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Artificial intelligence in higher education: Ethical and pedagogical challenges and the role of public policies

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Abstract

This article examines AI use in early and primary education, identifying ethical and pedagogical challenges for equitable policies. It also highlights research gaps on how technologies such as chatbots worsen educational inequalities, especially across gender and socioeconomic contexts and emphasizes the need for regulations ensuring responsible AI use. This is a non-experimental, cross-sectional, ex post facto quantitative study. The sample consisted of 252 university students with a margin of error of 3.21%. A 45-item questionnaire focused on chatbots was used to assess knowledge, use, and perceptions of AI. McDonald's omega reliability coefficient was above 0.82 across all four dimensions. Descriptive, correlational, and inferential analyses were conducted using IBM SPSS v26. Results indicate that students perceive chatbots as useful for organising ideas and retrieving information although concerns exist about overreliance. Significant gender and degree programme differences were found ($p < 0.05$ and $d > 0.4$) with male primary education students showing greater familiarity with and use of AI. This familiarity positively correlates with improvements in idea organisation suggesting an impact on academic performance. The conclusions call for equitable public policies and adequate teacher training to prevent AI from deepening educational inequalities, especially among women and students from vulnerable backgrounds.

Keywords: Artificial intelligence, Early childhood education, Gender differences, Higher education, Primary education, Public policies.

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Contents

Contribution of this paper to the literature
This paper looks at the AI use of a specific population (future teachers of early childhood and primary students), a population not previously studied. It identifies differences in the use of AI based on gender, age, and familiarity, indicating an urgent need to integrate these technologies effectively into initial teacher education.

1. Introduction

1.1. Artificial Intelligence and Higher Education

Recently, artificial intelligence (AI) has emerged as a universal and constantly evolving tool, whose use has increased significantly impacting various sectors of society (Crompton & Burke, 2023; García-Peña, Mora-Marcillo, & Ávila-Ramírez, 2020; Lund et al., 2023). This growth has been strongly influenced by national policies and administrative processes making AI a current and highly relevant topic of study within the field of education (Moreno, 2019). In this context, AI referred to as Artificial Intelligence in Education (AIEd) has gained particular prominence, especially in higher education (Crompton & Burke, 2023; Liang, Hwang, Chen, & Darmawansah, 2023) where it is recognised for its role in digital literacy and its endorsement by international bodies such as the United Nations and the Beijing Consensus in 2019 (Ayuso del Puerto & Gutiérrez Esteban, 2022).

Universities are encouraged to adopt a proactive approach to the regulation and ethical use of AI ensuring that its implementation enhances educational processes while upholding core principles such as equity and academic integrity (Fuenmayor, 2024). The emergence of AI should not be regarded as a threat but rather as a potential field of study, a practical tool, an enabler of new learning strategies (Fernández-Ferrer, 2023; Firestone & Scholl, 2016) and a generator of new questions for educational research.

1.2. Challenges of Public Policies on AI in Higher Education

The growing use of AI in education underscores the need to adopt an ethical and equitable approach to maximise its benefits without exacerbating existing inequalities. Ignoring the ways in which students utilise AI within the university context risks contributing to the misuse of this technological tool. AI holds considerable potential to transform educational processes yet its successful implementation depends on a robust regulatory framework that ensures its responsible use (McGuire & Perna, 2023). Public policy should focus on bridging the digital divide as evidenced by a study conducted across 18 educational institutions in Andalusia which highlights the importance of a reflective and participatory approach to digitalisation (Llorent-Vaquero, De Pablos-Pons, & Velez, 2024).

Effective collaboration among educational stakeholders and appropriate planning are essential to prevent AI from perpetuating or amplifying pre-existing inequalities (Center on Reinventing Public Education (CRPE), 2024; National Academies of Sciences, 2022). Strong leadership and policies are required to guide the ethical and context-sensitive integration of AI according to educational level, thereby optimising its benefits and mitigating associated risks (Delgado, Carrasco, de la Maza, & Etxabe-Urbieta, 2024). The lack of clear guidelines regarding AI use as noted by 276 teachers, indicates that students and lecturers are exposed to risks, turning its implementation into an uncontrolled experiment that demands stricter regulation (Knight et al., 2023). The incorporation of AI in education has driven the need to establish policies that ensure equitable access to technology and foster the development of critical skills, such as analytical thinking and the ability to discern reliable information in digital environments (Gabriel, Marrone, Van Sebille, Kovanovic, & de Laat, 2022).

1.3. Chatbots and ChatGPT in Higher Education

The use of chatbots, a popular AI tool has increased significantly in higher education over the past two years. It facilitates access to information and provides personalised feedback, thereby enhancing student motivation (Pérez & Robador-Papich, 2023). ChatGPT is an advanced chatbot that employs a large language model to understand and respond in natural language. Unlike traditional chatbots, ChatGPT draws on a wide range of real-time data sources, making it a versatile tool for higher education by offering interactions tailored to individual needs (Lund et al., 2023; Shorey, Mattar, Pereira, & Choolani, 2024).

However, its use also presents challenges, including the risk of diminishing creativity and critical thinking, as well as concerns regarding plagiarism and over-reliance on AI (Niloy et al., 2024). Institutions such as Cornell University and Stanford University have integrated ChatGPT with positive outcomes, improving writing quality and supporting academic assessment despite these risks (Pérez & Robador-Papich, 2023). The potential of ChatGPT to enhance personalised teaching and reduce teachers' workload is undeniable although its implementation must be carefully assessed to safeguard essential skills such as critical thinking (Moulaison-Sandy, 2023).

A study conducted with university lecturers revealed that 85% of participants believed AI could significantly transform pedagogical practices, particularly in the personalisation of teaching and the provision of immediate feedback to students (Costa-Júnior et al., 2024). In universities across Latin America, 72% of lecturers already use AI tools for preparing educational materials and delivering virtual instruction, highlighting its positive impact on personalised learning and the optimisation of teachers' time (Fuenmayor, 2024).

1.4. Ethical and Pedagogical Challenges in AI Integration in Higher Education

Integrating AI into higher education presents pressing pedagogical and ethical challenges. In pedagogical terms, it is vital to equip teachers with digital skills to ensure an appropriate use of AI that complements rather than replaces, the active role of the teacher. Educational policies should prioritise teacher training and create clear strategies to inclusively integrate technologies such as ChatGPT with school leadership playing a crucial role in resource distribution (De la Riva, 2024; Zhou, Shen, & Chen, 2024). Currently, the National Institute of Standards and Technology (NIST) in the U.S. is developing a risk management framework to better address the risks that AI poses to individuals, organisations and society. This framework aims to foster innovative approaches that address

reliability characteristics such as accuracy, explainability, privacy, security and the mitigation of unintended biases (National Institute of Standards and Technology (NIST), 2022).

Ethics and equity are the main concerns surrounding AI use as the automation of complex tasks may erode key academic competencies and impact educational equity. Female students are more reluctant to use AI highlighting the need for a strong regulatory framework and adequate training to prevent AI from undermining educational goals than their male counterparts (Cornejo-Plaza & Cippitani, 2023; Yan, 2023).

This study aims to analyse the use of AI among early childhood and primary education students at the University of Seville to identify ethical and pedagogical challenges that could guide equitable public policies keeping these considerations in mind. The research question is as follows: How can public policies ensure equitable and effective use of AI in the context of higher education taking into account students' varying levels of knowledge, experience, and perception? To address this question, four working hypotheses have been established.

H_1: Students in early childhood and primary education at the University of Seville possess limited knowledge of AI, acquired independently and after entering the university.

H_2: These students have limited experience with chatbots and perceive them as inaccessible tools although they acknowledge their usefulness in facilitating tasks within the teaching–learning process.

H_3: Students' perceptions of the benefits of using chatbots for organising ideas and seeking information positively correlate with the frequent use of these tools.

H_4: Students' perceptions of chatbots vary significantly depending on their degree programme and gender.

2. Method

This study follows a non-experimental, quantitative methodological design with a cross-sectional, exploratory, and ex post facto approach. It is a descriptive, correlational, and inferential study.

2.1. Participants

According to the Statistical Yearbook of the University of Seville for the 2022/2023 academic year (2023), the total population of early childhood education (718) and primary education (2282) students are 3,000. The final sample comprised 252 students from the Faculty of Education Sciences enrolled in early childhood and primary education degree programmes, representing a sampling error of 3.21% at the 95% confidence level. The sample was selected through a non-probabilistic convenience sampling method.

Among the participants, 90.1% were identified as female. 9.9% were identified as male with ages ranging from 18 to 35 years. Additionally, 55.6% were enrolled in primary education and 44.4% in early childhood education.

2.2. Data Collection Procedure

Data were collected through a survey technique using an ad hoc structured questionnaire administered without the direct presence of the researcher. The questionnaire gathered information regarding the frequency and use of chatbots as well as their implications for the teaching and learning process of future early childhood and primary education teachers. It was developed using Google Forms validated through expert judgement and distributed through platforms such as Blackboard, Gmail and QR codes. The distribution occurred after prior contact with professors from various departments across both degree programmes.

2.2.1. Instrument Design

The instrument's design was based on a specification table outlining the dimensions, constructs, and items for developing the ad hoc questionnaire. The questionnaire aimed to capture the perceptions of early childhood and primary education students regarding the use of chatbots. It comprises 45 items distributed across the following four dimensions: familiarity with AI, chatbots usage, AI training and knowledge of chatbots functionality. Responses followed a four-point Likert scale (1: none, 2: little, 3: quite a lot and 4: a lot). Additionally, sociodemographic information such as age, gender, degree programme, and participants' level of education was collected.

2.2.2. Instrument Validation

A pilot test was first conducted with seven students after which the number of items was reduced to 44, and the formats of some items were revised to validate the questionnaire. The questionnaire underwent expert validation to assess internal coherence, sequencing, clarity, and item length. It was reviewed by five professors from the University of Seville from the departments of Didactics and Educational Organisation, and Educational Research Methods and Diagnostics. A new item was added and orthographic and syntactic corrections were made based on their feedback.

For reliability analysis, McDonald's omega coefficient was chosen. Cronbach's alpha was not used for the three key reasons outlined in the scientific literature (Ventura-León & Caycho-Rodríguez, 2017): a) it is affected by the number of items (more items result in higher reliability). b) It is influenced by the number of variable values (more values increase reliability, while fewer decrease it). c) It is designed for continuous variables whereas this study uses ordinal variables. McDonald's Omega addresses these limitations by not being affected by the number of items or variable values and by working with ordinal variables. The results indicated high internal consistency across the four dimensions of the instrument with omega values of 0.82 (familiarity with AI), 0.92 (AI training), 0.85 (knowledge of chatbot functionality), and 0.94 (chatbot usage).

2.2.3. Final Instrument Design

The final version of the instrument was developed with the input of the improvement suggestions provided by the expert reviewers. It is a structured ad hoc questionnaire encompassing four dimensions (see Table 1) aimed at understanding the surveyed students' perceptions of chatbot usage.

Table 1. Dimensions of the ad hoc questionnaire.

Dimensions	Items
Approach to AI	1-15
Training in AI	16-28
Understanding of chatbot functionality	29-35
Use of the chatbots	36-45

The final instrument (see Appendix 1) comprises 45 statements. The participants are required to indicate their level of agreement via the proposed Likert scale.

2.3. Data Analysis Procedure

The data were analysed using IBM SPSS Statistics v.26. Descriptive, correlational, and inferential analyses were conducted. The descriptive analysis highlighted trends in the responses. Relationships between variables were assessed using correlational analyses, specifically Spearman's rank–order correlation (for ordinal variables) and contingency coefficients (for nominal variables). In addition, the Mann–Whitney U test was applied for inferential analyses to identify significant differences in chatbot usage according to sociodemographic variables (gender and degree programme). The effect size was calculated using Cohen's d.

2.4. Study Variables

The independent variables in the study are gender, degree programme, age, and academic year. The dependent variables include the level of knowledge and training in AI, previous experience with and use of chatbots, the accessibility and usefulness of chatbots, the impact of chatbots on performing specific academic tasks, familiarity with AI tools, and perceptions of the advantages and disadvantages of using chatbots in education.

2.5. Ethical Considerations

Regarding ethical considerations, participants' anonymity and informed consent for voluntary participation were guaranteed with data confidentiality, with information being used exclusively for academic purposes within this study. The research adhered to the ethical principles outlined by the Research Ethics Committee of the University of Seville (Spain) in April 2024 by Spanish Law 3/2018 on the Protection of Personal Data.

3. Results

The results are presented according to the study's hypotheses. The first two hypotheses were addressed through descriptive analyses. Concerning H_1, Table 2 shows the results indicating limited knowledge of AI among early childhood and primary education students (M=2.46) with participants demonstrating minimal familiarity with this tool without significant variation (SD=0.658). The respondents reported limited autonomous knowledge acquisition concerning AI (63.1%) after starting their university studies (70.2%). Notably, over half of the participants (55.7%) were unaware of the theoretical foundations of AI.

Only 25% reported having substantial knowledge of the various types of AI whereas two out of three students recognised they had limited or no knowledge. The most well-known chatbot was ChatGPT (60.7%) whereas the least familiar was perplexity (9.27%). Ambiguous perceptions were most pronounced for ChatBing with a high degree of deviation (SD=0.975).

Table 2. Approach to artificial intelligence (AI).

Descriptive statistics (%)						
Items	**None**	**Little**	**Considerable**	**A lot**	***X***	**S.D.**
p1	2.8	54.8	36.1	6.3	2.46	0.658
p2	25.0	63.1	25.0	11.9	2.24	0.961
p4	25.0	42.1	25.8	7.1	2.15	0.880
p5	1.6	10.1	27.5	60.7	3.47	0.742
p6	73.7	10.1	6.9	9.3	1.52	0.975
p7	88.3	8.1	1.6	2.0	1.17	0.547
p8	76.9	9.7	6.1	7.3	1.44	0.899
p9	92.7	4.5	1.2	1.6	1.12	0.475
p15	70.2	16.3	9.5	4.0	1.47	0.825

Concerning H_2, Table 3 shows that experience with the use of chatbots in education is not high as most participants (73.3%) reported little or no prior experience with AI educational tools. Although 36.5% of the participants considered chatbots to somewhat facilitate task completion and 22.2% thought they were very helpful, only approximately one in ten participants believed that chatbots significantly aided them in passing their courses. Additionally, 38.9% found chatbots less accessible than other learning tools with accessibility significantly influenced by the level of technological skill.

The level of knowledge about how chatbots function varies (SD>0.9) with a marked lack of understanding in 11.5% of the respondents. This lack of knowledge, concentrated in the none and little categories is evident in the formulation of prompts for the chatbot (60.7%), the understanding of how chatbot responses are generated (63%), and the process of improving comprehension and response production (80.2%) with high standard deviations close to or exceeding 1.

Table 3. Experience of using chatbots in the educational field.

Descriptive statistics (%)						
Items	**None**	**Little**	**Considerable**	**A lot**	***X***	**S.D.**
p12	13.5	27.8	36.5	22.2	2.67	0.968
p13	11.9	38.9	31.0	16.3	2.53	0.910
p14	11.9	38.9	31.0	16.3	1.98	0.892
p35	15.5	29.0	37.70	17.9	2.58	0.956
p37	38.5	32.9	19.4	9.1	2.30	0.968

Concerning the usefulness of chatbots in the teaching–learning process (see Table 4), perceptions vary (SD=0.968) with most indicating that chatbots contribute little (34.5%) or somewhat (29.4%). However, despite being considered a moderately or highly effective academic support tool for completing various tasks (69%), only 8.7% believed that chatbots significantly improve their search capabilities. Moreover, 36.9% highlighted benefits in specific tasks, such as organising information or generating ideas. Finally, almost half of the sample (48%) considered that the chatbot does not fully replace interaction with a teacher and that AI has had little influence on their teaching–learning process.

Table 4. Knowledge of how chatbots work and their usefulness in the teaching–learning process.

Descriptive statistics (%)						
Items	**None**	**Little**	**Considerable**	**A lot**	***X***	**S.D.**
p29	27.0	32.1	29.4	11.5	2.25	0.981
p30	11.5	19.4	44.4	24.6	2.82	0.934
p31	33.7	27.0	28.2	11.1	2.17	1.020
p32	31.3	31.7	25.8	11.1	2.17	0 .996
p33	51.2	29.0	12.70	7.1	1.76	0 .932
p37	38.5	32.9	19.4	9.1	2.30	0.968
p41	22.6	35.7	32.9	8.7	2.28	0.912
p42	19.4	27.4	36.9	16.3	2.50	0.984
p43	28.5	32.5	23.4	6.0	1.97	0.927

To address H_s, correlational analyses were performed. The results obtained through Spearman's coefficient provide significant evidence (see Table 5). First, there is a strong and positive correlation (r_s coefficients between .707 and .823) based on Bisquerra (2009) between the perception of the benefits of using chatbots and the frequency of use of these tools. This finding indicates that students who perceive greater benefits from chatbots in their university education tend to use them more frequently. For example, those who have learnt more about the advantages of chatbots also report learning about their disadvantages through experience (r_s=.706) using the chatbot independently (r_s=.704). This relationship suggests that experience in using chatbots, particularly independently is closely linked to the perception of their benefits. Moreover, students who use chatbots more frequently in their learning process also tend to train the chatbot to improve its response (r_s=.86), perceive greater benefits from its use (r_s=.707) and believe that the chatbot helps them pass their courses (r_s=.748). Additionally, there is a strong tendency for students who find chatbots useful for specific tasks to also perceive benefits in their learning process (r_s=.710) and in their ability to search for and analyse information (r_s=.744).

Table 5. Spearman correlation coefficient results (r_s).

Items			**p22**	**p23**	**p25**	**p26**	**p27**
Spearman´s Rho	p22	r_s Coeff.	--				
		Sig. (two-tailed)	.				
		N	252				
	p23	r_s Coeff.	0.664**	--			
		Sig. (two-tailed)	<0.001	.			
		N	252	252			
	p25	r_s Coeff.	0.688**	0.777**	--		
		Sig. (two-tailed)	<0.001	<0.001	.		
		N	252	252	252		
	p26	r_s Coeff.	0.608**	0.639**	0.780**	--	
		Sig. (two-tailed)	<0.001	<0.001	<0.001	.	
		N	247	247	247	247	
	p27	r_s Coeff.	0.781**	0.704**	0.785**	0.706**	--
		Sig. (two-tailed)	<0.001	<0.001	<0.001	<0.001	.
		N	252	252	252	247	252

Note: **. The correlation is significant at the 0.01 level (two-tailed)

The contingency coefficient is weakly correlated (C=0.186 and p=0.029) with the use of chatbots in the learning process with respect to the demographic variable of age (see Table 6). Specifically, younger students aged 18–20 years tend to use chatbots less frequently than those over 20 years. This difference suggests that younger students may require more time or experience to fully benefit from this tool in their learning.

Table 6. Results of the contingency coefficient for age and the use of chatbot AI tools in the learning process (p10).

Variables			None	Little	Considerable	A lot	Total	C. Coeff.	Sig.
Age	18–20 years	Count	43	**75**	**46**	13	177	0.186	0.029
		Expected F.	45	**68.1**	**45**	19	177		
	Over 20 years	Count	**21**	22	18	**14**	75		
		Expected F.	**19**	28.9	19	**8**	75		
Total		Count	64	97	64	27	252		
		Expected F.	64	97	64	27	252		

On the other hand, the results for the gender variable show significant correlations (see Table 7). Although the correlations are low (C<0.4), they indicate that male students take greater initiative in using autonomous chatbots and are more familiar with their use. Males also consider that chatbots facilitate task completion and exhibit greater dependence on using these tools in their learning process. Moreover, men demonstrate a better understanding of how to train the chatbot to improve its response and better comprehend how it works. In contrast, female students show less interest in using chatbots and other AI applications and are less familiar with these tools.

Table 7. Results of the contingency coefficient for gender.

Gender and the discovery of various AI tools like chatbot independently.									
Variables			**None**	**Little**	**Considerable**	**A lot**	**Total**	**C. Coeff.**	**Sig.**
Gender	Male	Count	1	**10**	**10**	**4**	25	0.173	0.05
		Expected F.	6.3	9.5	6.3	3	25		
	Female	Count	62	86	53	26	227		
		Expected F.	56.8	86.5	56.8	27	227		
Total		Count	63	96	63	30	252		
		Expected F.	63	96	63	30	252		
Gender and frequency of using applications or services that employ AI.									
Variables			None	Little	Considerable	Total	C. Coeff.	Sig.	
Gender	Male	Count	1	8	13	25	0.19	0.024	
		Expected F.	4.8	10.9	7.5	25			
	Female	Count	47	102	63	227			
		Expected F.	43.2	99.1	68.5	227			
Total		Count	48	110	76	252			
		Expected F.	48	110	76	252			
Gender and familiarity with the use of AI tools like chatbot.									
Variables			None	Little	Considerable	A lot	Total	C. Coeff.	Sig.
Gender	Male	Count	2	10	11	2	25	0.18	0.037
		Expected F.	7	9.2	6.2	2.6	25		
	Female	Count	69	83	51	24	227		
		Expected F.	64	83.8	55.8	23.4	227		
Total		Count	71	93	62	26	252		
		Expected F.	71	93	62	26	252		

H_4 is addressed through inferential analyses using the Mann–Whitney U test. All the significant differences concerning gender (see Table 8) and degree programme (see Table 9) are at the 99% confidence level. The effect size magnitude indicates a moderate difference (d=0.47) in favour of male students where the chatbots assist in course evaluations. In the remaining contrasts, the difference is small (d<0.4) with male students reporting that AI contributes to their ability to search for and analyse information. However, it also causes greater learning dependence among men than female students.

Table 8. Results of the Mann–Whitney U test for gender differences.

Items	Gender	N	Mean	U Mann–Whitney	p- value	Effect size (d)
p2	Male	25	2.68	1993	0.011	0.298
	Female	227	2.19			
p3	Male	25	2.72	1863	0.003	0.344
	Female	227	2.20			
p9	Male	24	1.21	2292	0.010	0.144
	Female	223	1.11			
p10	Male	25	2.68	1912	0.005	0.327
	Female	227	2.16			
p11	Male	24	1.96	1644	<0.001	0.383
	Female	222	1.47			
p18	Male	25	2.72	1806	0.002	0.364
	Female	227	2.15			
p29	Male	25	2.76	1927	0.006	0.321
	Female	227	2.20			
p32	Male	25	2.68	1905	0.005	0.329
	Female	227	2.11			
p33	Male	25	2.76	1872	0.003	0.340
	Female	227	2.22			
p37	Male	25	2.76	1517	<0.001	0.466
	Female	227	1.91			
p39	Male	25	2.28	1991	0.009	0.299
	Female	227	1.78			
p41	Male	25	2.72	1936	0.006	0.318
	Female	227	2.23			

According to the magnitude of the effect (d<0.4), all the significant differences related to the degree programme favouring primary education students are of low intensity. At the 99% confidence level, primary education students use AI more frequently and often employ it to pass their courses although they admit that it generates dependency within their learning process. Furthermore, at the 95% confidence level, these students are more familiar with using chatbots than early childhood education students recognising that this tool can contribute to information searches and analysis.

Table 9. Mann–Whitney U test results for the contrast of differences based on gender.

Items	Gender	N	Mean	U Mann–Whitney	p- value	Effect size (d)
p2	Male	25	2.68	1993	0.011	0.298
	Female	227	2.19			
p3	Male	25	2.72	1863	0.003	0.344
	Female	227	2.20			
p9	Male	24	1.21	2292	0.010	0.144
	Female	223	1.11			
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	Female	227	1.78			
p41	Male	25	2.72	1936	0.006	0.318
	Female	227	2.23			

4. Discussion

The results show that students in early childhood and primary education have limited knowledge of AI, mainly due to its novelty and rapid evolution in the educational context (Lund et al., 2023). The autonomy of learning, using external online resources has predominated in its use as indicated by previous studies (Crompton & Burke, 2023). However, this widespread lack of knowledge presents future challenges, particularly in the development of skills to apply and evaluate AI in the classroom (Martínez-Comesaña et al., 2023).

The study also highlights limited experience in the use of chatbots attributed to the scarce exposure to AI tools at earlier academic stages, which affects both accessibility and the effective use of such technologies (Ayuso del Puerto & Gutiérrez Esteban, 2022; Crompton & Burke, 2023). A lack of familiarity with these tools may hinder their effective implementation in teaching and learning processes, thereby underscoring the need for public policies aimed at reducing the digital divide and fostering a participatory approach to digitalisation (Llorent-Vaquero et al., 2024). In this regard, it is essential that public policies guarantee appropriate teacher training not only equipping teachers with the necessary skills to use AI but also supporting students throughout this process. Moreover, it is crucial to establish clear strategies for the inclusive and student-centred integration of technologies such as ChatGPT across university education (De la Riva, 2024).

Regarding perceptions of chatbots, findings reveal considerable variability influenced by factors such as prior experience, frequency of use and expectations towards AI (Niloy et al., 2024). Most students perceive chatbots, including ChatGPT as valuable tools for organising and accessing information as well as for generating ideas, thereby facilitating their learning process (Pérez & Robador-Papich, 2023). However, concerns have been raised about potential overreliance on these technologies which may undermine the development of essential cognitive skills (Moulaison-Sandy, 2023). For this reason, it is imperative to establish ethical criteria to regulate the use of AI in higher education, thereby mitigating the risks associated with its implementation.

Frequent use of chatbots has been positively correlated with improvements in idea organisation and efficient information retrieval (Crompton & Burke, 2023). Tools, such as ChatGPT which simulate human interaction and generate contextually appropriate responses have become valuable resources for personalising learning and providing support to students with special educational needs (Lund et al., 2023). Nevertheless, systemic implementation of such tools presents challenges, including the need to reduce dropout rates and to reform traditional methods of assessment (Gabriel et al., 2022).

Although AI offers significant benefits for learning, it also presents notable risks. Its potential to replace human skills must be approached with caution ensuring that these technologies serve as a complement rather than a substitute for the essential role of teachers (Shorey et al., 2024). The study also reveals marked differences in students' perceptions of chatbot use, depending on their degree programme and gender. Male students tend to regard them as useful tools for evaluation and data analysis, increasing their reliance on these systems whereas in primary education contexts, chatbots are more frequently employed for lesson planning and the design of assessment instruments (Ayuso del Puerto & Gutiérrez Esteban, 2022). It is imperative to establish a robust regulatory framework to guide AI use in education, minimising risks and ensuring its implementation is both equitable and pedagogically sound.

Implementing AI in higher education demands not only solid public policies but also pedagogical approaches that integrate AI ethically, inclusively, and conscientiously. A lack of access to technology and insufficient teacher

training perpetuates and deepen educational inequalities, severely affecting women and students from disadvantaged backgrounds. Strategic and collaborative planning is essential, ensuring that the transformative potential of AI benefits everyone equally to prevent this scenario.

5. Conclusion

The conclusions are structured around the following research question: How can public policies ensure equitable and effective use of AI in higher education, considering differences in student knowledge, experience, and perception, and the hypotheses posed?

First, it has been confirmed that student knowledge of AI is limited due to its recent integration into education and the rapid pace of technological development. This knowledge which is acquired primarily autonomously through online resources confirms H_1.

Second, experience with chatbots is limited due to a lack of prior exposure in earlier educational stages and technological limitations. Nevertheless, students recognise the usefulness and ease of use of these tools, seeing them as complementary to the teaching and learning process confirming H_2.

The evidence shows a strong relationship between the perception of chatbot benefits and their frequent use, particularly in organising ideas and information retrieval; thus, H_3 is confirmed.

Concerning H_4, significant differences were identified in chatbot use by degree programme and gender. Primary education students use these tools more frequently for academic tasks whereas male students show greater familiarity and are more likely to rely on them, confirming this hypothesis.

This study provides solid scientific evidence to document early childhood and primary education university students' use of AI. The sample's margin of error of 3.21% reinforces the validity of the results obtained. The conclusions underscore AI's transformative role in higher education and the urgent need for further research to integrate these technologies effectively into initial teacher education. They also highlight the importance of public policies promoting an equitable and ethical approach, closing the digital divide, and ensuring appropriate access and training for all educational stakeholders.

The limitations of this study include the absence of longitudinal data, preventing the observation of long-term trends, and the presence of uncontrolled variables that may have affected the results. Future research should analyse students' digital skills across various contexts to assess how these skills influence their ability to use AI effectively. Additionally, further studies could investigate specific actions taken by teachers to implement and strengthen these competencies in their students. The focus should be on developing public policies that reduce inequalities in access to and use of AI in learning processes.

Finally, it is essential to develop strategies that improve the use of AI in university environments, foster greater knowledge of its advantages and discuss its ethical implications. Public policies should support these initiatives, ensuring that future teachers, both in primary and early childhood education are better prepared to use these tools to optimise teaching and personalise learning, provide adaptive feedback and support online teaching.

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Appendix

Appendix 1. Final questionnaire.

Questionnaire on the use of the Teacher Chatbot Initial Training for Early Childhood and Primary Education

This questionnaire aims to identify the use of the teacher chatbots among students in initial training for early childhood and primary education. The objective of this study was to investigate the pedagogical use of chatbots by students in early childhood and primary education. The responses provided are not categorised as correct or incorrect; they are solely personal opinions. The participants are requested to answer all the questions. The information collected will be anonymous, confidential, and recorded only for research purposes.
Thank you very much for your cooperation.

Section 0: Sociodemographic Information

1. Age:
- 18–20 years
- 21–25 years
- 26–30 years
- 31–35 years
- Over 35 years

2. Gender:
- Male
- Female
- Other (Please specify):
- Prefer not to say

3. Degree:
- Students in early childhood education
- Students in primary education

4. Years of study (If more than one year is considered the highest):
- 1st Year in Early Childhood/Primary Education
- 2nd Year in Early Childhood/Primary Education
- 3rd Year in Early Childhood/Primary Education
- 4th Year in Early Childhood/Primary Education

Please respond to the following statements by circling your answer. A scale of 1 to 4 is considered, according to the legend:

1: None (N)	2: Little (P)	3: Considerable (B)	4: A lot (M)

No.	Section 1: Approach to artificial intelligence	N	P	B	M
1	What I know about artificial intelligence is…				
2	I have independently discovered various artificial intelligence tools such as Chatbot.				
3	The frequency with which I use applications or services that employ artificial intelligence is…				
4	I am able to identify examples of artificial intelligence in my daily life.				
5	I am familiar with Chat GPT.				
6	I am familiar with Chat Bing.				
7	I am familiar with Chat Google bard.				
8	I am familiar with LuzIA.				
9	I am familiar with Perplexity.				
10	I am familiar with another one:				
11	I am knowledgeable about the theoretical foundations of artificial intelligence.				
12	The Chatbot facilitates the completion of tasks.				
13	Chatbots are more accessible tools compared to other resources for my learning.				
14	I have prior experiences with educational tools based on artificial intelligence.				
15	I have learned to use artificial intelligence tools such as Chatbots before undertaking my university training				
	Section 2: Training	**N**	**P**	**B**	**M**
16	I am familiar with the use of artificial intelligence tools in the educational field				
17	I consider it important for my training as a teacher to know about artificial intelligence and its potential applications in education				
18	I understand the role of artificial intelligence in personalising learning and addressing diversity in the classroom.				
19	I identify barriers or challenges to the effective integration of artificial intelligence in my teaching practice.				
20	I have encountered various artificial intelligence tools such as Chatbots in a university context.				
21	I would like to receive specific training to integrate artificial intelligence into my teaching practice.				
22	I have learned to use artificial intelligence tools such as Chatbot during my university training.				
23	I have learned to use Chatbots as a tool for my learning independently.				
24	I understand the potential applications of Chatbots in my professional practice.				
25	I have learned about the advantages of using Chatbots through my own experience.				
26	I have learned about the disadvantages of using Chatbots through my own experience.				
27	I have learned about the advantages of using Chatbots in my university training.				
28	I have learned about the disadvantages of using Chatbots in my university training.				
	Section 3: Understanding of chatbot functionality	**N**	**P**	**B**	**M**
29	I know how to interact with a Chatbot.				
30	The Chatbot is a tool that can assist me in completing academic tasks (Searching, systematising, drafting, creating, etc.).				
31	I know how to use prompts (Questions) to obtain efficient responses from Chatbots.				
32	I understand how a Chatbot responds to the questions I ask (Its functioning).				
33	I know how to train a Chatbot to improve its comprehension and response generation.				
34	The difficulty I encounter when interacting with Chatbots is…				
35	The level of technological proficiency affects accessibility to Chatbots.				
	Section 4: Use of chatbots	**N**	**P**	**B**	**M**
36	I use artificial intelligence tools, such as Chatbots, in my learning process.				
37	Using Chatbots helps me to succeed in my assessments.				
38	The use of Chatbots provides benefits in my learning process.				
39	The use of Chatbots creates a dependency in my learning process.				
40	I am familiar with the use of artificial intelligence tools such as Chatbots.				
41	The use of Chatbots contributes to my ability to search for and analyse information.				
42	Chatbots are useful for specific tasks, such as organisation and idea generation.				
43	The use of Chatbots somewhat replaces interaction with a teacher or tutor.				
44	The use of artificial intelligence tools like Chatbots has not interfered with my learning process.				
45	I use artificial intelligence tools like Chatbots in my learning process.				