

DigiSET – The Academy of Digitally Sustainable European Teacher

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Teachers' Competences for Digital Sustainability in Spain

A survey amongst (future) teachers

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Disclaimer on Methodology and Authorship

The development of the survey instrument was a collaborative effort involving the entire consortium. However, the selection of scales and the final composition of the questionnaire were done by Dila Oral, Sezin Esfer and Sabiha Dulay (all BAU), Filiz Keser Aschenberger (UWK), Erina Guraziu (OpenCom), and Sandra Schön (TU Graz). The analysis template as well as the data analysis process — including data cleaning, selection, and the creation of all charts and diagrams — were carried out by Bettina Mair and Sandra Schön (both TU Graz). The textual descriptions, interpretations, and conclusions presented in this report reflect the views of the respective authors listed herein and are their sole responsibility. In addition, please note that certain descriptive and introductory sections of this report are based on consortium-wide templates applied uniformly across all country reports to ensure comparability. The specific analyses, interpretations, and country-specific findings remain the responsibility of the respective national teams.

Disclaimer on AI usage

Based on Academic Integrity and Transparency in AI-assisted Research and Specification Framework (Bozkurt, 2024, DOI: 10.55982/openpraxis.16.1.654), the author of this report acknowledges that it was drafted with the assistance of Claude (Anthropic; version as of August 2026), complementing the human editorial process. The human author critically assessed and validated the content to maintain academic rigor. The author also assessed and addressed potential biases inherent in the AI-generated content. The final version of the paper is the sole responsibility of the human author.

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Abstract

This report presents the results of the DigiSET teacher survey conducted in Spain, as part of the Erasmus+ project “DigiSET – The Academy of Digitally Sustainable European Teacher” (101249272). The survey aimed to assess (future) teachers’ self-perceived competences in digital teaching, artificial intelligence (AI), education for sustainable development (ESD), and open educational resources (OER), as well as their perceptions on four DigiSET-specific topics: adaptive AI use, gender bias in AI, inclusive practices for students with learning difficulties, and systems thinking for sustainability. Data were collected between April and June 2026 using an online questionnaire based on existing scales (DigCompEdu Check-In, TAICS, ATOER) and project-specific items. A total of 165 responses were received, of which 139 were included in the analysis following data cleaning procedures. Respondents were primarily experienced, mid-career educators (mean age 45.8 years; 50% women) working mainly at private or independent training providers and, to a large extent, in vocational education and training — including vocational training for employment (FPE) — with vocational subjects and computer science/digital literacy as the most common teaching fields.

Key findings indicate that participants reported a consistently high self-perceived digital teaching competence, with the highest values in professional engagement (80.6–92.0% often/always across D1–D4) and in the protection of personal data (84.8%), and the lowest in setting assignments that require learners to create digital content (62.3%). Regarding AI competence, confidence is markedly lower and more polarised: while 67.5% feel very or completely confident explaining what AI is, only about half report such confidence in AI-supported assessment (51.6–55.6%) and fewer than half in protecting sensitive content from AI tools (48.8%). For ESD, respondents express strong agreement with values-oriented items (up to 91.7%) but agree less with the digitally supported implementation of sustainability (73.3%) and with facilitating complex sustainability discussions (70.0%). In terms of OER, competence is moderate, with the largest uncertainty of all domains (29.1–35.0% neutral responses) and knowledge of intellectual property rights as the weakest aspect (55.2%). Among the four DigiSET-specific topics, respondents showed the highest values in systems thinking for sustainability (80.3–87.1% agreement) and the lowest in gender bias in AI (46.4–48.8% confidence). The most pressing professional development needs identified were using AI in teaching (63.6%) and creating and sharing OER (50.8%), while the most frequently reported barriers were lack of time (70.3%) and lack of suitable resources or materials (43.2%).

The findings should be interpreted in light of the non-probability, self-selected nature of the sample, which overrepresents vocational and adult training — particularly vocational training for employment (FPE) delivered by private providers — and underrepresents the school system’s public-sector teaching workforce, as well as of the self-reported nature of the data. Despite these limitations, the results provide valuable evidence for the design of the DigiSET Teacher Academy and the development of targeted training modules tailored to the national context of Spain.

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1. Introduction

1.1 Background and aim of the DigiSET survey

This section provides the background and rationale for the DigiSET survey conducted in Spain, situating the study within the national context and outlining its purpose and scope.

The DigiSET project (The Academy of Digitally Sustainable European Teacher) represents a transformative initiative addressing the urgent need for digital upskilling among European educators within a cross-border framework. The primary objective of DigiSET is to develop and implement a European Academy for teachers, equipping them with the competences to create, use, and adapt Open Educational Resources (OERs), digital technologies, and AI algorithms. DigiSET aims to enhance the digital skills of European educators, aligning with the DigCompEdu, LifeComp, and GreenComp frameworks. It addresses the specific need for teacher upskilling in digital technologies through comprehensive training and a supportive community of practice, fostering a sustainable education system across Europe.

To ensure that the training program effectively meets the needs of educators across diverse national contexts, needs analysis were conducted via a comprehensive teacher survey in all DigiSET countries. So, the presented survey in Spain serves as the empirical foundation for understanding the status of digital and sustainability teaching competences, identifying specific barriers to integration, and validating the requirements for the targeted training modules.

1.2 Spain's national strategies concerning teachers' competences for digital sustainability and current developments

The Spanish context offers a particularly relevant setting for this analysis. The desk study conducted by Maude Studio as the first step of Task 2.2 (Sola, 2026) showed that Spain has consolidated a robust institutional architecture for teacher digital competence: the national framework for teacher digital competence (Marco de Referencia de la Competencia Digital Docente, MRCDD), updated in 2022 and explicitly based on DigCompEdu, structures teacher digital competence into six areas and 23 competences and is linked to a formal accreditation procedure agreed between the Ministry of Education and the Autonomous Communities (Resolución de 4 de mayo de 2022; INTEF, 2022). Its implementation is supported by the Plan for Digitalisation and Digital Competences of the Education System (#DigEdu), endowed with more than EUR 1.66 billion and including the target of accrediting the digital competences of 560,000 teachers (European Commission, 2025). In parallel, the reform of vocational education and training introduced by Organic Law 3/2022 integrated sustainability and digitalisation modules across all VET programmes and created a new AI-and-data VET track (Ley Orgánica 3/2022; European Commission, 2025).

At the same time, the desk study concluded that key competences related to systems thinking for sustainability, the pedagogically grounded use of artificial intelligence, open educational practices and integrated competence development “remain fragmented” in Spain (Sola, 2026). Recent representative data point in a similar direction: according to the Spanish TALIS 2024 report, about one in three secondary teachers (35%) already uses AI regularly in the classroom, while only 56% of secondary teachers rate the professional development they received as being of high quality (INEE, 2025). The DigiSET survey in Spain therefore addresses a timely question: to what extent do (future) teachers perceive themselves as competent in the digital, AI, sustainability and OER domains, and which training needs do they consider most urgent?

As the Spanish partner of the DigiSET consortium, Maude Studio — a Málaga-based training organisation active in vocational training for employment (formación profesional para el empleo, FPE) and in continuing training on digital competences — administered the Spanish version of the consortium questionnaire. This institutional profile is directly reflected in the composition of the achieved sample (see Section 3) and must be taken into account when interpreting the results.

1.3 Structure

Following this introduction, Section 2 outlines the research methodology, detailing the sampling strategy, and data collection processes specific to the national context. Section 3 provides a comprehensive demographic profile of the respondents, offering essential context regarding their professional status, teaching experience, and subject specializations. The core empirical findings are presented in Section 4. This section systematically analyses teacher competences across four primary domains: Digital Teaching Competence, AI Competence, Education for Sustainable Development (ESD), and Open Educational Resources (OER). Furthermore, it examines specific competence requirements regarding adaptive AI use, gender bias, inclusive practices, and systems thinking, alongside an analysis of faced challenges and professional development needs. Section 5 synthesizes these results through a critical discussion, contextualizing the findings within the national framework and current state of research while addressing the generalizability and limitations of the study. Finally, Section 6 delineates the implications derived from the data, offering evidence-based recommendations for the development of the DigiSET Framework of Learning Outcomes and proposing strategies for the integration of these outcomes into national teacher training provisions.

2. Methodology

This section describes the methodological approach underlying the DigiSET teacher survey in Spain, including the survey development, sampling strategy, data collection procedures, and analytical methods employed.

2.1. Survey development, ethics and analysis

A detailed description of the questionnaire design and the analysis is given in a report by DigiSET (Keser Aschenberger et al., 2026).

In addition to the centrally coordinated analysis, two complementary analyses were carried out for this country report. First, item-level aggregates (shares of the two highest and the two lowest scale points, and item means) were computed from the frequency distributions provided by the TU Graz team in the accompanying Excel file (data export of 22 June 2026) in order to support the descriptions in Section 4. Second, an initial qualitative screening of the open-ended responses (Q1–Q3) was conducted with AI support (Claude, Anthropic; version as of August 2026) to identify recurrent themes and extract illustrative quotations. The thematic categorisations and all reported counts were subsequently cross-checked against the original Spanish responses by the author, and the quotations reported in Section 4.6 were translated from Spanish into English. While not a formal qualitative coding procedure, this approach served to surface dominant patterns transparently prior to the consortium-level analysis. In line with the approach of the central analysis team — which conducted no subgroup comparisons at consortium level given the large differences between the national data sets — no subgroup comparisons were undertaken for this country report either.

2.2. Sampling strategy and data collection

2.2.1. Target population and recruitment process

The target population of the Spanish DigiSET survey comprised practising teachers and trainers as well as future teachers in Spain, covering educational contexts with learners from age 6 to over 20, from primary education to vocational education and training, as defined in the survey instrument (Keser Aschenberger et al., 2026). In practice, recruitment was driven primarily through the professional networks of Maude Studio, the Spanish partner of the DigiSET consortium and national contact point for the survey. The invitation was disseminated through four complementary channels: (a) Maude Studio's own training networks, in particular teachers and trainers active in vocational training for employment (FPE) and participants in Maude Studio's courses on digital competences and teacher training; (b) direct e-mail invitations to collaborating training centres and organisations; (c) the social media channels of Maude Studio and its team; and (d) third-party multipliers who forwarded the invitation within their own networks, for example, associations of teachers. Given these recruitment pathways, the achieved sample is strongly rooted in the FPE subsystem — publicly funded, employment-oriented training for employed and unemployed adults, delivered largely by private accredited providers — rather than in the school system. Several respondents explicitly referred to training courses they had attended in the open comments. This composition differs substantially from a school-teacher sample and is examined in detail in Sections 3 and 5.3.

2.2.2. Data collection period and number of responses

The survey was administered online via umfrageonline.com. Data were collected between April and June 2026; the cleaned data set analysed in this report corresponds to the consortium data export of 22 June 2026.

Table 1 details the responses of the teacher survey: in total, 165 responses were recorded. Twenty-six respondents did not answer any question, and no response had to be excluded for answering only one or two questions, so that 139 responses were included in the analysis. Because the invitation was distributed through open channels and forwarded by multipliers, the total number of persons reached cannot be determined and no response rate can be calculated. Item non-response

increases over the course of the questionnaire: the digital teaching competence items were answered by 137–139 respondents, the AI items by 124–126, and the ESD, OER and background items by approximately 103–120 respondents (the lowest value corresponding to the open age question, $n = 103$).

Table 1: Responses and used entries of the teacher survey in Spain

Responses and used data	
Total	165
No questions answered	26
Only one or two questions	0
Included in the analysis (n)	139

3. Demographic profile of respondents

3.1. Gender and age (B6, B7)

Table 2 shows the gender distribution of the participants. Among the 116 respondents who answered this question, exactly half identify as women (50.0%), 43.1% as men and 6.9% preferred not to say; no respondent identified as non-binary. Twenty-three respondents did not answer this question.

Table 2: Gender of participants in the teacher survey in Spain

	How do you identify your gender?	
	Frequency	Percent
Woman	58	50,0
Man	50	43,1
Non-binary / Another gender identiy	0	0,0
Prefer not to say	8	6,9
Total	116	100,0

Figure 1 gives insights into the age of the participants ($n = 103$). Respondents are, on average, in mid-career: the mean age is 45.8 years (median 47; $SD = 9.3$), with a range from 24 to 66 years. The distribution leans towards the upper-middle age groups: the most frequent five-year band is 50–54 years, about two thirds of respondents are between 40 and 55 years old, and fewer than one in ten is younger than 30. The survey thus reached an experienced, adult workforce rather than students at the beginning of their careers.

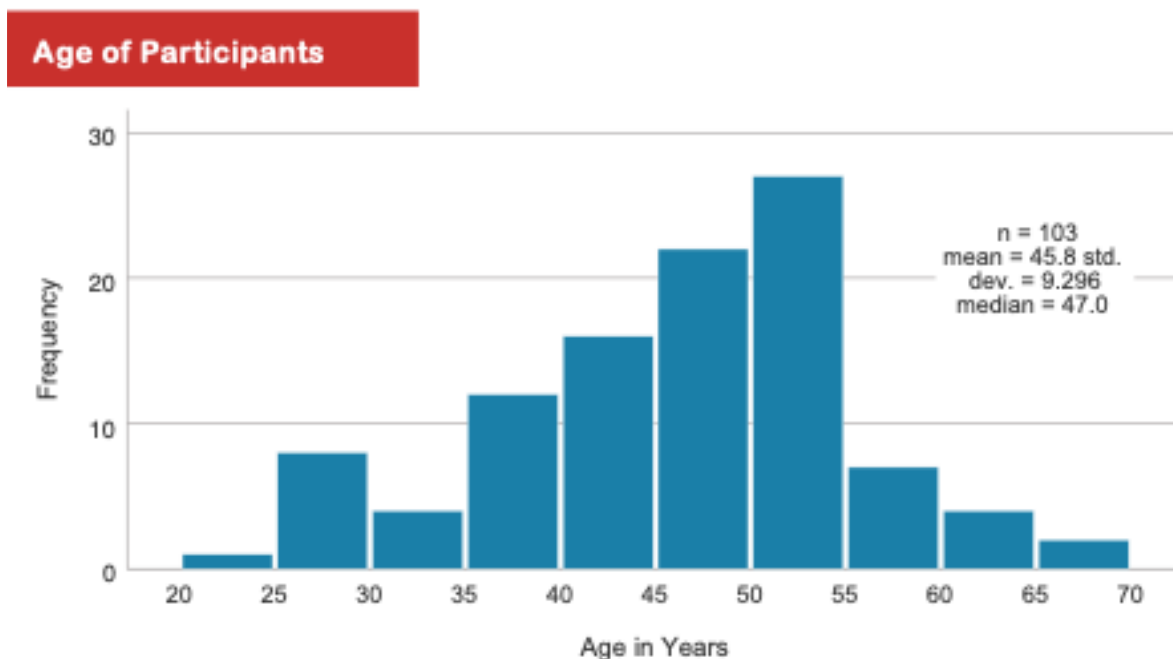


Figure 1: Age of participants in the DigiSET teacher survey in Spain.

3.2. Status of respondents (B1)

Figure 2 shows the current status of the respondents (n = 116). Half of the respondents (50.0%) work at a private or independent educational organisation, which is the single most frequent status. About one quarter (23.3%) state that they are studying to become a teacher, 14.7% work at a public or state-funded school, a further 14.7% are currently looking for a job, and 0.9% work at a church-affiliated school. An additional 15.5% selected “other”; these open answers refer almost exclusively to teaching in vocational training for employment (FPE) — for example as trainers of certificados de profesionalidad or in publicly funded upskilling programmes — alongside freelance trainers and one university lecturer. The high shares of private-provider staff, FPE trainers and job-seeking respondents reflect the structure of the FPE subsystem, in which many trainers work on temporary, course-based contracts; one respondent explicitly linked the job search to “the temporary nature of the contracts”.

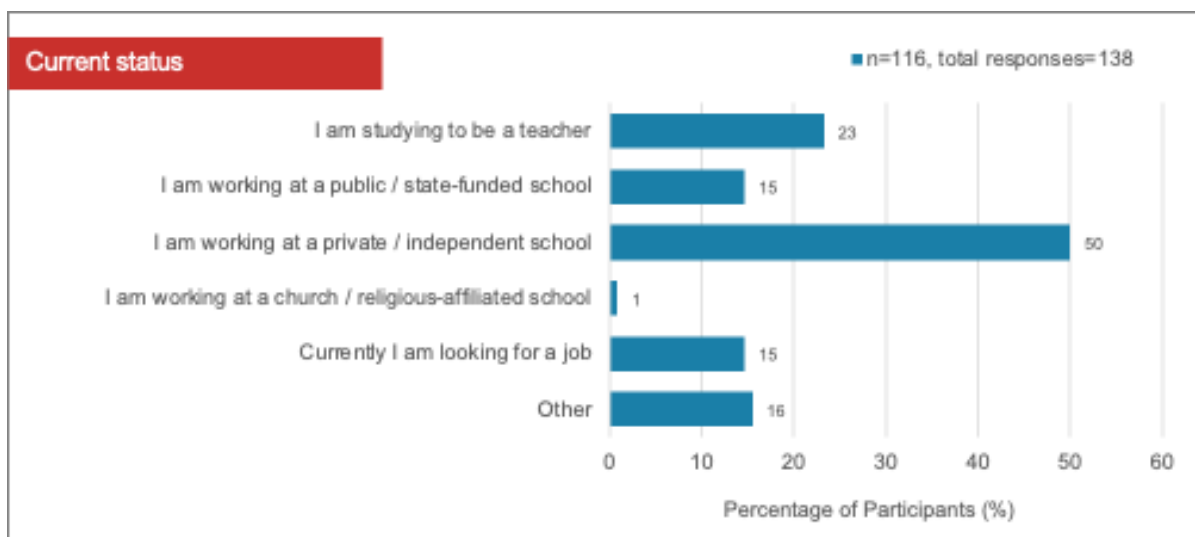


Figure 2: Current status of participants in the DigiSET teacher survey in Spain.

Note: Multiple responses were allowed; therefore, totals exceed 100%.

3.3. School levels taught or expected to teach (B2)

Figure 3 shows the school levels at which respondents teach or expect to teach (n = 117). Vocational education (ISCED 3/4) clearly dominates with 57.3%, followed by “other” with 31.6%. The open answers behind “other” overwhelmingly refer to vocational training for employment (FPE) and certificados de profesionalidad, together with non-formal training, online courses and adult education in general, and two mentions of university teaching. Lower secondary (17.1%), upper secondary (14.5%) and especially primary level (5.1%) are comparatively rare. The sample is thus overwhelmingly anchored in vocational and adult training contexts rather than in general school education.

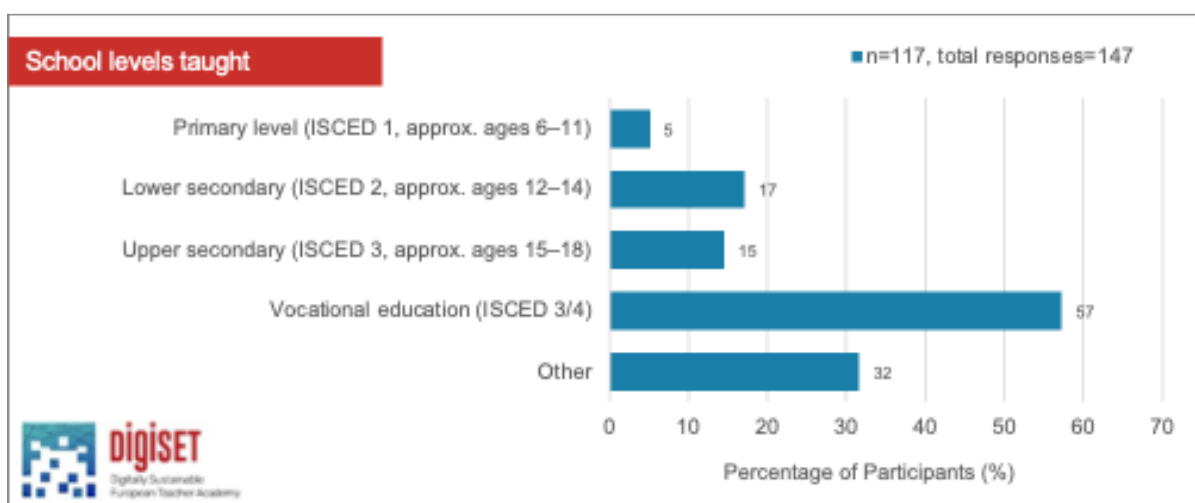


Figure 3: School levels taught or expected to be taught by participants in the DigiSET teacher survey in Spain.

Note: Multiple responses were allowed; therefore, totals exceed 100%.

3.4. Subjects currently taught or expected to be taught (B3)

Figure 4 shows the subjects taught or expected to be taught ($n = 113$). Vocational subjects are by far the most frequent (52.2%), followed by computer science / digital literacy (23.9%). All general school subjects remain below 15%: foreign languages (14.2%), social sciences/history (9.7%), natural sciences (7.1%), native language/reading (6.2%), art/music (5.3%), mathematics (3.5%) and physical education (0.9%). A large group (29.2%) selected “other”; these open answers list a wide spectrum of employment-oriented training fields — among others administration, commerce and marketing, electricity, hospitality, occupational risk prevention, labour-market orientation and legal training — as well as explicitly digital fields such as “generative AI, automation with AI and digital marketing” or “AI, 5G, digital skills, digital literacy”.

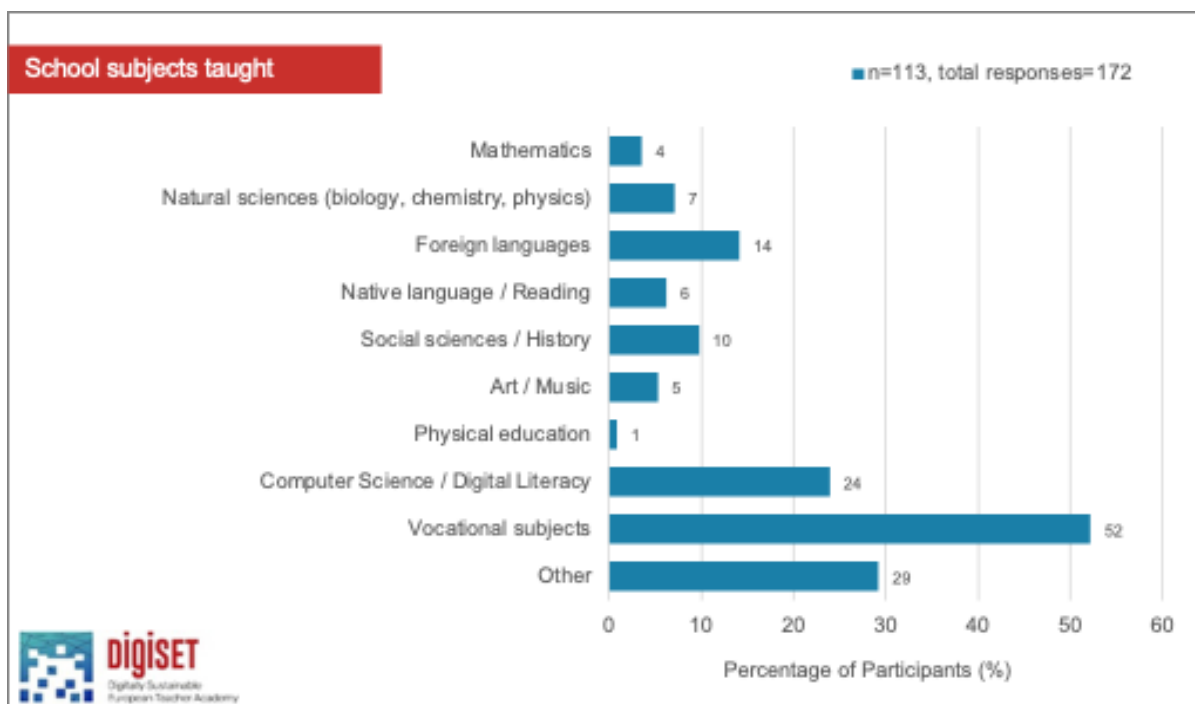


Figure 4: Subjects currently taught or expected to be taught by participants in the DigiSET teacher survey in Spain.

Note: Multiple responses were allowed; therefore, totals exceed 100%.

3.5. Teaching Experiences (B4)

Figure 5 shows the distribution of teaching experience ($n = 117$). The sample combines all career stages with a centre of gravity in the early-to-middle career: 21.4% have 1–5 years and 20.5% have 6–10 years of experience, while 15.4% have taught for more than 20 years, 11.1% for 11–15 years and 10.3% for 16–20 years. At the margins, 12.0% have less than one year of experience and 9.4% none at all. In total, 63.2% of respondents have at most ten years of teaching experience — a noteworthy pattern given the comparatively high mean age (Figure 1), which suggests that a substantial share of respondents entered teaching or training as a second career, a common trajectory in the Spanish FPE sector, where professionals often move into training after years of occupational practice.

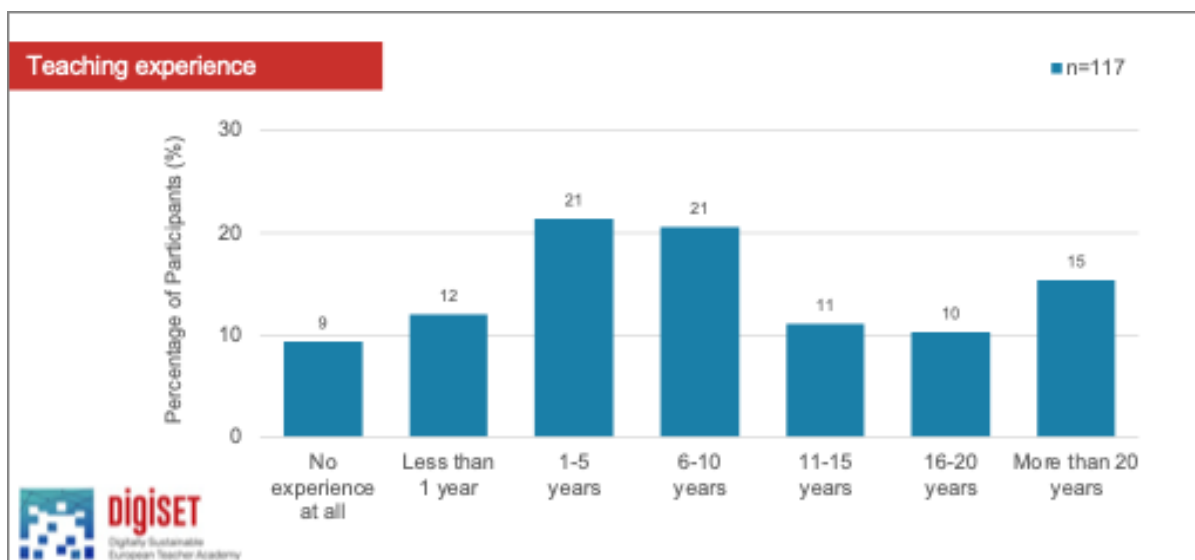


Figure 5: Teaching experiences of participants in the DigiSET teacher survey in Spain.

4. Results

This section reports the findings of the DigiSET teacher survey in Spain across four core competence domains — digital teaching, AI, education for sustainable development (ESD), and open educational resources (OER) — as well as specific DigiSET focus topics, followed by an analysis of challenges faced and professional development needs identified by respondents.

4.1. Self-perceived digital teaching competence

4.1.1. Professional engagement (D1-D4)

Figure 6 shows the professional engagement of the participants in relation to digital teaching. Self-reported engagement is very high across all four items. More than nine in ten respondents (90.6%) use different digital channels to communicate with learners and colleagues often or always, and the same share (90.6%) uses digital technologies to collaborate with colleagues inside and outside their organisation. Active development of one's own digital competence is nearly universal: 92.0% report doing so often or always, and no respondent answered never or rarely. Awareness of and participation in online training opportunities is only slightly lower (80.6% often/always), with 16.5% choosing sometimes and 2.9% never or rarely. Professional engagement is thus the strongest of the six DigCompEdu areas in the Spanish sample.

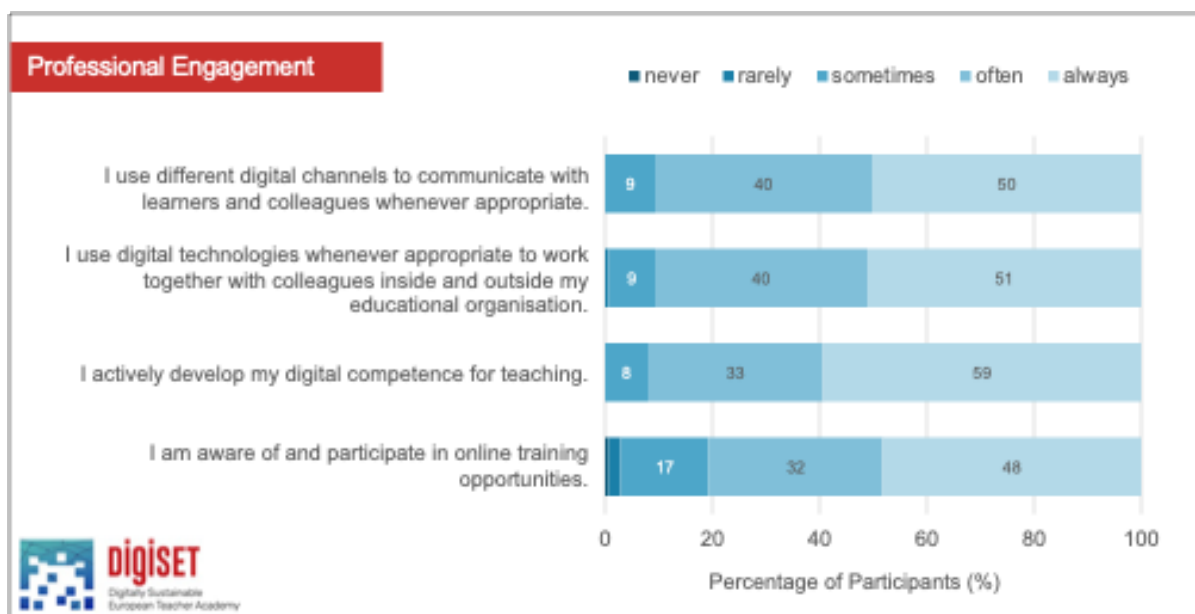


Figure 6: Self-perceived digital teaching competence – professional engagement.

4.1.2. Digital resources (D5-D7)

Figure 7 addresses the area of digital resources. A large majority of 88.5% often or always use different internet sites and search strategies to find and select digital resources, and 76.8% often or always create their own digital resources or modify existing ones, although 7.2% never or rarely do so. The strongest single value of the whole DigCompEdu section is found for data protection: 71.7% of respondents state that they always effectively protect personal data such as exams, learners' grades and personal information (84.8% often/always). At the same time, 5.1% report protecting personal data only rarely — a small but relevant group considering the legal obligations involved.

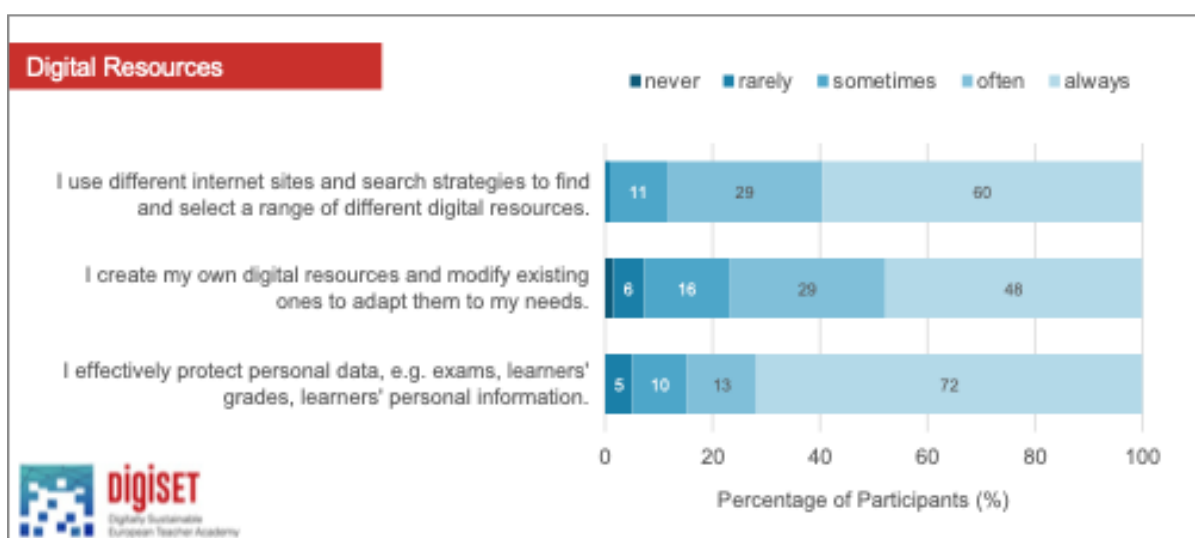


Figure 7: Self-perceived digital teaching competence – digital resources.

4.1.3. Teaching and learning (D8-D11)

Figure 8 addresses teaching and learning. Reflective technology use is nearly universal: 90.5% state that they carefully consider how, when and why to use digital technologies so that they are used with added value (only 2.2% never/rarely). Similarly, 88.5% often or always follow learners' activities and interactions in the collaborative online environments used — a pattern consistent with a sample in which online and distance teaching is widespread. Values are somewhat lower for learner-centred uses: 77.4% report that learners use digital technologies in group work often or always (6.6% rarely), and 76.8% use digital technologies to allow learners to plan, document and monitor their own learning (8.7% rarely). This relative order — higher for teacher-managed uses, lower for learner-managed uses — anticipates the pattern observed in the following areas.

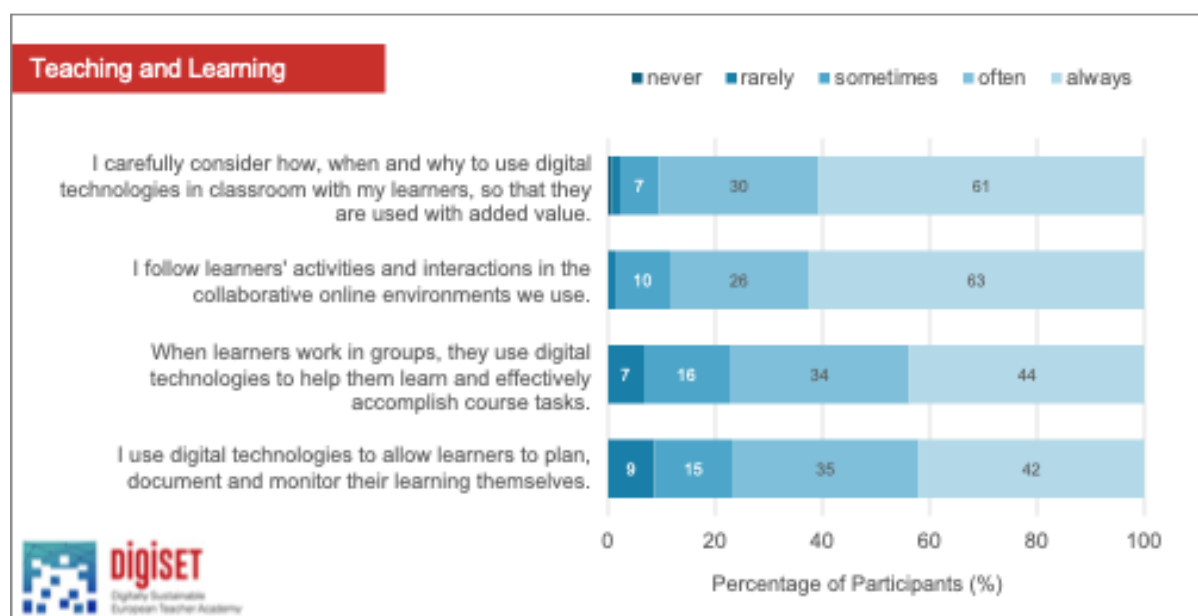


Figure 8: Self-perceived digital teaching competence – teaching and learning.

4.1.4. Assessment (D12-D14)

Figure 9 shows the assessment items, the comparatively weakest part of the digital teaching competence section. 73.2% of respondents use digital assessment tools to monitor learner progress often or always, whereas 12.3% never or rarely do so — including the largest “never” share of the section (5.1%). Analysing available data to identify learners who need additional support is more widespread (80.4% often/always; 54.3% always). Digital technologies are used to provide effective feedback often or always by 73.9% of respondents, with 8.7% answering never or rarely.

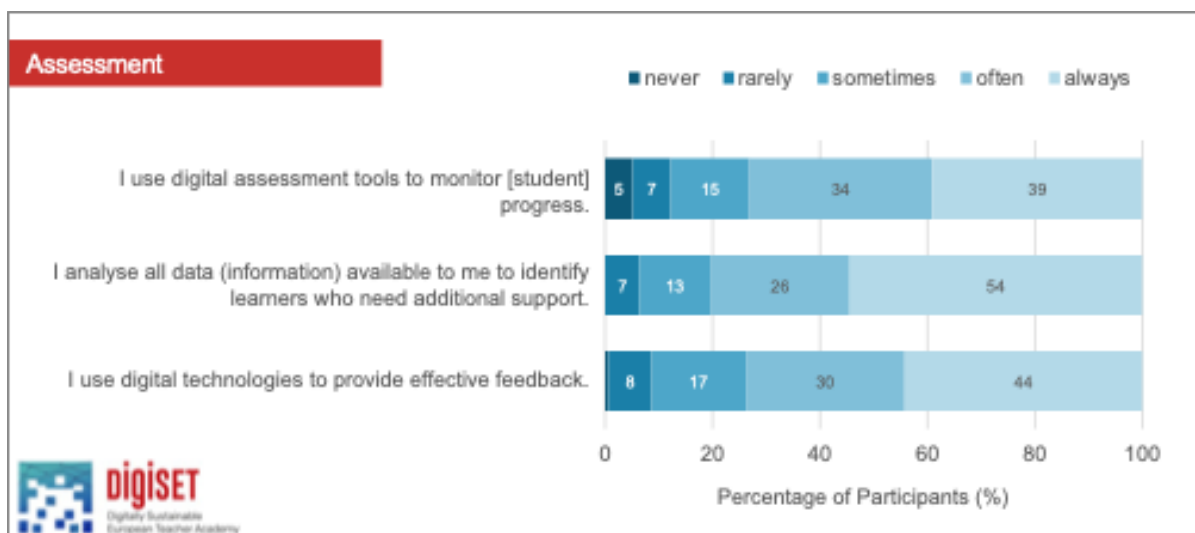


Figure 9: Self-perceived digital teaching competence – assessment.

4.1.5. Empowering learners (D15-D17)

Figure 10 presents the items on empowering learners. Anticipating practical or technical difficulties when creating digital assignments is almost universal (91.2% often/always). 84.1% often or always use digital technologies to enable learners to participate actively in class or online learning, whereas personalised learning opportunities are offered somewhat less frequently: 73.9% often/always, with 20.3% sometimes and 5.8% never/rarely. Personalisation is thus the relatively weakest item of this area — a finding that connects directly to the adaptive-learning results in Section 4.5.1.

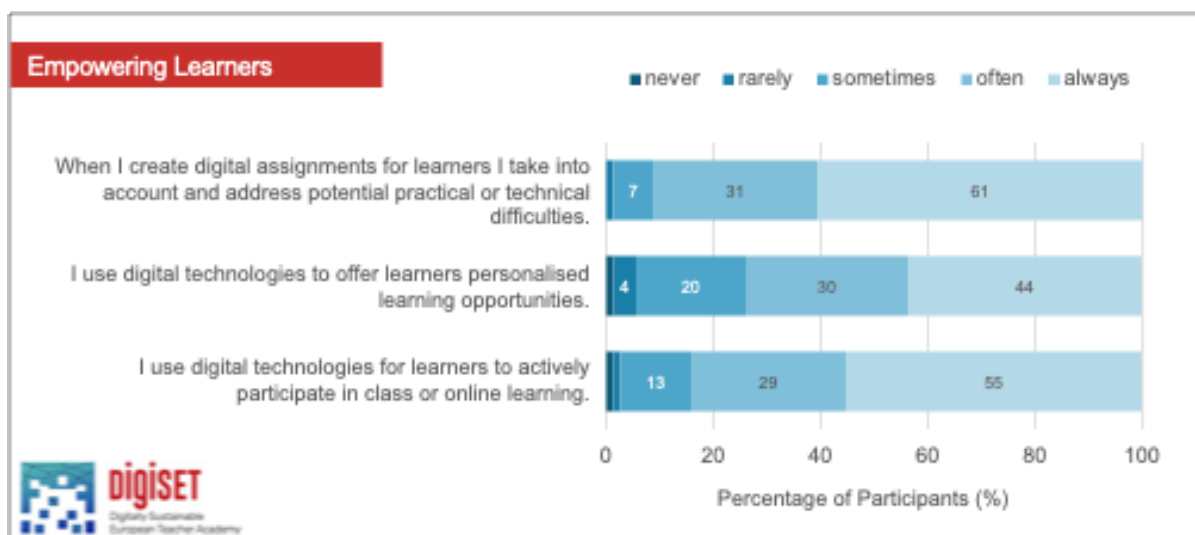


Figure 10: Self-perceived digital teaching competence – empowering learners.

4.1.6. Facilitating learners' digital competence (D18-D22)

Figure 11 shows the items on facilitating learners' digital competence, where the widest internal spread of the section appears. Teaching learners to use digital technology safely and responsibly (84.1% often/always) and to assess the reliability of information (83.3%) are well established, and 79.7% encourage learners to use digital technologies creatively to solve concrete problems. By contrast, tasks that require learners themselves to produce digital artefacts are markedly less common:

71.0% set course tasks requiring learners to use digital means to communicate and collaborate (10.1% never/rarely), and only 62.3% set assignments requiring learners to create digital content — the lowest value of all 22 DigCompEdu items, with 15.9% answering never or rarely. As in the teaching-and-learning area, respondents appear more confident in what they themselves do with technology than in what they have their learners do with it.

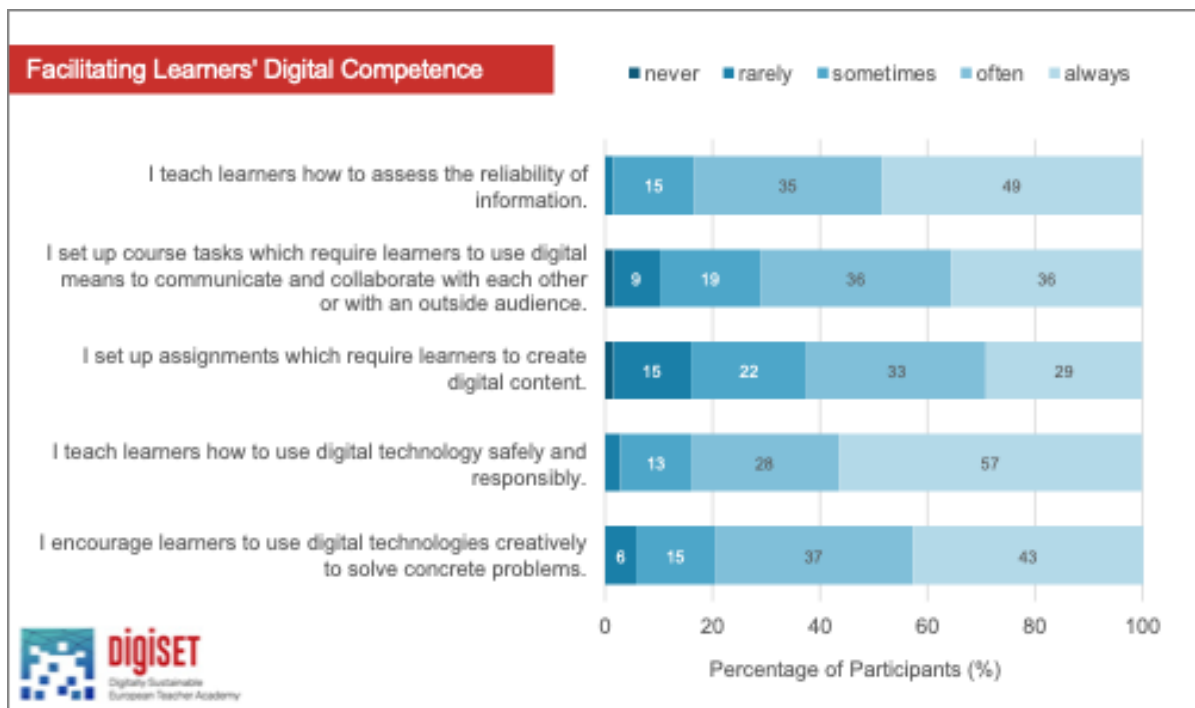


Figure 11: Self-perceived digital teaching competence – facilitating learners' digital competence.

4.2. Self-perceived AI competence

4.2.1. AI knowledge (A1-A4)

Figure 12 presents respondents' confidence in their AI knowledge. Two thirds (67.5%) feel very or completely confident explaining what AI is, and 64.3% feel confident creating content with AI. Confidence is markedly lower for the two more technical knowledge items: only 50.8% feel very or completely confident explaining what generative AI is (31.0% not at all or only slightly confident), and 46.8% in distinguishing whether a tool is AI-based or not (25.4% low confidence). Compared with the digital teaching competence section, responses are considerably more polarised: in every AI knowledge item, at least one in six respondents reports low confidence.

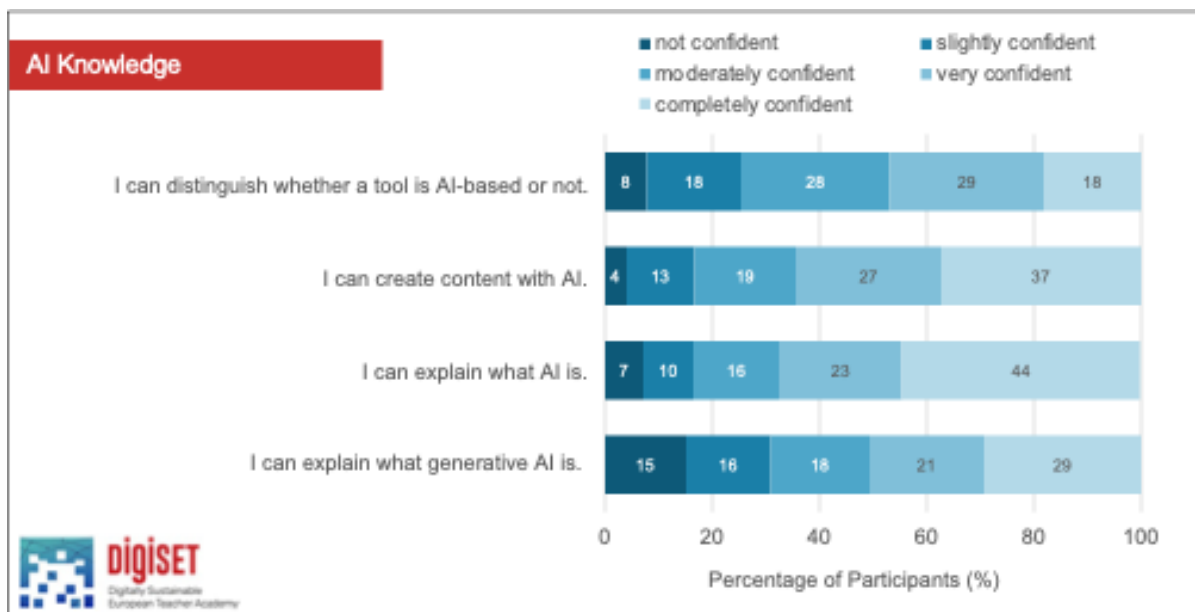


Figure 12: Self-perceived AI competence – AI knowledge.

4.2.2. AI pedagogy (A5-A8)

Figure 13 shows the AI pedagogy items. Around two thirds of respondents feel very or completely confident choosing an AI tool that enhances the subject content of a lesson (64.3%) or choosing an AI tool for classroom use that enhances what and how they teach (62.9%), and 62.7% feel confident teaching lessons that appropriately combine subject content, AI tools and pedagogical approaches. Helping others design such learning activities attracts the lowest confidence of the dimension (58.7%, with 26.2% not at all or only slightly confident). Across all four items, roughly one in five respondents reports low confidence, indicating a substantial group with concrete training needs in the pedagogical integration of AI.

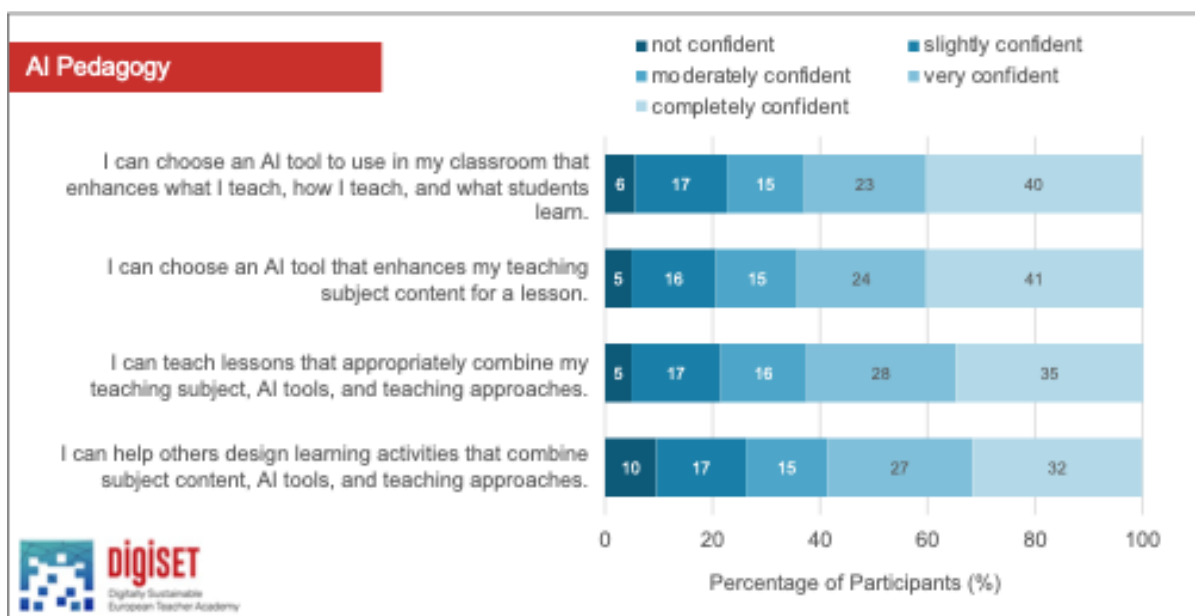


Figure 13: Self-perceived AI competence – AI pedagogy.

4.2.3. AI assessment (A9-A12)

Figure 14 addresses AI-supported assessment, which — together with AI ethics — is the weakest AI dimension. Only about half of the respondents feel very or completely confident using an AI tool to foster assessment for learning (55.6%), designing an assessment approach to improve student learning in AI-based environments (53.2%), using an AI tool to grade an assignment (52.4%) or assessing student learning in an AI-based environment (51.6%). Conversely, between 22.2% and 30.2% report feeling not at all or only slightly confident, with the largest low-confidence share for assessing learning in AI-based environments. Assessment thus emerges as a bottleneck in both the digital domain (Figure 9) and the AI domain.

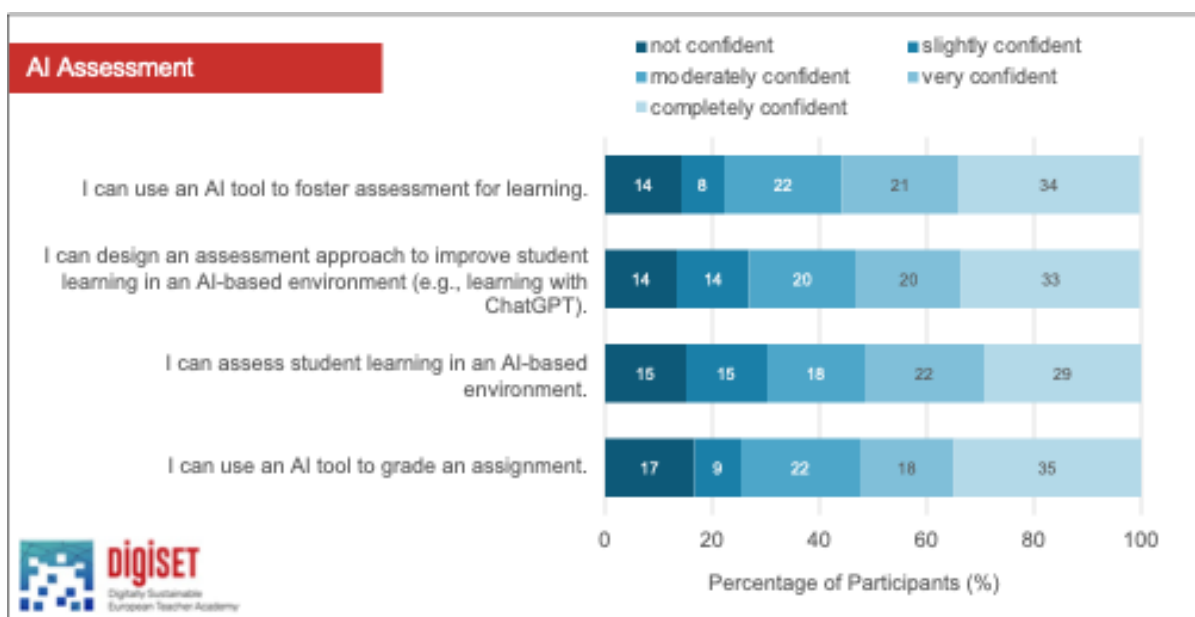


Figure 14: Self-perceived AI competence – AI assessment.

4.2.4. AI ethics (A13-A16)

Figure 15 presents the AI ethics items, which include the AI item with the largest share of low confidence in the entire Spanish survey: only 48.8% feel very or completely confident protecting sensitive content such as exams, grades and personal data from AI tools, while 32.8% — the highest low-confidence share of all 24 AI items — feel not at all or only slightly confident. Slightly more than half report high confidence teaching students to behave safely and responsibly when learning with AI tools (54.4%), teaching students ethics in this domain (53.2%) and ensuring their own health and well-being while using AI tools (52.0%). Given that the protection of personal data was the strongest item of the digital competence section (Figure 7), this contrast suggests that respondents feel well prepared for conventional data protection but not yet for its AI-specific dimension.

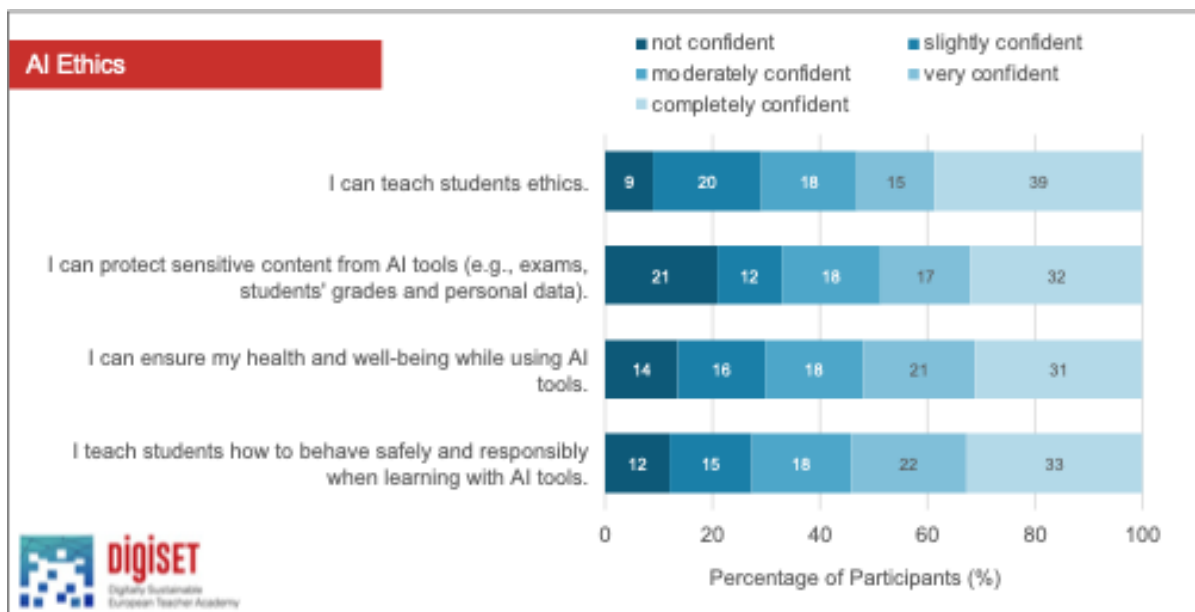


Figure 15: Self-perceived AI competence – AI ethics.

4.2.5. AI human-centred education (A17-A20)

Figure 16 shows the items on human-centred education. 62.1% feel very or completely confident recognising that humans are responsible for AI bias, and 57.9% explaining how AI impacts our society. Assessing the risks (56.5%) and the benefits (53.6%) of an AI tool follows closely. Although this dimension ranks among the stronger AI areas, between one fifth and one quarter of respondents (21.0–25.0%) report low confidence in every item, so that a critical-reflective AI competence can by no means be taken for granted in the sample.

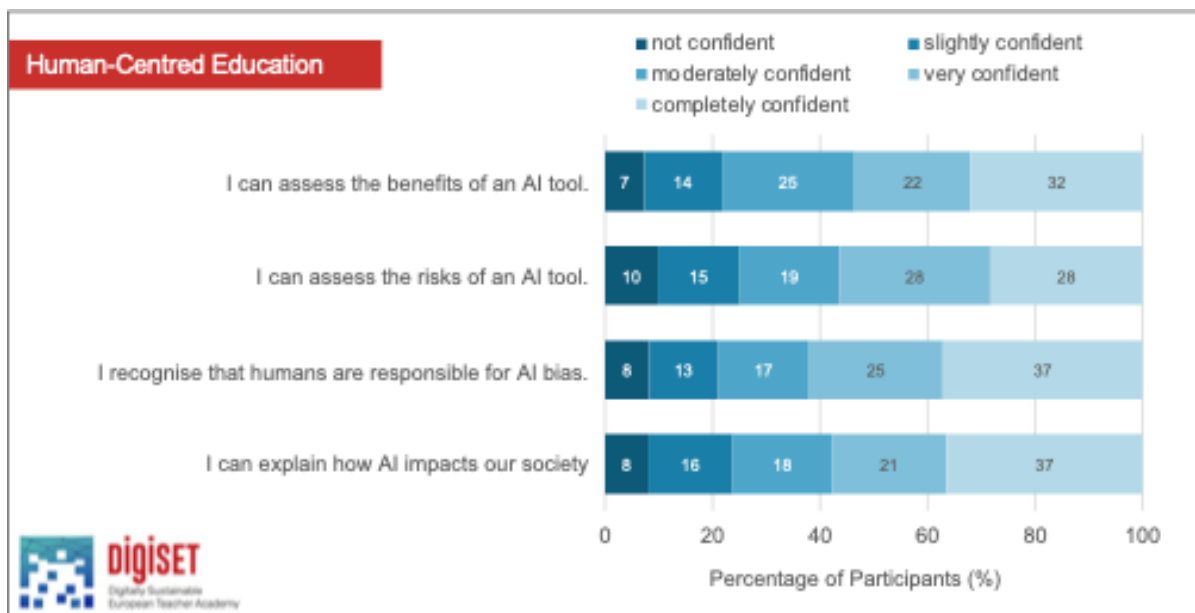


Figure 16: Self-perceived AI competence – human-centred education.

4.2.6. AI professional engagement (A21-A24)

Figure 17 addresses professional engagement in relation to AI. 60.3% of respondents feel very or completely confident actively looking for continuous professional development activities outside their organisation, and 55.6% using different websites and search strategies to find and select AI tools. Confidence is lower for the collegial dimension: 49.6% feel confident actively sharing their AI teaching experience with colleagues, and 49.6% state that they love to help colleagues design learning activities with AI, with around one quarter (24.8–26.4%) reporting low confidence. The peer-to-peer diffusion of AI competence within organisations thus appears to be the least developed aspect of professional engagement.

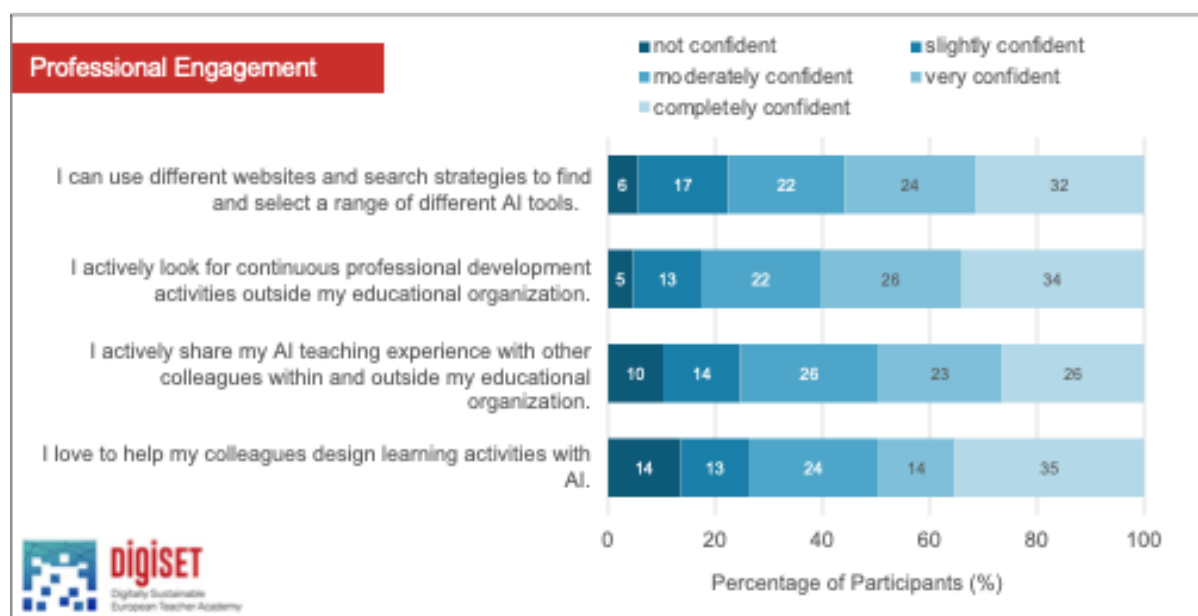


Figure 17: Self-perceived AI competence – professional engagement.

4.3. Self-perceived education for sustainable development (ESD) competence

4.3.1. Systems and critical thinking (S1-S3)

The questions on systems and critical thinking are presented in 4.5. (p. 24ff) as they are specifically addressing a DigiSET core topic.

At item level, the results are nevertheless summarised here, as they are among the strongest of the ESD section. 87.1% of respondents agree or strongly agree that they help learners understand the interconnections between the environmental, social and economic aspects of sustainability (53.4% strongly agree; $n = 116$), and 85.5% that they encourage learners to critically reflect on sustainability-related issues (53.0% strongly agree). Agreement is somewhat lower — though still high — for the most analytically demanding item: 80.3% support learners in analysing complex sustainability problems from multiple perspectives, with the largest neutral share of the three items (17.1%) and “strongly agree” falling below half (44.4%). Disagreement is marginal throughout (1.7–2.6%). The internal gradient is informative: agreement declines slightly as the items move from conveying an awareness of interconnections towards demanding multi-perspective analytical work with learners — the same awareness-to-application slope observed across the

survey. As with all ESD items, the agreement-scale format may have produced higher values than the confidence scales used elsewhere (Keser Aschenberger et al., 2026, Section 2.8).

4.3.2. Pedagogical practice for ESD (S4-S7)

Figure 18 shows how respondents apply pedagogical practices for ESD. A large majority of 83.9% agree or strongly agree that they integrate sustainability topics into their teaching practice, 81.5% use participatory and learner-centred approaches when addressing sustainability, and 81.4% design learning activities that promote active engagement with sustainability challenges. The clearly weakest item of this subsection is the digitally supported implementation of ESD: 73.3% agree or strongly agree that they use digital technologies — such as simulations, collaborative platforms, data visualisation tools or AI-based applications — to engage learners with real-world sustainability challenges, while 10.8% disagree or strongly disagree, the highest disagreement within the pedagogical-practice items. This pattern mirrors the DigiSET premise that the digital and the sustainability agendas are not yet systematically connected in classroom practice.

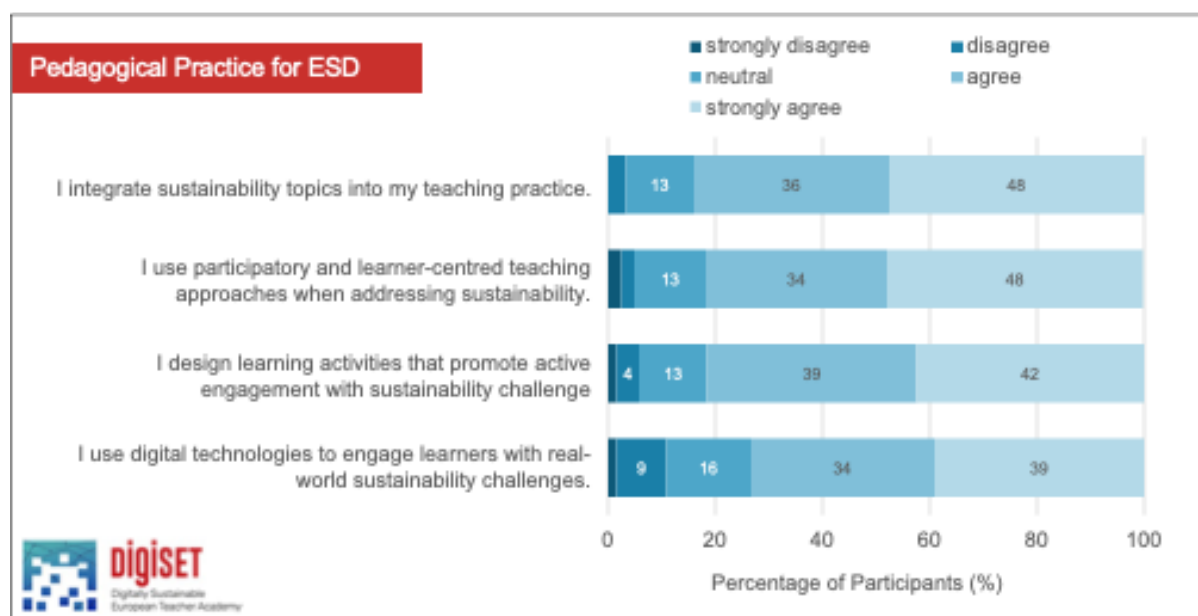


Figure 18: Self-perceived ESD competence – pedagogical practice for ESD.

4.3.3. Values and responsibility (S8-S10)

Figure 19 presents the values and responsibility items, which reach the highest agreement of the ESD section. 91.7% of respondents agree or strongly agree that they promote values such as responsibility, equity and respect for diversity in their teaching (65.0% strongly agree), 85.8% support learners in developing a sense of responsibility for sustainable development, and 85.7% encourage learners to consider the ethical implications of sustainability issues. Disagreement remains marginal throughout (1.7–2.5%).

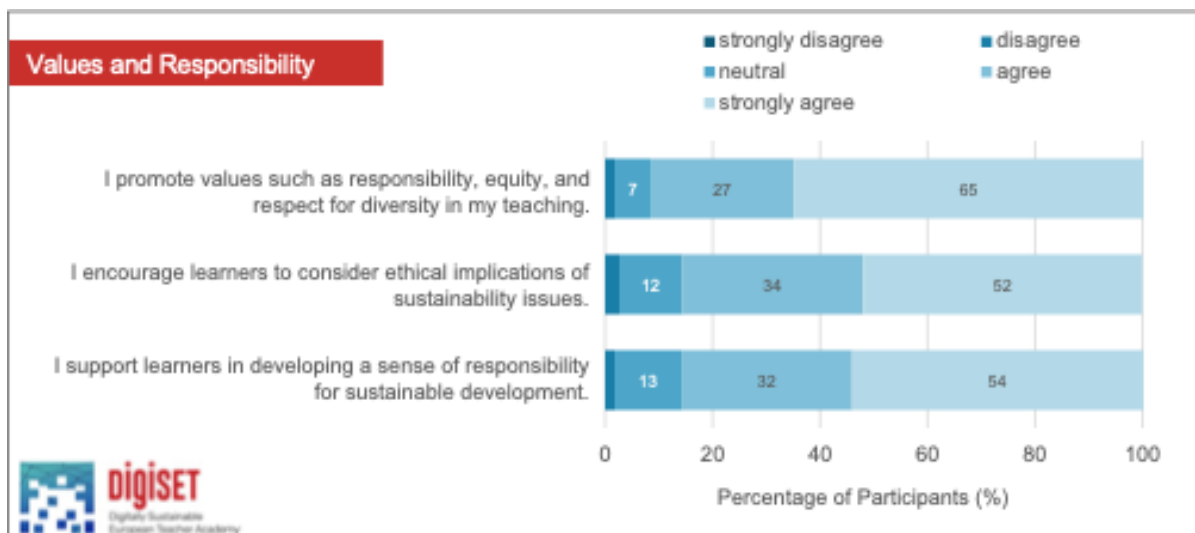


Figure 19: Self-perceived ESD competence – values and responsibility.

4.3.4. Reflective and action-oriented practice (S11-S13)

Figure 20 addresses reflective and action-oriented practice. 85.0% agree or strongly agree that they reflect on their teaching practice in relation to sustainability and seek continuous improvement, and 82.5% support learners in applying sustainability knowledge to real-life situations. Confidence is considerably lower for moderating discussions: only 70.0% agree or strongly agree that they feel confident facilitating discussions on complex or controversial sustainability issues, while 13.3% disagree or strongly disagree — the highest disagreement of the whole ESD section. Facilitating controversial sustainability debate thus stands out as the most concrete ESD-related training need in the Spanish sample.

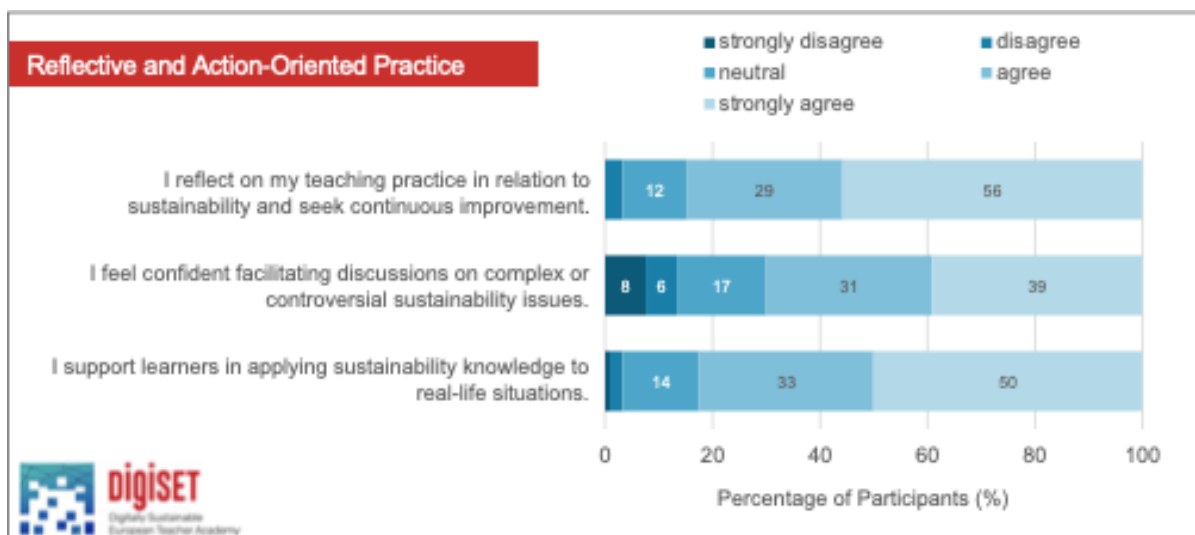


Figure 20: Self-perceived ESD competence – reflective and action-oriented practices.

4.4. Self-perceived Open Educational Resource (OER) competence (O1-O5)

Figure 21 shows the OER items, the domain with the most reserved and most uncertain answers of the survey. 60.7% agree or strongly agree that they have prior experience of using OER, 59.0% consider their ICT skills sufficient to adopt and use

OER, 58.1% adopt OER in their teaching because they fulfil the academic requirements of their students, and 56.4% state that their own competences and knowledge help them participate in or adopt OER. Knowledge of intellectual property rights is the weakest aspect (55.2% agreement; 15.5% disagreement). Most notably, between 29.1% and 35.0% of respondents chose the neutral middle category in every OER item — by far the largest neutral shares of the questionnaire — suggesting that about a third of the sample has no settled position towards OER, plausibly reflecting limited familiarity with the concept itself.

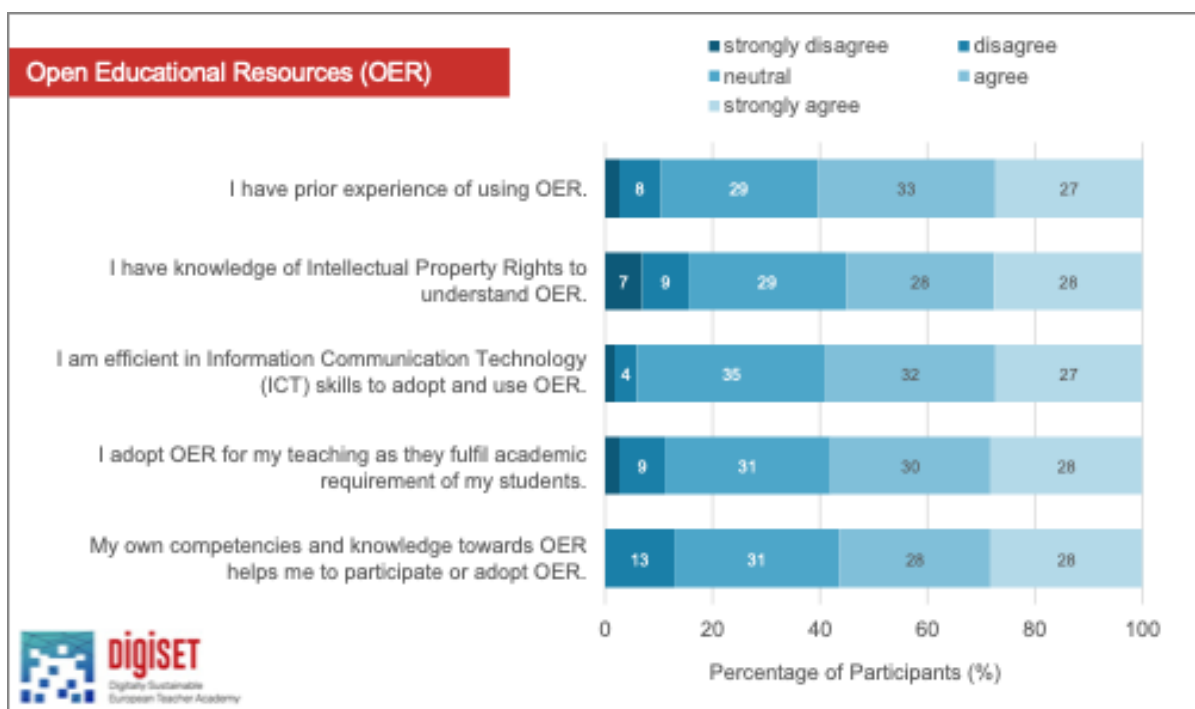


Figure 21: Self-perceived OER competence.

4.5. Self-perceived competences for specific DigiSET topics

4.5.1. Adaptive AI use (AD1, AD2)

Figure 22 shows the two items on AI for adaptive learning. Only about half of the respondents (51.6%) feel very or completely confident using AI tools to personalise learning for individual students, and the same share (51.6%) reports knowing how to use AI for differentiated instruction based on student needs. Conversely, 28.6% and 31.0% respectively feel not at all or only slightly confident. Adaptive AI use is thus considerably weaker than respondents' general, non-AI-specific personalisation practice (73.9% often/always; Figure 10), pointing to an AI-specific implementation gap. It should be noted that items AD1 and AD2 were phrased as behavioural/knowledge statements but assessed on a confidence scale (Keser Aschenberger et al., 2026, Section 2.8).

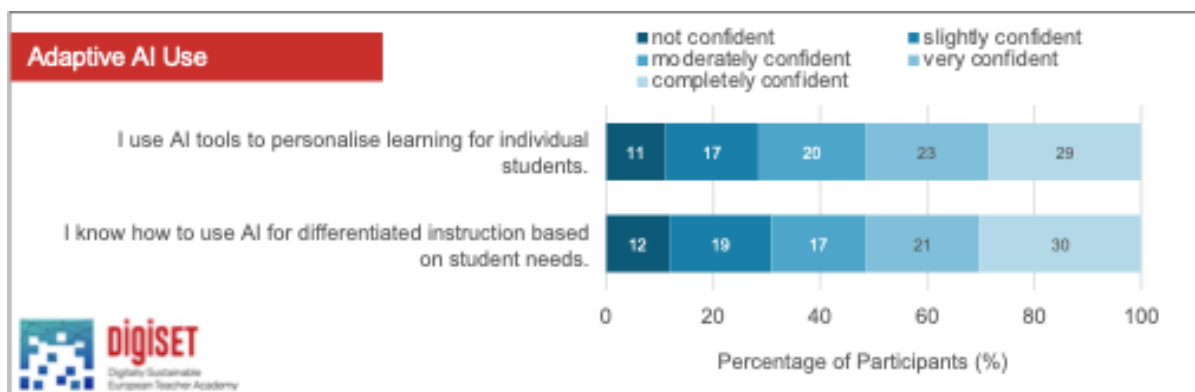


Figure 22: Adaptive AI use.

4.5.2. Gender bias in AI (GD1, GD2)

Figure 23 presents the items on gender bias in AI, the weakest of the four DigiSET-specific topics. Fewer than half of the respondents (48.8%) feel very or completely confident about being aware of gender bias in AI-generated content, and 46.4% about knowing how to address gender stereotypes when using AI in teaching; 25.6% and 29.6% respectively report low confidence. Unlike in other domains, awareness and actionable strategy are almost equally weak here, indicating that the topic as such is largely new to the sample. The same response-format caveat as for the adaptive AI items applies (Keser Aschenberger et al., 2026, Section 2.8).

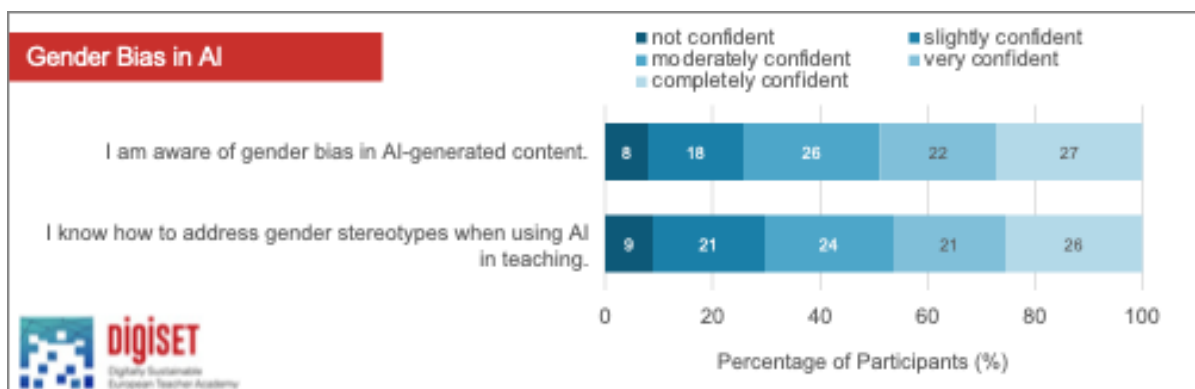


Figure 23: Gender bias in AI.

4.5.3. Inclusive practices for students with learning disabilities (I1, I2)

Figure 24 shows the two items on inclusive digital practices, asked on a frequency scale within the digital competence section. 79.6% of respondents use digital tools to support students with learning difficulties often or always, and 82.6% adapt digital learning materials for students with special educational needs often or always (58.0% always). Only 9.5% and 8.7% respectively answer never or rarely. Self-reported inclusive practice is thus remarkably widespread in the Spanish sample — plausibly connected to the pronounced heterogeneity of learner groups described in the open answers (Section 4.6.1), which makes adaptation a daily necessity for FPE and adult-education trainers rather than an optional refinement.

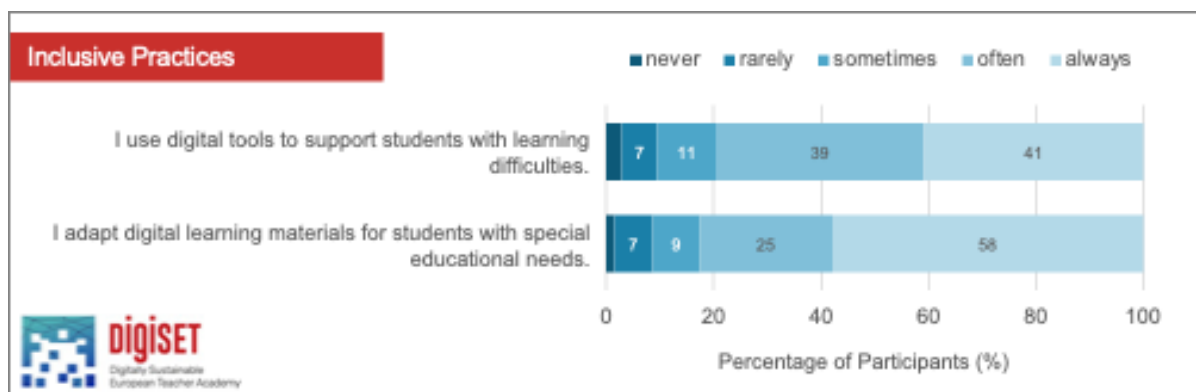


Figure 24: Inclusive practices.

4.5.4. System Thinking (S1-S3)

The following Figure 25 focuses on systems and critical thinking and presents a section of the questions relating to Education for Sustainable Development (see 4.3, p. 21ff).

Accordingly, 87.1% of respondents agree or strongly agree that they help learners understand the interconnections between environmental, social and economic aspects of sustainability, 85.5% that they encourage learners to critically reflect on sustainability-related issues, and 80.3% that they support learners in analysing complex sustainability problems from multiple perspectives (Figure 25).

Disagreement is marginal (1.7–2.6%). Within the self-assessment, systems thinking therefore presents itself as a strength — although the agreement-scale format of these items limits direct comparison with the confidence-scale topics (Keser Aschenberger et al., 2026, Section 2.8).

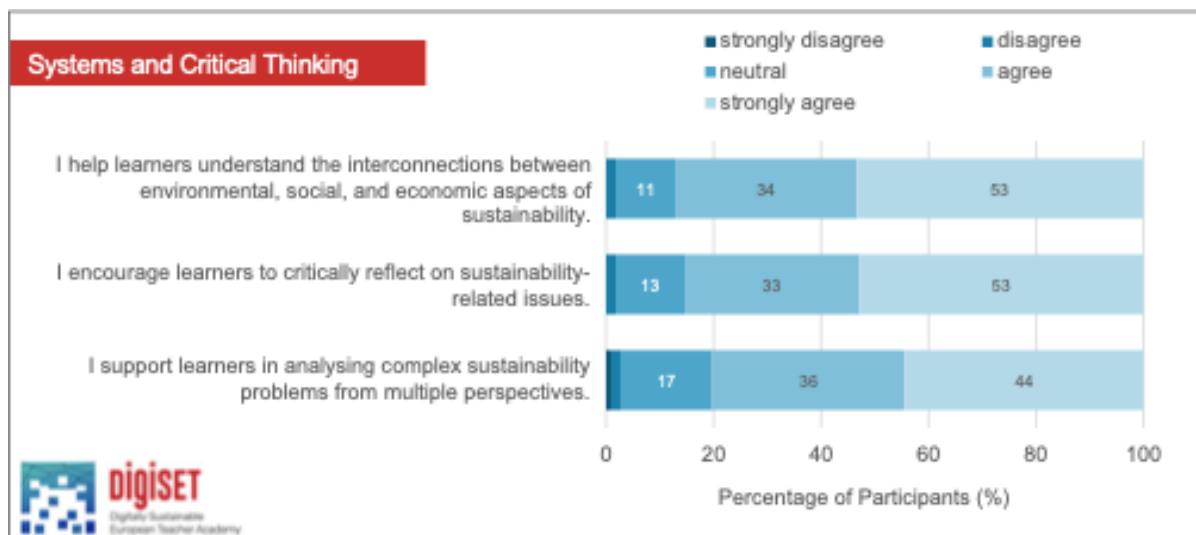


Figure 25: Education for sustainable development – systems and critical thinking.

4.6. Challenges faced in integrating digital teaching and sustainability in teaching, needed competences and existing barriers

This section focuses on the challenges teachers face in integrating digital technologies and sustainability into their teaching, on their professional development needs related to digital and sustainable teaching, and on the barriers they encounter.

4.6.1. Challenges faced in integrating digital technologies and sustainability into teaching (Q1)

The first open question addressed the challenges respondents currently face when integrating digital technologies and sustainability into their teaching. It was answered by 83 respondents, of whom 80 provided substantive answers. The AI-assisted thematic screening validated by the author (see Section 2.1) identified seven recurring themes; answers could address several themes. All quotations are translated from the original Spanish.

Time and workload (≈18 answers). The scarcity of time to prepare, adapt and redesign materials is the single most frequent challenge, often coupled with administrative burden. Representative quotes:

- “Lack of time in working hours and an excess of administrative bureaucracy.”
- “One of the main challenges is the lack of time to redesign teaching materials that coherently integrate both digital tools and sustainability approaches.”
- “The administrative overload and the lack of time — designing activities that meaningfully merge digital competence and sustainability requires deep planning.”

Learners’ digital divide and heterogeneity (≈14 answers). Many respondents — typically trainers of adult and online groups — describe learner groups whose digital competences range from none to advanced, which forces constant levelling and slows down any integration effort:

- “The digital competences of the learners, which are sometimes non-existent; it is very complicated to adapt to different levels within the same group.”
- “I work with adults and many of them do not have developed digital competences, which means explaining beforehand how to carry out any activity I set.”
- “Many students have connection problems, do not know how Zoom or the platform works and need continuous support to be able to follow the training correctly.”

Cost of tools and licences (≈10 answers). A distinctive Spanish theme is the monetisation of digital and AI tools, experienced as a personal cost by trainers:

- “ALL the AI tools are paid, and it is getting harder for me to teach because they are increasingly privatised.”
- “The price of many of the instruments, since they are not open source.”
- “I face the lack of means on the part of the students and in some cases on my own part; the necessary tools are not provided to teachers, so I have to supply them myself: training, AI programmes (paid), and the technological resources themselves (PC, internet...).”

Meaningful, critical and ethical integration (≈11 answers). A reflective group of respondents frames the challenge not as access but as educational sense-making, including the detection of AI misuse by learners:

- “The challenge is to find a balance between innovation and educational meaning. Learners handle devices with ease, but that does not mean they know how to use them critically, ethically or responsibly.”
- “Knowing whether my students use AI to do their assignments and tasks.”

Pace of technological change (≈8 answers). “One of the main challenges I currently face is the speed at which digital technologies evolve, especially in fields such as artificial intelligence, Big Data or 5G. This demands continuous updating of technical knowledge as well as of teaching methodologies.”

Infrastructure and equipment (≈8 answers). Deficient Wi-Fi, classrooms without computers or projectors and outdated equipment are reported, although less frequently than time or cost: “In most facilities the Wi-Fi connection is deficient, and that alone is a big obstacle.”

Own training gaps and other themes (≈8 answers). Several respondents simply state that they lack specific training (“I lack training”; “the scarce training offer for vulnerable groups”). Less frequent themes include the difficulty of translating sustainability into practical classroom experiences (≈5), rigid curricula and pre-packaged courses (≈3), and one notable reflexive comment on the environmental footprint of digital teaching itself: “considering the energy we spend when using digital content and AI — are we, teachers, sustainable in our teaching?”

4.6.2. Competences that would help to address these challenge (Q2)

The second open question asked which competences would help respondents address these challenges; 77 respondents answered, around 70 of them substantively. Five clusters emerge from the screening. All quotations are translated from the original Spanish.

AI-related competences (≈19 answers). By far the most frequent request, ranging from generic wishes (“to handle AI better”, “more training in technological topics and AI”) to highly specific demands such as “creation of agents”, AI-supported automation of teaching processes, AI-assisted assessment, and methods to detect AI-generated student work. One respondent asked for “a master’s degree in AI applied to teaching”.

General digital teaching competence (≈11 answers). Requests for “teacher digital competence”, command of educational platforms and collaborative tools, and basic digital skills courses — in some cases explicitly for teaching learners affected by the digital divide.

Pedagogical and methodological design (≈7 answers). Instructional design, active methodologies (project- and challenge-based learning) and “digital pedagogical design tools”, i.e. the didactic — not technical — side of integration.

Sustainability and OER competences (≈10 answers). “Applied sustainability” integrated transversally into subjects (≈7), and OER-specific competences (≈3), e.g. “the design and curation of open educational resources that address the Sustainable Development Goals”.

Structural conditions rather than competences (≈9 answers). A substantial group explicitly reframed the question: what they lack is not competences but time, funding, free licences, better equipment, an updated legal framework, or paid training within working hours:

- “It is not really a question of competences, but of time.”
- “Training, and facilitating access to paid programmes to make better preparations — and of course that this training and preparation time be part of our working day, and therefore paid.”
- “Free licences. I have acquired quite enough competences.”

Beyond these clusters, several respondents framed continuous adaptation itself as the core meta-competence — “to learn, unlearn and relearn constantly” — and one summarised the future teaching role as “facilitator, mentor, designer of experiences, critical guide, human leader in digital environments”. Six respondents could not name any competence (“I don’t know”).

4.6.3. Professional development needs related to digital and sustainable teaching (P1)

Figure 26 shows the most needed training areas (n = 118; up to three options could be selected). Using AI in teaching clearly ranks first: 63.6% of respondents selected

it. It is followed by creating and sharing OER (50.8%) — a remarkably high value that contrasts with the reserved OER self-assessments in Figure 21 and suggests genuine latent demand rather than indifference. Inclusive digital teaching (31.4%) and using adaptive learning tools (28.8%) form a middle group, followed by ethical and responsible AI use (24.6%). Addressing gender bias in AI (17.8%), integrating sustainability into teaching (14.4%) and systems thinking for sustainability (12.7%) rank last; 5.9% selected “other”, naming inter alia specific AI tools, the creation of AI agents, advanced AI automation and the identification of AI-generated student work.

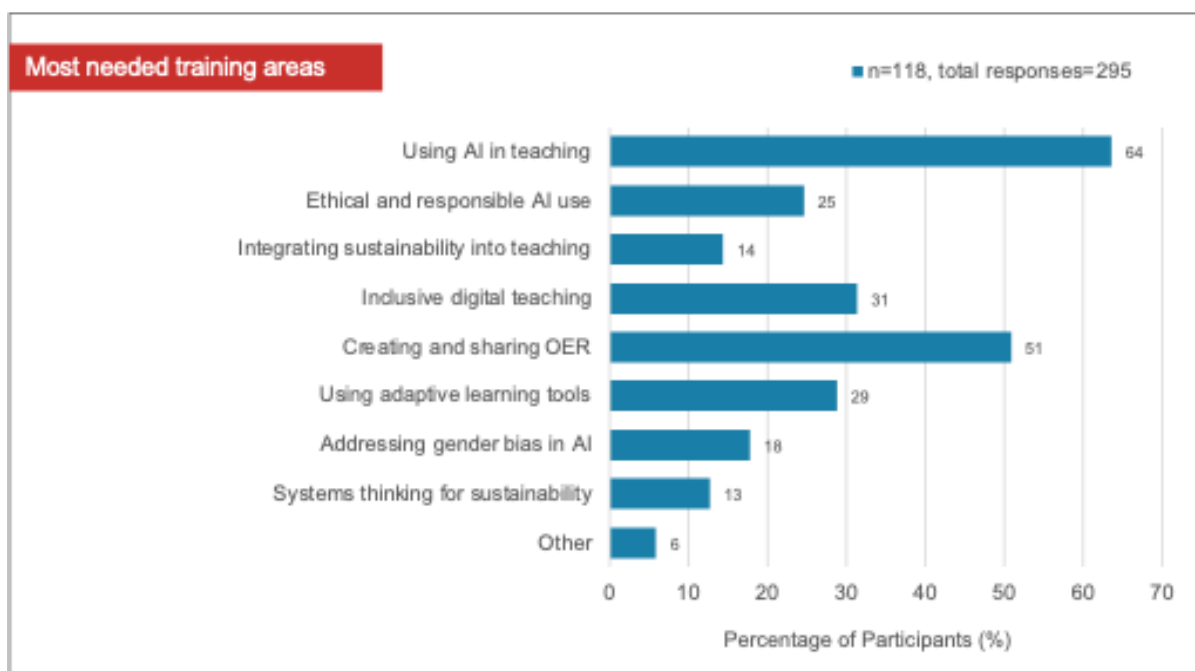


Figure 26: Most needed training areas.

Note: Responses to the DigiSET teacher survey in Spain. Multiple responses were allowed; therefore, totals exceed 100%.

4.6.4. Main barriers to professional development (P2)

Figure 27 shows the main barriers to professional development in these areas (n = 118; up to three options could be selected). Lack of time dominates: 70.3% of respondents selected it, consistent with the qualitative results of Q1. It is followed by lack of suitable resources or materials (43.2%), lack of available training (34.7%) and lack of institutional support (33.9%). Lack of infrastructure ranks last (14.4%), and 5.1% named other barriers — tellingly, several of these refer to money rather than time: the high cost of specialised courses, the need for funding to pay for advanced AI tools, requests for free digital resources and, in one case, simply “SALARY”. The cost theme, prominent in the open answers, is thus partly hidden inside the “resources/materials” and “other” categories of the closed item.

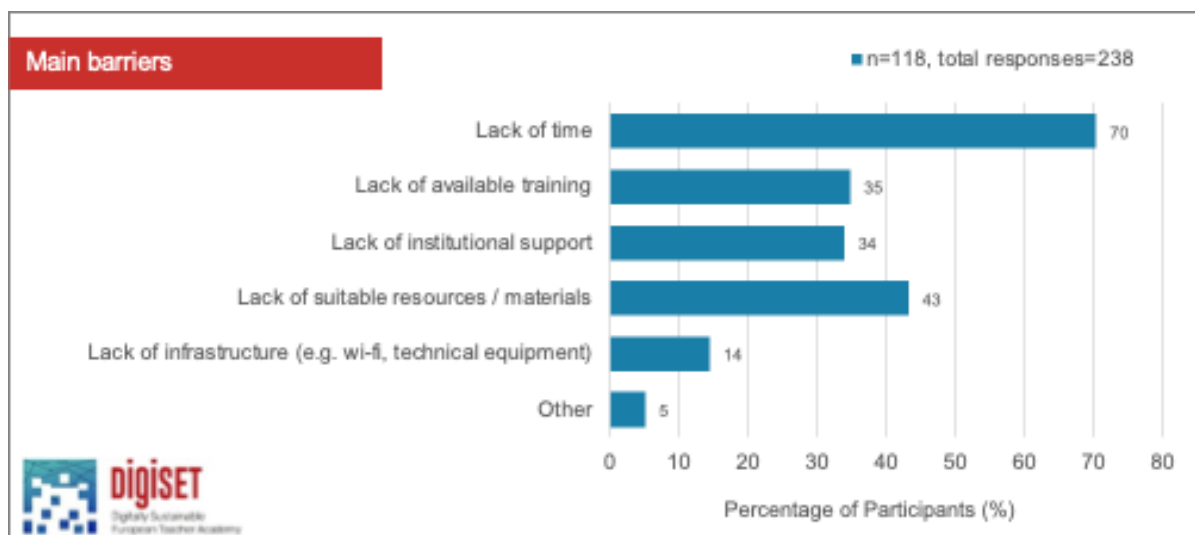


Figure 27: Main barriers to professional development in the addressed areas.

Note: Responses to the DigiSET teacher survey in Spain. Multiple responses were allowed; therefore, totals exceed 100%.

4.6.5. Additional Insights and comments (if) (Q3)

The final open question invited additional comments; 61 respondents answered, of whom around 30 provided substantive comments (the remainder answered “no” or equivalent). The following recurring threads were identified; given the small numbers per thread, they should be read as illustrative rather than representative. All quotations are translated from the original Spanish.

- Structural backing rather than individual effort: “The integration of digitalisation and sustainability does not depend solely on the voluntarism of teachers. Strong institutional support is needed.”
- Training conditions: several respondents ask for free, practical training within paid working hours — “I would love for us teachers to be trained in AI within our working hours” — and for “more practical, free and accessible training oriented to the real application of these technologies in the classroom”.
- Costs and licensing, again: “Free licences, please.”; “Many resources require subscription and payment. They should be included within the virtual platforms.”
- A broadly positive attitude towards AI, sometimes explicitly against restrictive framings: “AI, well used and well worked, is a perfect tool to advance towards a new way of teaching”; “the use of AI is being punished, when it should be integrated naturally, as the calculator was in its day”; “AI is here to stay, and all of us must engage in its continuous learning”.
- Ethics, misinformation and gender: several comments call for a deeper ethical, inclusive and sustainable approach to AI aligned with the 2030 Agenda, including the ability to “assess the veracity of digital content, detect misinformation and analyse the social impact of technology”. One respondent singles out gender: “The issue of gender bias seems extremely important to me, and I believe more training and depth in the matter is needed” — while another reports never having observed such biases in their field.
- Collaboration and repositories: proposals for teacher collaboration spaces and institutional repositories of ready-made activities that integrate technology and sustainability, so as to “reduce the workload associated with educational innovation”.
- Survey feedback: some respondents endorsed the survey’s relevance, while one criticised the questionnaire as “very long — ideas are repeated”, which is consistent with the item non-response documented in Section 2.2.2.

5. Discussion

This section synthesizes and critically discusses the key findings presented in Section 4, contextualizing them within the national educational landscape and existing research, while addressing the generalizability and limitations of the study.

5.1. Key results concerning teachers' competences

5.1.1. Teachers' competence in digital teaching, AI, ESD and OER

Digital teaching competence (D1–D22)

Respondents show the highest self-perceived competence in professional engagement (80.6–92.0% often/always; Figure 6) and in reflective, added-value technology use (90.5%; Figure 8); the protection of personal data shows the highest share of “always” responses of all 22 items (71.7%; 84.8% often/always; Figure 7). The weakest values concentrate where learners — not teachers — are the digital actors: setting assignments in which learners create digital content (62.3%; Figure 11), digitally supported communication and collaboration tasks (71.0%; Figure 11) and digital assessment tools (73.2%; Figure 9). Two readings follow. First, even in a digitally engaged sample, the DigCompEdu progression from teacher-centred to learner-activating technology use is clearly visible. Second, the overall level is high across all six areas — plausibly an upper-bound estimate reflecting the sample profile (half teach vocational subjects and a quarter computer science/digital literacy; Figure 4, Section 5.3).

AI competence (A1–A24)

The TAICS items reveal a pronounced gap between declarative knowledge and applied practice. Confidence is highest for explaining what AI is (67.5%) and creating content with AI (64.3%; Figure 12), while the lowest values are found for distinguishing whether a tool is AI-based (46.8% — the lowest of all 24 AI items; Figure 12), for protecting sensitive content from AI tools (48.8%; Figure 15) and for the assessment dimension (51.6–55.6%; Figure 14). The contrast between conventional data protection — the strongest digital practice (84.8%; Figure 7) — and AI-specific data protection (48.8%) is particularly instructive: an established competence does not automatically transfer to the AI context. In addition, responses are polarised throughout (16.7–32.8% low confidence in every AI item), and the collegial diffusion of AI competence is weak (49.6%; Figure 17), which limits organic peer-to-peer capacity building in training organisations.

ESD competence (S1–S13)

Respondents endorse values-oriented items almost unanimously (85.7–91.7%; Figure 19) and also rate their systems-thinking practice highly (80.3–87.1%; Figure 25). Agreement drops for operational implementation: using digital technologies for real-world sustainability challenges (73.3%, with 10.8% disagreement; Figure 18) and facilitating complex or controversial sustainability discussions (70.0%, with 13.3% disagreement; Figure 20) are the weakest aspects. The instruction–response format inconsistency of this section (confidence instruction versus agreement scale; Keser Aschenberger et al., 2026, Section 2.8) may have inflated agreement, which reinforces rather than weakens the substantive conclusion: teachers align with ESD

values, but the digitally supported and dialogic operationalisation of ESD is where support is needed.

OER competence (O1–O5)

OER is the most uncertain domain: agreement ranges only from 55.2% (intellectual property rights) to 60.7% (prior experience), while 29.1–35.0% of respondents are neutral in every item (Figure 21). Rather than rejection, this pattern suggests unfamiliarity — about a third of the sample appears not to have a settled position on OER at all. Combined with the cost-of-tools theme in the qualitative data (Section 4.6.1) and the high training demand for OER (50.8%; Figure 26), the Spanish data depict OER as a latent, highly receptive field for DigiSET.

Cross-domain observations

Three intersections stand out. First, assessment is a recurring weak point in both the digital (Figure 9) and the AI domain (Figure 14), compounded by the practical concern of detecting AI-generated student work (Section 4.6.1). Second, high sustainability values do not yet translate into digitally supported sustainability practice (Figures 18–20) — the precise intersection DigiSET targets. Third, the coexistence of low OER familiarity with high OER training demand and an acute cost problem indicates that open licensing is not only a competence gap but a strategic lever for this population. Finally, the comparison with representative national data — which confirms that these results describe a digitally engaged segment and should be read as upper-bound estimates — is developed in Sections 5.2.2 and 5.3.

5.1.2. Teachers' competence concerning the four DigiSET topics

The analysis of the four specific DigiSET thematic areas — adaptive AI use, gender bias in AI, inclusive practices, and systems thinking — reveals a clearly differentiated profile of self-perceived competence among the Spanish respondents. While value- and awareness-related items yield high figures, gaps emerge wherever AI-supported implementation is required. It should be noted that these findings are based on a self-selected sample and should not be generalised to the Spanish teaching population without caution (see Section 5.3).

Adaptive AI use (AD1, AD2)

Adaptive AI use is markedly weaker: only 51.6% feel confident using AI to personalise learning or to differentiate instruction, with 28.6–31.0% reporting low confidence (Figure 22). The contrast with respondents' general personalisation practice (73.9%; Figure 10) localises the gap precisely: it is not personalisation as a pedagogical principle that is missing, but its AI-supported implementation — exactly the competence the DigiSET simulation and adaptive-learning strand (WP3) addresses.

Gender bias in AI (GD1, GD2)

Gender bias in AI is the weakest of the four topics (46.4–48.8% confidence; 25.6–29.6% low confidence; Figure 23). Notably, awareness (GD1) and actionable strategy (GD2) are almost equally low — the topic is new to most respondents — and it simultaneously ranks near the bottom of stated training needs (17.8%; Figure 26). This awareness–priority gap makes gender-unbiased AI the topic with the greatest need for proactive intervention: demand will not articulate itself. For both AD and GD items, the confidence-scale format applied to behavioural/knowledge

statements should be kept in mind when interpreting absolute values (Keser Aschenberger et al., 2026, Section 2.8).

Inclusive practices for students with learning disabilities (I1, I2)

The findings on inclusive practices are, at first sight, a strength of the Spanish sample: 79.6% of respondents use digital tools to support students with learning difficulties often or always, and 82.6% adapt digital learning materials for students with special educational needs often or always — with the highest “always” share of the two items (58.0%) and only 8.7–9.5% answering never or rarely (Figure 24). This high frequency is plausibly a structural feature of the population rather than a mere attitude: the qualitative data (Section 4.6.1) describe adult learner groups whose digital competences range from none to advanced, so that adapting materials and supporting struggling learners is an everyday necessity of FPE and adult education rather than an optional refinement. Two qualifications apply. First, frequent adaptation under necessity does not guarantee methodological quality — and respondents themselves appear aware of this, since inclusive digital teaching still ranks third among stated training needs (31.4%; Figure 26): what is demanded is the deepening and systematisation of an already frequent practice, not its initiation. Second, a terminological nuance should be kept in mind: the Spanish instrument rendered I1 as learners with “dificultades de aprendizaje” (learning difficulties) and I2 as learners with “necesidades educativas especiales” (special educational needs) — two categories that only partially overlap in Spanish educational usage, so the two items may have evoked slightly different reference groups.

Systems thinking for sustainability (S1–S3)

In contrast to the other three thematic areas, systems thinking yields the highest self-perceived competence values. 87.1% of respondents agree or strongly agree that they help learners understand the interconnections between environmental, social and economic aspects of sustainability, 85.5% that they encourage critical reflection on sustainability-related issues, and 80.3% that they support learners in analysing complex sustainability problems from multiple perspectives, with marginal disagreement throughout (1.7–2.6%; Figure 25). Three considerations qualify this strength. First, these items were assessed on an agreement scale within the ESD section, which tends to produce higher values than the confidence scales used for the AI-related topics and limits direct comparison (Keser Aschenberger et al., 2026, Section 2.8). Second, the operational counterparts of systems thinking are visibly weaker: only 73.3% use digital technologies to engage learners with real-world sustainability challenges (Figure 18) and only 70.0% feel confident facilitating complex or controversial sustainability discussions (Figure 20) — the dialogic and digitally supported practice through which systems thinking becomes teachable lags behind the attitude. Third, the corresponding training demand is the lowest of the whole P1 list (12.7%; Figure 26), so respondents do not perceive this area as a development priority. Taken together, systems thinking is a declared strength whose classroom operationalisation — precisely the intersection targeted by the desk study’s diagnosis of fragmented, non-integrated competences (Sola, 2026) — still requires support.

Overall assessment and intervention needs

Across the four DigiSET topics a consistent pattern emerges: respondents report higher awareness, values and routine frequency than tool-mediated, AI-supported

competence. Systems thinking is the strongest area and gender-unbiased AI the weakest; inclusive practice is frequent but in demand of systematisation; adaptive AI use shows the sharpest gap between pedagogical principle and AI-supported implementation (73.9% general personalisation versus 51.6% AI-supported; Figures 10 and 22). The greatest need for proactive intervention lies in gender-unbiased AI, where low competence (46.4–48.8%; Figure 23) coincides with low stated demand (17.8%; Figure 26) — an awareness–priority gap that will not resolve itself through voluntary course choice — followed by adaptive AI use, where roughly three in ten respondents report low confidence (Figure 22). Importantly, the qualitative data suggest that these gaps are not purely individual deficits: respondents repeatedly point to the cost and unavailability of suitable tools (Sections 4.6.1, 4.6.5), so low confidence partly reflects an environment in which the relevant technologies are not reliably accessible. For the DigiSET Teacher Academy this implies a dual approach: building pedagogical competence while equipping participants with concrete, free and open tools for adaptive, inclusive and gender-aware AI use — a combination directly supported by the project’s open-source platform strand (WP3).

5.1.3. Teachers’ learning needs and interest

Open-ended responses (Q1–Q3): Challenges and desired competences

Across the open questions (n = 83 for Q1, 77 for Q2 and 61 for Q3; Sections 4.6.1–4.6.5), the dominant challenges are time and workload (“Lack of time in working hours and an excess of administrative bureaucracy”), learners’ digital divides, the cost of tools and licences (“ALL the AI tools are paid, and it is getting harder for me to teach because they are increasingly privatised”), and the search for a meaningful, ethical integration of AI — including the very practical concern of detecting AI-generated student work. Asked which competences would help (Q2), respondents request above all AI-related competences — from a better general command of AI to the creation of AI agents and AI-assisted assessment — followed by general digital teaching competence and pedagogical-methodological design, while a substantial group insists that their problem is structural rather than competence-related: “It is not really a question of competences, but of time.” Unexpected themes include the environmental footprint of digital teaching itself (“are we, teachers, sustainable in our teaching?”) and a distinctly positive, anti-restrictive attitude towards AI (“integrated naturally, as the calculator was in its day”; Section 4.6.5).

Priority training areas (P1)

The structured needs item (Figure 26) produced three clear priorities:

- Using AI in teaching (63.6%)
- Creating and sharing OER (50.8%)
- Inclusive digital teaching (31.4%)

These priorities align almost perfectly with the measured competence gaps: respondents request training precisely where their confidence is lowest (AI; Sections 4.2, 5.1.1) or their uncertainty greatest (OER; Figure 21), which strengthens the internal validity of the needs analysis. The two exceptions are instructive. Gender bias in AI is the weakest measured topic yet ranks near the bottom of stated needs (17.8%), and sustainability integration and systems thinking rank last (14.4% and 12.7%) despite the observed values–practice gap — in both cases, high self-assessments or low problem awareness appear to suppress articulated demand (Section 5.1.2). The “other” answers, finally, are almost exclusively AI-related

(specific tools, AI agents, advanced automation, identification of AI-generated work), reinforcing the AI priority.

Barriers (P2)

Barriers to professional development (Figure 27) were dominated by:

- Lack of time (70.3%)
- Lack of suitable resources / materials (43.2%)
- Lack of available training (34.7%)
- Lack of institutional support (33.9%)
- Lack of infrastructure (14.4%)

The overwhelming weight of time — confirmed almost verbatim in the open answers of Q1 — defines the binding constraint for any training design, while the comparatively low ranking of infrastructure distinguishes this adult-education sample from school-centred settings. Notably, the cost of tools, one of the most prominent qualitative themes, has no category of its own in the closed item and surfaces instead inside “resources/materials” and “other” (the high cost of specialised courses, funding for AI tools, and in one case simply “SALARY”); the closed item therefore understates a barrier that is structural for FPE trainers working on temporary, course-based contracts (Sections 3.2, 4.6.4).

Synthesis and implications for DigiSET training design

The alignment between stated training needs (P1), measured competence gaps (Sections 5.1.1–5.1.2) and reported barriers (P2) points to three concrete design implications:

- Modular, time-efficient formats within paid working time: because time is the binding constraint (70.3%; Figure 27) and respondents explicitly ask for training “within our working hours” (Section 4.6.5), the Spanish offer should consist of short, asynchronous, just-in-time units, recognised within working time wherever employers can be engaged.
- Free and open tools with an OER-first approach: building the programme exclusively on free and open-source tools, and making OER creation and licensing a central strand, simultaneously answers the second-ranked training need (50.8%; Figure 26), the weakest OER competence (intellectual property rights; Figure 21) and the pervasive cost barrier voiced in the open answers.
- Practice-oriented, assessment-focused AI training: AI modules must prioritise AI-supported assessment design, academic integrity (including the detection of AI-generated student work) and AI-specific data protection — the points where confidence collapses (Figures 14–15) while demand is highest (63.6%; Figure 26).

Finally, the low stated demand for sustainability-specific training (12.7–14.4%; Figure 26) despite the observed values–practice gap indicates that sustainability should be positioned as a transversal lever inside the AI and OER modules rather than as stand-alone courses — consistent with the integrated approach recommended by the desk study (Sola, 2026).

5.2. Contextualisation within the national framework and current state of research

The survey findings must be interpreted against a national policy landscape that has invested heavily and recently in exactly the fields covered by the survey. While Spain possesses a robust framework architecture for teacher digital competence, the data

reveal a structural misalignment between school-centred policy instruments and the vocational and adult-training workforce from which this sample is drawn.

5.2.1 Alignment with National Policies and Frameworks

The competence profile of the respondents largely mirrors the structural priorities of national digital-education policy. In the digital domain, the MRCDD (Resolución de 4 de mayo de 2022; INTEF, 2022) and the #DigEdu plan — with more than EUR 1.66 billion and a target of accrediting the digital competences of 560,000 teachers (European Commission, 2025) — have made teacher digital competence a system-wide priority with a formal accreditation culture, and the uniformly high digital self-assessments of this sample (Section 4.1) are consistent with that push. However, most respondents work in the FPE subsystem and in private provision (Figures 2–3), which sits largely outside these school-centred instruments: FPE trainers have no equivalent to the school system’s accreditation pathways or teacher-centre networks, and the qualitative data show them paying personally for tools and training (Sections 4.6.1, 4.6.5). The survey thus exposes a policy blind spot precisely in the workforce segment that delivers digital upskilling to the adult population.

In the VET domain, Organic Law 3/2022 embedded sustainability and digitalisation modules across all programmes and created a dedicated AI-and-data track (Ley Orgánica 3/2022; European Commission, 2025). The very high demand for AI training in this VET-dominated sample (63.6%; Figure 26) shows that the workforce’s appetite matches the policy direction, while the moderate AI confidence values (Section 4.2) show that delivery capacity has not yet caught up — a gap DigiSET can address directly.

5.2.2 Comparison with Existing Research (TALIS 2024)

Comparing the DigiSET findings with the representative Spanish TALIS 2024 results (INEE, 2025) provides essential context for reading this digitally engaged, self-selected sample. To avoid redundancy, all comparisons with representative national research are concentrated here:

- **AI usage and confidence.** In TALIS 2024, about one in three secondary teachers in Spain (35%; 28% in primary) reports using AI regularly in the classroom. In the DigiSET sample, by contrast, roughly two thirds feel very or completely confident creating content with AI (64.3%; Figure 12). This distance confirms the self-selection of the sample and justifies reading its competence values as upper-bound estimates (Section 5.3). At the same time, both data sets converge at the applied end of the spectrum: even in this AI-engaged sample, confidence in AI-supported assessment drops to 51.6–55.6% (Figure 14) — suggesting that the assessment bottleneck is a genuine systemic gap rather than an artefact of sampling.
- **Quality and fit of professional development.** In TALIS 2024, only 56% of Spanish secondary teachers rate the professional development they received as being of high quality. The DigiSET respondents echo this concern from their own position: 34.7% cite the lack of available training as a barrier (Figure 27), and the open answers repeatedly ask for more practical, free and accessible training (Section 4.6.5). Both sources point to a mismatch between the existing training offer and perceived needs — rather than to a lack of willingness to train.
- **Demographic position of the sample.** The sample’s mean age (45.8 years; Figure 1) is close to the TALIS 2024 average for Spanish secondary teachers (45 years), whereas its gender composition (50.0% women; Table 2) differs markedly from both the TALIS secondary teaching population (62% women) and the non-university

teaching workforce as a whole (72.3% women; MEFPD, 2025). The implications for generalizability are discussed in Section 5.3.

5.2.3 Reflection on the Desktop Research

The desk research for Spain (Sola, 2026) concluded that competences related to systems thinking, pedagogically grounded AI use, open educational practices and integrated competence development “remain fragmented”. The survey confirms this diagnosis at the level of individual self-perception: high generic values coexist with weak AI-specific data protection (48.8%; Figure 15), weak gender-bias competence (46.4–48.8%; Figure 23), uncertain OER positioning (Figure 21) and a values–practice gap in ESD (Figures 18–20). The most surprising finding against the national context is the strength of OER demand (50.8%; Figure 26): despite Spain’s long-standing public repositories and open-resource tradition documented in the desk report, a third of respondents have no settled position on OER — yet they actively want training in it, plausibly because open resources promise a way out of the cost trap that this FPE population experiences acutely.

In summary, while Spain’s framework architecture provides a sophisticated basis for digitally sustainable teaching, the survey shows that its translation into practice is uneven precisely along the lines anticipated by the desk study — and that the FPE workforce, central to adult upskilling yet marginal to school-centred policy instruments, is where the gap is widest.

5.3. Limitations

The findings of the Spanish DigiSET teacher survey should be interpreted in light of several methodological limitations affecting their validity and generalizability. The study employed non-probability convenience and snowball sampling, with recruitment conducted through the national partner’s networks and open dissemination channels. This approach produced a self-selected sample likely to have an above-average interest in digital technologies. The findings should therefore be understood as reflecting a digitally engaged segment of the Spanish vocational education and adult-training workforce rather than as representative of the wider Spanish teaching population.

The composition of the sample differs substantially from that of the national teaching workforce. Women accounted for half of the respondents, although they represented 72.3% of Spain’s approximately 800,000 non-university teachers in the 2025/26 school year (MEFPD, 2025). Men were therefore considerably overrepresented. In terms of age, the sample mean of 45.8 years (Figure 1) was close to the average age of Spanish secondary teachers reported in TALIS 2024 (45 years; INEE, 2025). Nevertheless, the sample included very few respondents in their early twenties, and those classified as future teachers were generally adults undergoing career transitions rather than undergraduate students.

More importantly, the sample differed structurally from the national teaching population. Half of the respondents worked in private or independent organisations, 57.3% taught in vocational education, and a further 31.6% worked in “other” contexts, consisting almost entirely of vocational training for employment (FPE) and adult education (Figures 2–3). By contrast, the Spanish teaching workforce is concentrated in general school education and the public sector. The recruitment

strategy did not specifically target public-school teachers, ESD-focused networks, or university-based initial teacher education. Consequently, the results are particularly relevant to DigiSET's VET focus but cannot be generalized to Spanish schoolteachers as a whole.

A total of 139 responses were included in the analysis, with between 103 and 126 valid responses across the different item blocks. This represents only a very small proportion of Spain's non-university teaching workforce (MEFPD, 2025). Because the survey invitation was openly distributed through networks and multipliers, the number of individuals who received it is unknown and a response rate cannot be calculated. Furthermore, the reference population of FPE trainers is not precisely delimited. The sample size supports descriptive analysis but does not permit robust subgroup comparisons; accordingly, no differences between groups, such as in-service and future teachers, should be inferred from this report.

The geographical distribution of the sample also cannot be verified because the questionnaire did not record respondents' region of residence. Given that recruitment was conducted through Maude Studio's networks, respondents may have been concentrated in Andalusia and online teaching communities. The sampling strategy may therefore have produced upper-bound estimates of competence among digitally engaged VET and FPE educators. At the same time, barriers more characteristic of school settings, such as classroom infrastructure problems, may be understated, whereas cost-related barriers may be more specific to the sampled population.

All competence measures were based on self-assessment and were not externally validated. Respondents' perceived competence may differ from their demonstrated ability in either direction. Social desirability may also have influenced responses concerning socially valued domains such as sustainability, inclusion, ethics, and educational values. Particular caution is therefore required when interpreting the very high levels of agreement with the ESD values items shown in Figure 19.

Several instrument-related limitations documented in the methodology report also affect the interpretation of the findings (Keser Aschenberger et al., 2026, Section 2.8). Items concerning adaptive AI use and gender bias in AI presented behavioural or knowledge-related statements but employed confidence scales. The questionnaire also alternated between the terms "learners" and "students," which may have led to variations in interpretation. In addition, the Spanish version contained a small number of typographical errors, primarily missing spaces, identified during the national quality review of the online questionnaire. Although these errors are unlikely to have materially affected comprehension, they are documented for transparency.

The questionnaire's length constitutes a further limitation. Item non-response increased from no more than two missing responses in the initial section to more than 20 in the final sections (Section 2.2.2), suggesting possible respondent fatigue. This interpretation is supported by one respondent's explicit criticism that the survey was very long and contained repetitive ideas. Finally, the data-collection period reported in this document remains subject to final confirmation (Section 2.2.2).

Taken together, these limitations mean that the findings should be treated as a well-documented and internally consistent account of digitally engaged Spanish VET, FPE, and adult educators rather than as population estimates. Their primary value

lies in providing targeted insights to inform the design and implementation of the DigiSET Teacher Academy.

6. Implications

By grounding the project design in these survey findings, DigiSET seeks to move beyond theoretical frameworks and establish a practical, evidence-based pathway for sustainable digital transformation in higher and vocational education. Building upon the teachers' survey results in Spain, the following implications should influence the DigiSET project.

6.1. Implication for DigiSET

Priority competence areas.

Four priorities follow directly from the data. (1) Pedagogically grounded AI use, with explicit emphasis on AI-supported assessment, academic integrity (including the detection of AI-generated student work) and AI-specific data protection: these are among the points of lowest confidence (48.8–55.6%; Figures 14–15) and of highest demand (63.6%; Figure 26), and they surface repeatedly in the open answers (Sections 4.6.1–4.6.2). (2) OER creation, licensing and sharing: the second-ranked need (50.8%; Figure 26), the weakest and most uncertain competence domain (Figure 21) and — through free licensing — the structural answer to the cost barrier that pervades the qualitative data. (3) Digitally supported ESD and systems thinking, addressed transversally: given high self-perceived sustainability competence (Figures 19, 25) but weak digital operationalisation (73.3%; Figure 18) and weak facilitation of controversial discussions (70.0%; Figure 20), sustainability content should be embedded inside the AI and OER modules — as data-visualisation, simulation and real-world challenge activities — rather than offered as stand-alone courses for which demand is low (12.7–14.4%; Figure 26). (4) Gender-unbiased AI as a mandatory, embedded strand: it is the weakest measured topic (46.4–48.8%; Figure 23) with the largest awareness–priority gap (17.8% demand; Figure 26), so it must be built into the AI modules rather than left to elective choice.

Training design addressing the identified barriers.

The binding constraints are time (70.3%; Figure 27) and cost. The Spanish DigiSET offer should therefore consist of short, modular, asynchronous units with just-in-time materials, deliverable within working hours wherever employers can be engaged, and should carry visible certification value — respondents operate in a system with a strong accreditation culture (MRCDD; Resolución de 4 de mayo de 2022) and micro-credential logic (D2.2) can connect to it. All tools used should be free or open source, and each module should leave participants with immediately reusable, openly licensed materials — responding to the explicit requests for repositories of ready-made activities (Section 4.6.5). Practice orientation must take precedence over theory (“more applied and less theoretical” training; Section 4.6.5). Finally, given the weak collegial diffusion of AI competence (49.6%; Figure 17) and the requests for collaboration spaces, the Spanish strand of the DigiSET Community of Practice (WP5) should provide a Spanish-language peer-exchange space that

explicitly includes FPE trainers — a workforce without the school system's established teacher-centre networks.

Specific learning outcomes for Spain.

Based on these priorities, the Framework of Learning Outcomes (D2.2) should enable Spanish participants to:

- design and implement AI-supported assessment approaches that are pedagogically sound, safeguard academic integrity (including identifying AI-generated student work) and protect sensitive data in AI environments;
- select, evaluate and use free and open digital and AI tools appropriate for resource-constrained training contexts;
- create, license and share open educational resources, applying intellectual property and open-licensing knowledge in Spanish VET/FPE contexts;
- design digitally supported ESD activities — using simulations, collaborative platforms and data visualisation — that connect learners with real-world sustainability challenges;
- facilitate complex or controversial sustainability discussions with heterogeneous adult learner groups;
- identify gender bias in AI-generated content and translate this awareness into concrete classroom strategies;
- use AI for adaptive learning and differentiated instruction with learner groups of highly heterogeneous digital competence, including learners affected by the digital divide.

6.2. Additional insights

Recommendations for national policymakers.

First, extend the digital-competence accreditation logic of the school system (MRCDD) to the FPE trainer workforce, and recognise training time within paid working hours: the survey shows a policy blind spot for the very trainers who deliver digital upskilling to adults (Sections 5.2–5.3), whose dominant barriers are time (70.3%) and personally borne tool costs. Second, prioritise public, openly licensed tool ecosystems and OER repositories for vocational training, so that trainers' access to AI and digital tools does not depend on private subscriptions (Sections 4.6.1, 4.6.5).

Recommendations for training providers and school leadership.

Pool licences and provide institutional access to the tools trainers are expected to use; count preparation and training time as working time; and build internal repositories of reusable, openly licensed activities to reduce duplicated preparation effort — a measure respondents themselves propose (Section 4.6.5).

Recommendations for teacher education institutions.

Embed AI-supported assessment, academic integrity and AI-specific data protection into initial teacher education and train-the-trainer routes for FPE, and integrate ESD didactics — especially the moderation of controversial discussions — into digital-competence courses rather than teaching the two agendas separately (Sections 5.1.1, 5.1.3).

Future research.

Two priorities emerge. First, complement self-assessments with objective or performance-based measures (scenario tasks, artefact analysis), particularly for AI assessment and data protection, where perceived and demonstrated competence may diverge. Second, replicate the survey with a school-system sample — including public primary and secondary teachers and a region variable — to test which of the patterns found here (cost barrier, OER latency, gender-bias awareness gap) are specific to the FPE population and which are general. The forthcoming consortium-level analysis of all national samples (MS6) will additionally show which patterns hold across countries.

Transferability.

Two findings are likely to travel well within the consortium: the awareness–priority gap in gender-unbiased AI, and the values–practice gap in digitally supported ESD. The cost-of-tools barrier and the FPE employment conditions, by contrast, are structural features of the Spanish sample; their weight in other countries will depend on how far partners’ samples draw on comparable adult-training workforces.

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