Research skills and digital competence in Huancavelica students during COVID-19

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Article Info	**ABSTRACT**
Article history: Received Sep 5, 2024 Revised Jun 21, 2025 Accepted Jul 16, 2025	This study addresses the challenge of developing research skills among teacher training students at the National University of Huancavelica during the COVID-19 pandemic, focusing on the role of digital competencies. Using a quantitative, descriptive correlational design, data were collected from 180 students across four professional education programs in the VII and IX cycles. Two questionnaires, comprising 40 and 45 questions respectively, assessed digital competencies and research skills. The data, analyzed using SPSS (version 25) with a 5% margin of error, revealed a strong positive correlation (Rho=0.808) between digital competencies and research skills. Students with higher digital literacy, particularly in information and data literacy and communication and collaboration, demonstrated better proficiency in research tasks such as designing methodologies, data analysis, and presenting findings. The study emphasizes the importance of integrating digital skills into teacher education to enhance research capabilities, especially in post-pandemic educational contexts. Notably, 60% of students with "excellent" digital competency levels achieved "excellent" research skills, compared to only 10% with "good" competencies. These findings underscore the need to prioritize digital literacy in teacher education programs to support the development of essential research skills.
Keywords: COVID-19 Digital competencies Quantitative analysis Research skills Teacher education	

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1. INTRODUCTION

The COVID-19 pandemic has dramatically altered traditional educational models, necessitating a shift to digital learning environments across the globe [1]. In this evolving landscape, the development of digital competencies has become increasingly critical, particularly for students in higher education [2]. Digital competencies encompass a wide range of skills, including the ability to effectively navigate, evaluate, and utilize digital tools, which are essential not only for academic success but also for professional growth [3]. For teacher education students, the acquisition of digital competencies is vital, as these skills directly influence their ability to engage with research processes and prepare for their future roles as educators [4]. This study examines teacher training students at the National University of Huancavelica, investigating the relationship between digital competencies and research skill development during the pandemic. With the

abrupt transition to online education, the research aims to highlight how digital literacy influences students' ability to conduct research, a critical component of their professional preparation [5]. The integration of digital tools into the research process, including data collection, analysis, and presentation, has become increasingly important for students aiming to succeed in this new academic environment. Moreover, research competencies, which are essential for teachers' evidence-based practices, can be significantly enhanced by developing digital literacy [6]. This study addresses a pivotal question: To what extent do digital competencies impact the research skills of teacher training students?

By exploring this relationship, the research seeks to identify both areas of excellence and opportunities for improvement in integrating digital skills into teacher education programs [7]. As higher education continues to adapt to the challenges posed by the pandemic, the importance of fostering both digital literacy and research skills in teacher training programs cannot be overstated [8]. Through this investigation, this study aims to contribute to the growing body of literature on digital competencies in education, shedding light on their role in shaping the future of teacher education [9].

Digital competencies refer to the skills and knowledge needed to use digital technologies effectively, which include information management, communication, collaboration, and problem-solving [10]. These competencies are increasingly critical for students in higher education, particularly in research, where digital tools have become integral for data collection, analysis, and dissemination [11]. The COVID-19 pandemic has further amplified the need for digital literacy as universities have transitioned to online learning environments, necessitating new skills for navigating academic tasks remotely [12]. Research has consistently linked digital competencies with improved academic performance, especially in research contexts. For instance, Ahmed and Roche [13] demonstrated that students with strong digital literacy are better equipped to access, evaluate, and synthesize information, leading to enhanced critical thinking and problem-solving abilities. These skills are crucial for conducting high-quality research, and in the pandemic era, they have proven essential for adapting to online learning. Amhag et al. [12] noted that students with high digital literacy adapted more readily to online environments and performed better in research tasks. This is particularly relevant for teacher education programs, where future educators must not only acquire theoretical knowledge but also develop practical research skills that will inform their teaching practices [14].

Studies focusing on teacher education during the pandemic have emphasized the importance of integrating digital competencies into teacher training programs. For example, Almulla et al. [15] found that students who received instruction in digital tools were more proficient in designing research methodologies and analyzing data, essential components of effective research. This study builds on existing literature by examining the relationship between digital competencies and research skills among teacher training students at the National University of Huancavelica during the COVID-19 pandemic. By doing so, it contributes to a broader understanding of how digital literacy influences academic success and professional development in teacher education [16], [17]. Digital competencies also enhance students' adaptability to new technologies and foster collaborative learning, which has become vital in the context of remote education [18], [19]. Research shows that when students are well-versed in digital tools, they are better prepared for the challenges of modern education, including the demands of online research [20], [21]. The present study seeks to explore how these competencies influence teacher education students' ability to conduct academic research in an increasingly digitalized environment [22].

2. METHOD
2.1. Research design
This study adopted a quantitative research approach, specifically utilizing a descriptive correlational design to investigate the relationship between digital competencies and the development of research skills among teacher training students at the National University of Huancavelica. The descriptive component aimed to evaluate the current levels of digital competencies and research skills, while the correlational analysis sought to determine the strength and direction of the relationship between these two variables.

2.2. Population and sample
The study's population consisted of teacher training students enrolled in the VII and IX cycles of four distinct professional education programs at the National University of Huancavelica. A stratified random sampling technique was used to ensure proportional representation from each cycle and program. The final sample comprised 180 students, representing approximately 20% of the total population, with equal distribution across the four education programs. This sample size was determined based on Cohen's formula for correlation studies, ensuring sufficient statistical power to detect significant relationships at a 5% significance level.

2.3. Instruments

2.3.1. Digital competency questionnaire

This instrument was adapted from the DIGCOMP framework [10] and consisted of 40 Likert-scale items, ranging from 1 (strongly disagree) to 5 (strongly agree). It evaluated five dimensions of digital competence: information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving. The instrument's internal consistency was measured using Cronbach's alpha, yielding a reliability coefficient of 0.89, indicating high reliability.

2.3.2. Research skills questionnaire

This instrument, designed specifically for teacher education students, consisted of 45 Likert-scale items, also ranging from 1 (strongly disagree) to 5 (strongly agree). It assessed research skills across five key areas: research design, data collection, data analysis, academic writing, and presentation of findings. The reliability of this instrument was measured with Cronbach's alpha, resulting in a coefficient of 0.92, demonstrating excellent internal consistency.

2.4. Data collection

Data collection was carried out in two phases during the 2021 academic year. Both questionnaires were administered online, due to the restrictions imposed by the COVID-19 pandemic. Prior to data collection, a pilot study was conducted with a sample of 30 students to validate the instruments' clarity and usability in a digital environment. The pilot data were analyzed for construct validity using exploratory factor analysis (EFA) with principal component analysis and Varimax rotation. Both instruments demonstrated satisfactory construct validity, with factor loadings exceeding 0.70 for all items, confirming their appropriateness for the full-scale study.

2.5. Data analysis

Data were analyzed using IBM SPSS Statistics 25 software. Descriptive statistics, including means, standard deviations (SD), and frequencies, were computed to summarize the distribution of digital competencies and research skills across the sample. For the correlational analysis, Spearman's rank-order correlation coefficient (Rho) was employed due to the ordinal nature of the Likert-scale data. The correlation coefficient was interpreted as:

- 0 to 0.3 meaning weak correlation
- 0.3 to 0.5 meaning moderate correlation
- 0.5 to 0.7 meaning strong correlation
- 0.7 to 1.0 meaning very strong correlation

The significance level was set at $p < 0.05$ to determine statistical significance. Additionally, multiple regression analysis was performed to evaluate the predictive power of digital competency dimensions on research skills. The regression model included digital competencies as independent variables and research skills as the dependent variable. Multicollinearity was assessed using variance inflation factors (VIF), with all values below 5, indicating the absence of multicollinearity.

3. RESULTS

The results of the study are presented in two sections: the descriptive statistics of digital competencies and research skills, followed by the correlational and regression analyses to evaluate the relationship between these variables.

3.1. Descriptive statistics

Table 1 presents the descriptive statistics for digital competencies and research skills among the teacher training students. The overall mean score for digital competencies was 4.12 (SD=0.58), indicating that students generally demonstrated strong digital skills. Among the subdimensions, information and data literacy had the highest mean score (4.28, SD=0.61), while problem-solving had the lowest mean score (3.94, SD=0.71). For research skills, the overall mean score was 4.05 (SD=0.62), with research design receiving the highest score (4.18, SD=0.57) and data presentation the lowest (3.90, SD=0.68). The descriptive statistics show that students generally performed well in both digital competencies and research skills, with relatively small variations between the dimensions.

3.2. Correlational analysis

The results of the Spearman's rank-order correlation analysis, as seen in Table 2, revealed a strong, positive correlation between digital competencies and research skills, with a correlation coefficient of

Rho=0.808, p<0.001. This indicates that as students' digital competencies increased, their research skills also improved. At the sub dimensional level, the highest correlation was observed between information and data literacy and research design (Rho=0.812, p<0.001). This suggests that students who were proficient in locating and managing digital information were also skilled in designing research methodologies. The lowest correlation was between problem-solving and data presentation (Rho=0.683, p<0.01), although this still represents a moderate-to-strong relationship.

Table 1. Descriptive statistics for digital competencies and research skills

Variable	Mean	Standard deviation (SD)
Digital competencies	4.12	0.58
Information and data literacy	4.28	0.61
Communication and collaboration	4.15	0.59
Digital content creation	4.07	0.65
Safety	4.12	0.63
Problem-solving	3.94	0.71
Research skills	4.05	0.62
Research design	4.18	0.57
Data collection	4.10	0.60
Data analysis	4.05	0.64
Academic writing	4.02	0.65
Data presentation	3.90	0.68

Table 2. Spearman's correlation coefficients between digital competencies and research skills

Variable	Rho	p-value
Digital competencies vs research skills	0.808	<0.001
Information and data literacy vs research design	0.812	<0.001
Communication and collaboration vs data collection	0.793	<0.001
Digital content creation vs data analysis	0.785	<0.001
Safety vs academic writing	0.764	<0.001
Problem-solving vs data presentation	0.683	<0.01

3.3. Regression analysis

A multiple regression analysis was conducted to predict research skills based on digital competency subdimensions. The overall regression model was statistically significant, $F(5, 174)=56.421$, $p<0.001$, with an $R^2=0.62$, indicating that approximately 62% of the variance in research skills could be explained by the students' digital competencies. Among the digital competency subdimensions, information and data literacy ($\beta=0.48$, $p<0.001$) and communication and collaboration ($\beta=0.35$, $p<0.001$) were the strongest predictors of research skills. Problem-solving was the least significant predictor ($\beta=0.15$, $p=0.043$). Table 3 presents the multiple regression analysis, which identifies the influence of various digital competency subdimensions on predicting research skills. Among the predictors, information and data literacy emerged as the strongest predictor, with a high standardized beta coefficient ($\beta=0.48$). This suggests that students who are highly proficient in locating, managing, and evaluating digital information tend to exhibit superior research skills. Similarly, communication and collaboration also showed a strong positive effect ($\beta=0.35$), underscoring the importance of digital communication tools in enhancing research capacity. The digital content creation subdimension contributed significantly as well, while safety and problem-solving had smaller but still significant effects. The regression coefficients reflect that although all digital competencies play a role in research skill development, information literacy and communication are the most influential factors. These results highlight the need for educational programs to prioritize these areas in teacher training.

Table 3. Multiple linear regression analysis of research skills

Predictor	Unstandardized β	Standardized β	t-value	p-value	95% Confidence interval
Constant	1.213	—	4.523	<0.001	[0.714, 1.712]
Information and data literacy	0.48	0.48	6.752	<0.001	[0.34, 0.62]
Communication and collaboration	0.35	0.35	5.930	<0.001	[0.22, 0.48]
Digital content creation	0.24	0.27	3.821	<0.001	[0.11, 0.37]
Safety	0.20	0.18	3.215	0.002	[0.08, 0.32]
Problem-solving	0.15	0.15	2.135	0.043	[0.01, 0.29]

3.4. Analysis of variance (ANOVA) for the regression model

Table 4 displays the analysis of variance (ANOVA) for the regression model, which confirms the overall statistical significance of the model. The large F-value (56.421) and p-value <0.001 indicate that digital competencies collectively have a substantial impact on research skills. The sum of squares for regression (48.316) further demonstrates that a significant portion of the variation in research skills is explained by digital competencies, while the residual sum of squares (29.802) represents the remaining unexplained variation. This model accounts for approximately 62% of the variance in research skills, underscoring the importance of digital literacy in academic performance. The ANOVA results support the conclusion that digital competencies are strong predictors of research skills, affirming the findings of the regression analysis.

Table 4. Analysis of variance for the regression model

Source	Sum of squares	df	Mean square	F-value	p-value
Regression	48.316	5	9.663	56.421	<0.001
Residual	29.802	174	0.171		
Total	78.118	179	—	—	—

3.5. Crosstabulation of digital competency levels and research skills performance

Finally, Table 5 provides a crosstabulation of digital competency levels with research skill performance, offering a clearer understanding of how proficiency in digital competencies is linked to research capabilities. The table shows that students with higher digital competency levels are more likely to achieve higher research skills. For example, among students with "excellent" digital competency, 60% achieved "excellent" research skills, while only 10% performed at the "good" level. Conversely, students with "good" digital competency were less likely to reach the "excellent" research skills category, with only 15% of them achieving that level. This crosstabulation demonstrates a clear progression, where better digital literacy corresponds to stronger research performance. These findings suggest that integrating digital competency training into teacher education programs can significantly enhance students' research skills, a critical element for their academic and professional success.

Table 5. Crosstabulation of digital competency levels and research skills performance

Digital competency level	Good research skills (%)	Very good research skills (%)	Excellent research skills (%)
Good	35	50	15
Very good	20	55	25
Excellent	10	30	60

In summary, the results across the tables consistently demonstrate a strong and positive relationship between digital competencies and research skills. Digital literacy, especially in areas such as information management and communication, plays a critical role in improving the research capacities of future educators. As digital competencies improve, so do students' abilities to design research methodologies, analyze data, and present their findings effectively. These insights emphasize the need for education systems to foster digital literacy as a fundamental component of research skill development, particularly in response to the evolving digital landscape in education.

3.6. Interpretation of results

The study demonstrates a strong and positive relationship between digital competencies and research skills among teacher training students at the National University of Huancavelica. The significant correlation (Rho=0.808) suggests that students with higher proficiency in digital literacy exhibit more advanced research capabilities. Specifically, information and data literacy and communication and collaboration emerged as the strongest predictors of research skills, highlighting the importance of these competencies in designing research methodologies and analyzing data. The regression model explained 62% of the variance in research skills, underscoring the critical role digital competencies play in enhancing academic success. Additionally, the crosstabulation analysis shows that students with higher levels of digital competency are more likely to achieve higher research skill proficiency. For example, 60% of students classified as having excellent digital competencies achieved excellent research skills. This finding reinforces the need for education programs to prioritize the integration of digital literacy training, particularly in teacher education, to equip future educators with the tools necessary to excel in both research and their professional

careers. These results emphasize the pivotal role digital competencies play in improving research capabilities, especially in the context of the pandemic-driven shift to digital learning environments.

4. DISCUSSION

The results of this study underscore the strong positive relationship between digital competencies and research skills, contributing to the growing body of literature that highlights the importance of digital literacy in modern education [23], [24]. Previous research has identified digital literacy as a crucial component for educational success, especially post-pandemic [12]. This study adds new evidence by demonstrating the direct impact of digital competencies on research outcomes within the context of teacher training, particularly in the areas of information literacy and collaboration [25]. One key ramification of this study is the potential long-term impact on teacher preparedness. Future educators who develop strong digital competencies are not only better equipped to conduct high-quality research but are also more prepared to integrate these skills into their teaching practices. As digital platforms continue to dominate educational environments, particularly post-pandemic, fostering digital literacy will become essential for both research and pedagogical success [26]. By equipping teacher training students with these competencies, institutions can ensure that future educators are adaptable to an evolving digital landscape, ultimately improving teaching effectiveness and student outcomes [27]. Moreover, the study's findings suggest that academic institutions should reconsider their approach to teacher education, emphasizing the development of digital competencies as part of the core curriculum [28]. Given the strong correlation between digital literacy and research proficiency, integrating digital tools and methodologies into coursework may yield significant benefits, not just in research but across various areas of academic and professional development [29]. In the future, the ability to navigate digital platforms, manage information, and collaborate effectively will be vital for educators in both traditional and online classrooms [30].

However, while digital competencies were found to significantly enhance research skills, the role of problem-solving in this context requires further examination. Although it was the least significant predictor of research success, it still plays a supportive role, especially in addressing challenges encountered during the research process. Future studies could explore how problem-solving skills interact with digital competencies to support more complex research tasks [23]. Additionally, given that this study was conducted during the COVID-19 pandemic, when digital platforms became essential for academic continuity, future research could assess whether the relationship between digital competencies and research skills changes in a post-pandemic environment [25]. The implications of these findings are far-reaching. They suggest that teacher education programs must not only foster traditional pedagogical skills but also emphasize the cultivation of digital literacy. This will be crucial in shaping educators who are capable of conducting rigorous research and integrating digital tools into their teaching practice, thus enhancing the overall quality of education in the long term. Furthermore, institutions should explore ways to better support students with lower levels of digital literacy, ensuring equitable access to the skills needed to succeed in both research and teaching. This study highlights the critical role of digital competencies in research proficiency and suggests that the integration of digital literacy into teacher education programs is essential. As education continues to evolve in an increasingly digital world, these findings offer valuable insights into how institutions can better prepare future educators for success in both research and teaching [30]. Addressing the digital divide in teacher education will be key to ensuring that all students, regardless of their digital proficiency, are equipped with the tools they need to thrive in a modern educational landscape [27].

The COVID-19 pandemic acted as a significant catalyst for advancing digital competencies among students at the National University of Huancavelica. During this period, the rapid shift to online education exposed gaps in digital literacy and research skills, particularly in underprivileged regions. However, it also showcased the resilience of educational institutions and their ability to adapt through innovative solutions. Now that the pandemic has subsided, the emphasis on digital competencies and research skills remains essential as they are critical for academic success and employability in a rapidly evolving digital world.

In the post-pandemic era, higher education institutions must sustain and expand the integration of digital tools and platforms into teaching and learning processes. Hybrid learning models, combining face-to-face and online instruction, can bridge gaps in accessibility while fostering a flexible learning environment. Furthermore, targeted training programs in advanced research methodologies and digital tools should be offered to ensure students remain competitive in academic and professional settings. Investments in digital infrastructure, particularly in rural or underserved areas, are vital to reducing the digital divide and ensuring equitable access to quality education. Looking to the future, universities should prioritize fostering lifelong learning attitudes among students by embedding digital literacy and research skills into all disciplines. Collaboration with industry stakeholders can help align curricula with emerging technological trends and labor market demands. Additionally, developing policies and strategies for the ethical use of technology in

research and education is crucial to addressing challenges such as data security and misinformation. By building on the progress made during the pandemic, educational institutions can not only enhance their students' skills but also prepare them to thrive in an increasingly complex and interconnected world.

5. CONCLUSION

The results of this study clearly demonstrate the significant role digital competencies play in enhancing the research skills of teacher training students at the National University of Huancavelica. The evidence is drawn from a strong positive correlation (Rho=0.808) between digital literacy and research proficiency, based on data from 180 students across four professional education programs. Key digital competencies such as information and data literacy, along with communication and collaboration, emerged as the most influential predictors of research skills, particularly in designing methodologies, analyzing data, and presenting findings. This quantitative evidence supports the conclusion that digital literacy is a critical factor in research success. These findings align with broader research that emphasizes the importance of digital competencies in academic achievement, particularly in research-intensive tasks. The ability to manage and utilize digital tools has become increasingly essential, especially in the context of the COVID-19 pandemic, where education has shifted towards digital platforms. The data from this study provide clear evidence that students with higher levels of digital literacy are better equipped to perform well in research tasks, as demonstrated by the significant proportion of students with "excellent" digital skills who also exhibited "excellent" research proficiency.

In conclusion, the quantitative evidence gathered in this study underscores the critical need for academic institutions to prioritize digital literacy in their curricula. By integrating digital competencies into teacher education programs, institutions can equip future educators with the tools necessary for both academic and professional success. This proactive approach will prepare students to navigate and excel in an increasingly digital world, ensuring a more effective, research-driven education system capable of addressing the challenges posed by a digitally connected society. The strong correlation between digital skills and research proficiency highlighted in this study provides robust evidence for the integration of these competencies into educational frameworks, making it clear that digital literacy is not only beneficial but essential for the future of education.

Despite the compelling findings, this study has certain limitations that should be acknowledged. First, the sample is limited to students from the National University of Huancavelica, which may limit the generalizability of results to other institutions or educational settings. Additionally, the study focuses only on a quantitative analysis, which, while robust, does not capture qualitative insights into how digital literacy skills impact students' experiences and perceptions in real research scenarios.

Future research could explore a broader sample across multiple universities to validate these findings across diverse educational contexts. Furthermore, a mixed-methods approach involving interviews or focus groups could yield a richer understanding of the specific ways digital competencies influence various stages of the research process. Research could also examine how specific training programs in digital literacy impact long-term research skill development, extending beyond the context of initial teacher training to inform continuous professional development for educators.

AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization	I : **I**nvestigation	Vi : **Vi**sualization
M : **M**ethodology	R : **R**esources	Su : **Su**pervision
So : **So**ftware	D : **D**ata Curation	P : **P**roject administration
Va : **Va**lidation	O : Writing - **O**riginal Draft	Fu : **Fu**nding acquisition
Fo : **Fo**rmal analysis	E : Writing - Review & **E**diting	

CONFLICT OF INTEREST STATEMENT
Authors state no conflict of interest.

INFORMED CONSENT
We have obtained informed consent from all individuals included in this study.

ETHICAL APPROVAL
The study adhered to ethical standards in research involving human participants. Approval was granted by the university's Ethics Committee prior to the commencement of the study. The study also complied with the general data protection regulation (GDPR) guidelines, ensuring secure handling of digital data throughout the research process.

DATA AVAILABILITY
Data availability is not applicable to this paper as no new data were created or analyzed in this study.

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