REVISTA INVECOM
ISSN en línea: 2739-0063

Self-regulated learning, digital skills and academic motivation in higher education students

Aprendizaje autorregulado, competencias digitales y motivación académica en estudiantes de educación superior

Received: 25/02/2026 - **Accepted:** 22/05/2026

Willams Mauro Carcagno Puma
https://orcid.org/0000-0002-5994-4060
wilycarcagno.puma@gmail.com
Instituto de Educación Superior Pedagógico Público Virgen de la Natividad

Pamela Sevillanos Grajeda
https://orcid.org/0009-0003-8913-6632
sevillanos.pame@gmail.com
Instituto de Educación Superior Pedagógico Público Virgen de la Natividad

Candi Achahuanco Fuentes
https://orcid.org/0009-0001-2851-4746
candiachahuancofuente@gmail.com
Instituto de Educación Superior Pedagógico Público Virgen de la Natividad

Rocio Susana Sánchez Gómez
https://orcid.org/0009-0004-9504-7158
rocio.ispvn@hotmail.com
Instituto de Educación Superior Pedagógico Público Virgen de la Natividad

Yermy Puma Álvarez
https://orcid.org/0009-0001-0521-7490
yermy.pual@gmail.com
Instituto de Educación Superior Pedagógico Público Virgen de la Natividad

Abstract

In the current landscape of technology-mediated higher education, strengthening digital skills represents one of the main challenges of contemporary education. Faced with this challenge, this study aimed to analyze whether self-regulated learning contributes to the development of these digital skills. The study was conducted with a total sample of 126 students, divided into two groups (n=62 and n=64), using a quasi-experimental design with a quantitative approach. The intervention lasted four weeks and incorporated strategies such as planning, followed by monitoring and reflection on one's own learning. The results from the experimental group showed significant improvements in information literacy, digital content creation, online safety, and technological problem-solving, compared to the control group. Furthermore, it was found that students with greater academic motivation exhibited a higher level of engagement and autonomy in the learning process. The study concludes that teaching students to self-regulate their learning is one of the most effective strategies for preparing them for the demands of current digital education.

Keywords: autonomous learning, digital literacy, educational motivation.

Resumen

En los actuales escenarios de la educación superior mediada por la tecnología, el fortalecimiento de las competencias digitales representa uno de los principales retos de la realidad educativa contemporánea. Frente a esta problemática, el presente estudio se propuso analizar si el aprendizaje autorregulado contribuye al desarrollo

de dichas competencias digitales. El estudio se desarrolló con una muestra total de 126 estudiantes, distribuidos en dos grupos (n=62 y n=64), mediante un diseño cuasiexperimental bajo un enfoque cuantitativo. La intervención tuvo una duración de cuatro semanas e incorporó estrategias como la planificación, seguida del control y la reflexión del propio aprendizaje. Los resultados del grupo experimental mostraron mejoras significativas en alfabetización informacional, creación de contenido digital, seguridad en línea y resolución de problemas tecnológicos, en comparación con el grupo control. Asimismo, se identificó que los estudiantes con mayor motivación académica presentaron mayor nivel de involucramiento y autonomía en el proceso. El estudio concluye que enseñar a los estudiantes a autorregular su aprendizaje constituye una de las estrategias más efectivas para prepararlos ante las exigencias de la educación digital actual.

Palabras clave: aprendizaje autónomo, alfabetización digital, motivación educativa.

Introduction

Contemporary higher education can no longer afford to overlook the digital dimension. With the consolidation of hybrid learning environments and the growing integration of virtual education, digital competencies have transitioned from being an ancillary asset to a factor that directly shapes teaching and learning processes. These competencies extend well beyond mere tool proficiency; as Van Laar et al. (2020) argue, they encompass critical thinking, information management, and problem-solving within digital settings, skills that no professional today can afford to lack.

The educational transformation accelerated by the COVID-19 pandemic has cemented technology not as a supplementary element but as a prerequisite for effective learning in the current era (Bond et al., 2021). Technology-mediated higher education environments create scenarios in which self-regulation, academic motivation, and digital competencies operate interdependently. A student who fails to strategically manage their own learning will struggle to sustain motivation in virtual contexts, and in the absence of such motivation, the development of digital skills becomes equally compromised (Pinto, 2023). The relationship among these three variables is neither linear nor hierarchical but rather dynamic and interactive, making a comprehensive understanding of their interplay essential for designing relevant educational proposals in higher education.

From a pedagogical standpoint, self-regulated learning occupies a determining role in higher education, enabling students to autonomously manage their learning process through planning, monitoring, and self-reflection. Recent research indicates that self-regulation not only enhances academic performance but also correlates significantly with the development of digital competencies in virtual environments by promoting strategic and conscious use of technological tools (Rodríguez et al., 2025; Pinto et al., 2023). In this vein, evidence suggests that students with higher levels of self-regulation demonstrate better adaptability to digitalized educational contexts, reinforcing the relevance of this construct in contemporary training.

Self-regulated learning thus constitutes a foundational process in students' academic development, involving the capacity to plan, monitor, and evaluate one's own learning autonomously. Various studies have shown that students who develop self-regulated strategies tend to achieve better academic outcomes by assuming an active role in knowledge construction (Marcelo & Santos, 2023).

Self-regulated learning does not operate in a vacuum, however. It remains closely tied, almost invariably, to the learner's level of motivation. When motivation is low, planning falters, monitoring dissipates, and effort wanes. When motivation is high, the opposite occurs: students not only employ more cognitive and metacognitive strategies but also persevere when difficulties arise. In other words, motivation and self-regulation feed into one another, and this interaction ultimately ranks among the factors with the greatest influence on academic outcomes (Suárez et al., 2026).

Within this framework, self-regulated learning connects closely with the use of digital technologies in educational settings, as it enables students to plan, organize, and manage their learning process through digital tools. Evidence indicates that although students possess a certain level of digital competence, the effective harnessing of these technologies depends on the development of self-regulated strategies and motivational support within the educational environment. Consequently, the integration of self-regulated learning and technology use proves critical for strengthening digital competencies in higher education (Basilotta et al., 2022).

Digital competencies in higher education extend beyond knowing how to use a particular program. As previously noted, they involve searching for, evaluating, and critically using information in digital environments, skills that, according to the evidence, many students have yet to fully develop. The gap between what the academic environment demands and what students can actually do constitutes the central problem. Digital literacy is thus not

an optional complement but a factor directly linked to academic performance when technology mediates learning (Morgan, Sibson & Jackson, 2022).

Digital competencies in higher education encompass a set of skills that transcend the technical mastery of technological tools and include capacities such as information search, evaluation, and critical management, communication and collaboration within digital environments, content creation, digital security, and technological problem-solving (Vodă et al., 2022; Audrin & Audrin, 2022; Kanyika, Sadykova & Kosmyrza, 2024). These abilities further involve cognitive and communicative dimensions oriented toward academic learning, making their development essential for meeting the demands of contemporary technology-mediated higher education (Yi & Siqian, 2025).

Nevertheless, the relationship between self-regulated learning and digital competencies cannot be understood in isolation, as psychological variables intervene to explain the underlying mechanisms of this relationship. Among these, academic motivation occupies a central position, directly influencing the degree of student engagement, persistence, and self-regulation in the learning process. Recent studies have demonstrated that motivation acts as a key factor that enhances the application of self-regulated strategies and facilitates the achievement of academic outcomes in higher education settings (Usán & Castellanos, 2024).

Academic motivation comprises a set of psychological processes that influence the direction, intensity, and persistence of student learning. Contemporary theories explain that factors such as expectations, task value, and achievement goals determine the effort students invest in their academic activities. Consequently, motivation not only impacts performance but also serves as a crucial element in learning regulation and the attainment of educational objectives (Urhahne & Wijnia, 2023).

At the empirical level, academic motivation is recognized as a determining factor in student performance and engagement. Evidence shows that both intrinsic and extrinsic motivation correlate positively with academic commitment, self-regulated learning, and satisfaction with academic achievement. Students who exhibit higher levels of motivation tend to demonstrate greater participation in academic activities and higher persistence in achieving their educational goals (Bin Abdulrahman et al., 2023).

In the present study, academic motivation is incorporated as a mediating variable between self-regulated learning and digital competencies, given that empirical evidence suggests its presence enhances the effect of self-regulated strategies on the development of these competencies in higher education settings.

Taking the foregoing into account, the study's objective is to analyze the effect of a self-regulated learning program on digital competencies in higher education students, considering academic motivation as a mediating variable. The guiding research question is: How does self-regulated learning influence digital competencies in higher education students from the perspective of academic motivation?

Ultimately, the findings are intended to contribute relevant evidence to the field of educational research, advancing the understanding of processes that facilitate learning in digital environments and informing pedagogical decision-making in educational contexts.

Methodology

This study corresponds to applied research, as its central purpose is to generate practical solutions to a concrete problem identified in pedagogical higher education contexts (Balwan et al., 2022). The explanatory level addresses a specific question: whether self-regulated learning causes improvements in digital competencies and what role academic motivation plays in this process. Regarding the approach, a quantitative framework was most appropriate, as it allows for working with numerical data, statistical analysis, and testable hypotheses (Sánchez-Martín et al., 2024).

In terms of design, the study employed a quasi-experimental design with non-equivalent groups, one serving as the control and the other as the experimental group. This design is used when random assignment of participants is not feasible but the effect of an intervention in real-world contexts still needs to be evaluated.

For group comparison, a posttest-only experimental design was used, in which measurement was conducted at a single time point following the intervention for both the experimental and control groups, as the study's interest lay in comparing the effect of the treatment between the two groups. The population consisted of students enrolled at a pedagogical higher education institution in the Cusco region, who undergo training in both face-to-face and virtual environments mediated by digital technologies. The sample comprised a total of 126 students distributed across two groups: 64 students in the experimental group (third and fourth semesters) and 62 students in the control group (first and second semesters), selected through non-probabilistic convenience

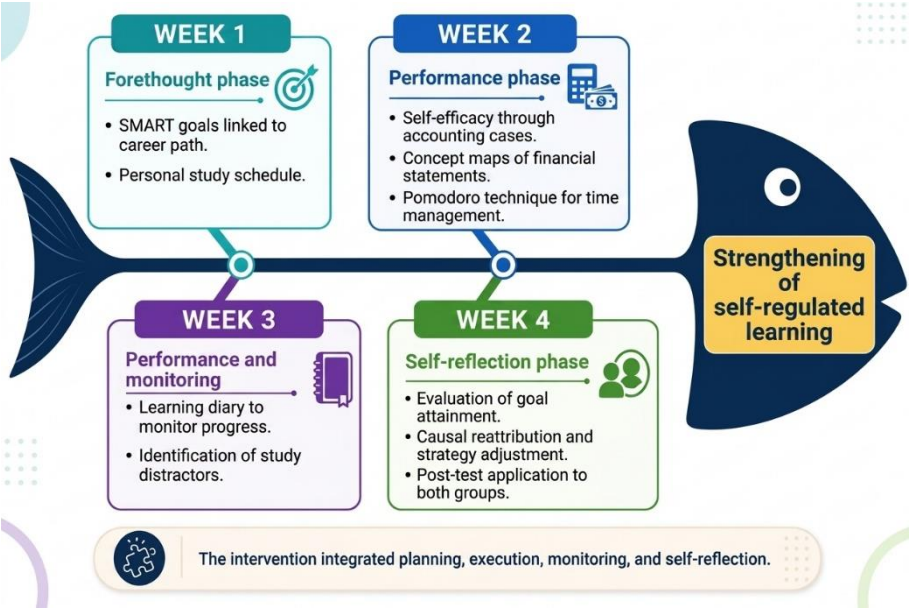
sampling, which is common in quasi-experimental educational studies due to institutional constraints and access limitations (Etikan, Musa & Alkassim, 2015).

The intervention followed the three phases proposed by Zimmerman (2002) in his cyclical model of self-regulated learning: first planning, then execution, and finally reflection on what occurred. This logic structured the entire program. In the first phase, students learned to set concrete goals and organize their study time. In the second phase, they put cognitive strategies into practice while working with content and observing their own process. In the third phase, they looked back, evaluated what had worked, understood why, and adjusted what needed adjustment.

The program was implemented with students enrolled in the education program at the public pedagogical higher education institute in Cusco. It lasted four weeks, with eight face-to-face sessions of 45 minutes each.

Figure 1

Pedagogical intervention process based on self-regulated learning strategies



Note. Intervention sequence developed over four weeks to strengthen self-regulated learning through planning, execution, monitoring, and self-reflection activities

The data collection technique used in this research was the survey, a method that enables systematic and direct information gathering based on participants' perceptions of the topic under study. This technique is regularly employed in quantitative educational research and functions adequately when working with large samples and when analyzing relationships among variables systematically.

Regarding the instrument, a customized Likert-type questionnaire was developed for the present study, drawing on the dimensions proposed by Tourón et al. (2018) for measuring digital competencies: information literacy, digital communication and collaboration, digital content creation, digital security, and digital problem-solving. Once developed, the instrument was not administered immediately; it was first reviewed by experts who evaluated whether each item was relevant, clearly worded, and coherent with what was intended to be measured. Only after this process was it considered valid for use in the study.

To measure instrument reliability, McDonald's Omega coefficient was used instead of Cronbach's alpha, for a specific reason: Omega provides a more robust estimate of internal consistency in psychometric scales because it accounts for each item's factor loading, something alpha does not do with the same precision. Hayes and Coutts (2020) strongly recommend this approach in educational measurement studies, and the results justified the choice: the control group yielded an Omega of 0.88 and the experimental group 0.95, both within a highly acceptable reliability range that lends solidity to the instrument used in this research.

Regarding ethical considerations, the research respected the rights of participants throughout the investigative process. No one was included without consent, participation was entirely voluntary, and collected data were used solely for academic purposes without revealing anyone's identity. These procedures followed international ethical guidelines aimed at protecting participant welfare and ensuring the integrity of scientific work, as established by the World Medical Association (2013).

Results

This section presents the statistical results derived from the analysis of data obtained from the control and experimental groups. The presentation of results allows for an assessment of the intervention program's effects on self-regulated learning among participating higher education students.

Table 1

Descriptive statistics for digital competencies

Groups	N	Minimum	Maximum	Mean	Standard Deviation
CG_DC	62	51,00	100,00	64,98	10,475
EG_DC	64	61,00	116,00	95,55	13,553

Note. Descriptive statistics calculated in SPSS

The descriptive statistics reveal clear differences between the groups analyzed. The experimental group (M = 95.55; SD = 13.553) exhibited higher levels of digital competencies compared to the control group (M = 64.98; SD = 10.475). Furthermore, the experimental group not only achieved a higher mean but also a higher minimum score (61 versus 51), suggesting more consistent performance following the intervention.

The slightly larger standard deviation in the experimental group indicates greater variability in scores, which is expected in educational contexts where students respond differently to interventions.

The establishment of intervals for interpreting digital competence levels was conducted using the equal-interval division method, in this case, three levels, basic, intermediate, and advanced, considering the instrument's minimum and maximum possible scores. Given that the questionnaire consisted of 25 items on a 5-point Likert scale, the total score range was between 25 and 125.

Table 2

Control group estimates

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Basic	18	29,0	29,0	29,0
	Intermediate	42	67,7	67,7	96,8
	Advanced	2	3,2	3,2	100,0
	Total	**62**	**100,0**	**100,0**	

Note. Instrument estimation

As shown in Table 2, the control group displayed a distribution concentrated in the lower levels: 67.7% of students were at the intermediate level, 29% at the basic level, and only 3.2% reached the advanced level. The scant presence at the upper level is noteworthy, it indicates that, without intervention, students' digital proficiency tends to remain where it is.

The data are straightforward: without a program that structures planning, monitoring, and self-reflection, digital competencies do not develop spontaneously. The control group's distribution confirms this, the majority remained at intermediate and basic levels, with no factor guiding learning toward superior performance.

Table 3
Digital competencies by dimension – control group

Level of critical thinking	Information literacy		Communication and collaboration		Content creation		Digital security		Problem solving	
	N	%	N	%	N	%	N	%	N	%
Basic	22	35.5	18	29.0	19	30.6	23	37.1	16	25.8
Intermediate	39	62.9	42	67.7	40	64.5	37	59.7	44	71.0
Advanced	1	1.6	2	3.2	3	4.8	2	3.2	2	3.2
Totals	**62**	**100**	**62**	**100**	**62**	**100**	**62**	**100**	**62**	**100**

Note. Dependent variable instrument estimation

In the control group, certain patterns emerge with distributions clustering at the intermediate level across all evaluated dimensions. In information literacy, 62.9% of students fell into this level, while 35.5% remained at the basic level. Similarly, in communication and collaboration, 67.7% reached the intermediate level and 29.0% stayed at basic. Content creation showed comparable behavior, with 64.5% at the intermediate level and minimal presence at the advanced level. This means most students can produce basic digital content but do not master more advanced tools or formats. Digital security presents a more concerning distribution, 37.1% at the basic level, the second highest across all dimensions, indicating that secure practices in digital environments represent the weakest area. Problem-solving recorded the highest percentage at the intermediate level (71.0%), the highest across all categories, though here too the advanced level remains marginal.

The overall picture is consistent: most students reached the intermediate level, but few surpassed that ceiling. The advanced level appears only marginally across all dimensions, suggesting development that progressed to a point and then stagnated. For an academic environment increasingly mediated by technology, this stagnation is not a minor detail, it is precisely the problem justifying the intervention.

Table 4
Experimental group estimates

		Frequency	Percentage	Valid percentage	Cumulative percentage
Valid	Intermediate	24	37.5	37.5	37.5
	Advanced	40	62.5	62.5	100,0
	Total	**64**	**100,0**	**100,0**	

Note. Instrument estimation

Table 4 shows that the experimental group presented a distribution radically different from the control group: 62.5% of students reached the advanced level and the remaining 37.5% the intermediate level. No student remained at the basic level. In other words, the intervention moved all participants into the two upper performance ranges without exception.

The difference from the control group speaks for itself. Where intermediate and basic levels previously predominated, the self-regulated learning program produced a complete shift toward higher levels of digital competence. That no student remained at the basic level is not a minor detail, it suggests the intervention had a homogeneous reach, benefiting not only those who started from better positions.

Table 5
Digital competencies by dimension – experimental group

Level of critical thinking	Information literacy	Communication and collaboration	Content creation	Digital security	Problem solving

	N	%	N	%	N	%	N	%	N	%
Basic	2	3.1	0	0	0	0	2	3.1	1	1.6
Intermediate	28	43.8	36	56.3	27	42.2	30	46.9	19	29.7
Advanced	34	53.1	28	43.8	37	57.8	32	50.0	44	68.8
Totals	**64**	**100**	**64**	**100**	**64**	**100**	**64**	**100**	**64**	**100**

Note. Dependent variable instrument estimation

In the information literacy dimension, 53.1% of students reached the advanced level, followed by 43.8% at intermediate and a mere 3.1% at basic. These results reflect solid development in students' ability to search for, select, and critically evaluate digital information, suggesting a positive impact of the program on strengthening complex informational skills.

Regarding digital communication and collaboration, 56.3% of students were at the intermediate level and 43.8% at the advanced level, with no presence at basic. This indicates that students have consolidated competencies for interacting and collaborating in digital environments, though room remains for promoting more advanced levels related to active participation and collective knowledge construction.

In content creation, 57.8% of students positioned themselves at the advanced level and 42.2% at intermediate, with no basic-level records. This result reflects strong development in the capacity to produce and adapt digital content, showing that students not only consume information but also generate it creatively and relevantly in academic contexts.

In digital security, 50.0% of students reached the advanced level, followed by 46.9% at intermediate and 3.1% at basic. These data suggest that most students have developed adequate competencies for data protection and responsible technology use, although some cases with limited knowledge persist.

Finally, the problem-solving dimension showed the highest percentage at the advanced level (68.8%), followed by 29.7% at intermediate and 1.6% at basic. This outcome demonstrates a high level of autonomy and capacity to use digital tools in solving academic problems, positioning this as the most strengthened dimension following the intervention.

Inferential analysis

As previously noted, the research set out to analyze the effect of a self-regulated learning program on digital competencies in pedagogical higher education students, considering academic motivation as a mediating variable. The following hypotheses were established:

- **Ha**: The self-regulated learning program significantly influences the development of digital competencies in higher education students through academic motivation.
- **Ho**: The self-regulated learning program does not significantly influence the development of digital competencies in higher education students through academic motivation.

Table 6

Normality test

	Kolmogorov-Smirnov		
	Statistic	**df**	**Sig.**
Control group	,403	62	,000
Experimental group	,404	64	,000

Note. SPSS results

The Kolmogorov-Smirnov normality test results showed the same outcome for both groups: both the control and experimental groups obtained a p-value of .000, below the 0.05 threshold. This indicates that the data did not follow a normal distribution in either case, and therefore parametric tests were not appropriate for analysis.

Consequently, given these results, the Mann-Whitney U test was employed, as it allows for comparing differences between the two groups (control and experimental) in relation to the digital competencies examined in this study.

Table 7
Test statistics

	Digital competencies
Mann-Whitney U	592,000
Wilcoxon W	2545,000
Z	-7,518
Asymp. Sig. (2-tailed)	,000

Note. Statistical results

The Mann-Whitney U test revealed statistically significant differences between the two groups, control and experimental, in digital competencies ($U = 592.000$; $Z = -7.518$; $p < .001$). With a p-value below the $\alpha = .05$ threshold, the null hypothesis is rejected and the alternative hypothesis retained. The obtained Z statistic reflects a considerable difference between both groups, supporting the statistical robustness of the study's findings.

Furthermore, the mean ranks of the experimental group consistently exceeded those of the control group across the entire distribution, indicating a shift toward higher percentiles attributable to the self-regulated learning intervention. This distributional behavior is consistent with a robust and favorable treatment effect. Since the Mann-Whitney U test does not assume normality or homogeneity of variances, it is suitable for analyzing data with distributions that do not meet these assumptions and with unequal sample sizes, conditions frequently encountered in quasi-experimental studies conducted in higher education.

Academic motivation partly explains why the experimental group achieved better results. The more motivated students not only engaged more deeply with their activities but also sustained that engagement when learning became demanding, which is where the real difference emerges. In this sense, self-regulated learning appears to have fostered not only the development of autonomous strategies but also a greater willingness among students to interact with digital tools and strengthen their technological competencies. Academic motivation thus helped explain how interest, effort, and student involvement positively influenced the achievement of higher digital competence levels within the experimental group.

Discussion

The data demonstrate that students who self-regulated their learning developed stronger digital competencies. Zimmerman (2002), Rodríguez et al. (2025), and Pinto et al. (2023) confirm this, asserting that in virtual contexts, planning, monitoring, and reflecting on one's own process changes how technologies are used, not just how frequently.

Motivation also accounts for part of this outcome. Urhahne and Wijnia (2023), as well as Usán and Castellanos (2024), argue that motivated students not only work harder but also make better choices about how to work, they activate self-regulated strategies they would otherwise not employ, and this is reflected in performance.

Observing that the control group remained at intermediate and basic levels confirms that access to digital tools does not itself produce competencies. Morgan, Sibson, and Jackson (2022) identified precisely this gap: students face technological demands for which they are not necessarily prepared, even when they have the devices.

Finally, the evidence also showed that digital competencies cannot be reduced to technical proficiency. Van Laar et al. (2020) and Vodă et al. (2022) argue that the critical, cognitive, and problem-solving components are equally important, and these components only develop when students learn autonomously and participate actively, not when they simply use a platform.

Conclusions

The research allowed for the conclusion that the self-regulated learning program did influence the development of students' digital competencies, as statistically confirmed through the Mann-Whitney U test with a

p-value below 0.05. The differences between the experimental and control groups were significant, leading to acceptance of the alternative hypothesis and rejection of the null hypothesis.

Furthermore, students in the experimental group achieved predominantly positive levels, with advanced levels prevailing within the established ranges, while those in the control group remained at intermediate and basic levels. This indicates what can be achieved by systematically working on planning, monitoring, and self-reflection strategies.

Among the dimensions evaluated, those that grew most in the experimental group were digital problem-solving and content creation. This result may be explained by the fact that both dimensions require a degree of autonomy, critical thinking, and decision-making capacity during the learning process. The self-regulated learning intervention provided students with tools to plan their actions, monitor difficulties, and adjust their strategies when facing more complex digital tasks. Thus, the increase in these areas demonstrates that self-regulation not only supports study organization but also fosters the development of digital skills related to content production and problem-solving within educational contexts.

Finally, academic motivation constituted an important factor in the results obtained. Students with higher motivation levels showed greater commitment, persistence, and participation during the intervention, which facilitated the development of fundamental aspects related to higher digital competence performance. This finding suggests that motivation should not be understood as a peripheral aspect but rather as a component that drives self-regulated learning by strengthening students' disposition to set goals, monitor progress, and sustain effort when faced with complex digital tasks.

References

Audrin, C., & Audrin, B. (2022). Key factors in digital literacy in learning and education: A systematic literature review using text mining. *Education and Information Technologies*, *27*(6), 7395–7419. https://doi.org/10.1007/s10639-021-10832-5

Balwan, A. K., Balwan, W. K., & Saba, N. (2022). Glance of research methodology for researchers: A logical assessment. *Scholars Bulletin*, *8*(3), 95–100. https://doi.org/10.36348/sb.2022.v08i03.004

Basilotta-Gómez-Pablos, V., Matarranz, M., Casado-Aranda, L.-A., & Otto, A. (2022). Teachers' digital competencies in higher education: A systematic literature review. *International Journal of Educational Technology in Higher Education*, *19*(1), 1. https://doi.org/10.1186/s41239-021-00312-8

Bin Abdulrahman, K. A., Alshehri, A. S., Alkhalifah, K. M., Alasiri, A., Aldayel, M. S., Alahmari, F. S., Alothman, A. M., & Alfadhel, M. A. (2023). The relationship between motivation and academic performance among medical students in Riyadh. *Cureus*, *15*(10), e46815. https://doi.org/10.7759/cureus.46815

Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2021). Emergency remote teaching in higher education: Mapping the first global online semester. *International Journal of Educational Technology in Higher Education*, *18*(1), 50. https://doi.org/10.1186/s41239-021-00282-x

Etikan, I., Musa, S., & Alkassim, R. (2015). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, *5*(1), 1–10. https://doi.org/10.11648/j.ajtas.20160501.11

Hayes, A. F., & Coutts, J. J. (2020). Use Omega rather than Cronbach's alpha for estimating reliability. *Communication Methods and Measures*, *14*(1), 1–24. https://doi.org/10.1080/19312458.2020.1718629

Kanyika, M. E., Sadykova, R., & Kosmyrza, Z. (2024). Digital literacy competencies among students in higher learning institutions in Kazakhstan. *Global Knowledge, Memory and Communication*. https://doi.org/10.1108/gkmc-04-2024-0224

Marcelo Quispe, R. C., & Santos Jiménez, O. C. (2023). Habilidades intelectuales y aprendizaje autorregulado relacionado a los logros de aprendizaje en estudiantes de la facultad de educación, Universidad Nacional Federico Villarreal–Lima. *IGobernanza*, *6*(21), 105–127. https://doi.org/10.47865/igob.vol6.n21.2023.235

Montgomery, D. C., & Runger, G. C. (2014). *Applied statistics and probability for engineers* (6ta ed.). John Wiley & Sons.

Morgan, A., Sibson, R., & Jackson, D. (2022). Digital demand and digital deficit: Conceptualising digital literacy and gauging proficiency among higher education students. *Journal of Higher Education Policy and Management*, *44*(3), 258–275. https://doi.org/10.1080/1360080x.2022.2030275

Pinto Santuber, C., Bravo Molina, M., Ortiz Salgado, R., Jiménez Gallegos, D., & Faouzi Nadim, T. (2023). Autorregulación del aprendizaje, motivación y competencias digitales en educación a distancia: Una

revisión sistemática. *Revista Mexicana de Investigación Educativa*, *28*(98), 965–986. https://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1405-66662023000300965

Rodríguez Vintimilla, A. C., Chicaiza Sinchi, D. L., Bayas Machado, R. F., & Tapia Arévalo, M. A. (2025). Estrategias para fomentar la autorregulación del aprendizaje en la educación a distancia. *Perspectivas Sociales y Administrativas*, *3*(1), 155–166. https://doi.org/10.61347/psa.v3i1.85

Sánchez Martín, M., Ponce Gea, A. I., Navarro-Mateu, F., Rubio-Aparicio, M., & Olmedo Moreno, E. M. (2024). Una aproximación práctica a los diseños de investigación cuantitativa. *Espiral. Cuadernos del Profesorado*, *17*(35). https://doi.org/10.25115/ecp.v17i35.9725

Suárez Zurita, E. L., Zurita Sacon, K. G., Dorado Ubidia, G. E., Alvarez Piza, R. A., & Flores Haro, A. E. (2026). Estrategias metacognitivas para fortalecer la autorregulación del aprendizaje en estudiantes con necesidades educativas especiales en Educación General Básica. *Perspectiva XXI*, *4*(1), 428–447. https://doi.org/10.70577/5c4rtw62

Tourón, J., Martín, D., Navarro, E., Pradas, S., & Íñigo, V. (2018). Validación de constructo de un instrumento para medir la competencia digital docente de los profesores (CDD). *Revista Española de Pedagogía*, *76*(269), 25–54. https://doi.org/10.22550/REP76-1-2018-02

Urhahne, D., & Wijnia, L. (2023). Theories of motivation in education: An integrative framework. *Educational Psychology Review*, *35*(2), 1–25. https://doi.org/10.1007/s10648-023-09767-9

Usán Supervía, P., & Castellanos Vega, R. (2024). Fomento de la motivación académica y la competencia digital de alumnado universitario a través del proyecto de innovación educativa "PracTICS". *Electronic Journal of Research in Education Psychology*, *22*(63), 419–440. https://doi.org/10.25115/ejrep.v22i63.9519

Van Laar, E., van Deursen, A. J. A. M., van Dijk, J. A. G. M., & de Haan, J. (2020). Measuring the levels of 21st-century digital skills among professionals working within the creative industries: A performance-based approach. *Poetics*, *81*, 101434. https://doi.org/10.1016/j.poetic.2020.101434

Vodă, A. I., Cautisanu, C., Grădinaru, C., Tănăsescu, C., & de Moraes, G. H. S. M. (2022). Exploring digital literacy skills in social sciences and humanities students. *Sustainability*, *14*(5), 2483. https://doi.org/10.3390/su14052483

World Medical Association. (2013). World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects. *JAMA*, *310*(20), 2191–2194. https://doi.org/10.1001/jama.2013.281053

Yi, W., & Siqian, W. (2025). Digital literacy education among students: Status, pathways, and implications in the current digital era. *International Journal of Education and Teaching Zone*, *4*(1), 66–85. https://doi.org/10.57092/ijetz.v4i1.385

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice*, *41*(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2

AUTHORSHIP CONTRIBUTION:

1. Conceptualization: Willams Mauro Carcagno Puma.
2. Data curation: Pamela Sevillanos Grajeda.
3. Formal analysis: Willams Mauro Carcagno Puma.
4. Funding acquisition: Candi Achahuanco Fuentes.
5. Research: Pamela Sevillanos Grajeda.
6. Methodology: Candi Achahuanco Fuentes.
7. Project administration: Willams Mauro Carcagno Puma.
8. Resources: Pamela Sevillanos Grajeda.
9. Software: Rocio Susana Sánchez Gómez.
10. Supervision: Yermy Puma Álvarez.
11. Validation: Rocio Susana Sánchez Gómez.
12. Visualization: Yermy Puma Álvarez.
13. Writing – original draft: Yermy Puma Álvarez.
14. Writing – proofreading and editing: Rocio Susana Sánchez Gómez.