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ORIGINAL PAPER

Empowering Teachers for the AI-GenAI Era: Predictors of Digital Competence in Curriculum Innovation

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Abstract

Artificial Intelligence (AI) and, more recently, Generative Artificial Intelligence (GenAI), have emerged as innovative technologies with strong potential for educational planning and the creation of learning resources. However, their effective integration into teaching requires teachers to demonstrate sufficient digital competence. This study aimed to analyze and compare teachers' self-assessment of their digital competence in the use of GenAI tools for curriculum planning, while considering the influence of different sociodemographic and professional variables. Specifically, the objectives were: (1) to determine teachers' self-perception of digital competence in using GenAI for curriculum planning, according to educational stage, and (2) to examine whether significant differences exist in digital competence across sex, type of territory, prior training in educational technology, and creativity in the development of educational content. A quantitative, ex post facto design was applied, using a non-probabilistic purposive sample of 502 in-service teachers from the Dominican Republic, covering early childhood, primary, secondary, and higher education. The data were collected using an instrument developed by the authors themselves, which measures self-perception in digital competence, based on the Technology Acceptance Model (TAM) framework. The findings revealed a medium–high level of perceived digital competence, with Early Childhood Education teachers achieving the highest scores. Significant differences were observed in relation to prior training and creativity, whereas no effect was found for territory. In higher education, sex differences emerged in favor of female teachers. These results highlight the importance of fostering continuous training and creativity-oriented strategies to enhance digital competence for GenAI-based curriculum innovation.

Keywords Digital competence · Generative artificial intelligence · Curriculum planning · Teachers · GenAI tools

Introduction

Artificial Intelligence (AI) has established itself today as one of the technological innovations with the greatest potential in the educational field (Almazán-López et al., 2024), by offering adapted pedagogical suggestions and personalized teaching resources in an efficient and contextualized manner (Holmes et al., 2023; Zawacki-Richter et al., 2019). In addition to the variety of possibilities that AI offers to the educational process, generative artificial intelligence (GenAI) tools have emerged as innovative applications that can produce new content in diverse formats, such as images, text, sound, and videos (Leong et al., 2023; Zhang, 2022). These technologies offer significant potential both for the creation and production of multimedia resources that can be used in the educational process (Chen & Wu, 2024), and for curriculum planning management (Acosta Faneite & Finol de Franco, 2024).

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Young (2014) states that "the concept 'curriculum' refers to the knowledge that it is hoped pupils will acquire by the end of a course. In contrast, pedagogy refers to the activities that teachers devise for their pupils to enable them to acquire the knowledge specified by the curriculum" (p.12). This does not separate the two concepts in teaching practice but rather highlights their interdependence in ensuring effective teaching geared toward achieving the expected learning outcomes. Scott (2007) points out that a curriculum can be structured in four broad dimensions: goals or objectives, content or subject matter, methods or procedures, and assessment. For the content or subject creation dimension, in-service teachers can use GenAI tools to generate personalized texts with writing tools such as ChatGPT, Gemini or COPILOT (Navío-Inglés et al., 2024), visual images to improve illustrations of the theoretical content of the curriculum with applications such as DALL-E 3 or Midjourney (Hutson & Lang, 2023), explanatory videos through platforms such as Synthesia, Pictory or HeyGen (Yu et al., 2024), and dynamic multimedia presentations using tools such as Prezi.AI, Beautiful.ai or Canva, all of them with AI-powered functions (Danesi, 2024).

However, this new scenario also poses important training challenges that require the development of new digital competence in AI and GenAI by teachers (Ng et al., 2023), as well as professional skills that allow them to use these tools with technological, pedagogical criteria and content knowledge (Hava & Babayiğit, 2025). In this context, Alotaibi and Alshehri (2023) emphasize that "it is essential for instructors to master the tools and understand their applications when adopting AI systems" (p. 15). Within this framework, Edwards et al. (2018) suggest that the teaching role may shift toward functions of supervision, design, and selection of machine-led instruction, as well as monitoring student learning and providing pedagogical support. Although their analysis was situated at an early stage of AI development, this approach remains conceptually applicable to the current landscape. Therefore, these functions require strong pedagogical and digital competence to integrate such technological agents into curriculum planning effectively. In this sense, Putman (2017) affirms that the term "competence" is understood as the ability to carry out a task by applying acquired knowledge in a systematic way, that is, "as mastery of specific learned sets of abilities needed to specialize and complete tasks" (Sanusi et al., 2022, p. 4). This raises the question of whether in-service teachers are sufficiently trained in pedagogical digital competence to integrate GenAI tools into curriculum planning?

From a psychological perspective, the concept of technological self-efficacy is particularly relevant, understood as an individual's belief in their ability to effectively use technological tools and resources in specific contexts (Bandura, 1977, 1986, 1997). Research has shown that self-efficacy significantly influences the adoption, use, and pedagogical integration of digital technologies, as it shapes motivation, persistence in the face of difficulties, and the willingness to experiment with new tools. Likewise, classical technology adoption models, such as the Technology Acceptance Model (Davis, 1989), have highlighted that perceptions of usefulness and ease of use influence the willingness to incorporate new technologies into professional practice. In the context of AI and GenAI, perceived digital competence depends not only on objective technical mastery but also on the extent to which teachers perceive themselves as capable of designing, adapting, and implementing these technologies in curriculum planning.

Furthermore, the acquisition and development of digital skills linked to the use of GenAI do not depend exclusively on the individual will of teachers, but could be conditioned by various individual and social variables. The scientific literature has identified factors such as the territory where the teacher resides (Pham et al., 2024), the level of technological infrastructure both in their environment and in the educational center (Archana, 2025, UNESCO, 2019), personal creativity to design learning resources (Kyslitsyn et al., 2025), continuous training in educational technology (Ruiz-Palmero et al., 2023). Among these variables, sex has received particular attention within the broader framework of the digital gender gap. Numerous studies have documented persistent differences in digital competence, technological self-efficacy, and the adoption of emerging technologies (Guillen-Gámez et al., 2020; Guillén-Gámez et al., 2024). Empirical research across diverse educational contexts shows that sex differences in digital literacy and digital skills remain a relevant concern, with male teachers often reporting higher levels of certain digital competence and use patterns than female teachers (Guillén-Gámez et al., 2025; Nurzhanova et al., 2024; Qazi et al., 2022). In the context of AI and generative AI (technologies that are rapidly reshaping educational planning and content production) examining potential sex differences becomes especially relevant.

Therefore, this study examines whether sex influences in-service teachers' competence in using GenAI for curriculum planning, as well as the role of territory, prior training, and creativity.

Related Works

Regarding teachers' digital competence in the use of AI across educational stages, the available scientific literature remains limited. Most existing studies have focused on preservice teachers, while few include in-service teachers. At the primary education stage, Saharuddin et al. (2025) analyzed the level of TPACK in teachers from Semporna (Malaysia) in relation to the application of AI in teaching, finding a high level of integration of this technology. Similar results were also evidenced by Arkorful et al. (2025) in a sample of 319 basic education teachers from Ghana. However, other studies have found contradictory results. Huong et al. (2025), with a sample of 129 primary school teachers in Vietnam, reported that they displayed low confidence in applying AI in their teaching. At the secondary education stage, Zalisman (2025) explored AI knowledge in 378 Indonesian teachers, finding a moderate to high level of understanding of AI concepts. In another similar study, Polak et al. (2022) explored the perspectives of 135 secondary school teachers in Bulgaria, Greece, Italy, and Romania on the teaching of digital skills related to AI. The authors found that, although teachers had a high level of digital skills, their level of skills related to AI was low, but they showed a positive attitude toward AI education and a high motivation to introduce related content in their classrooms. In higher education, Khalil and Alsenaidi (2024) identified, in a sample of 26 teachers from Oman, that there was a positive assessment of the relevance of AI competences, especially in relation to fundamental knowledge, the effective use of digital tools and the pedagogical integration of AI. However, teachers showed a low-intermediate level of AI literacy. In addition, Dringó-Horváth et al. (2025) assessed the competences of 1,103 higher education teachers in Hungary regarding the use of AI technologies for communication, collaboration, and online use, both in personal and professional contexts. Their results indicated that AI literacy levels were in the low-intermediate range.

On the other hand, scientific literature has investigated sex-related variations in teacher competences for many years, a topic that generates disparate findings. If we focus this context on teachers' digital competence in the use of AI, the literature remains limited. For example, Lucas et al. (2024) used a sample of 211 primary and secondary school teachers from Portugal to analyze the relationship between their confidence in using AI, their knowledge of AI, and their digital competence. The findings identified that confidence in using AI is independent of sex. With similar results, Estrada-Araoz et al. (2024) identified no differences in a sample of 55 active higher education teachers from Peru. Other similar studies described in the previous paragraph have also corroborated these results (Saharuddin et al., 2025).

However, Fakhar et al. (2024) found significant differences in a sample of 38 teachers from Morocco, in relation to their perspectives on the skills to integrate AI applications in teaching, in favor of the male teachers. In the same context, Yue et al. (2024) analyzed technological pedagogical content knowledge (TPACK) and attitudes toward AI teaching in a sample of 1,664 teachers from China. The findings showed no sex differences in the TPACK model, but there were differences in attitudes toward the use of AI, favoring males. Similar results in favor of the male teachers were also identified in the studies by Mouraz and Nobre (2024) and Arkorful et al. (2025), in the primary education stage. However, some studies have found contradictory results, with more favorable scores for female university faculty (Guillen-Gamez & Mayorga-Fernández, 2019). Although the scientific literature is beginning to offer studies related to this topic, there are still very few existing ones, and none that analyze these competences with the same psychometric instrument, and that identify and compare them at different educational stages at the same time (preschool, primary, secondary and university), which is a contribution to the science of this study.

In relation to the incidence of territorial variables that can affect the digital competence of teachers, various studies indicate that teachers in urban contexts generally have greater digital training than those who work in rural areas (Colomo-Magaña et al., 2025; Soriano-Alcántara et al., 2024a; Soriano-Alcántara et al., 2024b). However, specific research on the use of AI in this area is still limited. For example, Purnama et al. (2025) analyzed the preparation of 73 teachers from different educational stages for the use of AI, concluding that "urban teachers were more ready than rural teachers, largely because urban teachers have more access to training materials and technology than rural teachers" (p. 23). However, Portela et al. (2024) studied the implementation and impact of AI in rural and urban public schools in Brazil. The study included 8,238 schools where it was found that the integration of AI effectively supported the development of writing skills in both rural and urban students, with no significant differences between the two contexts. Despite these contributions, the few existing studies have not focused on analyzing in-service teachers' digital competence and the use of GenAI in curriculum planning, which represents one of the main contributions of this work.

Regarding teacher training, ElSayary (2023) developed a 10-week intervention program aimed at improving teachers' digital competence. The results showed that the proposal allowed not only the acquisition of knowledge and skills, but also the strengthening of more proactive attitudes toward ICT. Along the same lines, Reisoğlu (2022) demonstrated in a sample of 24 Turkish teachers that the implementation of a training course leads to progress in organizational communication and cooperation through the use of digital technologies. In this sense, the present study provides an advance over previous research, by focusing specifically on the analysis of teachers' digital competence linked to the use of GenAI, considering as a differentiating variable whether or not they have previously completed training programs in educational technology.

On the other hand, teachers' creativity in the design and production of teaching materials is a decisive factor in the development of their digital competence (Gualán et al., 2024; Guillén-Gámez et al., 2024). This creative process fosters mastery of competences associated with information searching, multimedia editing, and communication in digital environments, contributing to a more effective pedagogical integration of technologies. In this sense, the present study provides an advance over previous research by focusing specifically on the analysis of teachers' digital competence in the use of GenAI for curriculum planning, considering their level of creativity (high or low) in the creation of educational content as a differentiating variable.

In addition to research on digital competence, many studies on technology integration in education are based on the Technology Acceptance Model (TAM) (Davis, 1989; Venkatesh & Davis, 2000). This model explains how people decide to use new technologies, mainly through factors such as perceived usefulness, perceived ease of use, attitude toward use, and behavioural intention. In educational settings, TAM has been widely used to understand teachers' willingness to adopt digital tools, including AI-based applications (Ali et al., 2025). However, while TAM helps explain teachers' attitudes and intentions toward technology, it does not directly measure their practical pedagogical skills. For this reason, combining TAM-related variables with digital competence dimensions allows for a more complete understanding of both teachers' acceptance of GenAI tools and their actual professional preparedness to use them. This integrated framework informed the design of the instrument, although the present study analyses only the digital competence dimension, which captures teachers' practical readiness to use GenAI in curriculum planning.

Therefore, and considering the previous literature, this study seeks to advance this field of knowledge. Specifically, it focuses on examining how in-service teachers self-assess their digital competence in relation to the use of GenAI tools and how this competence varies depending on various personal and professional variables. Accordingly, the purposes of the study are the following:

1. To understand and compare teachers' self-perceived digital competence in using GenAI tools for curriculum planning, according to their educational stage.
2. Identify whether there are significant differences in the level of digital competence of teachers between the internal categories of the following variables (sex, type of territory, prior training in educational technology, and creativity in the creation of educational content).

Method

Design and Sample

A quantitative, non-experimental, ex post facto design was used, following the approach proposed by Khaldi (2017). Data collection was conducted anonymously using a form that guaranteed confidentiality and did not allow participants to be identified. The sample was intentional and non-probabilistic, as indicated by Etikan and Bala (2017), and was composed of in-service teachers from the Dominican Republic. Data collection took place during the first semester of the 2024/2025 academic year. The initial sample for the article published on the instrument's validation was 434 in-service teachers in the Dominican Republic. However, for this study, the sample was extended for a couple of months to broaden the scope of the data and, consequently, to better generalize the results. Therefore, the final sample included a total of 502 in-service teachers from the Dominican Republic. Table 1 shows the distribution of the sample in percentages, by sex-years of age, type of territory and training in previous courses in educational technology, according to each educational stage.

Instrument

The questionnaire consisted of 40 items organized into seven dimensions, following a causal model developed by the authors of the present study, that combines variables from the TAM model and digital teaching competence, which has been developed by the authors. The dimensions were: perceived usefulness (PU, 6 items), perceived ease of use (PEOU, 6), perceived enjoyment (PE, 6), self-efficacy (SE, 6), attitude toward use (AOU, 4), behavioral intention to use (BI, 6), and digital competence (DC, 6). All items were rated on a 7-point Likert scale (1 = strongly disagree; 7 = strongly agree).

Since the original study sample was expanded to include a larger number of participants, it was deemed necessary to re-examine the psychometric properties of the instrument. The causal model was evaluated using SmartPLS 4 software. Regarding the reliability of the instrument, adequate values were obtained, calculated using Cronbach's alpha coefficients and composite reliability. To analyze the validity, several indicators were considered: (1) the average variance extracted (AVE), whose values exceeded the threshold of 0.5, indicating adequate convergent validity; (2) discriminant validity, verified through the Fornell-Larcker criteria and the HTMT (Heterotrait-Monotrait Ratio of Correlations) index; (3) the cross-loadings analysis, which showed appropriate correlations between the items and their corresponding latent factors, parameters recommended by Hu and Bentler (1999), indicating a good model fit. Cronbach's alpha, composite reliability and AVE values are presented in Table 2, while the rest of the psychometric properties are not included here for reasons of space. The original version on the psychometric properties of the instrument can be found in (authors). Figure 1 shows the causal model with the expanded subject sample for this study.

Table 1 Sampling distribution

Sex	Female		Male	
	N (%)	Age	*N* (%)	Age
Early Childhood Education	98.4%	36.43 ± 7.10	1.60%	36.00 ± 4.24
Primary Education	76.9%	40.53 ± 8.57	23.1%	37.90 ± 7.62
Secondary Education	60.7%	38.66 ± 8.51	39.3%	39.22 ± 9.43
Higher Education	46.8%	47.40 ± 9.95	53.2%	45.95 ± 10.01
Territory	Urban		Rural	
	N (%)	Age	*N* (%)	Age
Early Childhood Education	49.6%	36.54 ± 7.68	50.4%	36.31 ± 6.44
Primary Education	52.2%	40.83 ± 8.32	47.8%	38.94 ± 8.46
Secondary Education	58.1%	38.76 ± 9.38	41.9%	39.04 ± 8.15
Higher Education	88.7%	47.39 ± 10.07	11.3%	40.64 ± 6.77
Training in courses in educational technology	No		Yes	
	N (%)	Age	*N* (%)	Age
Early Childhood Education	31.5%	36.00 ± 5.73	68.5%	36.62 ± 7.60
Primary Education	29.1%	41.67 ± 9.45	70.9%	39.21 ± 7.88
Secondary Education	26.5%	39.26 ± 10.22	73.5%	38.74 ± 8.36
Higher Education	23.4%	48.66 ± 10.58	76.6%	46.01 ± 9.75

Own elaboration

Table 2 Psychometric properties of the instrument

	PU	PEOU	PE	SE	AOU	BI	DC
Cronbach's alpha	.976	.962	.984	.963	.957	.983	.952
CR	.977	.965	.984	.968	.959	.984	.963
AVE	.891	.842	.984	.846	.885	.920	.807

Own elaboration

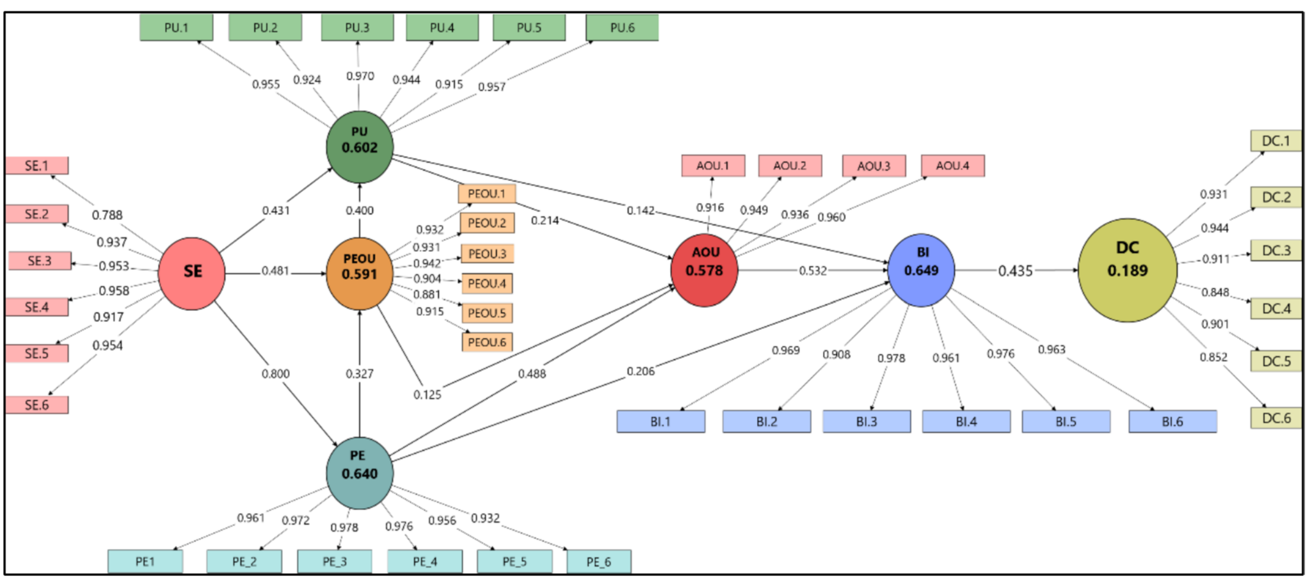

Fig. 1 Causal model of the instrument

Although the full model includes seven interrelated factors, the present study focuses exclusively on the digital teaching competence dimension associated with the use of GenAI tools in curriculum planning. This decision reflects a deliberate analytical focus. While the TAM-related factors (e.g., perceived usefulness, perceived ease of use, behavioral intention) capture attitudinal and acceptance-related mechanisms (Davis, 1989; Venkatesh & Davis, 2000), the primary objective of this study is to assess teachers' pedagogical preparedness to integrate GenAI into curriculum design. Therefore, digital competence is treated here as a central construct, directly linked to instructional practice and curriculum innovation, rather than as an outcome of technology acceptance processes. The remaining dimensions form part of a broader research framework examining the attitudinal and motivational pathways underlying GenAI adoption and will be addressed in complementary analyses.

Data Analysis Procedure and Techniques and Variables Analysed

The data analysis was carried out using the following procedures.

- To meet the first objective, a descriptive analysis of each of the items (estimated marginal means) was carried out for each educational stage.
- For the comparative contrast (second objective), different variables were used. The first variable to be analyzed was sex, which was included as a biological variable (female/male), as reported by participants. Given that the study did not assess socially constructed roles, identities, or expressions, the term 'sex' is used instead of 'gender. The second variable was the type of territory where the teacher taught, categorized as urban or rural environments. The third variable examined whether teachers had previously (in recent years) completed continuing education courses related to educational technology, categorized as yes/no. For the analysis of these three variables, non-parametric techniques (Mann–Whitney U test) were employed because the assumption of normality was not met. Normality was assessed using the Kolmogorov–Smirnov test, which yielded statistically significant results for all digital competence items and for the overall score ($p<.001$), indicating systematic deviations from normal distribution. Although the sample size was relatively large ($n=502$), the consistent violation of normality assumptions justified the use of non-parametric procedures to ensure more robust and conservative statistical inference. In cases where significant differences were found, the effect size (ES) was also calculated according to Hattie's (1992) criterion, based on Cohen's interpretation: values less than.1 indicate a "small effect", between.2 and.3 a "medium effect", and greater than.4 a "large effect". Related to the fourth variable (teacher's self-perceived level of creativity in the development of teaching content), a 10-point Likert scale was used, with 1 representing the "lowest level" and 10 representing the "highest level", and the Spearman correlation test was used.

Results

Self-perception of the Level of Digital Competence for Curriculum Planning with GenAI

Figure 2 shows the estimated marginal means by educational stage for each of the items assessing teachers' digital competence for planning with GenAI. Overall, the scores obtained by teachers at all educational stages are around 5 out of 7, indicating a medium–high level of perceived digital competence for planning with GenAI tools. Specifically, early childhood education teachers present the highest scores in most items, especially in item 5 (*skills to use GenAI applications on multimedia presentations*) and item 1 (*adaptation of AI tools to the area of knowledge*). In contrast, Primary and higher education teachers tend to score the lowest, particularly in Item 6 (use of GenAI applications for video editing). Item 4 (*skills in using GenAI applications for image editing*) represents the lowest score across all stages, although early childhood education still shows a slight advantage. In Item 3 (*use of academic writing applications*), scores remain very similar across the four stages. Finally, in the overall average of digital competence (*Global DC*), Early Childhood Education again ranks above the rest, while Secondary, Higher, and Primary education show similar values.

Statistical Contrast According to Sex, Territory, Previous Training in Technology and Creativity

Tables 3, 4, 5, and 6 show teachers' scores for each educational stage, based on sex, type of territory, prior training in educational technology, and level of creativity. Specifically, the measure of central tendency (arithmetic mean) is shown, as well as the effect size in cases where there were significant differences between groups.

In Table 1, no statistically significant differences were found in digital competence scores between male and female teachers in the stages of Early Childhood Education, Primary Education and Secondary Education. In the case of Higher Education, the results in Table 3 reveal significant differences between female and male teachers in all the items analyzed. Female teachers consistently report higher levels of digital competence for curriculum planning with GenAI. The most pronounced differences are observed in item 1 (*adapting and planning the use of these AI tools to the area of knowledge*), where female teachers reach a mean of 5.67 ± 1.67 compared to 4.77 ± 2.06 in male teachers (ES $=.42$), and in item 2 (*personalized learning planning*

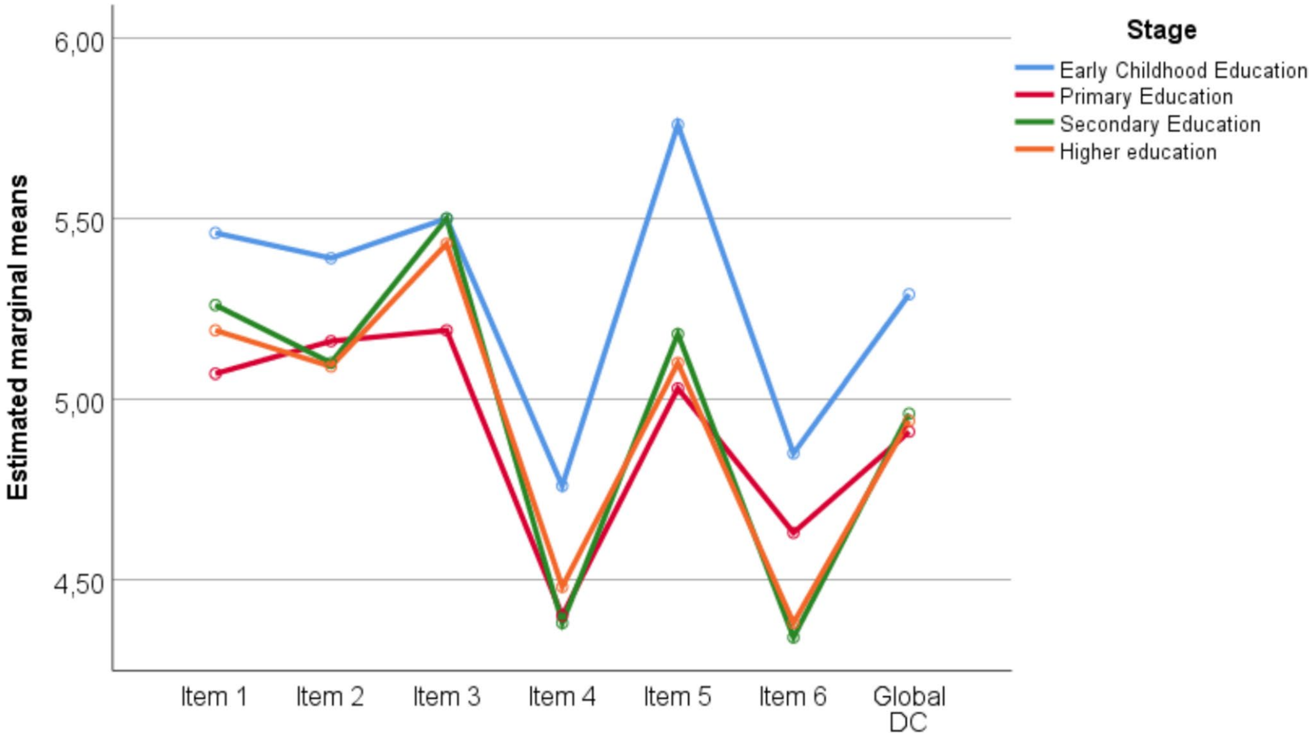

Fig. 2 Digital competence level for curriculum planning with GenAI

Table 3 Teachers' digital competence in the use of GenAI for sex-based curriculum planning

	Early childhood education			Primary education			Secondary education			Higher education		
Item	Female	Male	ES	Female	Male	ES	Female	Male	ES	Female	Male	ES
1	5.46	5.50	-	5.09	5.03	-	5.06	5.59	-	5.67	4.77	.42*
2	5.37	6.50	-	5.15	5.23	-	4.94	5.35	-	5.60	4.64	.45*
3	5.47	7.00	-	5.20	5.13	-	5.42	5.63	-	5.98	4.94	.42*
4	4.75	5.50	-	4.35	4.58	-	4.18	4.70	-	4.84	4.15	.34*
5	5.74	7.00	-	5.02	5.06	-	5.10	5.30	-	5.64	4.64	.42*
6	4.83	6.00	-	4.62	4.65	-	4.25	4.48	-	4.86	3.95	.43*
DC	5.27	6.25	-	4.90	4.95	-	4.83	5.17	-	5.43	4.52	.47*

*: there are significant differences; Significance level at 0.05

Table 4 Teachers' digital competence in the use of GenAI for curriculum planning according to the type of territory

	Early childhood education			Primary education			Secondary education			Higher education		
Item	Urban	Rural	ES	Urban	Rural	ES	Urban	Rural	ES	Urban	Rural	ES
1	5.35	5.58	-	5.19	4.95	-	5.21	5.35	-	5.21	5.07	-
2	5.25	5.52	-	5.24	5.08	-	5.04	5.18	-	5.12	4.86	-
3	5.43	5.56	-	5.19	5.19	-	5.47	5.55	-	5.48	5.00	-
4	4.73	4.80	-	4.70	4.08	-	4.32	4.47	-	4.44	4.79	-
5	5.59	5.92	-	4.94	5.13	-	5.18	5.18	-	5.15	4.79	-
6	4.75	4.95	-	4.77	4.47	-	4.29	4.41	-	4.38	4.36	-
DC	5.18	5.39	-	5.00	4.82	-	4.92	5.02	-	4.96	4.81	-

*: there are significant differences; Significance level at 0.05

Table 5 Teachers' digital competence in the use of GenAI for curriculum planning depending on whether or not teachers have taken prior training courses in technology

	Early childhood education			Primary education			Secondary education			Higher education		
Item	Not	Yes	ES	Not	Yes	ES	Not	Yes	ES	Not	Yes	ES
1	4.95	5.70	.31*	4.54	5.29	-	4.39	5.58	.63*	4.66	5.36	.37*
2	4.75	5.68	.41*	4.69	5.36*	.36	4.03	5.49	.75*	4.41	5.29	.45*
3	4.68	5.87	.56*	4.85	5.33	-	4.84	5.74	.42*	4.83	5.61	.37*
4	4.10	5.07	.49*	4.21	4.48	-	3.81	4.59	.34*	3.83	4.67	.34*
5	5.50	5.87	-	4.56	5.22	-	4.32	5.49	.53*	4.31	5.35	.49*
6	4.10	5.20	.50*	4.18	4.81	-	3.52	4.64	.49*	3.76	4.57	.33*
DC	4.68	5.57	.52*	4.50	5.08	-	4.15	5.26	.61*	4.30	5.14	.43*

*: there are significant differences; Significance level at 0.05

Table 6 Correlational results between the level of creativity and the digital skills of the teacher to create educational content

Educational stage of the teaching staff	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Total
Early Childhood Education	.494**	.447**	.373**	.524**	.427**	.533**	.552**
Primary Education	.483**	.584**	.541**	.468**	.404**	.451**	.521**
Secondary Education	.432**	.467**	.340**	.409**	.538**	.529**	.517**
Higher education	.401**	.433**	.361**	.512**	.450**	.509**	.510**

**. Correlation is significant at the 0.01 level (two-tailed)

according to students' levels and styles), with means of 5.60 ± 1.73 in female teachers compared to 4.64 ± 2.09 in male teachers (ES = .45). Also noteworthy are items 3 (*use of academic writing applications such as ChatGPT, Gemini or COPILOT*, M = 5.98 ± 1.48 vs. 4.94 ± 2.17; ES = .42) and 5 (*skills to plan the use of multimedia applications such as Gamma or CanvaAI*, M = 5.64 ± 1.83 vs. 4.64 ± 2.32; ES = .42), where the female teachers show a more advanced mastery in the use of technological tools applied to didactic design. The overall average of digital competence is also notably higher in females (M = 5.43 ± 1.55) compared to males (M = 4.52 ± 2.01), with a medium effect size (ES = .47), indicating a sustained difference across all dimensions measured. These data suggest that, at the university level, sex acts as a relevant differentiating factor in terms of teachers' digital preparation for planning the use of AI-based technologies.

Table 4 shows teachers' scores by territory type (urban or rural), indicating that it is not a significant differentiating factor in teachers' digital competences in using GenAI for curriculum planning. Scores are similar across all items, both in urban and rural contexts. This pattern is repeated across all stages, suggesting that teachers' geographic location does not influence their digital competency in planning with GenAI.

Table 5 analyses the differences in teachers' digital competence based on whether teachers have received prior training in educational technology. In general, teachers who have received training obtain higher scores on all items and educational stages, although the degree of significance varies. In the Early Childhood and Secondary Education stages, the differences are more marked and statistically significant in almost all items, especially in item 2 (*planning personalized activities*, ES = .41 and.75 respectively) and in the overall average of digital competence, where an effect size of.61 was reached in the Secondary Education stage. In contrast, in the Higher Education stage, significant differences were observed in all items and in overall digital competence. Items 2 (*personalization of learning*, ES = .45), 3 (use of academic writing applications, ES = .37), and 5 (multimedia presentations, ES = .49) stand out, indicating that lifelong learning is associated with a stronger development of digital competence at this educational level. However, at the Primary Education stage, there are hardly any significant differences in scores between teachers with and without training. Only item 2 (*personalization of learning with AI*, ES = .36) shows statistical significance, while the remaining items, as well as the overall average of digital competence, show no significant differences, suggesting that prior training may not be having such a clear impact at this stage.

Finally, to examine the influence of teachers' creativity on their digital competence for GenAI-based curriculum planning, Spearman's rank-order correlation was conducted, given the ordinal nature of the creativity variable. In addition, the coefficient of determination (R^2) was calculated to estimate the proportion of variance in digital competence associated with creativity (Field, 2009). Across all educational stages, statistically significant and positive correlations were observed between teachers' self-perceived creativity and each of the six digital competence items, as well as the overall competence score ($p < .01$). The magnitude of these associations ranged from moderate to moderately high.

Table 6 shows the correlational results. In Early Childhood Education, correlations ranged from R = .373 (Item 3- plan the use of academic writing tools such as ChatGPT, COPILOT, GEMINI in the teaching–learning process) to R = .533 (Item 6-use of video editing tools), with the overall digital competence score reaching R = .552. This indicates that approximately 30.5% of the variance in overall digital competence (R^2 = .305) is associated with teachers' creativity at this stage. In Primary Education, correlations were similarly robust, ranging from R = .404 (Item 5- use of multimedia presentation tools) to R = .584 (Item 2- ability to use GenAI tools for personalized learning planning). The strongest association was observed for Item 2, where creativity explained approximately 34.1% of the variance (R^2 = .341). The overall competence score showed a correlation of R = .521 (R^2 = .271). In Secondary Education, correlation coefficients ranged between R = .340 (Item 3) and R = .538 (Item 5). Particularly noteworthy were Items 5 and 6, with R^2 values exceeding.28, suggesting that creativity plays a relevant role in technologically demanding instructional tasks. The total digital competence score correlated at R = .517 (R^2 = .267). Finally, in Higher Education, correlations ranged from R = .361 (Item 3) to R = .512 (Item 4- photography tools with AI), with the overall competence score reaching R = .510 (R^2 = .260). These findings indicate that approximately 26% of the variance in university teachers' digital competence for GenAI curriculum planning is associated with their perceived creativity.

Discussion

The emergence of GenAI tools has opened up new possibilities for the creation of educational resources and curriculum planning, as these applications allow the generation of text, images, videos or presentations with high pedagogical potential (Chen & Wu, 2024; Zhang, 2022). However, as Ng et al. (2023) and Hava and Babayiğit (2025) warn, the effectiveness of these technologies in teaching–learning processes depends largely on the digital competence of in-service teachers, which is essential for selecting, adapting, and integrating these tools within a solid pedagogical framework. Accordingly, this study aimed to examine whether teachers had sufficient digital competence to use GenAI tools in curriculum planning based on the educational stage in which they teach, and to compare whether significant differences exist in this level of competence according to variables such as sex, type of territory, prior training in educational technology, and creativity in content development.

Focusing on the level of digital competence as self-perceived by teachers at each educational stage (O1), this study identified that teachers demonstrate a moderate to high level of digital competence at all levels. In Primary Education, the results corroborate the findings of Saharuddin et al. (2025) and Arkorful et al. (2025), although contradictory to those of Huong et al. (2025). In Secondary Education, the data coincide with those obtained by Zalisman et al. (2025) and differ from those reported by Polak et al. (2022). In the case of Higher Education, the findings partially align with Khalil and Alsenaidi (2024) and Dringó-Horváth et al. (2025), who reported intermediate-low levels of digital literacy in AI. In comparative terms, this study highlights that early childhood education teachers perceive greater digital competence in using GenAI tools for curriculum planning compared to their colleagues in other stages. This result partially coincides with previous research that points to a greater predisposition to innovation and methodological flexibility in the initial levels of schooling (Arkorful et al., 2025; Saharuddin et al., 2025). However, our findings differ from other works (Huong et al., 2025), since we have found that primary school teachers have lower skills in using GenAI compared to preschool teachers, which reinforces the need to explore in future research what training, institutional or cultural factors explain these differences. Plausible explanations may be related to these findings. Firstly, the early childhood education stage is characterised by strong methodological flexibility and an orientation towards playful and creative approaches, which could fit with the potential of generative tools to produce visual, narrative or audiovisual resources adapted to the needs of students (Saharuddin et al., 2025). A second explanation could be due to less pressure from teachers at this stage for curricular standardization and greater freedom to experiment with innovative resources, which could foster more positive attitudes toward technological integration. On the other hand, at higher levels, the weight of disciplinary content, standardized assessment, and academic demands could tend to create a more rigid framework, where teachers' experimentation with emerging technologies may be limited. Another plausible reason could be related to the heavy curriculum load faced by teachers in higher education, which limits the time available for pedagogical innovation and the creation of ICT-based materials. This limited time reduces opportunities for experimentation with GenAI and, consequently, their self-perception of digital competence, an issue that warrants further investigation in future research.

Regarding the second objective (O2), the results were analyzed considering each of the variables included in the study. Regarding sex, significant differences were identified at the higher education level, favouring female faculty. This finding provides a differentiating nuance to previous literature, where some studies did not show sex differences in AI literacy (Estrada-Araoz et al., 2024; Lucas et al., 2024), while others found better competence in male teachers (Fakhar et al., 2024; Yue et al., 2024). Instead of interpreting this result as a direct consequence of sex, it is more appropriate to understand it within the specific university context. In this study, digital competence refers to the pedagogical use of GenAI tools for curriculum planning, not simply to general knowledge about AI. Previous research has shown that differences in digital competence are often related to factors such as technological self-efficacy (Bandura, 1997) and teachers' pedagogical orientation toward technology (Guillen-Gamez et al., 2020; Lucas et al., 2024). Therefore, when technology is clearly connected to instructional design and teaching practice, patterns of self-perceived competence may differ from those found in studies focused only on technical AI knowledge. Although the sex distribution in the Higher Education group was relatively balanced, this study did not collect detailed information about the type or intensity of professional development activities (frequency, duration, intensity or content of the activities). For this reason, the results should be interpreted as a contextual difference in self-perceived competence, rather than as evidence of structural or training-related inequalities. At the same time, these findings open new questions about how motivational and self-perception factors influence the adoption of GenAI tools in university teaching.

Regarding the territory variable, the results of this study do not show significant differences between teachers from urban and rural contexts, which contrasts with previous research that did point out inequalities based on place of residence (Colomo-Magaña et al., 2025; Soriano-Alcántara et al., 2024a). A plausible explanation for this homogeneity could be the increasing access to training programs and technological resources in rural areas of the Dominican Republic, which has contributed to reducing traditional gaps. This approach is consistent with recent evidence highlighting the role of AI in promoting greater digital equity across diverse contexts (Portela et al., 2024).

The third predictor analyzed, and at the same time one of the most consistent in relation to digital competence for using GenAI, was prior teacher training. This result confirms the importance of ongoing and permanent training programs, showing that those who have participated in them demonstrate a significantly higher level of digital competence. Consequently, the need to promote training proposals that integrate both the technical and pedagogical components in the use of these technologies is reinforced (ElSayary, 2023; Reisoğlu, 2022; Ruiz-Palmero et al., 2023).

Finally, creativity was identified as a decisive factor in the development of digital competence for the design of educational materials. Previous research had already highlighted this relationship (Gualán et al., 2024; Guillén-Gámez et al., 2024), indicating that creativity enhances teachers' ability to meaningfully integrate technologies. Within the framework of this study, the results confirm that teachers with greater creativity perceive a greater mastery in the use of generative tools, which coincides with authors who link pedagogical innovation with technological experimentation (Hava & Babayiğit, 2025; Ng et al., 2023).

Conclusions, Limits and Future Work

This study provides significant evidence on the level of digital teaching competence in the Dominican Republic regarding the use of GenAI tools for curriculum planning, considering both academic and sociodemographic variables. In addition to describing competence levels, the study helps identify significant predictors that explain the differences found in teachers' scores across the analyzed educational stages. The findings highlight the following: (1) key factors linked to educational stage and teacher creativity directly influence digital competence; (2) prior teacher training is confirmed as a strong predictor, reinforcing the importance of designing specific training programs focused on GenAI; and (3) at the higher education level, sex differences are identified that require further analysis in future research.

However, the findings of this study come with several limitations that are important to consider. A primary limitation of the study is the use of non-probability sampling, which reduces the generalizability of the results to other educational contexts. In this regard, future research should incorporate larger and more balanced samples that proportionally include teachers from Early Childhood, Primary, Secondary, and Higher Education, as well as diverse professional profiles, such as teachers with varying seniority, subject specializations, levels of digital competence, types of contracts (temporary, tenured, contracted), and institutional contexts (public, private, or subsidized schools). This would improve representativeness and facilitate more robust comparative analyses.

Secondly, the data are based on self-perception questionnaires, which may introduce biases in the responses, particularly in the overestimation or underestimation of digital competence. Therefore, future research should complement these measures with more objective assessments, such as performance tests, analyses of practical tasks, digital portfolios, or even classroom observations, in order to compare teachers' perceptions with their actual performance. This future research could also incorporate mixed methods designs, not only through classroom observations, but also through focus groups or oral interviews with teachers from the different profiles analyzed.

A third, highly relevant limitation is the gender imbalance among teachers in the Early Childhood Education stage, where the majority were female. While this distribution reflects the professional reality of this stage, it hinders robust comparisons between groups. Therefore, future studies should attempt to balance this variable or, at least, incorporate designs that allow for a more precise analysis of these differences. Furthermore, it would be advisable to include gender-related variables from a broader sociocultural perspective, capturing identity and contextual factors that may influence the perception and use of technology.

A fourth limitation relates to the way the questionnaire was designed, as the study uses global and simplified measures of key variables such as prior technology training, considered only dichotomously (yes/no). Therefore, future research should analyze teacher training in greater depth, considering aspects such as duration, modality (face-to-face, online, or hybrid), training intensity, level of specialization in generative artificial intelligence, and certifications obtained. This more detailed analysis would allow for a better understanding of how training contributes to the development of teachers' digital competence. Finally, while the study identifies differences in digital competence according to educational stage and within the context of higher education, it does not delve into the underlying causes of these differences. Therefore, future research should explore in greater detail factors such as curricular flexibility, teaching load, the methodological culture of each stage, and motivational factors. Likewise, within the university setting, it would be relevant to analyze the differences observed among faculty members using objective indicators of professional development and working conditions.

Theoretical and Practical Implications of the Study

The results of this study have important theoretical and practical implications for the development of educational policies and teacher training in the use of GenAI tools. In the field of instructional design, it is evident that the use of GenAI tools does not depend solely on the technical proficiency associated with digital teaching competence. It is also influenced by variables such as prior training and creativity. In particular, prior training shows a significant influence at various educational stages, although with varying intensity depending on the level, while creativity has a significant influence at all educational stages. Based on these findings, it is suggested that instructional design models evolve toward more flexible approaches. GenAI tools should not be used solely for automating tasks such as content generation. They should also be integrated for developing multimodal resources, adapting curricula, and personalizing learning. Consequently, the teacher's role is strengthened. More active participation is required in the selection, review, adaptation, and validation of resources generated using GenAI tools. These functions must be linked to pedagogical decision-making processes and instructional design. From an educational technology perspective, the need to review teacher training strategies becomes clear. The proposal is to move from an approach focused on the instrumental use of tools to a more comprehensive model, geared towards the pedagogical integration of GenAI tools. Furthermore, the relationship between digital competence and creativity is confirmed. This result suggests that teacher training programs should incorporate environments that foster critical thinking, experimentation, and innovation in the use of emerging technologies. In this way, creativity emerges as a key element in the development of teachers' digital competence.

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Declarations

Conflicts of interest All authors have accepted the submission of the article to the Journal, accepting the issuance of rights.

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