



Article

Artificial Intelligence Professional Development Provision for Teachers in Andalusia: Documentary Analysis and Recommendations for a Comprehensive Approach

Manuel Reina-Parrado *, Pedro Román-Graván and Carlos Hervás-Gómez

Department of Didactics and School Organization, Faculty of Education, University of Seville, 41013 Seville, Spain; proman@us.es (P.R.-G.); hervas@us.es (C.H.-G.)

* Correspondence: mreina@us.es

Abstract

This study analyses the professional development provision in artificial intelligence (AI) offered to non-university teachers in Andalusia during the 2023–2024 academic year. The research follows a descriptive documentary design based on the systematic review of training activities provided by the Teacher Training Centres (CEPs) in the eight Andalusian provinces. The initial corpus comprised 1832 training activities. After screening course titles and, when available, objectives, descriptions, metadata and content lists, 26 AI-related activities were identified; after excluding repeated editions and activities whose information was not accessible, the final analysable corpus consisted of 15 distinct and visible courses. The analysis combined quantitative description of distribution by province with qualitative content analysis supported by Atlas.ti. The results show that AI-related training represented only 1.42% of the overall offer and that the final analysable corpus represented 0.82% of all training activities. The provision was also unevenly distributed across provinces and tended to privilege specific tools, generative AI applications and productivity-oriented uses, with comparatively limited attention to ethical, pedagogical, assessment-related and interdisciplinary dimensions. The findings suggest the need for a more coherent regional strategy based on common minimum AI literacy modules, differentiated pathways by educational stage, blended and mentored formats, classroom-based projects and systematic evaluation of training impact.

Keywords: artificial intelligence in education; teacher professional development; AI literacy; digital competence; teacher training; Andalusia

Academic Editors: Stavros Kaperonis, Eirini Karakasidou, Fani Gkritseli, Panagiotis A. Tsaknis and Yolanda Abel

Received: 8 May 2026

Revised: 15 June 2026

Accepted: 30 June 2026

Published: 6 July 2026

Copyright: © 2026 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution \(CC BY\)](https://creativecommons.org/licenses/by/4.0/) license.

1. Introduction

1.1. Artificial Intelligence, Teacher Professional Development and the Andalusian Context

Artificial intelligence has become one of the most visible dimensions of current educational digitalisation. In schools, AI is associated with adaptive learning, automated feedback, educational chatbots, content generation, learning analytics and support for administrative and teaching tasks (Harati et al. 2021; Pozdniakov et al. 2024; Stöhr et al. 2024). These possibilities have increased expectations about the capacity of AI to support teaching and learning, but they have also generated new professional demands for teachers.

The integration of AI into education cannot be reduced to the instrumental use of applications. Teachers need to understand the basic principles of AI, the pedagogical con-

ditions under which it may improve learning, and the ethical and legal implications of its use with students. Issues such as privacy, bias, authorship, transparency, reliability and the risk of uncritical dependence on automated systems require explicit treatment in teacher professional development (Bond et al. 2024; Chen et al. 2020).

For this reason, AI training should be analysed through a comprehensive framework that includes at least four dimensions: AI literacy, pedagogical integration, ethical and legal awareness, and transfer to classroom practice. This approach is consistent with the broader field of teacher digital competence, especially the DigCompEdu framework, which stresses professional engagement, digital resources, teaching and learning, assessment, learner empowerment and the facilitation of learners' digital competence (Redecker and Punie 2017).

1.2. Teacher Training Needs in AI

The incorporation of educational technology has transformed teaching methodologies, access to resources and the organisation of learning environments (Kanglang and Afzaal 2021; Baek et al. 2024). Nevertheless, the educational value of technology depends largely on teachers' capacity to select, adapt and critically integrate digital tools into meaningful pedagogical designs. In the case of AI, this requirement is particularly relevant because the tools evolve rapidly and their educational use often requires both technical and pedagogical judgement.

Previous research has shown the educational potential of AI for tutoring, feedback, monitoring of student performance and personalised learning (Khan et al. 2021; Jokhan et al. 2022). However, these uses require training that goes beyond isolated demonstrations of applications. Teachers need professional development opportunities that help them design activities, assess risks, interpret outputs, adapt tools to different educational stages and evaluate their impact on learning.

In this study, a shortcoming in AI training is understood as any relevant imbalance in the provision that may limit teachers' capacity to use AI in an informed, ethical and pedagogically meaningful way. Specifically, the analysis considers the scarcity of courses, unequal provincial distribution, excessive specialisation, limited interdisciplinary integration, limited attention to assessment and feedback, insufficient treatment of ethical and legal issues, and weak alignment with classroom-based pedagogical strategies.

1.3. AI in Schools and the Digital Divide

AI has begun to establish itself in education as a tool for improving teaching, learning and institutional decision-making (Harati et al. 2021; Pozdniakov et al. 2024). Its uses include adaptive learning environments, intelligent tutoring systems, chatbots, automated feedback, content generation and support for assessment. These applications can enrich learning processes, but their implementation depends on the existence of suitable infrastructure, adequate guidance and teacher competence.

The digital divide is relevant as a contextual factor. It includes not only unequal access to devices, connectivity and infrastructure, but also unequal opportunities to develop the competences required to use technology effectively (Joudieh et al. 2024; Redecker and Punie 2017). The present study does not directly measure infrastructure, teacher motivation or socio-economic conditions. Consequently, references to the digital divide are interpreted as contextual considerations that help explain why access to high-quality teacher training matters, rather than as direct empirical findings of this documentary analysis.

This distinction is important because the study focuses on the documented training provision of CEPs. It can identify how much AI training is offered, where it is offered and what topics are visible in course documentation, but it cannot determine the real effective-

ness of the courses, teachers' satisfaction or the transfer of training to classroom practice without additional evidence from participants and institutional decision-makers.

1.4. Non-University Teacher Training and CEPs in Andalusia

In the Andalusian context, non-university teacher training refers to continuing professional development aimed at teachers working outside the university system. This includes, depending on the scope of each activity, teachers in Early Childhood Education, Primary Education, Compulsory Secondary Education, Baccalaureate, Vocational Training, adult education, special education and other school-level educational provisions.

Teacher Training Centres (Centros del Profesorado, CEPs) are a key institutional structure for this professional development. Their role is especially relevant in emerging areas such as AI because they mediate between educational policy priorities, local school needs and teachers' opportunities for continuing training. Therefore, analysing CEP provision offers a useful diagnostic view of how AI is being incorporated into the official continuing teacher training ecosystem in Andalusia.

The CEPs in Andalusia emerged in the 1980s as a response to the need to improve the continuous training of teaching staff in the region (Junta de Andalucía n.d.-a). Their historical development forms part of a broader movement that recognised permanent teacher training as a condition for educational quality. Internationally, professional development systems have also emphasised sustained, situated and practice-oriented teacher learning, rather than isolated training events.

Before the 1970s, teacher training in Spain was mainly centred on initial preparation, with less systematic attention to continuing professional development. Pedagogical renewal movements and permanent seminars, such as the Summer Schools, began to highlight the need for sustained professional updating. At the international level, experiences such as Teacher Centres in the United States and the United Kingdom also stressed the value of specialised institutions devoted to teachers' continuing development (Junta de Andalucía n.d.-c).

In 1984, the Spanish Ministry of Education and Science established Teacher Centres, inspired by international models and by the growing demand for continuing teacher education. Their main purpose was to provide permanent training, support adaptation to educational change and promote pedagogical renewal (Junta de Andalucía n.d.-b). Following this national initiative, Andalusia created its Teachers' Centres through Decree 16/1986, of 5 February, on the creation and operation of Teachers' Centres.

Over time, CEPs have evolved in response to new educational and technological demands. In 2013, Decree 93/2013 organised the Andalusian System of Permanent Teacher Training as a network of 32 centres with pedagogical and managerial autonomy (Junta de Andalucía n.d.-c). This networked structure enables a more contextualised training provision, but it may also lead to territorial differences in priorities and available courses.

Within this institutional framework, AI training should ideally combine a common regional baseline with local adaptation. A common baseline would ensure that all teachers have access to essential AI literacy, ethical and pedagogical content, whereas local adaptation would allow CEPs to respond to the specific needs of provinces, educational stages and professional communities.

The specific gap addressed by this study is the absence of a detailed diagnosis of AI-related professional development provision in the Andalusian CEP network during the 2023–2024 academic year. The study examines the volume, distribution and thematic orientation of this provision and identifies areas where the current offer could be strengthened.

2. Objective and Research Questions

The general objective of this study is to analyse the AI professional development provision offered by Andalusian Teacher Training Centres to non-university teachers during the 2023–2024 academic year, identifying its volume, territorial distribution, thematic focus and main areas for improvement. The study is descriptive and documentary; therefore, it does not evaluate the effectiveness or quality of training in terms of participant learning or classroom impact.

RQ1. How many AI-related training activities were offered by Andalusian CEPs during the 2023–2024 academic year?

RQ2. How were these activities distributed across the eight Andalusian provinces?

RQ3. What topics, educational stages, tools and pedagogical approaches were visible in the documented course information?

RQ4. To what extent did the courses include ethical, pedagogical, assessment-related and interdisciplinary dimensions?

RQ5. What shortcomings and areas for improvement can be identified from the documented training provision?

3. Methodology

This study follows a descriptive documentary design with quantitative description and qualitative content analysis. The unit of documentary analysis was the AI-related training activity offered by Andalusian Teacher Training Centres during the 2023–2024 academic year. The study did not involve intervention, experimental manipulation or direct measurement of course effectiveness.

The documentary sources were the official course lists, course pages, metadata, objectives and content descriptions available through the CEP websites and the information requested by email from CEPs when the course information was not publicly visible. The search covered the CEPs associated with the eight Andalusian provinces: Huelva, Jaén, Seville, Córdoba, Cádiz, Almería, Granada and Málaga.

The search strategy combined a first review of all training activities listed for the 2023–2024 academic year with a targeted screening for AI-related terms. The screening considered course titles and, when available, objectives, descriptions, content lists and metadata. The main terms used for identification were artificial intelligence, AI, IA, generative artificial intelligence, ChatGPT, chatbot, machine learning, Google Colab, DALL-E, Midjourney, Stable Diffusion and other explicit references to AI-based tools or processes.

Inclusion criteria were: (a) training activities offered by Andalusian CEPs during 2023–2024; (b) activities explicitly related to AI in the title, objectives, contents or metadata; and (c) activities for which sufficient documentary information was available for analysis. Exclusion criteria were: (a) repeated editions of the same course, which were counted for the descriptive distribution but not duplicated in the qualitative analysis; (b) activities whose information was not visible and could not be obtained after request; and (c) activities using digital tools without any explicit AI component.

3.1. Sample Selection

The initial sample consisted of all training activities offered by Andalusian CEPs in the 2023–2024 academic year (Table 1). A total of 1832 activities were identified across the eight provinces. This full corpus was used to calculate the proportion of AI-related training within the overall professional development provision.

Table 1. Number of Andalusian training activities by province.

Province	Number of Courses Offered
Huelva	206
Jaén	246
Seville	432
Córdoba	280
Cádiz	109
Almería	156
Granada	202
Málaga	201
Total	1832

3.2. Screening and Corpus Construction

After compiling the 1832 activities, all records were organised in an Excel file. The first screening identified training activities whose title, objectives, contents or metadata explicitly referred to AI or AI-based tools. This produced an initial set of 26 AI-related activities. Repeated editions and unavailable courses were then differentiated in order to construct the final analysable corpus (Table 2).

Courses without visible information were requested from the corresponding CEPs. In several cases, the response indicated that the activities had been offered by private or subsidised educational centres and that the detailed data were not available. Only one additional course description was obtained through this process. This lack of visibility affected the final corpus and is treated as a limitation of the study.

Some training activities corresponded to repeated editions of the same course. These repetitions were retained in the descriptive account of the offer but were not duplicated in the qualitative analysis. Therefore, the final qualitative corpus consisted of 15 distinct and visible AI-related courses.

Table 2. Construction of the AI-related corpus.

Category	Number
Total training activities	1832
AI-related activities	26
Visible AI-related activities	18
Repeated editions	3
Distinct and visible courses analysed qualitatively	15

3.3. Content Analysis

The qualitative analysis was supported by Atlas.ti, which was used as qualitative data analysis software for coding, memo writing, grouping codes into categories and obtaining descriptive counts of thematic recurrence. Atlas.ti was not used as a statistical analysis tool.

The coding strategy was mixed. Deductive categories were initially derived from the conceptual framework and the research questions: AI fundamentals, pedagogical integration, tools and technologies, assessment and feedback, ethics and legislation, digital competence, target educational stage and interdisciplinary orientation. Inductive codes were then added when course descriptions contained recurring themes not fully captured by the initial scheme.

The unit of analysis was the individual course description, including title, objectives, contents and metadata. Each course could receive more than one code because several courses combined different topics and approaches. The coding process involved initial

coding, thematic grouping, iterative review and consolidation of final categories. As this was a documentary study based on course information, the analysis focused on what was explicitly visible in the documents and avoided inferring unreported elements (Table 3).

Table 3. Analytical variables used for the qualitative description of the final corpus.

Variable	Description
Province and CEP	Territorial location of the training activity.
Educational stage	Target level: Early Childhood, Primary, Secondary, Vocational Training or interlevel.
Topic	Main focus: AI fundamentals, generative AI, language learning, STEAM, ethics, tools or digital competence.
Tools	Explicit AI applications or platforms mentioned in the course documentation.
Pedagogical approach	Project work, personalised learning, STEAM integration, team-work or other visible strategies.
Ethics and assessment	Explicit references to privacy, bias, copyright, responsible use, feedback or evaluation.

4. Results

Of the 1832 training activities offered in Andalusia during the 2023–2024 academic year, 26 were identified as AI-related, representing 1.42% of the total provision. After removing repeated editions and excluding activities without sufficient visible information, the final analysable corpus consisted of 15 distinct courses, equivalent to 0.82% of the total training offer. Therefore, 1.42% refers to the broader AI-related offer, whereas 0.82% refers to the final corpus available for qualitative analysis.

Table 4 shows the distribution of AI-related activities by province. The results indicate an uneven territorial distribution. Málaga had the largest number of AI-related activities, whereas Huelva had no identified AI-related courses. These differences should be interpreted cautiously because the study does not directly analyse the size of each CEP, local priorities, trainer availability or institutional initiatives that may explain provincial variation.

Table 4. Breakdown of AI training courses by province.

Province	AI-Related Activities	Repeated	Not Visible	Distinct and Visible
Huelva	0	0	0	0
Jaén	3	0	2	1
Seville	3	0	0	3
Córdoba	5	1	2	2
Cádiz	2	0	0	2
Almería	1	0	0	1
Granada	4	0	2	2
Málaga	8	2	2	4
Total	26	3	8	15

The qualitative results are presented in the following order: first, the categorical system; second, the thematic orientation of courses; third, comparison between CEPs; fourth, objectives and competencies; fifth, target educational stages; sixth, pedagogical strategies; and seventh, training needs and areas for improvement.

4.1. Categorical System

Fundamentals of artificial intelligence: Definition and basic concepts, machine learning and generative models, and the relationship between AI and education.

Application of AI in the classroom: Creation of teaching materials, personalisation of learning, assessment and feedback.

AI tools and technologies: Content generation platforms such as ChatGPT, DALL-E, Midjourney and Google Colab, as well as chatbots, virtual assistants and search or data analysis tools.

Digital competence and teacher productivity: Development of teachers' digital competence in relation to the Teacher Digital Competence Framework and optimisation of teaching tasks.

AI projects and STEAM activities: Integration of AI into science, technology, engineering, arts and mathematics through classroom projects.

Ethics and legislation in AI: Risks, bias, responsibility, copyright, privacy and legal considerations in educational settings.

Vocational Training applications: Generative AI tools for creativity, productivity, graphic design, audiovisual production and technical tasks.

Innovation and digital transformation: Classroom of the future, school digital transformation and preparation of teachers for emerging technologies.

4.2. Analysis of the Subject Matter of the Courses

The thematic analysis identified six main areas. The first area was the use of AI in language teaching, including courses such as "Artificial Intelligence in Language Teaching and Learning" and "AI in the Language Classroom". These courses focused on linguistic content generation, prompt writing, chatbots and personalisation for language learners.

The second area was generative AI, including courses on graphic design, audiovisual production and vocational contexts. These courses emphasised tools such as DALL-E, Midjourney and generative language models, often in creative, artistic or professional environments.

The third area was AI ethics, including courses that addressed privacy, bias, legal implications and responsible use. The fourth area focused on tools and platforms, especially Google Colab and AI programming or model experimentation. The fifth area related to digital competence and productivity, and the sixth addressed the classroom of the future and digital transformation.

4.3. Comparison Between CEPs

CEP Seville offered a relatively varied set of practical applications, from language teaching to STEAM projects and future classroom environments. CEP Cádiz was more oriented towards generative AI for graphic design and audiovisual production. CEP Málaga stood out for technical and project-oriented uses of AI, including Google Colab and applications in Secondary Education and Vocational Training.

CEP Granada placed comparatively greater emphasis on ethics and responsible use, whereas CEP Almería focused on digital competence and teacher productivity. CEP Córdoba was especially linked to language learning and practical classroom tools. This variability suggests local adaptation, but it also confirms the absence of a clearly shared regional baseline for AI teacher training.

4.4. Objectives, Competencies and Target Audience

The courses developed competencies in AI fundamentals, practical application and content creation, personalisation of learning, assessment, ethics and legislation, digital

skills, productivity, STEAM projects and educational innovation. However, the intensity and balance of these competencies varied considerably across courses.

The segmentation of the final corpus by educational level shows that the provision was not evenly balanced across stages. Approximately 20% of the analysed courses were aimed at Primary Education. Around 30% targeted Secondary Education and generally adopted a more technical and practical approach. Courses aimed at Vocational Training represented approximately 20% of the corpus and focused especially on generative AI for practical tasks in design, audiovisual production and technical or professional contexts.

Interlevel courses represented approximately 30% of the offer and addressed broader competencies such as ethics, digital competence and general AI use. However, the limited number of interlevel courses suggests that the provision may not yet offer a sufficiently common baseline of AI literacy for all non-university teachers.

4.5. Pedagogical Strategies and Training Needs

Regarding pedagogical strategies, approximately 35% of the analysed courses adopted project development as a central approach. This strategy can support classroom transfer because it requires teachers to design or implement practical AI-based activities. Nevertheless, the available documentation did not always specify follow-up mechanisms, mentoring or evidence of implementation in real classrooms.

A second group of courses, approximately 25%, focused on personalised learning through AI. This orientation is relevant because AI can help adapt contents, exercises and feedback to learners' needs. However, the analysis showed limited explicit attention to assessment criteria, data interpretation and the pedagogical validation of AI-generated outputs.

Finally, 20% of the courses focused on integration into the STEAM curriculum and another 20% promoted teamwork. These approaches are pedagogically valuable because they can connect AI with interdisciplinary projects, creativity, problem solving and collaboration. Even so, the corpus suggests that interdisciplinary integration remains partial and is often linked to specific technical or creative areas rather than to a fully transversal curricular approach.

The analysis identified several areas for improvement. Firstly, the offer for Early Childhood and Primary Education was insufficient. Secondly, AI tools for assessment and feedback were underrepresented. Thirdly, the training offer would benefit from stronger interdisciplinary and ethical grounding. A higher-quality provision should combine technical fluency with pedagogical, ethical and disciplinary integration.

5. Discussion

The results show that AI-related professional development represented a very small proportion of the Andalusian CEP training provision during the 2023–2024 academic year. The broader AI-related offer accounted for 1.42% of all training activities, and the final distinct visible corpus accounted for 0.82%. This finding supports the conclusion that AI training was scarce in the analysed documentary corpus, although it should not be interpreted as a direct measure of teachers' actual competence or of the whole educational system beyond the available records.

A second relevant finding is the uneven territorial distribution of AI-related training. Málaga concentrated the highest number of activities, whereas Huelva had no identified AI-related courses. The data demonstrate provincial imbalance in the documented provision. However, the study cannot determine its causes. Possible explanatory factors for future research include CEP size, local strategic priorities, availability of expert trainers, institutional initiatives, urban–rural distribution, school demand and differences in the visibility of course information.

The thematic analysis also suggests that the provision tended to prioritise specific tools, generative AI applications and productivity-oriented uses. These orientations are useful, but they are insufficient if they are not accompanied by broader AI literacy, ethical reflection and pedagogical design. In line with DigCompEdu, AI-related training should help teachers select resources, design learning activities, support assessment, empower learners and develop students' digital competence, rather than merely demonstrate isolated applications (Redecker and Punie 2017).

These findings can also be interpreted in relation to current policy and competence frameworks on teachers' digital and AI-related professional development. At the European level, DigCompEdu conceptualises teachers' digital competence as a multidimensional construct that includes professional engagement, digital resources, teaching and learning, assessment, learner empowerment and the facilitation of students' digital competence. From this perspective, the predominance of courses centred on specific tools, generative AI applications and productivity-oriented uses suggests a partial alignment with digital competence frameworks, but not yet a fully comprehensive approach. Similarly, the Spanish Framework for Teacher Digital Competence provides a national reference for structuring professional development around progressive levels of competence, rather than around isolated technological applications. The limited presence of ethical, assessment-related and interdisciplinary dimensions in the analysed corpus therefore points to the need to move from tool-based training towards a more coherent AI literacy pathway for teachers.

This interpretation is also consistent with recent international AI-specific frameworks. UNESCO's AI Competency Framework for Teachers emphasises that teacher preparation in AI should include a human-centred mindset, ethics of AI, AI foundations and applications, AI pedagogy and AI for professional learning. Likewise, European policy documents on digital education and the ethical use of AI and data in teaching and learning stress that AI integration should be inclusive, pedagogically meaningful, transparent, responsible and attentive to risks such as bias, privacy and overreliance on automated systems. In this sense, the scarcity and thematic fragmentation identified in the Andalusian offer should not be understood merely as a local organisational issue, but as a gap between the documented provision and the broader policy expectation that teachers develop situated, ethical and pedagogically grounded AI competence.

The same argument applies to the limited interdisciplinary orientation of the courses. AI is not only a technical resource for language teaching, STEAM activities, graphic design or productivity tasks; it is increasingly a transversal educational phenomenon that affects curriculum design, assessment, authorship, inclusion, data protection, critical thinking and students' digital citizenship. Consequently, a regional teacher training strategy should ensure both a common minimum baseline in AI literacy and differentiated pathways by educational stage and subject area. Such a strategy would allow local CEPs to maintain contextual flexibility while guaranteeing that all teachers have access to essential training in AI concepts, pedagogical integration, ethical and legal implications, assessment practices and classroom-based transfer.

The limited interdisciplinary integration identified in the corpus is another relevant issue. Several courses were linked to languages, graphic design, STEAM or vocational contexts, but fewer activities appeared to promote AI as a transversal educational phenomenon applicable across curriculum areas. This suggests that AI is still being introduced through specialised niches rather than through a coherent professional development strategy for all teachers.

Claims related to the digital divide must be interpreted cautiously. The documentary analysis does not measure teachers' access to devices, connectivity, motivation or socioeconomic conditions. Nevertheless, the limited and uneven training provision may con-

tribute to unequal opportunities for teachers to develop AI-related competence. From this perspective, the digital divide functions here as a contextual framework rather than as a directly measured result.

Finally, the analysis points to the need for stronger pedagogical guidance. A considerable part of the provision focuses on tools, but high-quality AI training should also include classroom scenarios, didactic sequencing, assessment rubrics, ethical decision-making, student data protection, critical validation of AI outputs and transfer tasks. Without these elements, teachers may learn how to use specific applications without acquiring the professional judgement required to integrate AI meaningfully into teaching and learning.

Overall, the study contributes a documentary diagnosis of AI training provision in Andalusia. Its main value lies in identifying the limited volume, uneven territorial distribution and thematic imbalance of the offer. Its contribution should be understood as a basis for improving teacher professional development policy and for designing further empirical studies involving teachers, CEP coordinators and course participants.

6. Conclusions

This study found that AI-related training represented a very limited part of the Andalusian CEP professional development provision in the 2023–2024 academic year. From 1832 training activities, 26 AI-related activities were identified and only 15 distinct visible courses could be analysed in depth. These data indicate that AI training was scarce in the documented corpus.

The provision was also unevenly distributed across provinces and thematically fragmented. Some courses addressed valuable areas such as generative AI, language teaching, STEAM, digital competence and ethical issues. However, the overall offer did not yet show a sufficiently balanced strategy across educational stages, provinces and pedagogical dimensions.

The main areas for improvement are the need to increase the volume of AI training, guarantee a common minimum baseline for all non-university teachers, strengthen ethical and legal content, expand assessment and feedback training, adapt courses to Early Childhood and Primary Education and promote interdisciplinary classroom-based projects.

These conclusions should be read in light of the study design. The research describes documentary evidence from one academic year and does not evaluate learning outcomes, teacher satisfaction or classroom transfer. Therefore, the findings support a diagnosis of the visible training provision, not a definitive assessment of the effectiveness of the Andalusian teacher training system.

Despite these limitations, the results suggest that AI should become a more systematic component of teacher professional development in Andalusia. A comprehensive strategy would combine AI literacy, pedagogical integration, ethical awareness, stage-specific resources, blended formats, mentoring, micro-credentials and evaluation of training impact.

7. Proposals for Improvement, Limitations and Future Research

The findings support several practical recommendations. Firstly, the Andalusian CEP network could define common minimum AI training modules for all non-university teachers. These modules should include basic AI concepts, generative AI, critical use of outputs, data privacy, bias, copyright, ethical decision-making and examples of classroom integration.

Secondly, training should be differentiated by educational stage. Early Childhood and Primary Education require visual, playful and age-appropriate activities; Secondary Education requires interdisciplinary and critical projects; and Vocational Training re-

quires sector-specific applications linked to professional contexts. This differentiation would prevent both excessive generality and excessive specialisation.

Thirdly, MOOCs may be useful to extend access, but they should not be proposed as a standalone solution. To avoid reproducing inequalities, MOOCs should be complemented with blended sessions, mentoring, local CEP support, accessible materials, flexible schedules, micro-credentials and follow-up tasks linked to classroom implementation. In addition, completion rates and transfer to teaching practice should be evaluated.

The study has several limitations. It analyses only one academic year; it relies on publicly available or requested documentary information; it excludes courses whose information was not visible or could not be obtained; and the screening process may have missed courses that included AI without explicit references in titles, objectives, contents or metadata. In addition, the study does not include direct evidence from teachers, trainers or CEP decision-makers.

Future research should conduct longitudinal analyses across several academic years, compare Andalusia with other autonomous communities, interview CEP coordinators, survey or organise focus groups with teachers, analyse completion rates and evaluate the real transfer of AI training into classroom practice. These lines would complement the documentary diagnosis presented here and allow a more robust evaluation of AI teacher professional development.

Author Contributions: Conceptualization: M.R.-P.; methodology: M.R.-P.; software: M.R.-P.; validation: M.R.-P., P.R.-G.; formal analysis: M.R.-P.; investigation: M.R.-P.; resources: M.R.-P.; data curation: M.R.-P.; writing—original draft preparation: M.R.-P.; writing—review and editing: M.R.-P., P.R.-G.; visualization: M.R.-P. and C.H.-G.; supervision: P.R.-G.; project administration: M.R.-P. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

References

- Baek, Clare, Tamara Tate, and Mark Warschauer. 2024. "ChatGPT seems too good to be true": College students' use and perceptions of generative AI. *Computers and Education: Artificial Intelligence* 5: 100294. <https://doi.org/10.1016/j.caeai.2024.100294>.
- Bond, Melissa, Hassan Khosravi, Maarten De Laat, Nina Bergdahl, Violeta Negrea, Emily Oxley, Phuong Pham, Sin Wang Chong, and George Siemens. 2024. A meta systematic review of artificial intelligence in higher education: A call for increased ethics, collaboration, and rigour. *International Journal of Educational Technology in Higher Education* 21: 4. <https://doi.org/10.1186/s41239-023-00436-z>.
- Chen, Xieling, Haoran Xie, Di Zou, and Gwo-Jen Hwang. 2020. Application and theory gaps during the rise of artificial intelligence in education. *Computers and Education: Artificial Intelligence* 1: 100002. <https://doi.org/10.1016/j.caeai.2020.100002>.
- Harati, Hoda, Laura Sujo-Montes, Chih-Hsiung Tu, Shadow J. W. Armfield, and Cherng-Jyh Yen. 2021. Assessment and learning in knowledge spaces (ALEKS) adaptive system impact on students' perception and self-regulated learning skills. *Education Sciences* 11: 603. <https://doi.org/10.3390/educsci11100603>.
- Jokhan, Anjeela, Aneesh A. Chand, Vineet Singh, and Kabir A. Mamun. 2022. Increased digital resource consumption in higher educational institutions and the artificial intelligence role in informing decisions related to student performance. *Sustainability* 14: 2377. <https://doi.org/10.3390/su14042377>.

- Joudieh, Noura, Hassan Harb, Chamseddine Zaki, Alaaeddine Ramadan, Louai Saker, Nour Mostafa, and Layla Tannoury. 2024. Higher education in the era of artificial intelligence: Academic freedom as a case study. *Discover Sustainability* 5: 220. <https://doi.org/10.1007/s43621-024-00425-w>.
- Junta de Andalucía. n.d.-a. Centros del profesorado–Educación. Available online: <https://www.juntadeandalucia.es/educacion/portales/profesorado/formacion-del-profesorado/centros-del-profesorado> (accessed on 6 June 2026).
- Junta de Andalucía. n.d.-b. Historia del CEP—Centro del Profesorado de Córdoba. Available online: <https://www.juntadeandalucia.es/educacion/portales/web/cep-cordoba/datos-del-cep> (accessed on 6 June 2026).
- Junta de Andalucía. n.d.-c. Historia del CEP—Centro del Profesorado de Linares-Andújar. Available online: <https://www.juntadeandalucia.es/educacion/portales/web/cep-linares-andujar/datos-del-cep> (accessed on 6 June 2026).
- Kanglang, Liu, and Muhammad Afzaal. 2021. Artificial intelligence (AI) and translation teaching: A critical perspective on the transformation of education. *International Journal of Educational Sciences* 33: 64–73. <https://doi.org/10.31901/24566322.2021/33.1-3.1159>.
- Khan, Ijaz, Abdul Rahim Ahmad, Nafaa Jabeur, and Mohammed Najah Mahdi. 2021. An artificial intelligence approach to monitor student performance and devise preventive measures. *Smart Learning Environments* 8: 17. <https://doi.org/10.1186/s40561-021-00161-y>.
- Pozdniakov, Stanislav, Jonathan Brazil, Solmaz Abdi, Aneesha Bakharia, Shazia Sadiq, Dragan Gašević, Paul Denny, and Hassan Khosravi. 2024. Large language models meet user interfaces: The case of provisioning feedback. *Computers and Education: Artificial Intelligence* 7: 100289. <https://doi.org/10.1016/j.caeai.2024.100289>.
- Redecker, Christine, and Yves Punie. 2017. European Framework for the Digital Competence of Educators: DigCompEdu. Joint Research Centre (JRC) Science for Policy Report. Available online: <https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/european-framework-digital-competence-educators-digcompedu> (accessed on 6 June 2026).
- Stöhr, Christian, Amy Wanyu Ou, and Hans Malmström. 2024. *Perceptions and Usage of AI Chatbots Among Students in Higher Education Across Genders, Academic Levels and Fields*. Oxford: Computers and Education: Artificial Intelligence.

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.