education levels
Yilmaz E, Güner B, Mutlu H, Doğanay G, Yilmaz D	Turkey	300 students	Quantitative	Surveys	Analyze students' attitudes toward online learning	Attitudes, motivation, engagement	Questionnaire	Homogeneous sample in socioeconomic terms
Bao W	Netherlands	200 students	Mixed	Surveys and interviews	Assess online assessment and digital competencies	Digital competencies, online assessment	Surveys, interviews	Results limited to specific contexts
Kim J	South Korea	200 teachers	Mixed	Surveys and interviews	Examine post-pandemic hybrid learning	Hybrid methodologies, technology adoption	Questionnaires, interviews	Focus limited to teachers' perceptions
Adedoyin OB, Soykan E	Nigeria	300 students	Mixed	Surveys and focus groups	Investigate challenges of online education in developing countries	Access to technology, educational quality	Surveys, focus groups	Significant inequality in access to resources

Note. Developed based on the data reviewed in the research, 2024.

DISCUSSION

The reviewed studies provide evidence that the development of digital competencies during the pandemic varies significantly depending on the context. On one hand, research in Spain and Brazil shows progress in teachers' digital competencies due to the intensive use of technology, although these findings are limited to specific regions and do not account for broader socioeconomic disparities.[15] On the other hand, studies in South Africa and Nigeria highlight how inequalities in access to technology have deepened existing educational gaps, limiting the success of online education.[4,26] Additionally, the variability in the implementation of educational policies during the pandemic in the United Kingdom and the United States resulted in unequal educational quality, depending on institutional support and available resources.[23,24] Finally, negative effects on student well-being have been observed due to the lack of personal interaction and inconsistent connectivity, affecting satisfaction with remote learning in contexts such as Australia and China.[19,25] The disparity observed in the results of the cited studies leads to the conjecture that, although online education and the development of digital competencies have had positive effects in some contexts, they have exacerbated existing inequalities in others. The effectiveness of digital methodologies is not universal; it largely depends on equitable access to technological resources and contextualized support for students and teachers. It is essential for future research to consider these factors to develop more inclusive strategies that can be applied equitably across diverse global educational settings. This includes improving adaptation to hybrid educational models, developing digital competencies in higher education, and reducing the digital divide.[27-29]

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