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*CORRESPONDENCE
Cinthia Rosales-Márquez
✉ crosalesma@ucvvirtual.edu.pe

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Self-confidence as a predictor of digital skills: a fundamental pillar for the digitalization of higher education

Cinthia Rosales-Márquez[1]*, Carmen Elena Carbonell-García[1], Víctor Miranda-Vargas[1], Rocio Diaz-Zavala[2] and Kevin Mario Laura-De La Cruz[3]

[1]Universidad César Vallejo, Trujillo, Peru, [2]Universidad Nacional de San Agustín de Arequipa, Arequipa, Peru, [3]Universidad Nacional Jorge Basadre Grohmann, Tacna, Peru

Contemporary higher education must prepare students for a digital world by equipping them with both technical and critical competencies. In this context, self-confidence is key, as believing in oneself facilitates the acquisition and use of digital tools. This research aims to examine the role of self-confidence as a predictor of digital competency development among university students in Peru. A mixed-approach was employed, utilizing predictive calculations on one hand, alongside quantitative data collection and analysis through interviews. The sample consisted of 213 postgraduate students from various regions of Peru, along with 20 university professors at the postgraduate level. The study's findings confirm that self-confidence is a significant predictor of the development of digital skills in Peruvian university students. A moderate positive correlation ($r = 0.484$, $p < 0.001$) was identified between the two variables, indicating that students with higher levels of self-confidence are more likely to develop advanced digital skills. These results are further reinforced by qualitative analysis, as the digitalization of education cannot be contemplated with students who lack digital skills.

KEYWORDS

self-confidence, digital skills, digitalization, higher education, information and communication technologies

1 Introduction

In the age of digital transformation, higher education is facing a fundamental challenge: the development of digital skills in students, which is essential for their adaptation to the growing demands of the work and academic environments. These competencies encompass not only the technical management of digital tools but also the critical capacity to create, analyze, and innovate through their application. Within this context, self-confidence emerges as a crucial factor. Self-confidence is defined as the belief in one's own capacity to accomplish a specific task successfully, and it not only influences academic performance but also acts as a structural barrier that can both facilitate or limit the development of competencies.

Globally, numerous studies have demonstrated that students who possess greater confidence in their digital skills are more likely to explore and master new technologies such as artificial intelligence (AI), as well as successfully navigate the associated challenges (Jones, 2020; Khampirat, 2021). In contrast, the students who lack self-confidence in

their technological abilities tend to avoid applying advanced digital tools, which narrows their capacity to fully benefit from the educational resources available. This is particularly noticeable in the Peruvian context, where the absence of self-confidence in the application of emerging technologies, platforms, social networks, software, and AI has become a structural barrier that blocks the integrated development of digital skills (Berkowsky and van Deursen, 2016; Andrés et al., 2020).

In Peru, self-confidence has turned into a pivotal factor in the adoption process of digital technologies, especially in regions with minor access to technological infrastructure and formative support. According to a recent study by the Ministry of Education (MINEDU), a considerable percentage of university students, specifically from rural zones, report feeling insecure regarding the application of advanced digital tools. This uncertainty has a direct impact on their capacity to seize key resources, such as artificial intelligence, which is consolidating as an essential tool in academic research and in the resolution of complex issues (Fernández and Ruiz, 2020; Cotten and Gupta, 2012).

The effective use of artificial intelligence in higher education not only relies upon access to devices and connectivity but also on students' self-confidence to engage with these technologies (Hwang and Oh, 2021). AI provides powerful tools for advanced information retrieval, content generation, and data analysis, among others. However, many students, even those with access to these tools, do not utilize them correctly due to lack of self-confidence. This problem shows up when academic papers have a lot of similarities or plagiarized content, which means that technologies like AI-assisted text generators and advanced search engines are not being used properly. In fact, interviews with university professors in Peru indicate that most students are unaware of how to optimize their use of AI through advanced search techniques or the formulation of precise prompts (Pérez et al., 2022; OCDE, 2020).

Lack of self-confidence in using new technologies such as AI not only poses a personal obstacle but also has structural implications, as it perpetuates the digital gap in the educational field. Students who lack confidence in their technological abilities not only avoid using these tools but also adopt a more passive approach to digital learning. In contrast, the students who possess a higher level of self-confidence tend to adopt an active attitude regarding emerging technologies, pursuing creative solutions, and overcoming the digitalization challenges with more confidence (Sander and Sanders, 2003; Ramírez-Armenta et al., 2021). This difference in attitude with respect to technology has a direct impact on academic performance and the students' capacity to innovate in their respective fields while exerting autonomy in their learning (Serdyukov, 2017; Bransen et al., 2022).

It is evident that self-confidence not only facilitates the use of technologies such as AI but also enhances its utilization in academic environments. Higher self-confidence enables students to delve deeper into the advanced features of AI, such as predictive analysis, data modeling, and the customization of educational content, thereby significantly enhancing their capacity to conduct extensive and sophisticated research. In this sense, digital self-confidence influences the adoption of emerging technologies and determines the extent to which students can benefit from these tools to develop advanced skills (Bandura, 1997; Bong, 2001; Bandura and Cervone, 1983).

Self-confidence has emerged as a crucial factor in reducing digital disparities in Peru, particularly in regions with limited access to technological infrastructure. Students who are confident in their digital skills are more willing to overcome structural barriers related to limited access to devices and connectivity by using technology effectively to improve their academic performance. In contrast, those with low levels of self-confidence often face greater difficulties in using digital tools, which aggravates pre-existing gaps and limits their participation in the digital economy (Mendoza, 2023).

This study aims to examine the role of self-confidence as a predictor of the development of digital skills in university students in Peru, considering variables such as age, gender, and socioeconomic context. The central hypothesis is that students with greater self-confidence develop more advanced digital skills, allowing them not only to adapt to the era of educational digitalization but also to take full advantage of technological tools such as AI. This analysis takes on special relevance in the Peruvian context, where the urgency to close the digital gaps has intensified due to the policies promoted by the Congress of Peru, starting from July 2024: "the total virtualization of university classes."

2 Materials and methods

2.1 Study design

The research employed a quantitative, observational, hypothetical deductive, explanatory-level, non-experimental design, which is suitable for analyzing the relationships between variables without directly manipulating them (Creswell, 2014). The design was cross-sectional, as it collected data only once, with the aim of evaluating the impact of self-confidence on the development of digital skills, which are crucial in the current trend of digitalization in university education. The quantitative approach allows obtaining generalizable results from the analysis of numerical data and providing robust conclusions about the relationships between self-confidence and digital skills in university students. As noted by Hernández et al. (2014). In this case, the aim is to predict how self-confidence impacts the development of digital skills.

2.2 Participants

The sample of 213 university students was selected through stratified sampling, ensuring adequate representation of diverse geographic areas and socioeconomic levels. "Stratified sampling provides a proportional representation of different subgroups in a population" (Cohen et al., 2018). This approach enabled the capture of contextual differences in terms of access to technology and self-confidence, which are important factors in the development of digital skills. Furthermore, considering that Peruvian university students face significant barriers to accessing advanced technologies, particularly in rural areas (Mendoza, 2023), this type of sampling is crucial to capture these variations. The chosen sample, by region, included 33.8% from the mountains, 31.9% from the jungle, and 34.3% from the coast; the ages ranged

TABLE 1 Characterization of the sample according to age in years.

Age	23–27	28–32	33–37	38–42	43–47	48–52	53–57	58–63	Total
f	25	26	38	59	19	21	18	7	213
%	11.7	12.2	17.8	27.7	8.9	9.9	8.5	3.3	100.0

from 23 to 63 years, with 27.7% between 38 and 42 years old (see Table 1).

2.3 Variables

The main variables of the study are:

Self-confidence: It is defined as the "belief in one's own ability to carry out a task or face a challenge successfully" (Bandura, 1997, 1986). To measure this variable, the *Academic Self-Confidence Scale* (Jones, 2020) was used, which has been shown to be valid and reliable in previous studies on digital skills in higher education.

Digital skills: These are defined as "the ability to use digital technologies in a critical, creative, and efficient way" (European Commission, 2018). The *Digital Skills Questionnaire for University Students* (Fernández and Ruiz, 2020) enabled the evaluation of multiple dimensions, including the technical management of digital tools and the capacity for critical analysis.

Educational digitalization: The study evaluated students' ability to use digital tools for academic task development, a key dimension. Given the growing importance of digitalization in our country and its demonstrated versatility and usefulness in virtual education, it is crucial for educational innovation in the 21st century (Pérez et al., 2022; Rosales Márquez, 2022).

2.4 Instruments

The following instruments were used:

- Self-Confidence Scale (Jones, 2020): The scale measures students' self-perception of their digital skills, with a focus on the confidence they feel when using technologies such as artificial intelligence. This scale has been validated in various educational contexts, showing high reliability ($\alpha = 0.87$) in previous studies (Jones, 2020).
- Digital Skills Questionnaire: This instrument measures skills such as digital content creation and digital information management. It is widely used in research on digital literacy, with a reported reliability index of ($\alpha = 0.91$) (Fernández and Ruiz, 2020).
- Semi-structured interviews: Interviews were conducted with 20 university teachers to complement the quantitative data. These interviews centered on the teachers' perspectives regarding the significance of students' digital skills in the digitalization of education.

2.5 Procedure

The data collection process was carried out in the second semester of 2023. As part of the collection procedure, an online platform was used that facilitated remote access to the questionnaires by students, especially in regions with lower connectivity. Statistical authors (Cohen et al., 2018) indicated the usefulness of digital surveys to facilitate collection in samples with dispersed geography.

In addition, in the semi-structured interviews with teachers, a question guide was used focused on identifying difficulties in using technological tools as part of the digitalization of education, particularly in the lack of self-confidence in students. The interviews were recorded and transcribed for a subsequent qualitative analysis, enabling a more comprehensive understanding of the structural barriers. As noted by Creswell (2014), "the qualitative mixed approach allows contextualizing the numerical findings" (p. 232).

2.6 Data analysis

Data analysis was performed using *SPSS* software (version 26.0). Initially, descriptive analyses were carried out to characterize the sample. Subsequently, Pearson's correlation test was used to assess the relationship between self-confidence and digital skills. This technique effectively measures the degree of association between two continuous variables, enabling the assessment of the relationship's strength and direction (Hernández et al., 2014).

On the other hand, for predictive analysis, regression was performed using Jamovi 2.3.28 software, which predicts the value of a dependent variable based on one or more independent variables (Field, 2013). Likewise, statistical mediation analysis was used, which is particularly useful in this study, as it allows estimating the impact of self-confidence on the development of digital skills while controlling other variables such as age, gender, and socioeconomic context (Cohen et al., 2018).

3 Results

3.1 Quantitaive results

The Table 2 displays the correlation coefficient matrix between university students' self-confidence and their digital competence. Correlations with coefficients ranging from (0.313 to 0.822) are found, indicating moderate to strong, positive, and highly significant relationships ($p < 0.001$). These results show that after verifying the correlation between the study variables' dimensions, the first phase of the explanatory analysis begins.

The Table 3 shows the bivariate relationship between the variables self-confidence and digital skills. It reveals a highly significant moderate relationship of a direct type at the dimension level, indicating that as self-confidence increases, so does the level of digital competence.

The analysis demonstrates the predictive capacity of self-confidence in the digital skills of Peruvian university students

TABLE 2 Correlation matrix between the dimensions of self-confidence and digital skills in Peruvian university students.

		Study	Comprehension	Verbalization	Clarification	Student notes	Information literacy
Comprehension	Coef	0.749					
	Sig.	<0.001	-				
Verbalization	Coef	0.717	0.755				
	Sig.	<0.001	<0.001	-			
Clarification	Coef	0.749	0.742	0.641			
	Sig.	<0.001	<0.001	<0.001	-		
Student notes	Coef	0.809	0.822	0.694	0.813		
	Sig.	<0.001	<0.001	<0.001	<0.001	-	
Information literacy	Coef	0.485	0.419	0.467	0.387	0.450	
	Sig.	<0.001	<0.001	<0.001	<0.001	<0.001	-
Use of technology	Coef	0.403	0.313	0.382	0.329	0.369	0.757
	Sig.	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Source: Self elaboration.

TABLE 3 Correlation between self-confidence and digital skills in Peruvian university students.

		SELF_CONFIDENCE
Digital Skills	Pearson's R	0.484
	Sig.	< 0.001

(Table 4). Evidence confirming a causal relationship between self-confidence (predictor) and digital skills (predicted) suggests that an increase of one unit in self-confidence leads to an expected increase of 0.377 units in the digital skills of university students, implying a positive correlation between self-confidence and improved digital skills. The confidence interval reinforces the fulfillment of a positive relationship between the variables, with a significance <0.001.

The regression Table 5 shows the predictive capacity of the dimensions of self-confidence with respect to digital skills. Each row represents one of these variables, and the numbers associated with it indicate its importance and relationship with digital competence. Significant values were evidenced for the predictors: study (0.385); verbalization (0.011); marginally significant predictors like compression (0.371) and student grades (0.247), as well as non-significant predictors such as clarification (0.803). All these dimensions, simultaneously serving as predictor variables, demonstrated varying degrees of significance in elucidating the development of digital skills among university students, with the study and verbalization dimensions garnering the most importance.

The diagram enables the examination of the mediating role of sex (male or female) in the direct relationship between self-confidence and digital skills in university students. It reveals that the mediating or indirect effect (−0.00) (−0.24) holds less significance than the direct relationship between both variables (0.38); consequently, sex does not serve as a mediating effect, as it does not enhance the relationship between the variables under investigation (Figure 1).

The indirect effect on digital skills is 1.58E-04; this effect reveals the mediating role of gender. However, the confidence interval includes zero, suggesting that this effect is not statistically significant. On the other hand, the direct effect of self-confidence on digital skills is 0.377 and is statistically significant ($p < 0.001$). This indicates that, independently of any mediating effect, self-confidence has a direct influence on digital skills. The total effect of self-confidence on digital skills is 0.377, which is equal to the direct effect. This confirms that the direct effect primarily explains the relationship between gender and digital skills, while the indirect effect is not significant (Table 6).

Figure 2 illustrates the impact of age as a mediating function on the direct relationship between self-confidence and digital skills in university students. It reveals that the mediating or indirect effect (−0.03) (−0.06) has a lower statistical significance compared to the direct relationship between both variables. Consequently, age did not demonstrate a mediating effect that enhances the relationship between self-confidence and digital skills.

The table shows that there is an indirect effect on digital skills of 0.00193 with a confidence interval that includes zero, which proves that this effect is not statistically significant. The direct effect on digital skills is 0.37526 and is statistically significant ($p < 0.001$). This indicates that, independently of any mediating effect, self-confidence has a direct influence on digital skills. The total effect of self-confidence on digital skills is 0.37720, which is close to the direct effect. This demonstrates that the direct effect between the variables under study primarily explains the relationship between sex and digital skills and that the indirect effect is not significant.

The region of origin of the students does not appear to have a mediating effect on the direct relationship between self-confidence and digital skills, which are crucial to develop given the impending digitalization of education (Table 7).

The table indicates that the direct effect holds a higher statistical significance (0.48325) ($p < 0.001$). In contrast, the analysis failed to demonstrate the indirect effect that determines the mediation. This

TABLE 4 Predictive table for the development of digital skills based on self-confidence in Peruvian university students.

Model coefficients—digital skills							
			95% confidence interval				
Predictor	Estimate	SE	Lower	Upper	t	p	Standard Estimator
Constant	15.871	4.5601	6.882	24.860	3.48	<0.001	
SELF_CONFIDENCE	0.377	0.0469	0.285	0.470	8.04	<0.001	0.484

TABLE 5 Predictive table for the development of digital skills based on self-confidence in Peruvian university students.

			95% confidence interval				
Predictor	Estimate	SE	Lower	Upper	t	*p*	Standard estimator
Constant	17.145	4.636	8.006	26.284	3.698	< 0.001	
Study	0.926	0.385	0.166	1.686	2.403	0.017	0.2703
Comprehension	−0.373	0.416	−1.193	0.447	−0.896	0.371	−0.1071
Verbalization	0.634	0.246	0.148	1.119	2.572	0.011	0.2508
Clarification	−0.115	0.460	−1.021	0.791	−0.250	0.803	−0.0271
Student notes	0.679	0.585	−0.473	1.832	1.162	0.247	0.1552

means that the condition of coming from a specific region of Peru does not alter the relationship between both variables (Table 8).

3.2 Qualitative results

This analysis collected the opinions of university teachers regarding the relevance of developing digital skills in students so that they can guarantee their optimal academic performance in their higher education experience, from which the following comments on the subject were compiled:

> *"Digital skills are paramount skills in today's education, this because of the use of digital platforms immersed in hybrid education."*
>
> *"Both students and teachers must develop digital skills for education, otherwise we do not fit in this new trend of education, we know that virtual education or digitization of it is something that will happen and will be standardized, so we must prepare ourselves, knowing how to optimize the use of technology for higher quality learning."*
>
> *"The use of digital tools generates great challenges to the university student community, but we are aware that the digitization of education is going to be predominant also in our country."*
>
> *"The digitization of education at the higher level is necessary, because universities encourage research in students, this would not be possible, if they are not able to access databases for information, this becomes possible when the student applies their digital skills for academics, but there are also students who are generally older, who are resistant to the use of technology, as it generates difficulty for them."*
>
> *"Currently there are teachers and students who show aversion to the use of digital platforms and other tools that are strategic in education, therefore, it is necessary to work with them on their self-confidence to dare to take on new challenges, such as those of digitized education."*
>
> *"We know that temporary virtual education was only the beginning of a growing stream of digitization of education, we just need to be prepared..."*

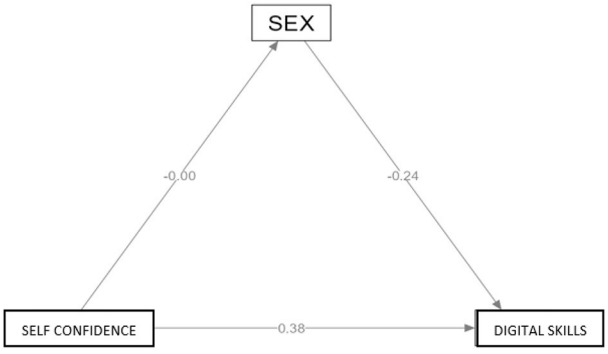

FIGURE 1
Diagram of the mediating effect of sex between the relationship between self-confidence and digital skills.

4 Discussion

This section will discuss the quantitative data obtained and how it supports the study's hypothesis. According to the results in Tables 1, 2, a significant correlation is observed between self-confidence and digital skills, which reinforces the central hypothesis that students with higher self-confidence develop better competencies. Internationally, studies such as that of Jones (2020) have indicated a similar behavior, where students with high levels of

TABLE 6 Mediating effect of students' sex on the relationship between self-confidence and digital skills.

				95% C.I. (a)				
Type	Effect	Estimate	SE	Lower	Upper	β	z	*p*
Indirect	SC ⇒ SEX ⇒ DS	1.58e-4	0.00102	−0.00185	0.00216	2.03e-4	0.155	0.877
Direct	SC ⇒ DS	0.377	0.04672	0.28548	0.46861	0.4839	8.071	<0.001
Total	SC⇒ DS	0.377	0.04683	0.28542	0.46898	0.4841	8.055	<0.001

Nota. Betas are completely standardized effect sizes.
SC, self-confidence; DS, digital skills.

self-confidence in their technological skills tend to adopt emerging technologies more efficiently. In the Peruvian context, however, the lack of self-confidence remains a structural challenge, particularly in rural areas (Ministerio de Educación, 2023).

4.1 Speculation about the future

The predictive capacity of self-confidence in digital skills is key to projecting future trends in the digitalization of education in Peru. As University Law 30220 encourages the total virtualization of university classes, it is expected that students with greater self-confidence will be the first to adapt to the new educational dynamics. Self-efficacy theories (Bandura, 1997) suggest that individuals who develop strong self-confidence in their abilities tend to maintain and improve these skills in the long term (Pajares and Schunk, 2001). In this sense, it could be predicted that Peruvian students with high levels of digital self-confidence will be the first to integrate emerging technologies such as artificial intelligence into their learning.

4.2 Use of theories to test and predict the future

Self-efficacy theory (Bandura, 1997) is key to explaining the results obtained and projecting the future impact of self-confidence in the educational field. People who believe in their abilities to complete complex tasks, such as using digital tools, will be more successful in facing the challenges of digitalization (Luszczynska et al., 2005). This theory can help predict that, in a scenario with greater access to digital tools and better technological inclusion policies, self-confidence will continue to be a crucial factor in academic success (Serdyukov, 2017; Shunk and Pajares, 2010) also supports this idea by suggesting that digital literacy, mediated by self-confidence, is essential for continuous learning in the digital age.

The correlation between self-confidence dimensions and digital skills is moderate to strong, with coefficients between 0.313 and 0.822 (Table 2). These results are in line with global research showing that self-confidence in learning by themselves plays a fundamental role in the development of technological and other skills (Rosales-Márquez et al., 2023). At the national level, the Ministerio de Educación (2023) reports that students with greater self-confidence in their technological skills tend to adapt better to advanced digital tools. The achievement motivation theory,

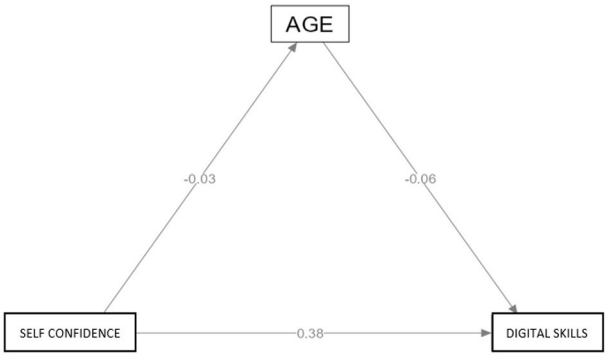

FIGURE 2
Diagram of the mediating effect of age between the relationship between self-confidence and digital skills.

which posits that two factors drive individuals to achieve goals: the desire for success and the fear of failure, finds confirmation in these results. Students who have high levels of self-confidence tend to have a greater motivation to achieve digital skills, as they perceive the use of technologies as an achievable challenge (Atkinson, 1964). This motivation may explain the positive relationship between self-confidence and the development of digital skills.

Including activities that encourage reflective practice in educational programs could help students internalize their achievements and learn from their mistakes, thereby increasing their self-confidence. For example, by reviewing their use of digital technologies, including AI, students could develop a deeper understanding of their capabilities and limitations, progressively improving their digital skills. International studies, such as those by Field (2013), have also shown that reflection on digital practice promotes more efficient and effective use of technologies in educational contexts.

Mediation analysis of sex in the relationship between self-confidence and digital skills suggests that sex does not have a significant mediating effect (Figure 1). This is in line with international studies, such as that by Pérez et al. (2022), who found that sociodemographic factors such as gender have a minor impact on the adoption of technologies, while self-confidence remains the main predictor of digital skills.

The digital literacy theory (Eshet-Alkalai, 2004) emphasizes the importance of advanced cognitive skills for handling technological tools, and Table 4 shows that predictors like "verbalization" and

TABLE 7 Mediating effect of the students' region of origin in the relationship between self-confidence and digital skills.

				95% C.I. (a)				
Type	Effect	Estimate	SE	Lower	Upper	β	z	*p*
Indirect	SC ⇒ RO⇒ DS	6.67e-4	0.00426	−0.0076	0.0090	8.56e-4	0.156	0.876
Direct	SC⇒ DS	0.37526	0.04690	0.2846	0.4684	0.48325	0.156	<0.001
Total	SC⇒ DS	0.37720	0.04683	0.2854	0.4689	0.48410	8.055	<0.001

Nota. Betas are completely standardized effect sizes.
SC, self-confidence; DS, digital skills; RO, region_origin.

TABLE 8 Mediating effect of students' age on the relationship between self-confidence and digital skills.

				95% C.I. (a)				
Type	Effect	Estimate	SE	Lower	Upper	β	z	*p*
Indirect	SC ⇒ AGE ⇒ DS	0.00193	0.00379	−0.005	0.0094	0.00248	0.510	0.610
Direct	SC⇒ DS	0.37526	0.04664	0.284	0.4667	0.48162	8.047	<0.001
Total	SC⇒ DS	0.37720	0.04683	0.285	0.4689	0.48410	8.055	<0.001

Nota. Betas are completely standardized effect sizes.
SC, self-confidence; DS, digital skills.

"studying" have a greater influence on digital skills. Another author emphasizes the importance of verbalization to generate greater self-confidence and greater acquisition of digital skills (Chávez and Montes, 2015). In turn, Figure 2, which examines the mediating effect of age, can be analyzed under the digital divide theory (van Dijk, 2006), since older students may have had less access to technology in their previous training, which influences their current confidence in using digital tools. Figure 3 examines the unproven mediating effect of the region of origin. This can be justified by the educational level since, in Peru, the universities are located in central cities in the different regions and departments of the country, where students can access technology, so their region of origin did not make a difference between the groups.

The results of the study confirm that self-confidence is a significant predictor of the development of digital skills in Peruvian university students. A moderate positive correlation ($r = 0.484$, $p < 0.001$) was found between both variables, indicating that students with higher levels of self-confidence are more likely to develop advanced digital skills. This finding highlights the importance of fostering self-confidence in educational settings, as students who are confident in their ability to use digital tools tend to use emerging technologies, such as artificial intelligence (AI), more effectively, which improves their academic performance and their ability to innovate in the context of the digitalization of university education.

The study also reveals that a lack of self-confidence perpetuates structural barriers that limit the access and adequate use of digital technologies in university contexts, especially in regions with lower connectivity and resources. The results show that self-confidence directly influences the effective use of digital technologies, as students with low levels of self-confidence tend to avoid or underuse these tools ($\beta = 0.377$, $p < 0.001$), which exacerbates existing digital gaps. These results suggest that, in order to close technological gaps in Peruvian higher education, it is crucial to implement pedagogical strategies that not only provide access to technology but also develop self-confidence in the use of these tools.

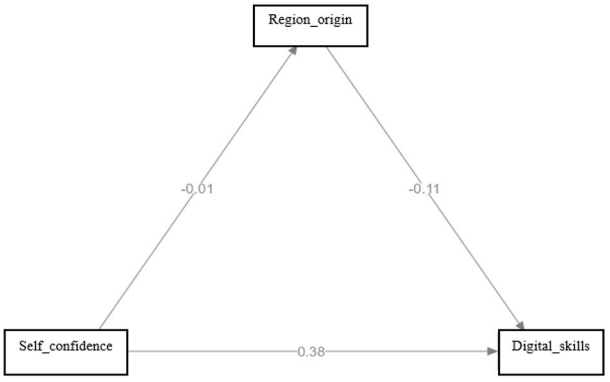

FIGURE 3
Diagram of the mediating effect of the region of origin between the relationship between self-confidence and digital skills.

The analysis of the quantitative data in contrast to the quantitative data shows us that for the digitization of higher education, first of all, self-confidence must be developed to take on new challenges, as suggested by the one of digital platforms, AI, software, among others. In this sense, it is essential that students and teachers have developed digital skills oriented to education. The university should foster self-confidence in its students through interventions such as workshops, and teachers should play a strategic role by accompanying them and providing trust, enabling them to tackle new challenges, including those posed by digitized education.

To strengthen the development of digital skills in Peruvian university students, it is recommended to implement training programs focused on increasing self-confidence in the use of emerging technologies, such as artificial intelligence. These programs should include practical workshops and mentoring that promote the critical and creative use of digital tools, allowing

students to become familiar with their operation and apply them in academic tasks. In addition, it is crucial that universities adapt their digital inclusion policies, ensuring that both students and teachers have the necessary support to overcome technological barriers, especially in regions with fewer resources.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by Comité de ética de la Universidad César Vallejo. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

CR-M: Conceptualization, Formal analysis, Investigation, Methodology, Software, Supervision, Writing – original draft, Writing – review & editing. CC-G: Conceptualization, Investigation, Project administration, Writing – original draft, Writing – review & editing. VM-V: Data curation, Investigation, Validation, Writing – review & editing. RD-Z: Project administration, Resources, Visualization, Writing – review & editing. KL-D: Investigation, Project administration, Resources, Validation, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2024.1515033/full#supplementary-material

References

Andrés, J., Ortiz, T., Thiago, I., Barnabé, H., and Ii, C. (2020). Aspectos pedagógicos del conectivismo y su relación con redes sociales y ecologías del aprendizaje. *Rev. Bras. Educ.* 25:24782020250026. doi: 10.1590/s1413-24782020250026

Atkinson, J. W. (1964). *An Introduction to Motivation*. Princeton: Van Nostrand.

Bandura, A. (1986). *Social Foundations of Thought and Action*. London: Englewood Cliffs.

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. New York: W. H. Freeman/Times Books/Henry Holt & Company.

Bandura, A., and Cervone, D. (1983). Self evaluative and self-efficacy. Mechanisms governing the motivational effects of goal systems. *J. Personal. Soc. Psychol.* 45, 1017–1028. doi: 10.1037//0022-3514.45.5.1017

Berkowsky, R., and van Deursen, A. J. A. M. (2016). Age differences in digital skills: a meta-analysis. *Comp. Human Behav.* 62, 472–480.

Bong, M. (2001). Between- and within-domain relations of academic self concept and achievement: a meta-analysis. *Rev. Educ. Res.* 71, 535–582.

Bransen, D., Govaerts, M. J., Panadero, E., Sluijsmans, D. M., and Driessen, E. W. (2022). Putting self-regulated learning in context: Integrating self-, co-, and socially shared regulation of learning. *Med. Educ.* 56, 29–36. doi: 10.1111/medu.14566

Chávez, D. J., and Montes, J. A. (2015). Niveles de verbalización y resolución colaborativa de problemas poco estructurados. *Perspectiva Psicológica* 11, 51–66. doi: 10.15332/s1794-9998.2015.0001.03

Cohen, L., Manion, L., and Morrison, K. (2018). *Research Methods in Education, 8th edn*. London: Routledge.

Cotten, S. R., and Gupta, S. (2012). Digital inequality: a conceptual framework for understanding the gap in Internet access and use. *Inform. Commun. Soc.* 15, 663–682.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 4th edn*. Los Angeles: Sage.

Eshet-Alkalai, Y. (2004). Digital literacy: a conceptual framework for survival. *J. Educ. Multimed. Hypermedia*. 13.

European Commission (2018). *DigComp: The Digital Competence Framework for Citizens*. Luxembourg: Publications Office of the European Union.

Fernández, J., and Ruiz, M. (2020). Digital competence and self-efficacy in higher education. *Comp. Educ.* 149:103708.

Field, A. (2013). *Discovering Statistics Using IBM SPSS Statistics, 4th edn*. London: SAGE Publications.

Hernández, R., Fernández, C., and Baptista, P. (2014). *Metodología de la investigación, 6th edn*. México: McGraw-Hill.

Hwang, Y., and Oh, J. (2021). The relationship between self-directed learning and problem-solving ability: the mediating role of academic self-efficacy and self-regulated learning among 57 nursing students. *Int. J. Res. Public Health, Environm.* 18:1738. doi: 10.3390/ijerph18041738

Jones, C. (2020). Digital literacy and self-efficacy in the 21st century. *Educ. Technol. Res. Dev.* 68, 785–802.

Khampirat, B. (2021). Relationships between ICT competencies related to work, self-esteem, and self-regulated learning with engineering competencies. *PLoS ONE* 16:e0260659. doi: 10.1371/journal.pone.0260659

Luszczynska, A., Scholz, U., and Schwarzer, R. (2005). The general self efficacy scale: multicultural validation studies. *J. Psychol.* 139, 439–457. doi: 10.3200/JRLP.139.5.439-457

Mendoza, L. (2023). *Digital Divide in Peru: Challenges and Opportunities for Higher Education*. Peru: Ministry of Education.

Ministerio de Educación (2023). *Informe sobre el estado de la educación en Perú*. Lima: Ministerio de Educación.

OCDE (2020). *Making the Most of Technology for Learning and Training in Latin America*. Available at: https://www.fundaciontelefonica.com.pe/cultura-digital/publicaciones/aprovechar-al-maximo-la-tecnologia-para-el-aprendizaje-y-la-formacion-en-america-latina/718/

Pajares, F., and Schunk, D. (2001). "Self-beliefs and school success: self efficacy, selfconcept, and school achievement," in *Self-Perception*, eds. E. R. Riding and S. Rayner (London: Ablex Publishing), 239–266.

Pérez, J., Abarca, M. T., and Mancera, Y. C. (2022). Digitalización en la educación: Retos y oportunidades en América Latina. *Revista de Educación Superior* 12, 1–20.

Ramírez-Armenta, M., García-López, R., and Edel-Navarro, R. (2021). Validación de una escala para medir la competencia digital en estudiantes de posgrado. *Formación Universitaria* 14, 115–125. doi: 10.4067/S0718-50062021000300115

Rosales Márquez, C. (2022). Teorical analysis proposed models in university education for virtual Education. *RUS* 14, 34–44.

Rosales-Márquez, C., Silva-Aguilar, A., Miranda-Vargas, V., and Salas-Sánchez, R. (2023). Aprendizaje autorregulado para aprender a aprender en la formación universitaria. *Human Rev.* 21, 269–281. doi: 10.37467/revhuman.v21.5058

Sander, P., and Sanders, L. (2003). Medida de la confianza en el estudio académico: un Informe-Resumen. *Electron. J. Res. Educ. Psychol.* 1, 1–17 doi: 10.25115/ejrep.1.100

Serdyukov, P. (2017). Digital competence and self-efficacy in the context of lifelong learning. *Int. J. Lifelong Educ.* 36, 359–374.

Shunk, D., and Pajares, F. (2010). Self-efficacy beliefs. *Int. Encyclop. Educ*. 668–672. doi: 10.1016/B978-0-08044894-7.00620-5

van Dijk, J. (2006). Digital divide research, achievements and shortcomings. *Poetics* 34, 221–235. doi: 10.1016/j.poetic.2006.05.004