

DigiSET – The Academy of Digitally Sustainable European Teacher

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Teachers' Competences for Digital Sustainability in Turkey

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 (IF)

Based on Academic Integrity and Transparency in AI-assisted Research and Specification Framework (Bozkurt, 2024, DOI: 10.55982/openpraxis.16.1.654), the authors of this report acknowledge that it was drafted with the assistance of ChatGPT and Claude (Versions as of July 2026), complementing the human editorial process. The human authors critically assessed and validated the content to maintain academic rigor. The authors 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 authors.

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Abstract

This report presents the findings of the DigiSET teacher survey conducted in Türkiye as part of the Erasmus+ project *DigiSET The Academy of Digitally Sustainable European Teacher* (101249272). The survey examined current and future teachers' self-perceived competences in digital teaching, artificial intelligence (AI), education for sustainable development (ESD), and Open Educational Resources (OER), together with four DigiSET-specific areas: adaptive AI use, gender bias in AI, inclusive practices, and systems thinking for sustainability. Data were collected online between May and June 2026 using a questionnaire based on established scales and project-specific items. Of 469 survey entries, 296 were included after data cleaning. Respondents were predominantly women (71.4%), most worked in public or state-funded schools (76.9%), and 78.4% had at least 11 years of teaching experience. The findings show a mixed competence profile. In digital teaching, protecting learners' personal data was the most frequently reported practice, while personalised learning through digital technologies was less common. For AI, respondents felt most confident explaining what AI is, whereas confidence was lower for AI-supported assessment. ESD responses were generally positive, particularly for promoting responsibility, equity, and respect for diversity. In OER, prior experience was relatively high, but knowledge of intellectual property rights was more limited. Among the DigiSET-specific areas, systems thinking showed the strongest results, while confidence in addressing gender bias in AI was comparatively low. The main professional development needs were AI use in teaching, inclusive digital teaching, and integrating sustainability into teaching. Lack of time and suitable resources were the main barriers. The findings should be interpreted in light of the non-probability sampling strategy and the self-reported nature of the data. Nevertheless, they provide useful country-level evidence for the DigiSET Teacher Academy and related learning outcomes for Türkiye.

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1. Introduction

Türkiye has undergone substantial digital transformation in education over the past decade, driven largely by centrally coordinated initiatives such as the FATİH Project, the Education Information Network (EBA), and more recent efforts to establish a national framework for teachers' digital competences. This policy direction has been strengthened by the Ministry of National Education's 2024–2028 Strategic Plan, the Türkiye Yüzyılı Maarif Modeli, and the Digital Teacher Competencies Framework, which increasingly emphasise not only access to digital technologies but also their pedagogically meaningful, inclusive, safe, and responsible use. More recently, the AI in Education Policy Document and Action Plan (2025–2029) has positioned AI literacy, ethical AI use, and the integration of AI into teaching and learning as explicit national priorities. However, the *DigiSET Türkiye National Desk Study Report* concluded that these areas have not developed at the same pace: while digital pedagogy and AI literacy have gained considerable policy visibility, sustainability competences, Open Educational Resources (OER), and teacher autonomy in creating and sharing digital resources remain less systematically institutionalised in teacher education and professional development (Esfer et al., 2026).

Studies with teachers in Türkiye also show that competence levels vary considerably across different areas.. Using the DigCompEdu framework, Süzer and Koç (2024) found that teachers were, on average, at the Integrator (B1) level of digital competence, suggesting established but still developing capacity for pedagogically meaningful technology use. However, being digitally competent does not necessarily mean that teachers feel equally prepared to use AI in teaching. In a study of 401 teachers from different provinces in Türkiye, Hava and Babayiğit (2025) reported above-average digital proficiency but below-average AI-TPACK competence, indicating a gap between general digital skills and the ability to integrate AI pedagogically. Similarly, Turkish K–12 teachers recognised the potential of AI for efficiency, interactivity, personalisation, and lesson planning, while also reporting technical, curricular, ethical, and contextual challenges that require targeted professional support (Filiz et al., 2025). From a sustainability-in-education perspective, Turkish teachers may hold positive views on integrating sustainability into teaching yet report insufficient curricular and institutional support (Arslan & Curle, 2024).

OER represents another area in which access to digital resources does not necessarily correspond to competence in open educational practice. In a study involving 588 in-service teachers in Türkiye, researchers identified lack of time and knowledge as major barriers to OER use and reported teachers' demand for greater institutional support and awareness-building activities (Tosun & Altıntaş, 2024). These findings suggest that teacher development in Türkiye needs to be considered more broadly than digital competence alone. Rather, there is a need to examine how digital pedagogy intersects with AI competence, sustainability, inclusion, ethics, and open educational practice.

Within this national context, the DigiSET project (*The Academy of Digitally Sustainable European Teacher*) addresses the broader European need to strengthen teachers' competences for digitally sustainable education within a cross-border framework. DigiSET aims to develop and implement a European Teacher Academy

that supports teachers in using and adapting digital technologies, AI-supported tools, and OER in pedagogically sound and responsible ways. The project builds on relevant European competence frameworks, including DigCompEdu, LifeComp, and GreenComp, and combines competence development with training opportunities and a supportive community of practice. DigiSET therefore goes beyond technical upskilling. It considers digital competence together with pedagogical judgement, sustainability, inclusion, openness, and responsible technology use. The relevance of such an integrated approach is particularly evident in the Turkish context. The DigiSET Türkiye National Desk Study identified five interconnected areas requiring further attention: *pedagogically grounded digital design, critical and ethical AI use, inclusive digital teaching, interdisciplinary integration of sustainability, and teachers' capacity to create, adapt, and share OER* (Esfer et al., 2026). Also, the desk study further highlighted structural challenges including *uneven access to high-quality professional development, fragmented continuous professional development provision, limited competence-linked certification, and differences across regions and school contexts*. These findings also raised an important question: are the same priorities visible in teachers' own perceptions of their competences and professional learning needs?

In Türkiye, the survey complements the National Desk Study by providing direct empirical evidence from current and future teachers. It examines self-perceived competences across four main domains (digital teaching, AI, ESD, OER) as well as four DigiSET-specific areas: *adaptive AI use, gender bias in AI, inclusive practices for students with learning difficulties, and systems thinking for sustainability*. The survey also investigates challenges encountered in integrating digital technologies and sustainability into teaching, professional development needs, and barriers to participation in further training. In doing so, the Turkish survey contributes empirical evidence to both the Teacher Competence and Training Needs Analysis (D2.1) and the Framework of Learning Outcomes for the Digitally Sustainable European Teacher (D2.2).

Following this introduction, *Section 2* presents the methodology and the country-specific sampling and data collection procedures, while *Section 3* describes the demographic profile of the respondents. The survey findings are reported in *Section 4*, covering the four competence domains, DigiSET-specific topics, professional development needs, and barriers. *Section 5* discusses these findings in relation to the Turkish context and addresses generalisability and methodological limitations. *Section 6* concludes with implications for the DigiSET Teacher Academy, the Framework of Learning Outcomes, and teacher professional development in Türkiye.

2. Methodology

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

2.1. Survey development, ethics and analysis

No additional quantitative analyses were conducted beyond the descriptive analyses prepared centrally by the TU Graz team, but the open-ended responses in the survey were reviewed qualitatively to identify recurring themes and representative responses.

2.2. Sampling strategy and data collection

2.2.1. Target population and recruitment process

The target population comprised *in-service and pre-service teachers* in Türkiye across pre-school, primary, lower-secondary, and upper-secondary education. Participants were recruited using a non-probability convenience and snowball sampling approach. The survey link was distributed through *social media, direct e-mail communication, and the personal and professional networks of the research team*. No probability-based sampling frame or official teacher registry was used for participant selection.

2.2.2. Data collection period

The survey was conducted between May 2026 and June 2026. Of the 469 survey entries, 167 contained no responses and six contained responses to only one or two questions; these cases were excluded. *Table 1* details the responses of the teacher survey in Turkey. Of the 469 individuals who accessed the survey, 167 (35.6%) did not answer any question and 6 (1.3%) answered only one or two questions; these cases were excluded from the analysis. The remaining 296 responses (63.1% of all accesses) were included in the analysis ($n = 296$). Response rates declined progressively across the questionnaire: valid responses remained between 292 and 296 for the closed items on digital teaching competence (D1-D22), dropped to around 239 to 241 for the AI competence and DigiSET-topic items (A1-A24, AD1-AD2, GD1-GD2), to around 205 to 210 for the ESD, OER and professional development items (S1-S13, O1-O5, P1, P2), and to 199 for the demographic and status items (B1-B4, B6), with the lowest valid count of 185 for age (B7). This pattern points to a gradual drop-out over the course of the survey rather than to a single point of attrition.

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

Responses and used data	
Total	469
No questions answered	167
Only one or two questions	6
Included in the analysis (n)	296

3. Demographic profile of respondents

This section summarises the demographic profile of respondents in Türkiye, including gender, age, professional status, school levels taught or expected to teach, subject areas, and teaching experience.

3.1. Gender and age (B6, B7)

Table 2 shows the gender distribution of the participants included in the demographic analysis (n = 199; 97 cases had missing demographic data). The majority of respondents identified as women (71.4%), followed by men (26.1%). No participants identified as non-binary or another gender identity, and 2.5% preferred not to disclose their gender.

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

	How do you identify your gender?	
	Frequency	Percent
Woman	142	71,4
Man	52	26,1
Non-binary / Another gender identity	0	0,0
Prefer not to say	5	2,5
Total	199	100,0

Figure 1 shows the age distribution of participants (n = 185; 111 cases missing). The mean age was 41.8 years (SD = 8.60, median = 42), with ages ranging from 19 to 69 years (range = 50), indicating a broad age range with a predominantly mid-career to senior professional profile among respondents.

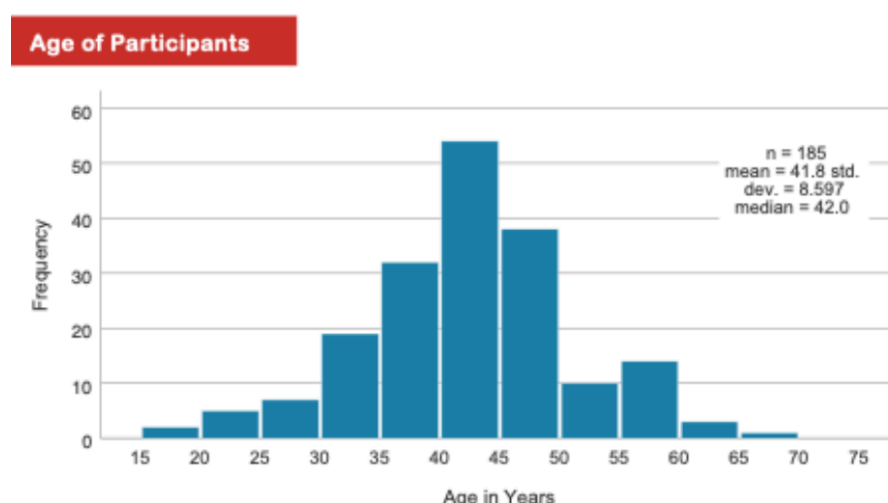


Figure 1: Age of participants in the DigiSET teacher survey in Turkey.

3.2. Status of respondents (B1)

Figure 2 shows the current status of participants (n = 199; multiple responses were allowed). The large majority of respondents were working at a public or state-funded

school (76.9%), followed by those working at a private or independent school (18.1%). Smaller proportions were studying to become a teacher (3.5%), currently looking for a job (0.5%), or reported another status (2.0%). The write-in 'other' responses ($n = 4$) described being retired but continuing to work, for example a retired teacher working in special education institutions for 13 years, a retired teacher working independently as a mandala instructor, an employee of a Provincial National Education Directorate, and a private-school science department head who also teaches.

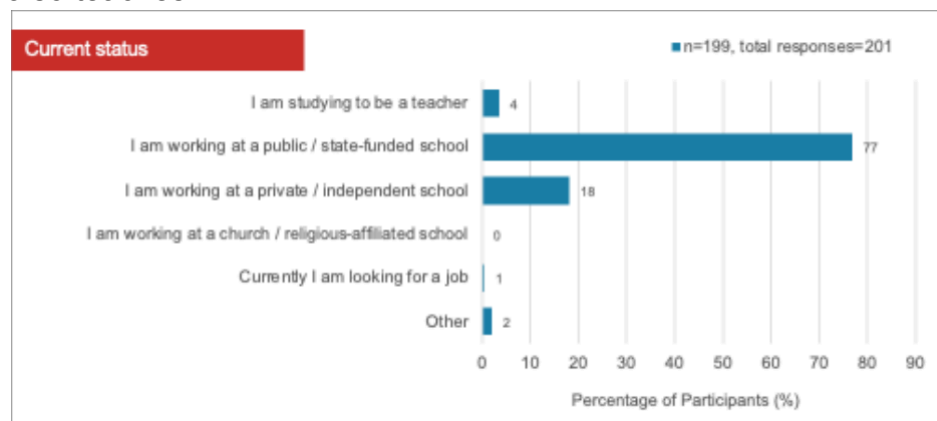


Figure 2: Current status of participants in the DigiSET teacher survey in Turkey.

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 currently taught or expected to be taught by participants ($n = 199$; multiple responses were allowed). Lower secondary education (ISCED 2, approx. ages 12–14) was the most frequently reported level (55.3%), followed by upper secondary education (ISCED 3, approx. ages 15–18; 30.7%) and primary education (ISCED 1, approx. ages 6–11; 16.6%). Vocational education (ISCED 3/4) was reported by only 1.5% of respondents, and 4.5% reported another level, with write-in responses referring mainly to pre-school education and specialised settings such as science and art centres, special education classrooms, university preparatory and foreign-language programmes, and classes for gifted and talented students.

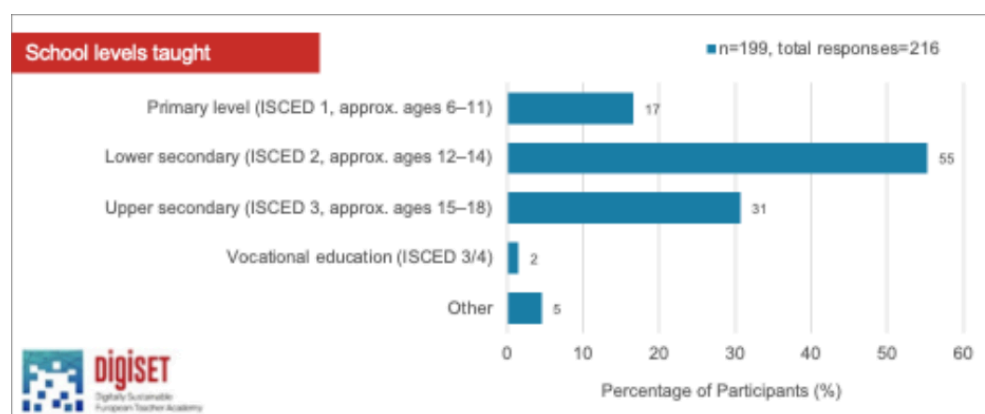


Figure 3: School levels taught or expected to be taught by participants in the DigiSET teacher survey in Turkey.

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

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

Figure 4 shows the school subjects currently taught or expected to be taught by participants ($n = 199$; multiple responses were allowed). Mathematics was the most frequently reported subject (24.1%), followed by natural sciences (biology, chemistry, physics; 19.6%), foreign languages (19.1%), and native language/reading (19.1%). Social sciences/history (12.6%), art/music (11.6%), physical education (10.1%), and computer science/digital literacy (9.0%) were reported less frequently, while vocational subjects were reported by only 2.0% of respondents. A relatively large share (15.1%) selected 'other'; among the write-in responses, technology and design and guidance/counselling were mentioned several times each, and classroom teaching was mentioned a few times, alongside single or occasional mentions of subjects such as German, philosophy, religious culture and ethics, Turkish language and literature, and various pre-school-related subjects.

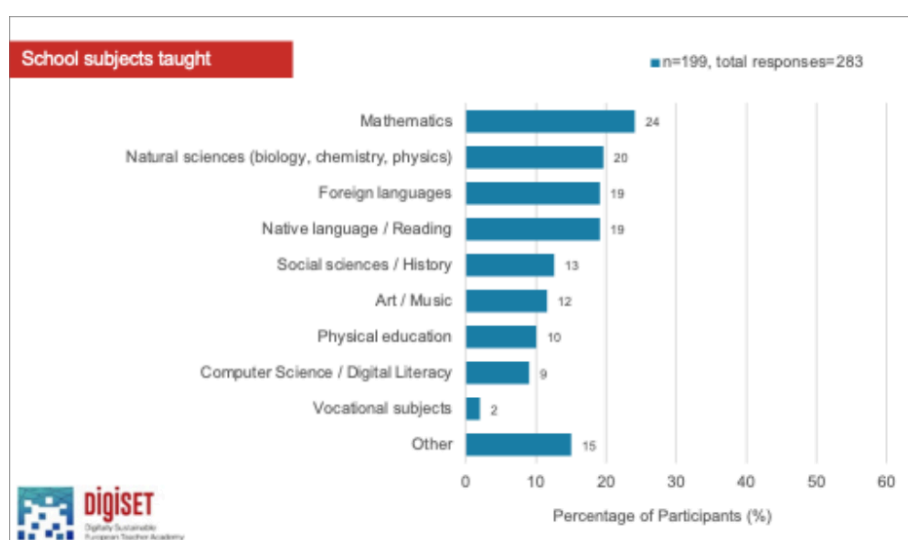


Figure 4: Subjects currently taught or expected to be taught by participants in the DigiSET teacher survey in Turkey.

3.5. Teaching Experiences (B4)

Figure 5 shows the teaching experience of participants ($n = 199$). The sample was dominated by highly experienced teachers: 33.7% reported more than 20 years of teaching experience, 20.1% reported 16–20 years, and 24.6% reported 11–15 years, meaning that 78.4% of respondents had at least 11 years of teaching experience. Only small proportions reported limited or no experience: 6–10 years (12.6%), 1–5 years (5.5%), less than 1 year (2.0%), or no experience at all (1.5%).

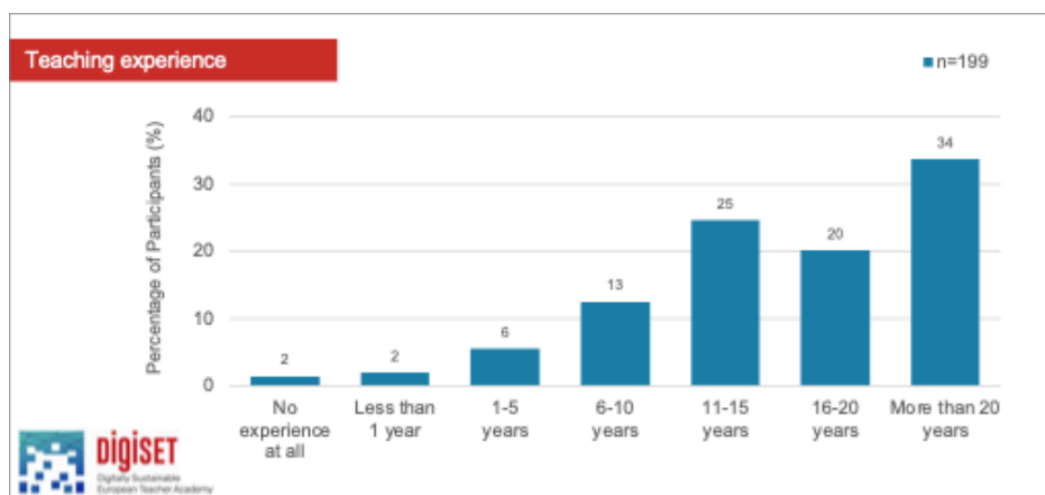


Figure 5: Teaching experiences of participants in the DigiSET teacher survey in Turkey.

4. Results

This section reports the findings of the DigiSET teacher survey in Turkey 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 presents teachers' self-reported professional engagement in digital teaching (DigCompEdu area 1; n = 292–295). Respondents reported the most frequent engagement in actively developing their own digital competence for teaching (43.8% always, 78.4% combined often/always) and in using different digital channels to communicate with learners and colleagues (41.7% always, 75.9% combined). Working together with colleagues inside and outside the educational organisation was also frequently reported (34.9% always, 73.5% combined). Awareness of and participation in online training opportunities was the least frequent behaviour in this area (24.1% always, 59.0% combined often/always), and the only item in this set with a notable share of rarely (11.2%) or never (0.3%) responses.

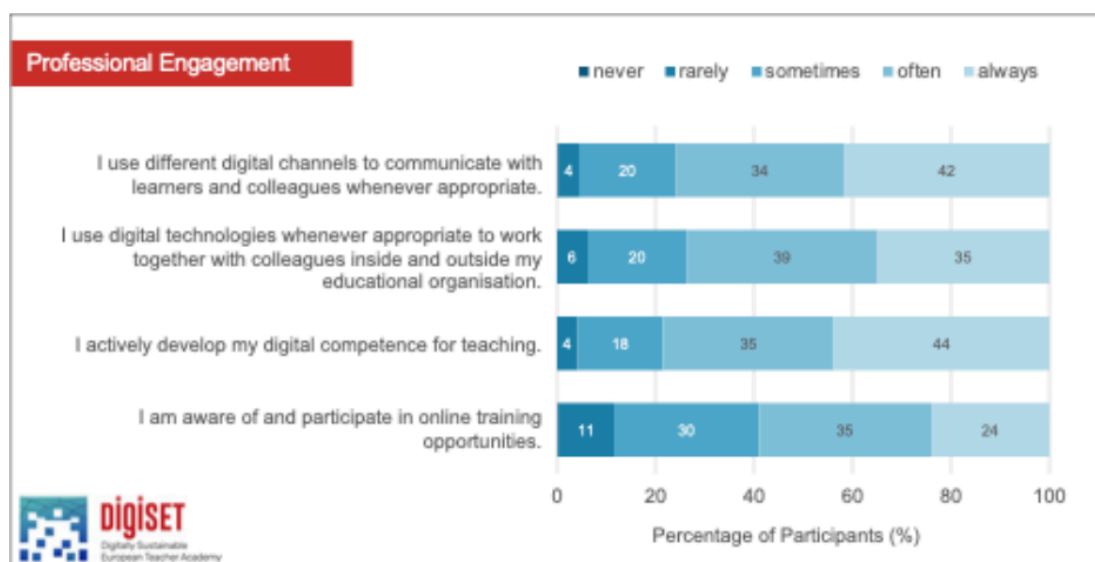


Figure 6: Self-perceived digital teaching competence – professional engagement. Responses to the DigiSET teacher survey in Turkey, utilising the items from DigCompEdu CheckIn questionnaire, area “professional engagement”, JRC, n.d., p. 11ff.

4.1.2. Digital resources (D5-D7)

Figure 7 presents teachers’ self-reported competence in handling digital resources (DigCompEdu area 2; n = 292–294). Protecting personal data (e.g., exam results, learners’ grades and personal information) was the most consistently reported practice, with 67.5% of respondents always doing so (92.9% combined often/always). Using different internet sites and search strategies to find and select digital resources was also common (36.1% always, 69.8% combined). Creating and modifying one’s own digital resources was reported markedly less frequently (20.2% always, 52.7% combined often/always), with the highest combined share of rarely/never responses in this set (18.5%).

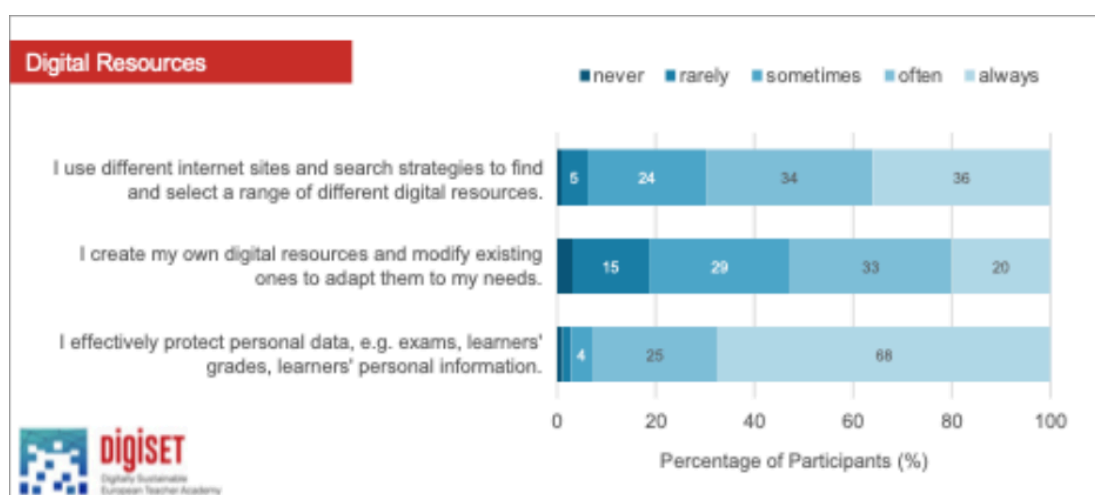


Figure 7: Self-perceived digital teaching competence – digital resources. Responses to the DigiSET teacher survey in Turkey, utilizing the items from DigCompEdu CheckIn questionnaire, area “digital resources”, JRC, n.d., p. 17ff.

4.1.3. Teaching and learning (D8-D11)

Figure 8 presents teachers’ self-reported practices in teaching and learning with digital technologies (DigCompEdu area 3; n = 294–295). Carefully considering how,

when and why to use digital technologies with learners so that they add value was the most frequently reported practice (45.8% always, 87.2% combined often/always). Using digital technologies to allow learners to plan, document and monitor their own learning was the least frequently reported practice in this area (19.3% always, 53.9% combined), followed by using digital technologies to support group work (25.1% always, 59.7% combined) and following learners' activities and interactions in collaborative online environments (26.2% always, 57.8% combined).

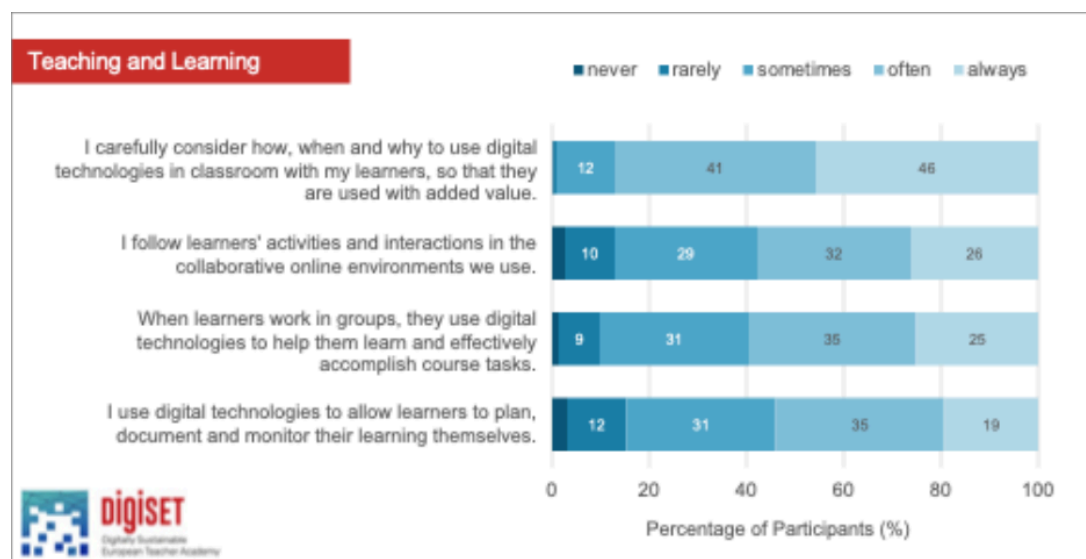


Figure 8: Self-perceived digital teaching competence – teaching and learning.

Note: Responses to the DigiSET teacher survey in Turkey, utilizing the items from DigCompEdu CheckIn questionnaire, area “teaching and learning”, JRC, n.d., p. 21.

4.1.4. Assessment (D12-D14)

Figure 9 presents teachers' self-reported use of digital technologies for assessment (DigCompEdu area 4; n = 294–295). Analysing available data to identify learners who need additional support was the most frequently reported practice (25.1% always, 66.5% combined often/always), followed by using digital technologies to provide effective feedback (23.8% always, 63.9% combined). Using digital assessment tools to monitor learner progress was the least frequently reported practice in this area (18.0% always, 52.2% combined often/always), suggesting that dedicated digital assessment tools are used somewhat less consistently than digital feedback and data-analysis practices more broadly.

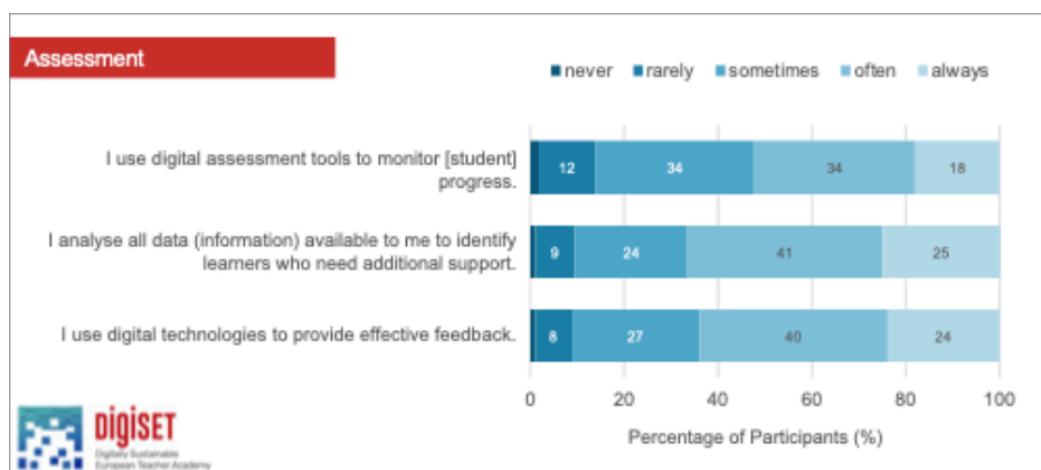


Figure 9: Self-perceived digital teaching competence – assessment.

Note: Responses to the DigiSET teacher survey in Turkey, utilizing the items from DigCompEdu CheckIn questionnaire, area “assessment”, JRC, n.d., p. 27.

4.1.5. Empowering learners (D15-D17)

Figure 10 presents teachers’ self-reported practices for empowering learners through digital technologies (DigCompEdu area 5; n = 295–296). Using digital technologies for learners to actively participate in class or online learning was the most frequently reported practice (29.1% always, 76.4% combined often/always), followed by taking into account potential practical or technical difficulties when creating digital assignments (27.1% always, 72.9% combined often/always). Offering learners personalised learning opportunities through digital technologies was the least frequently reported practice in this area (18.3% always, 50.8% combined often/always).

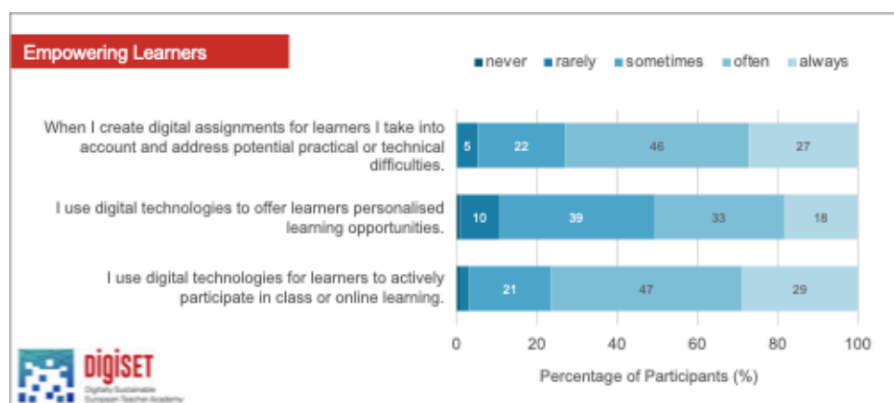


Figure 10: Self-perceived digital teaching competence – empowering learners.

Note: Responses to the DigiSET teacher survey in Turkey, utilizing the items from DigCompEdu CheckIn questionnaire, area “empowering learners”, JRC, n.d., p. 32.

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

Figure 11 presents teachers’ self-reported practices for facilitating learners’ digital competence (DigCompEdu area 6; n = 295–296). Teaching learners how to assess the reliability of information was the most frequently reported practice (35.3% always, 74.6% combined often/always), followed by teaching learners how to use digital technology safely and responsibly (30.8% always, 69.1% combined) and encouraging learners to use digital technologies creatively to solve concrete

problems (27.0% always, 63.8% combined). Setting up course tasks that require learners to use digital means to communicate and collaborate with an outside audience was the least frequently reported practice (18.6% always, 51.0% combined often/always), followed by setting up assignments that require learners to create digital content (21.7% always, 52.5% combined).

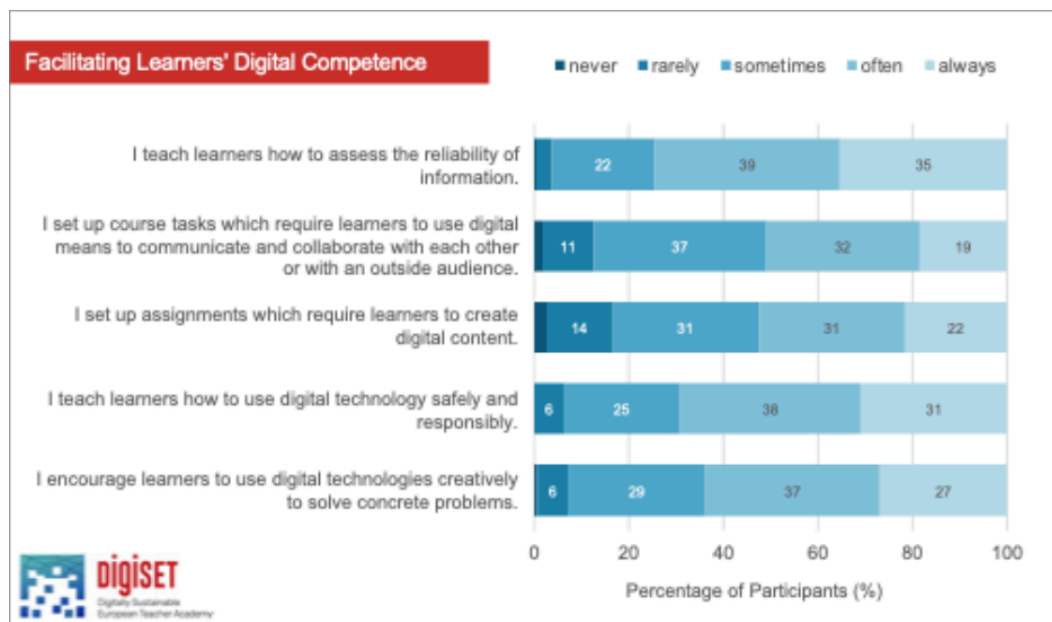


Figure 11: Self-perceived digital teaching competence – facilitating learners' digital competence.

Note: Responses to the DigiSET teacher survey in Turkey, utilizing the items from DigCompEdu CheckIn questionnaire, area “facilitating learners’s digital competence”, JRC, n.d., p. 37.

4.2. Self-perceived AI competence

4.2.1. AI knowledge (A1-A4)

Figure 12 presents teachers’ self-reported confidence in AI knowledge (TAICS dimension 1; n = 240–241). Respondents felt most confident in explaining what AI is (27.5% completely confident, 58.8% combined very/completely confident) and in creating content with AI (22.9% completely confident, 43.3% combined). Confidence was more moderate for explaining what generative AI is (22.0% completely confident, 45.2% combined) and clearly lowest for distinguishing whether a tool is AI-based or not, where the majority of respondents (55.4%) rated themselves only moderately confident and just 9.2% felt completely confident (34.6% combined very/completely confident).

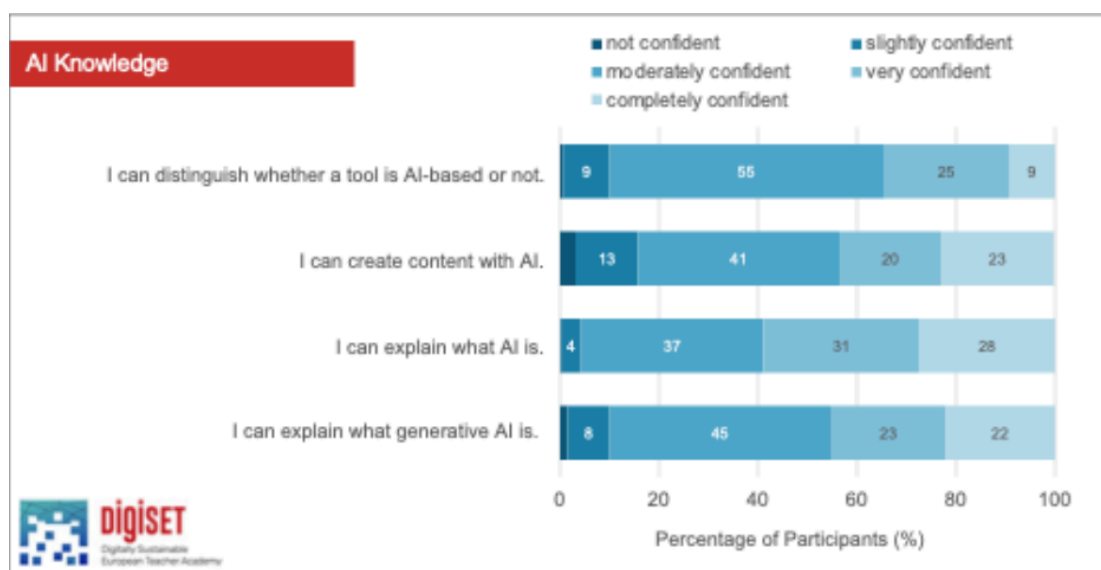


Figure 12: Self-perceived AI competence – AI knowledge.

Note: Responses to the DigiSET teacher survey in Turkey, utilizing items from Chiu, Ahmad, & Çoban (2025) section “AI knowledge”.

4.2.2. AI pedagogy (A5-A8)

Figure 13 presents teachers’ self-reported confidence in AI pedagogy (TAICS dimension 2; n = 240–241). Confidence levels were moderate and fairly similar across items. Choosing an AI tool that enhances subject content for a lesson showed the highest combined confidence (17.1% completely confident, 42.9% combined very/completely confident), closely followed by choosing an AI tool that enhances what, how and what is taught (17.9% completely confident, 41.7% combined). Helping others design learning activities that combine subject content, AI tools and teaching approaches showed the lowest confidence, with the highest share of ‘not confident’ responses in this domain (9.2%) and 33.8% combined very/completely confident.

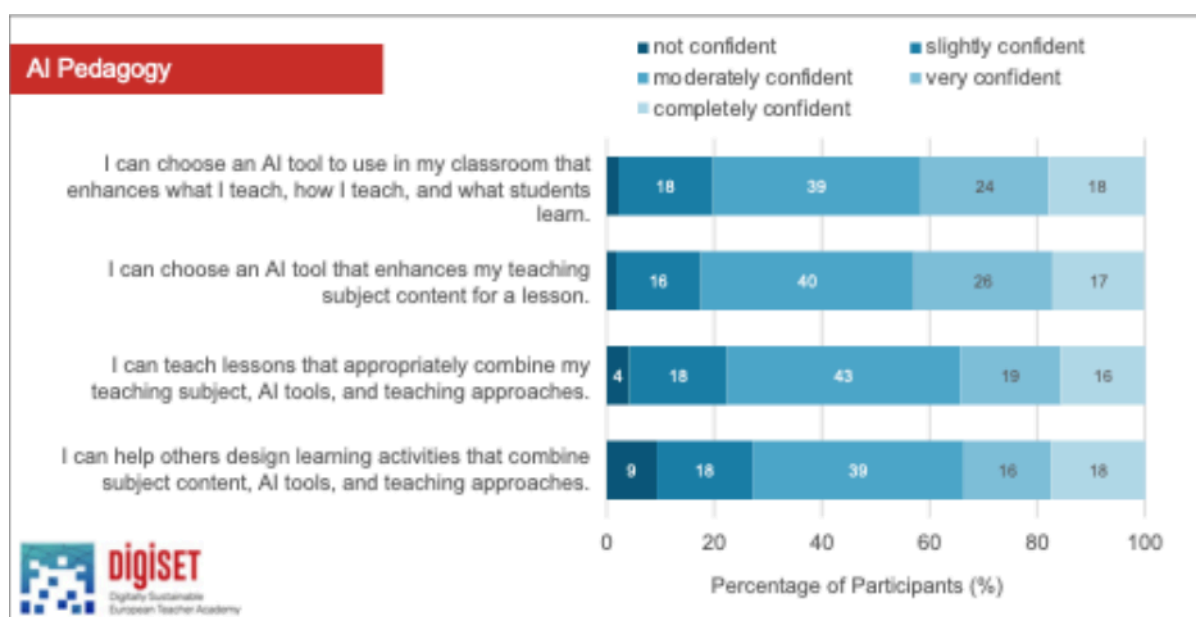


Figure 13: Self-perceived AI competence – AI pedagogy.

Note: Responses to the DigiSET teacher survey in Turkey, utilizing items from Chiu, Ahmad, & Çoban (2025) section “AI pedagogy”.

4.2.3. AI assessment (A9-A12)

Figure 14 presents teachers’ self-reported confidence in AI assessment (TAICS dimension 3; n = 240–241). Confidence in AI assessment was relatively low compared with the other AI competence areas. Using an AI tool to foster assessment for learning showed the highest combined confidence in this set (17.9% completely confident, 38.3% combined very/completely confident), while designing an assessment approach to improve student learning in an AI-based environment showed the lowest (16.3% completely confident, 33.4% combined), alongside the highest share of ‘not confident’ responses in this domain (7.1%).

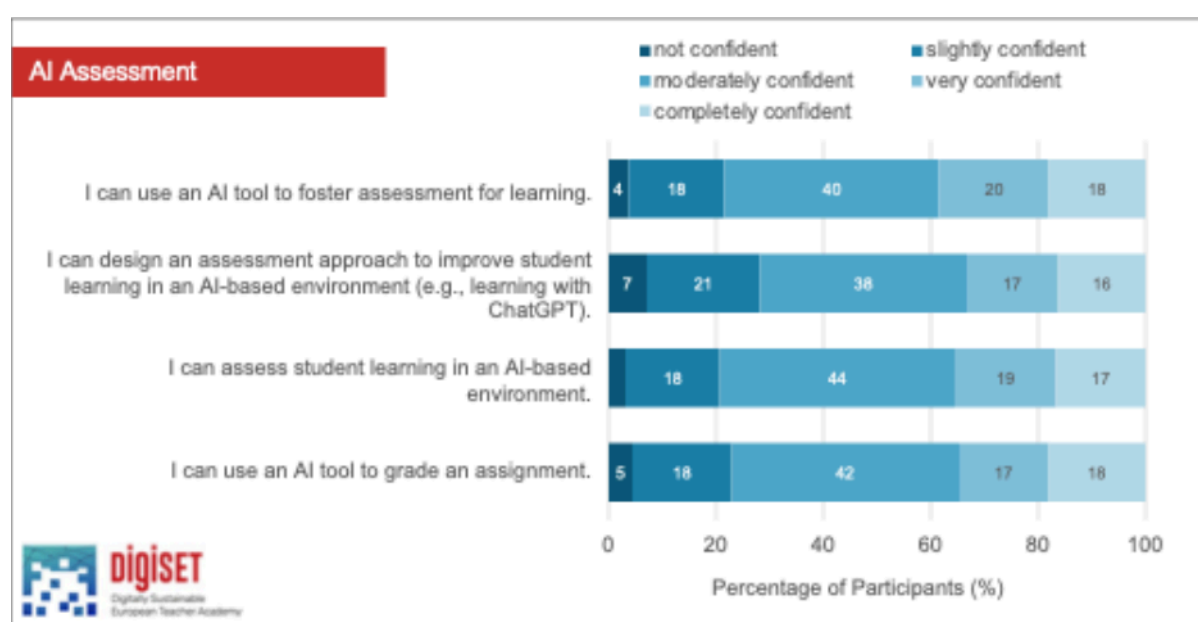


Figure 14: Self-perceived AI competence – AI assessment.

Note: Responses to the DigiSET teacher survey in Turkey, utilizing items from Chiu, Ahmad, & Çoban (2025) section “AI assessment”.

4.2.4. AI ethics (A13-A16)

Figure 15 presents teachers’ self-reported confidence in AI ethics (TAICS dimension 4; n = 240–241). Teaching students ethics (23.8% completely confident, 45.9% combined very/completely confident) and ensuring one’s own health and well-being while using AI tools (23.8% completely confident, 49.2% combined) showed the highest confidence in this domain. Protecting sensitive content from AI tools (e.g., exams, learners’ grades and personal data) showed the lowest confidence (17.9% completely confident, 35.8% combined), together with the highest share of low-confidence responses in this set (5.8% not confident, 23.8% only slightly confident).

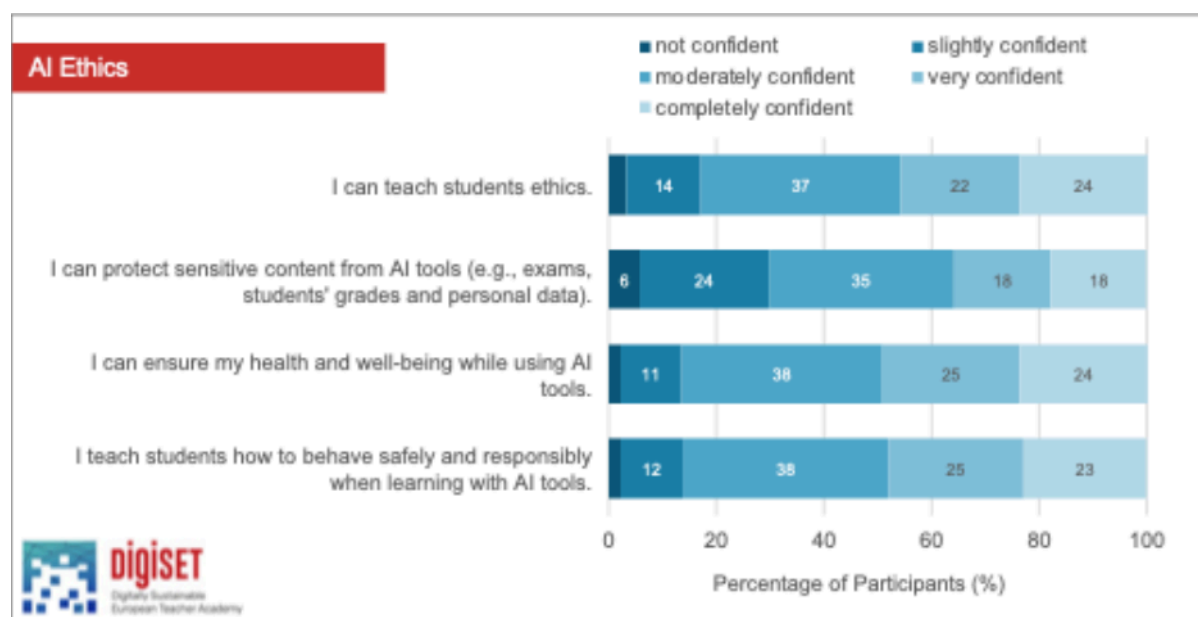


Figure 15: Self-perceived AI competence – AI ethics.

Note: Responses to the DigiSET teacher survey in Turkey, utilizing items from Chiu, Ahmad, & Çoban (2025) section “AI ethics”.

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

Figure 16 presents teachers' self-reported confidence in human-centred AI education (TAICS dimension 5; n = 240–241). Assessing the benefits of an AI tool showed the highest combined confidence (21.9% completely confident, 48.5% combined very/completely confident), followed closely by assessing the risks of an AI tool (18.8% completely confident, 45.9% combined). Explaining how AI impacts society showed the lowest confidence (14.6% completely confident, 43.4% combined), on a par with recognising that humans are responsible for AI bias (16.7% completely confident, 43.4% combined).

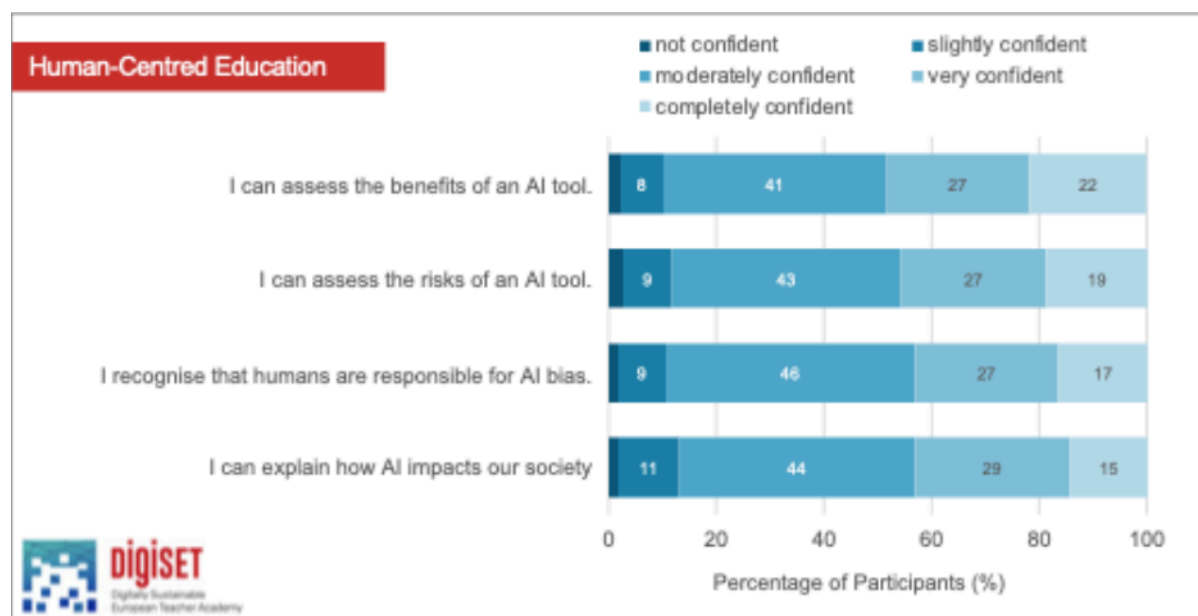


Figure 16: Self-perceived AI competence – human-centred education. Responses to the DigiSET teacher survey in Turkey, utilizing items from Chiu, Ahmad, & Çoban (2025) section “human-centred education”.

4.2.6. AI professional engagement (A21-A24)

Figure 17 presents teachers’ self-reported confidence in AI-related professional engagement (TAICS dimension 6; n = 240–241). Loving to help colleagues design learning activities with AI showed the highest combined confidence (22.3% completely confident, 47.5% combined very/completely confident), followed by actively looking for continuous professional development activities outside one’s educational organisation (21.3% completely confident, 46.7% combined). Actively sharing AI teaching experience with colleagues showed comparatively lower confidence (20.1% completely confident, 42.7% combined) and the highest share of ‘not confident’ responses in this set (4.6%).

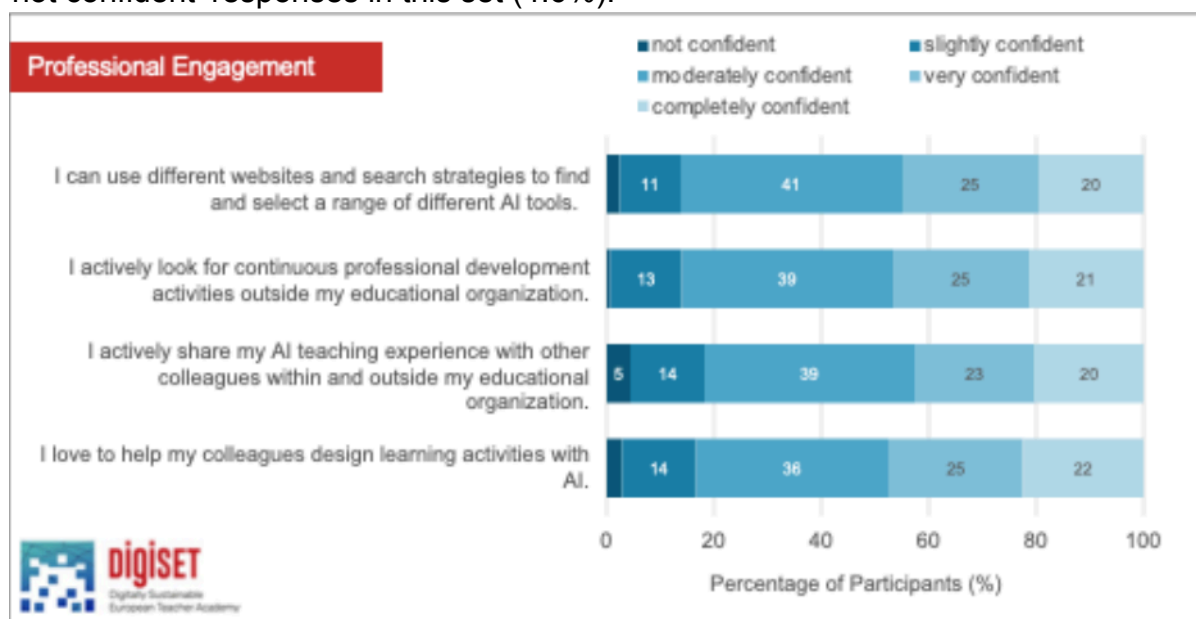


Figure 17: Self-perceived AI competence – professional engagement.

Note: Responses to the DigiSET teacher survey in Turkey, utilizing items from Chiu, Ahmad, & Çoban (2025) section “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, as they are specifically addressing a DigiSET core topic.

4.3.2. Pedagogical practice for ESD (S4-S7)

Figure 18 presents teachers’ self-reported pedagogical practice for education for sustainable development (ESD; n = 209–210). Agreement was highest for integrating sustainability topics into teaching practice (21.2% strongly agree, 80.3% combined agree/strongly agree) and for using participatory and learner-centred teaching approaches when addressing sustainability (25.8% strongly agree, 80.8% combined). Designing learning activities that promote active engagement with

sustainability challenges showed comparatively lower agreement (17.8% strongly agree, 68.8% combined) and the highest share of disagreement in this set (1.4% strongly disagree, 5.3% disagree). Using digital technologies to engage learners with real-world sustainability challenges also showed relatively lower agreement (18.7% strongly agree, 71.3% combined).

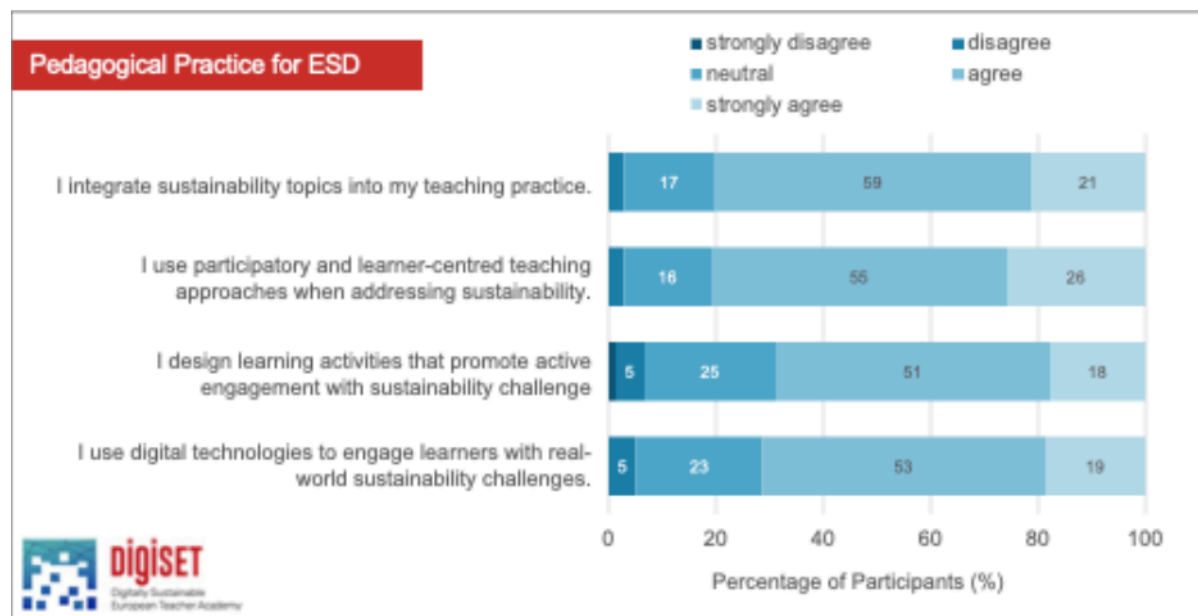


Figure 18: Self-perceived ESD competence – pedagogical practice for ESD.

Note: Responses to the DigiSET teacher survey in Turkey, items were created for the DigiSET survey.

4.3.3. Values and responsibility (S8-S10)

Figure 19 presents teachers' self-reported values and sense of responsibility regarding ESD (n = 209–210). Agreement was consistently high across all three items. Promoting values such as responsibility, equity and respect for diversity showed the highest agreement (31.1% strongly agree, 90.4% combined agree/strongly agree), followed by encouraging learners to consider ethical implications of sustainability issues (29.7% strongly agree, 86.2% combined) and supporting learners in developing a sense of responsibility for sustainable development (25.4% strongly agree, 83.8% combined).

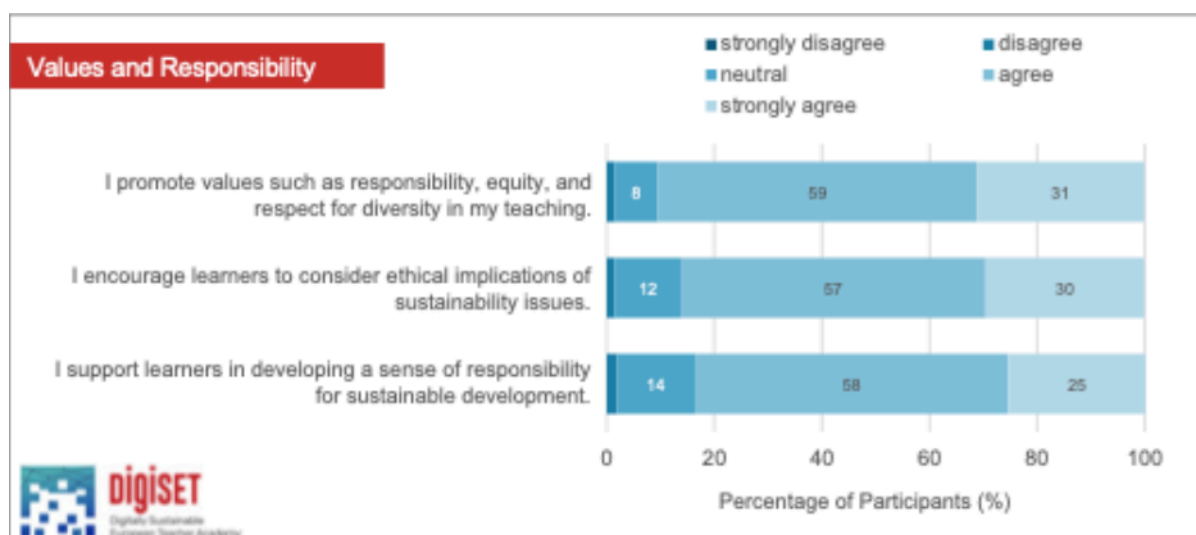


Figure 19: Self-perceived ESD competence – values and responsibility.

Note: Responses to the DigiSET teacher survey in Turkey, items were created for the DigiSET survey.

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

Figure 20 presents teachers' self-reported reflective and action-oriented ESD practice (n = 209–210). Reflecting on one's own teaching practice in relation to sustainability and seeking continuous improvement showed the highest agreement (21.2% strongly agree, 79.4% combined agree/strongly agree), followed by supporting learners in applying sustainability knowledge to real-life situations (23.0% strongly agree, 76.1% combined). Feeling confident facilitating discussions on complex or controversial sustainability issues showed the lowest agreement in this set (20.6% strongly agree, 71.3% combined) and the highest share of disagreement (5.3% disagree).



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

Note: Responses to the DigiSET teacher survey in Turkey, items were created for the DigiSET survey.

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

Figure 21 presents teachers' self-perceived OER competence (n = 207–208). Prior experience of using OER showed the highest agreement (28.8% strongly agree, 72.6% combined agree/strongly agree). Adopting OER because it fulfils the academic requirements of students (18.4% strongly agree, 70.1% combined) and respondents' own competencies and knowledge supporting OER adoption (20.8% strongly agree, 66.7% combined) also showed relatively high agreement. Efficiency in the ICT skills needed to adopt and use OER showed more moderate agreement (15.9% strongly agree, 59.4% combined), and knowledge of Intellectual Property Rights to understand OER showed the lowest agreement in this domain (18.3% strongly agree, 54.8% combined), together with the highest share of disagreement (1.9% strongly disagree, 8.2% disagree) and the highest share of neutral responses (35.1%).

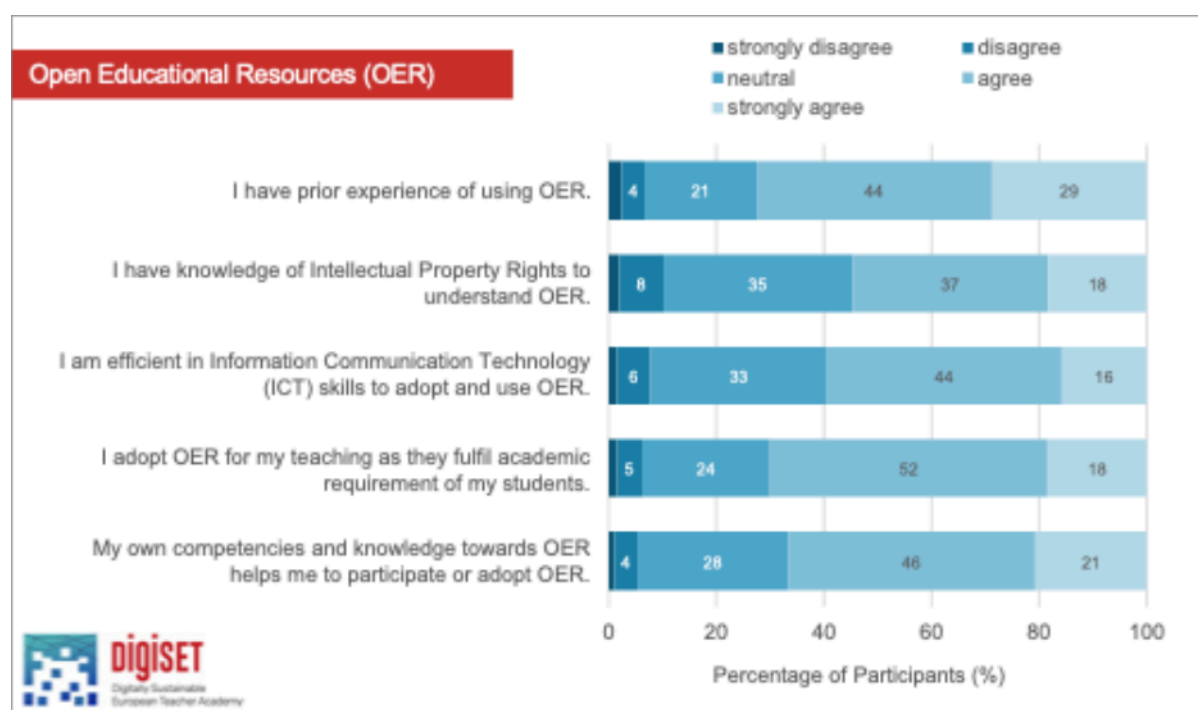


Figure 21: Self-perceived OER competence.

Note: DigiSET teacher survey results for Turkey, utilizing a subset of items from Mishra et al. (2016).

4.5. Self-perceived competences for specific DigiSET topics

4.5.1. Adaptive AI use (AD1, AD2)

Figure 22 presents teachers' self-reported confidence in adaptive AI use (n = 239–240). Confidence levels were similar for both items: 16.3% reported being completely confident in using AI tools to personalise learning for individual students (36.8% combined very/completely confident), and 17.1% reported being completely confident in using AI for differentiated instruction based on student needs (36.7% combined). For both items, a substantial share of respondents reported only moderate confidence (42.3% and 42.1%, respectively). The underlying data notes

that responses to these items may not fit well with the item wording, consistent with the response-format mismatch documented in the survey methodology report (Esfer et al., 2026, Section 2.8); this should be considered when interpreting the results.

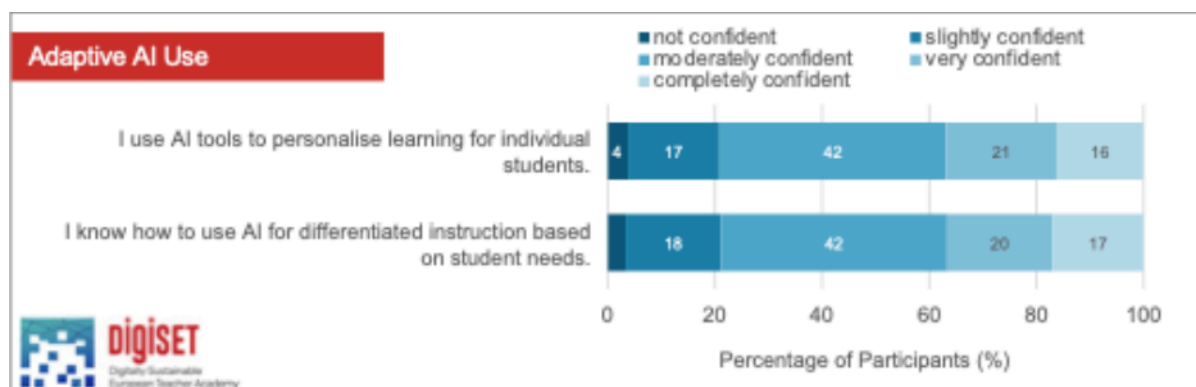


Figure 22: Adaptive AI use.

Note: Responses to the DigiSET teacher survey in Turkey, items were created for the DigiSET survey.

4.5.2. Gender bias in AI (GD1, GD2)

Figure 23 presents teachers' self-reported confidence in addressing gender bias in AI (n = 239). Confidence was comparatively low for both items: only 13.4% reported being completely confident in their awareness of gender bias in AI-generated content (30.5% combined very/completely confident), and 15.5% reported being completely confident in knowing how to address gender stereotypes when using AI in teaching (28.5% combined). Both items also had the highest share of 'not confident' responses among the DigiSET-specific topics (7.5% and 7.1%, respectively). As with the adaptive AI use items, the underlying data notes that responses to these items may not fit well with the item wording, consistent with the response-format mismatch documented in the survey methodology report (Esfer et al., 2026, Section 2.8).

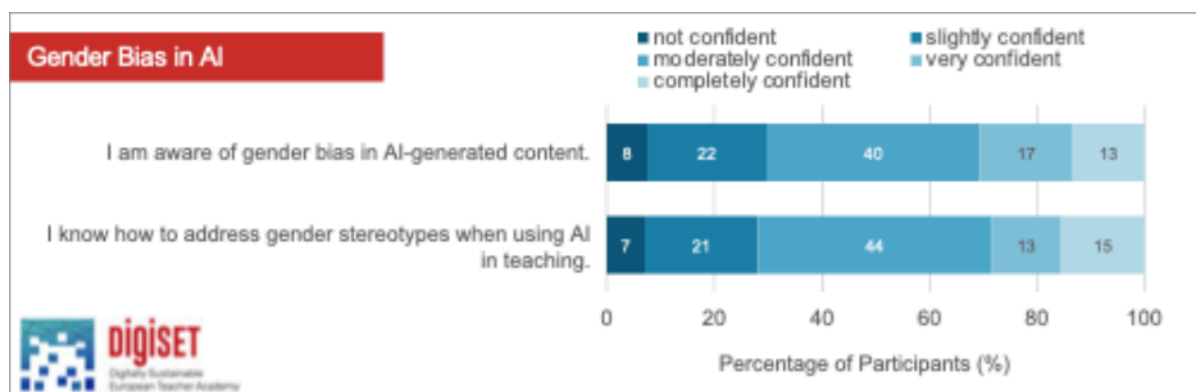


Figure 23: Gender bias in AI.

Note: Responses to the DigiSET teacher survey in Turkey, items were created for the DigiSET survey.

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

Figure 24 presents teachers' self-reported inclusive practices for students with learning disabilities (n = 296). Using digital tools to support students with learning difficulties was reported somewhat more frequently (20.9% always, 52.7% combined

often/always) than adapting digital learning materials for students with special educational needs (18.2% always, 43.2% combined). For the latter item, 18.2% of respondents reported rarely doing so and 2.7% never, the highest shares of infrequent practice among the DigiSET-specific topics.

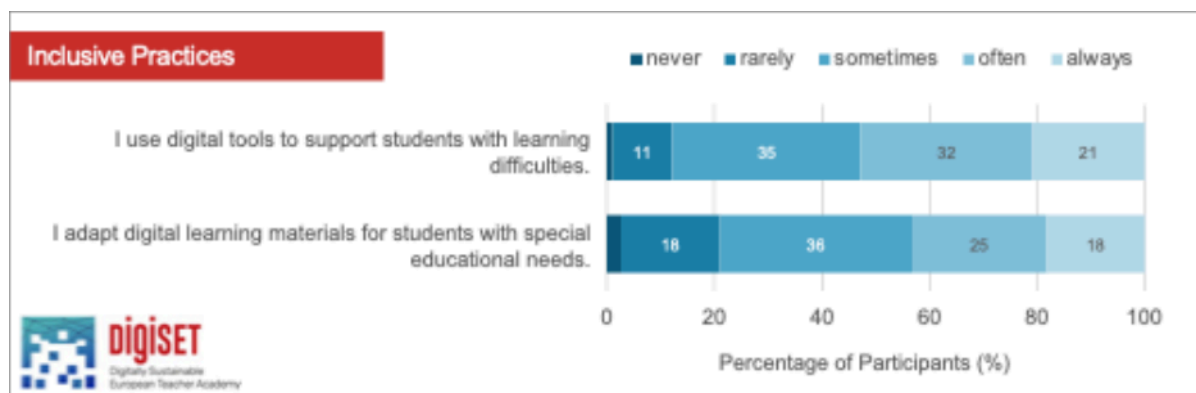


Figure 24: Inclusive practices.

Note: Responses to the DigiSET teacher survey in Turkey, items were created for the DigiSET survey.

4.5.4. Systems 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). Figure 25 presents teachers' self-reported systems and critical thinking practices for sustainability (n = 209–210). Agreement was consistently high across all three items: encouraging learners to critically reflect on sustainability-related issues showed the highest agreement (23.4% strongly agree, 84.6% combined agree/strongly agree), followed by supporting learners in analysing complex sustainability problems from multiple perspectives (23.3% strongly agree, 82.8% combined) and helping learners understand the interconnections between environmental, social and economic aspects of sustainability (23.4% strongly agree, 78.9% combined). Disagreement was minimal across all three items (at most 2.9% disagree, no strongly disagree responses).

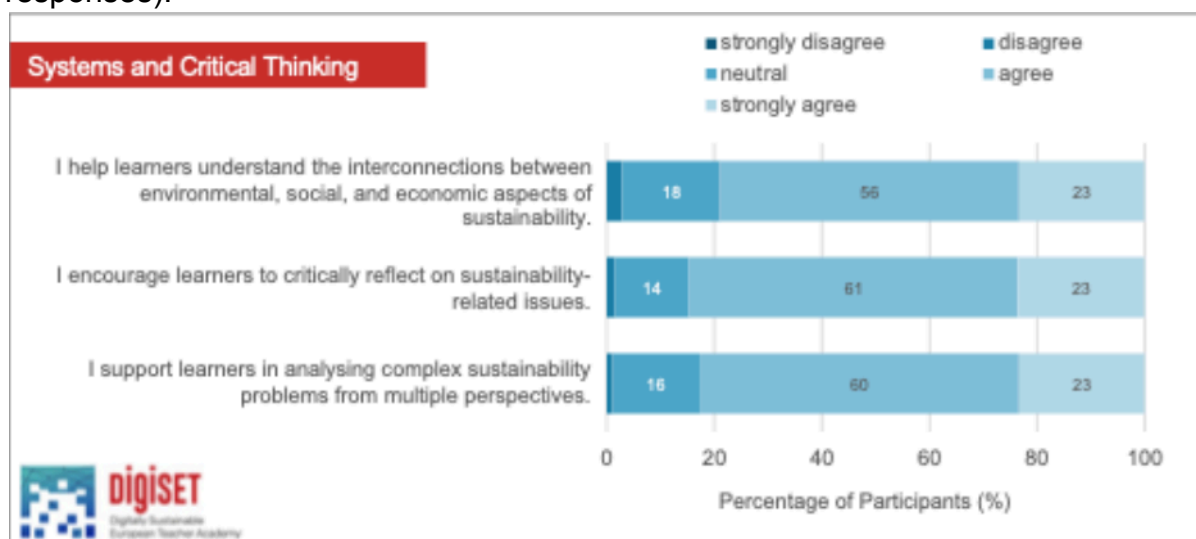


Figure 25: Education for sustainable development – systems and critical thinking.

Note: Responses to the DigiSET teacher survey in Turkey, items were created for the DigiSET survey.

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 teaching, as well as their competence and professional development needs. The qualitative data analyses presented in this report were conducted using [Academetrica Quali](#), a locally developed qualitative data analysis software from Türkiye.

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

Analysis of the open-ended responses to this question (n = 128) showed that the challenges reported by teachers clustered around two dominant and roughly equally prevalent concerns: time pressure created by a dense curriculum (35%) and infrastructural or technical limitations, including unreliable internet access, insufficient hardware and malfunctioning interactive whiteboards (35%). Overcrowded classrooms (13%) and teachers' own knowledge or skill gaps regarding digital tools and sustainability content (12%) were also frequently mentioned, alongside a lack of suitable materials or quality content (10%) and unequal access to digital devices and differing digital literacy levels among students (9%). A smaller number of respondents pointed to problems with student motivation, distraction or the uncritical use of AI tools (5%), financial barriers (2%), insufficient institutional support (2%), assessment-related difficulties (2%), or concerns about the reliability of AI-generated information (2%). A small share of respondents (5%) reported facing no particular challenges.

“Insufficient infrastructure, lack of adequate equipment, and large class sizes.”

“Time shortage arising from the intensity of the curriculum - students not having equal access to digital equipment and not having the same level of digital literacy.”

“One of the biggest challenges when integrating digital technologies and sustainability topics into teaching is that students do not have equal access to technology.”

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

Regarding the competences that would help address the challenges identified in Q1 (n = 119), the most frequently mentioned need was for structured training and professional development, such as in-service training, courses or seminars (13%), followed by improved infrastructure and equipment (12%). Around one in ten respondents pointed to digital literacy and technology-use skills (9%), institutional or ministry-level support (8%), problem-solving/adaptability/continuous-learning dispositions (8%), personal motivational traits such as curiosity and willingness to engage (8%), and pedagogical or instructional design skills (8%). Time (8%) and collaboration with colleagues or parents (6%) were also raised. Smaller numbers of respondents referred to the value of practical examples and sample materials (5%), the use of AI tools to support planning (4%), financial support or free access to

resources (4%), sustainability-specific content knowledge (3%), or stated that nothing was needed or that they did not know (3%). A substantial share of responses (21%) were highly individual, one-off suggestions that did not cluster into a larger theme.

“Technological support provided by the Ministry, and proper training delivered by competent experts in the field.”

“Problem-solving, adaptability and continuous-learning skills help the most in overcoming these challenges.”

“Digital literacy and technology-use skills, quickly finding solutions to technical problems encountered, time-management and planning skills, collaboration.”

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

Figure 26 shows the training areas that participants felt they needed most (n = 205; multiple responses were allowed). Using AI in teaching was by far the most frequently selected training need (61.5%), followed by inclusive digital teaching (42.4%), integrating sustainability into teaching (35.6%), and ethical and responsible AI use (33.7%). Creating and sharing OER (32.2%) and using adaptive learning tools (28.8%) were selected by around a third of respondents, while systems thinking for sustainability (22.9%) and addressing gender bias in AI (13.2%) were the least frequently selected training needs. Only 1.0% selected ‘other’.

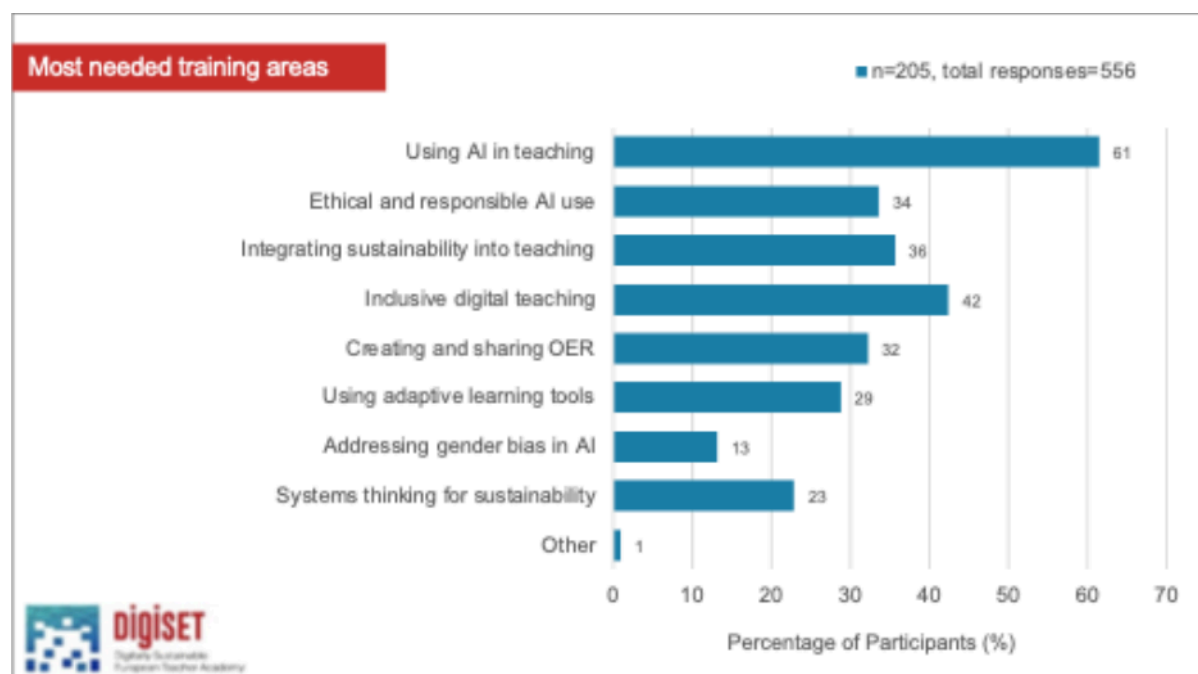


Figure 26: Most needed training areas.

Note: Responses to the DigiSET teacher survey in Turkey. Note: 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 reported by participants (n = 205; multiple responses were allowed). Lack of time was the most frequently reported barrier (70.7%), followed by lack of suitable resources or materials (52.2%) and lack of available training (47.8%). Lack of institutional support (37.1%) and lack of infrastructure, such as wi-fi or technical equipment, (27.3%) were reported less frequently. Only 1.0% selected 'other'; the write-in responses referred to overcrowded classrooms and to 'no barrier' / a 'biased approach'.

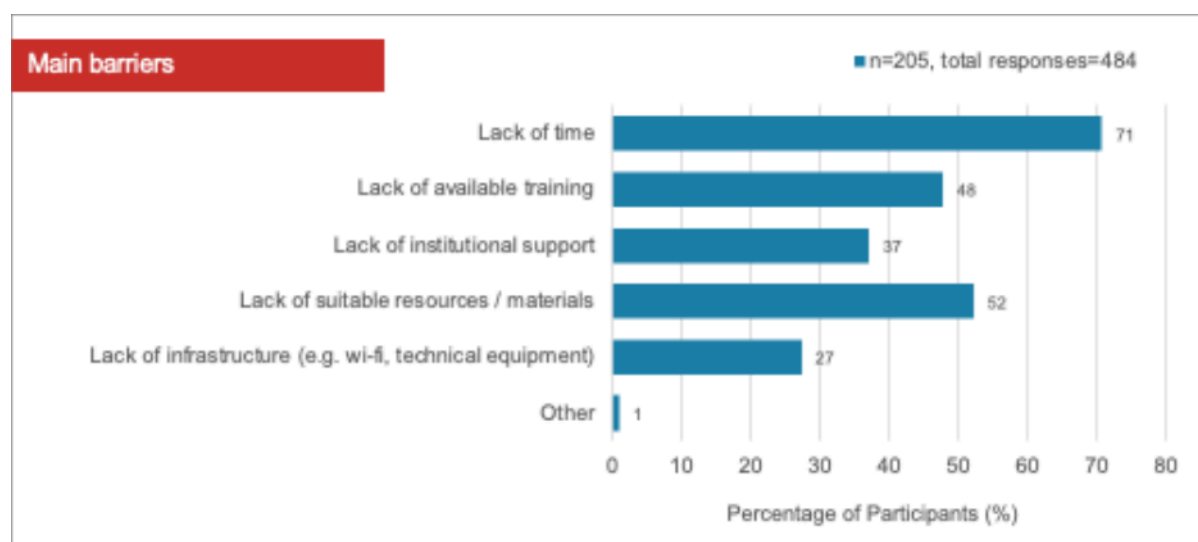


Figure 27: Main barriers to professional development in the addressed areas.

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

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

Most respondents (64%) did not provide an additional comment. Only a smaller group raised concerns about inappropriate or excessive use of AI and screen time, particularly for younger learners (4%), and some stressed the importance of including teachers' classroom experiences and perspectives in decisions about digitalisation (3%).

5. Discussion

This section synthesises and critically discusses the key findings presented in Section 4, contextualising them within the national educational landscape and existing research, and addressing the study's generalisability and limitations.

5.1. Key results concerning teachers' competences

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

Digital teaching competence (D1–D22)

Across the six DigCompEdu areas, respondents generally reported moderate to high levels of digital teaching competence, although variation was observed across specific practices. Professional Engagement appeared to be one of the strongest areas. In particular, 78.4% of respondents reported often or always actively developing their digital competence for teaching, while 75.9% frequently used digital channels to communicate with learners and colleagues (Figure 6). Within Digital Resources, protecting personal data was the most consistently reported practice with 92.9% of respondents reporting that they did so often or always (Figure 7). Similarly, within Teaching and Learning, 87.2% reported often or always considering how, when and why to use digital technologies to add value to learning (Figure 8). In contrast, offering learners personalized learning opportunities through digital technologies within Empowering Learners (18.3% always, 50.8% combined often/always, Figure 10) and setting up course tasks that require learners to use digital means to communicate and collaborate with an outside audience (18.6% always, 51.0% combined often/always, Figure 11) were the least frequently reported practices. These findings do not indicate a simple divide between stronger and weaker DigCompEdu areas; rather, they reveal a consistent pattern in which established and teacher-oriented practices, such as digital safety and purposeful technology use, are more frequently reported than pedagogically advanced practices, particularly those involving personalisation, assessment, digital collaboration and content creation.

AI competence (A1–A24)

Within the six TAICS dimensions, respondents generally reported moderate levels of confidence in their AI competence, but a clear gap emerged between AI knowledge and AI pedagogy/assessment. Regarding AI competence, teachers felt most confident explaining what AI is but least confident in AI-supported assessment practices, particularly designing assessments for AI-based environments. On average, 45.5% of respondents across the four AI Knowledge items reported being very or completely confident (Figure 12), compared with 38.2% across AI Pedagogy items (Figure 13) and 35.5% across AI Assessment items (Figure 14).

Confidence was particularly high in explaining what AI is (58.8% very/completely confident, Figure 12), while only 33.4% felt confident in designing assessments for AI-based environments (Figure 14). Moreover, within AI Pedagogy, helping others design learning activities that combine subject content, AI tools and teaching approaches showed low confidence, with the highest share of 'not confident' responses (9.2%) and 33.8% combined very/completely confident (Figure 13).

Consequently, the findings reveal a noticeable knowledge-to-practice gap, as teachers appear more confident in understanding and defining AI than in translating these competencies into AI-supported pedagogy and assessment. This suggests that teachers have a foundation for AI integration, but their readiness to apply AI in teaching is less developed when it requires pedagogical redesign, assessment and the alignment of AI tools with subject content and teaching approaches.

ESD competence (S1–S13)

Among the four ESD dimensions, respondents reported generally high levels of agreement, although a distinction emerged between values-oriented and more pedagogical or action-oriented aspects of ESD. Values and Responsibility was the strongest dimension, with an average of approximately 86.8% of respondents agreeing or strongly agreeing with its three items (Figure 19). The highest level of agreement across all 13 items was observed for promoting responsibility, equity and respect for diversity in teaching (90.4%), followed by encouraging learners to consider ethical implications of sustainability issues (29.7% strongly agree, 86.2% combined) within values and responsibility (Figure 19). In comparison, agreement was lower for Reflective and Action-Oriented Practice (approximately 74.3%) and Pedagogical Practice for ESD (approximately 75.3% on average). Within these areas, relatively lower levels of agreement were observed for designing learning activities that actively engage learners with sustainability challenges (68.8%), using digital technologies to engage learners with real-world sustainability challenges (71.3%, Figure 18) and feeling confident in facilitating discussions on complex or controversial sustainability issues (71.3%, Figure 20). Taken together, the findings suggest that respondents more strongly endorse the values and responsibilities associated with ESD than its more applied pedagogical and action-oriented practices.

OER competence (O1–O5)

In terms of OER, teachers reported relatively high prior experience of using OER (72.6%) but more limited knowledge of Intellectual Property Rights (54.8%). Similarly, 70.1% reported adopting OER in their teaching to meet students' academic requirements, and 66.7% considered their own knowledge and competencies sufficient to support OER participation or adoption (Figure 21). However, respondents were less positive about some of the competencies underpinning effective OER use. While 59.4% agreed or strongly agreed that they had sufficient ICT skills to adopt and use OER, only 54.8% reported having adequate knowledge of Intellectual Property Rights (IPR) to understand OER (Figure 21). As a conclusion, teachers' practical experience with and adoption of OER appear relatively well established, whereas their perceived readiness regarding the technical and legal knowledge required for effective OER use is less consistent.

Several notable intersections emerge across digital teaching, AI, ESD and OER competence domains.

First, respondents appear relatively strong in established digital teaching practices, but less confident when similar practices involve AI. For example, professional engagement is a relative strength within DigCompEdu, whereas confidence in AI Pedagogy and AI Assessment is considerably more moderate. This suggests that general digital competence does not necessarily translate directly into readiness to

integrate AI pedagogically. A similar pattern is visible within assessment. Respondents report relatively established use of digital technologies for feedback and data-informed support, but confidence declines when assessment is situated specifically in AI-based environments, particularly when designing assessment approaches for learning with AI.

Second, the ESD results reveal a distinction between values-oriented competence and its practical or technology-mediated implementation. Respondents strongly endorsed promoting responsibility, equity, and respect for diversity (90.4% agree/strongly agree) and encouraging critical reflection on sustainability issues (84.6%). However, agreement was lower for designing activities that actively engage learners with sustainability challenges (68.8%) and using digital technologies to engage learners with real-world sustainability challenges (71.3%). Thus, teachers appear more strongly aligned with the values and principles underpinning ESD than with translating these principles into technology-supported and action-oriented learning experiences.

Third, a similar knowledge-to-application pattern can be observed across AI and OER. Within AI competence, respondents were more confident in explaining AI and understanding its broader implications than in AI pedagogy and assessment. In the OER domain, prior experience and adoption were relatively widespread, yet perceived knowledge of Intellectual Property Rights was less established and characterised by considerable uncertainty. Across these domains, therefore, the main competence gap appears not to concern basic awareness, but rather the capacity to translate these foundations into specialised pedagogical practices.

5.1.2. Teachers' competence concerning the four DigiSET topics

The analysis of the four specific DigiSET topics — adaptive AI use, gender bias in AI, inclusive practices and systems thinking — reveals a different level of self-competence among the respondents. Across the four DigiSET topics, systems thinking for sustainability emerged as the strongest area, while confidence in addressing gender bias in AI was comparatively low. Significant gaps emerge in practical application and pedagogical implementation, particularly where digital technologies require complex ethical, practical or inclusive requirements.

Adaptive AI use (AD1, AD2)

Adaptive AI use emerged as a relatively less developed area, with only 36.8% of respondents reporting that they were very or completely confident in using AI tools to personalise learning for individual students and 36.7% reporting similar confidence in using AI for differentiated instruction based on student needs (Figure 22). Notably, the largest proportion of respondents reported moderate confidence in both practices (42.3% and 42.1%, respectively), suggesting that adaptive AI use represents an emerging rather than an established competence. While respondents reported comparatively higher confidence in AI Knowledge, confidence was lower in AI Pedagogy. The adaptive AI findings therefore reinforce the gap between understanding and engaging with AI at a general level and applying it to more pedagogically demanding practices. Consequently, it is obvious that understanding what AI is (knowledge) does not automatically translate into the confidence in leveraging it for adaptive learning and learner-centred pathways (pedagogy).

Gender bias in AI (GD1, GD2)

Gender bias in AI has been an emerging area of concern in this study. Only 30.5% of respondents reported being very or completely confident in their awareness of gender bias in AI-generated content, while confidence was even lower for knowing how to address gender stereotypes when using AI in teaching (28.5%). Both items also recorded the highest proportions of “not confident” responses among the DigiSET-specific topics (7.5% and 7.1%, respectively). This pattern contrasts with the broader AI competence findings, where respondents reported comparatively higher confidence in AI Ethics and Human-Centred Education. The lower confidence observed for gender bias therefore points to a gap between general ethical and human-centred AI competence and the ability to recognise a specific form of bias in educational contexts.

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

The findings of inclusive practices indicated that while 52.7% of respondents reported often or always using digital tools to support students with learning difficulties, this proportion decreased to 43.2% for adapting digital learning materials to students with special educational needs (Figure 24). It is consistent with the DigCompEdu findings, where the use of digital technologies to provide personalised learning opportunities was among the less frequently reported practices (50.8% often/always). These findings suggest that although teachers engage with digital technologies to support diverse learners, adapting digital resources and learning experiences to specific learner needs remains less consistently embedded in practice. Consequently, there is a need for further attempts to move from general use of digital technologies towards more individualised and inclusive forms of digital pedagogy to support learners.

Systems thinking for sustainability (S1–S3)

Systems thinking provides the highest self-perceived competence values among the respondents. A large majority of 84.6% agree (combined agree/strongly agree) that they encourage learners to critically reflect on sustainability-related issues, 82.8% (combined agree/strongly agree) agree that they support learners in analysing complex sustainability problems from multiple perspectives, and 78.9% (combined agree/strongly agree) agree that they help learners understand the interconnections between environmental, social, and economic aspects of sustainability (Figure 25). Disagreement was minimal across all three items (at most 2.9% disagree, no strongly disagree responses). This pattern is consistent with ESD competence findings (Section 4.3), which suggests that respondents are particularly well oriented towards the conceptual part of sustainability education, including values and responsibilities. However, when considered alongside the comparatively lower level agreement of Pedagogical Practice for ESD and Reflective and Action-Oriented Practice, this strength in systems thinking does not appear to extend equally to the practical and action-oriented implementation of ESD.

Overall, the findings indicated that among the four DigiSET-specific topics, systems thinking for sustainability represented the strongest area, while gender bias in AI appeared to represent the greatest need for intervention. Adaptive AI use also represents an important area for development, particularly in relation to personalisation and differentiated instruction, while inclusive digital practices indicate a need for greater capacity to adapt materials to specific learner needs.

5.1.3. Teachers' learning needs and interest

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

The most frequently reported challenges (Q1) were time pressure associated with a dense curriculum (35%) and infrastructural or technical limitations (35%), including unreliable internet access, insufficient hardware, and malfunctioning interactive whiteboards. Overcrowded classrooms (13%) and teachers' own knowledge or skill gaps related to digital tools and sustainability content (12%) were also frequently mentioned. A smaller number of respondents pointed to problems with financial barriers (2%), insufficient institutional support (2%), assessment-related difficulties (2%) or concerns about the reliability of AI-generated information (2%). Representative statements included:

“Insufficient infrastructure, lack of adequate equipment, and large class sizes.”

“Time shortage arising from the intensity of the curriculum - students not having equal access to digital equipment and not having the same level of digital literacy.”

Responses concerning the competences and resources needed to address these challenges (Q2) reflected this combination of individual and contextual factors. Training and professional development was the most frequently mentioned need (13%), followed closely by improved infrastructure and equipment (12%). Participants also highlighted digital literacy and technology-use skills (9%), institutional or ministry-level support (8%), problem-solving, adaptability and continuous learning (8%), personal motivation and willingness to engage (8%), and pedagogical or instructional design skills (8%). On the other hand, smaller numbers of respondents referred to the value of practical examples and sample materials (5%), the use of AI tools to support planning (4%), financial support or free access to resources (4%), sustainability-specific content knowledge (3%). Representative statements included:

“Technological support provided by the Ministry, and proper training delivered by competent experts in the field.”

“Digital literacy and technology-use skills, quickly finding solutions to technical problems encountered, time-management and planning skills, collaboration.”

Although most respondents (64%) did not provide additional comments (Q3), some (6%) described sharing positive practices already in use (project-based, game-based, digital art, etc.). Others reiterated the need for further teacher training and support for teachers (5%). More notably, several comments raised concerns about AI/screen-time misuse, especially at younger ages (4%), while others called for teachers' field voice to be taken into account (3%). These comments introduce a more critical perspective on digitalisation, suggesting that respondents were concerned not only with developing technological competencies but also with recognising effective practices and the potential negative impacts of technology use.

Priority training areas (P1)

Using AI in teaching was by far the most frequently selected training need (61.5%), followed by inclusive digital teaching (42.4%), integrating sustainability into teaching (35.6%), and ethical and responsible AI use (33.7%). Creating and sharing OER (32.2%) and using adaptive learning tools (28.8%) were selected by around a third of respondents, while systems thinking for sustainability (22.9%) and addressing gender bias in AI (13.2%) were the least frequently selected training needs.

Participants' training priorities broadly, but not fully, aligned with the competence gaps identified in Sections 5.1.1 and 5.1.2. Using AI in teaching was by far the most frequently selected training need (Figure 26), which is consistent with the comparatively lower confidence observed in AI Pedagogy and AI Assessment and the knowledge-to-practice gap identified in the broader AI competence results.

Inclusive digital teaching was the second most frequently selected area also corresponding closely with the relatively limited use of personalised learning in DigCompEdu and the lower frequency of adapting digital materials for students with special educational needs. However, this alignment was not consistent across all areas. Most notably, addressing gender bias in AI was the least frequently selected training need (13.2%), despite gender bias emerging as one of the clearest competence gaps, with fewer than one third of respondents reporting high confidence in recognising or addressing it. Moreover, despite relatively limited confidence in using AI for personalisation and differentiated instruction, only 28.8% selected adaptive learning tools as a training priority.

These findings indicate that perceived training needs do not necessarily mirror the measured competence gaps. This gap may also reflect differences in teacher awareness of their actual competencies and training needs. In this context, self-identified training priorities alone may not fully reflect the areas in which teachers report lower levels of competence. It is thus important to consider both expressed training priorities and reported competence profiles while identifying the professional development needs.

Barriers (P2)

Lack of time was the most frequently reported barrier (70.7%), followed by lack of suitable resources or materials (52.2%), lack of available training (47.8%), lack of institutional support (37.1%) and lack of infrastructure, such as wi-fi or technical equipment, (27.3%). These findings indicate that barriers to competence development extend beyond teachers' individual knowledge and skills and include organisational and resource-related constraints.

Within the DigiSET Teacher Academy, these barriers could be addressed by providing flexible and manageable professional learning opportunities that can be integrated into teachers' existing workloads, together with ready-to-use and adaptable teaching resources. Three components emerge:

Flexible and workload-sensitive training: The DigiSET Teacher Academy should provide professional learning opportunities that can be flexibly integrated into teachers' existing workloads, minimising additional time demands while maintaining meaningful engagement.

Practice and pedagogy oriented professional development: Training should emphasise practical and pedagogically meaningful applications, providing teachers with concrete examples and strategies for integrating digital and AI tools into inclusive, differentiated and learner-centred teaching practices.

A supportive digital education ecosystem: The Academy should extend beyond individual teacher competence development by engaging school leaders and ensuring adequate infrastructure, appropriate digital tools and resources.

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

Across digital teaching, AI, ESD, and OER, a consistent pattern emerged between competencies. Respondents demonstrated relatively strong general digital practices, AI knowledge, values-oriented ESD competencies, whereas confidence was less consistent when competencies require personalization, assessment and pedagogical adaptation. Recently, there have been many attempts in national policies to develop teachers' digital competences such as the FATİH Project, the Education Information Network (EBA), This policy direction has been strengthened by the Ministry of National Education's 2024–2028 Strategic Plan, the Türkiye Yüzyılı Maarif Modeli, and the Digital Teacher Competencies Framework, which increasingly emphasise not only access to digital technologies but also their pedagogically meaningful, inclusive, safe, and responsible use.

According to findings, respondents appeared relatively strong in established digital teaching practices, but less confident when similar practices involve AI. Therefore, established digital practices did not necessarily translate into confidence in AI-supported pedagogy and assessment. More recently, the AI in Education Policy Document and Action Plan (2025–2029) has positioned AI literacy, ethical AI use, and the integration of AI into teaching and learning as explicit national priorities. However, the DigiSET Türkiye National Desk Study Report concluded that these areas have not developed at the same pace: while digital pedagogy and AI literacy have gained considerable policy visibility, sustainability competences, Open Educational Resources (OER), and teacher autonomy in creating and sharing digital resources remain less systematically institutionalised in teacher education and professional development (Esfer et al., 2026). Moreover, studies with teachers in Türkiye also show that competence levels vary considerably across different areas. In a study of 401 teachers from different provinces in Türkiye, Hava and Babayiğit (2025) reported above-average digital proficiency but below-average AI-TPACK competence, indicating a gap between general digital skills and the ability to integrate AI pedagogically. Similarly, Turkish K–12 teachers recognised the potential of AI for efficiency, interactivity, personalisation, and lesson planning, while also reporting technical, curricular, ethical, and contextual challenges that require targeted professional support (Filiz et al., 2025). Consequently, these findings suggest that teachers have established foundations in digital competence but are still developing their capacity to use technology in pedagogically meaningful ways (Süzer and Koç, 2024).

ESD results reveal a distinction between values-oriented competence and its practical or technology-mediated implementation. Respondents strongly endorsed

promoting responsibility, equity, and respect for diversity and encouraging critical reflection on sustainability issues. However, agreement was lower for designing activities that actively engage learners with sustainability challenges and using digital technologies to engage learners with real-world sustainability challenges. Thus, teachers appear more strongly aligned with the values and principles underpinning ESD than with translating these principles into technology-supported and action-oriented learning experiences. The DigiSET Türkiye National Desk Study Report similarly identified a gap between policy commitment and implementation in sustainability education. Although sustainability is clearly recognised in national policy frameworks, including the Twelfth Development Plan, the MoNE Strategic Plan, and SDG reporting, its integration into teacher competence development remains fragmented. Sustainability is addressed primarily through specific initiatives and subject-based curricular components rather than as a cross-cutting teacher competence, while its connection with digital education is not yet systematically articulated. Consequently, sustainability-related teacher competence development remains relatively ad hoc, with growing policy attention but limited institutionalisation within teacher education and professional development. This policy–implementation gap resonates with the present findings, in which respondents strongly endorsed the values, responsibilities, and systems-thinking dimensions of ESD, while its pedagogical, action-oriented, and technology-mediated implementation was comparatively less established.

A similar knowledge-to-application pattern can be observed across AI and OER. Within AI competence, respondents were more confident in explaining AI and understanding its broader implications than in AI pedagogy and assessment. In the OER domain, prior experience and adoption were relatively widespread, yet perceived knowledge of Intellectual Property Rights was less established and characterised by considerable uncertainty. Therefore, OER represents another area in which access to digital resources does not necessarily correspond to competence in open educational practice. In a study involving 588 in-service teachers in Türkiye, researchers identified lack of time and knowledge as major barriers to OER use and reported teachers' demand for greater institutional support and awareness-building activities (Tosun & Altıntaş, 2024). These findings suggest that teacher development in Türkiye needs to be considered more broadly than digital competence alone. Rather, there is a need to examine how digital pedagogy intersects with AI competence, sustainability, inclusion, ethics, and open educational practice.

The training priorities and barriers identified in the present study broadly converge with the findings of TALIS 2024 Türkiye. Most notably, using AI in teaching was the leading training priority in the present study (61.5%), while TALIS similarly identified skills for using AI in teaching and learning as the most frequently reported area of high professional learning need among Turkish teachers (38%). Inclusive digital teaching was the second most frequently selected priority (42.4%), consistent with TALIS findings identifying teaching students with special education needs as another prominent professional learning need. According to TALIS 2024 Türkiye results, teachers tend to use AI to efficiently learn about and summarise a topic (88%), generate lesson plans or activities (70%), and help students practice new skills in real-life scenarios (59%). On the other hand, the least frequent use of AI is to automatically adjust the difficulty of lesson materials according to students' learning

needs (54%), generate text for student feedback or parent/guardian communications (51%), and support students with special education needs (41%).

Another striking result is about the barriers teachers face. Lack of time was reported as the leading barrier in the present study (70.7%), almost identical to the 71% of teachers in TALIS 2024 Türkiye who reported insufficient time due to other commitments or responsibilities as a barrier to professional learning. Taken together, the convergence between the two datasets suggests that the needs identified in the DigiSET sample reflect broader challenges facing teachers in Türkiye, particularly the need for AI-related pedagogical development, inclusive teaching competence, workload-sensitive professional learning, and supportive technological conditions.

5.3. Limitations of the study

- a. The findings should not be interpreted as nationally representative. Participants were recruited through snowball sampling using social media, e-mail, and the professional networks of the research team, rather than through a probability-based national sampling frame.
- b. The sample also differs somewhat from national teacher statistics. Women represented 71.4% of respondents, compared with approximately 62% of teachers nationally, and the sample included a relatively higher proportion of private-school teachers than the national teacher population (MoNE, 2025). Respondents were also relatively experienced, with 78.4% reporting at least 11 years of teaching experience. Comparisons with TALIS should also be treated cautiously because TALIS 2024 focuses specifically on lower-secondary teachers (OECD, 2025).
- c. The methodology report also identifies several instrument-related issues, including response-format mismatches for the adaptive AI and gender-bias items, an instruction–response inconsistency in the ESD section, and some terminological inconsistencies (Keser Aschenberger et al., 2026).
- d. Teachers' motivation to participate in professional learning was not directly measured and should not be considered independently of contextual factors such as workload, available time, institutional support, access to relevant training, and perceived professional value.
- e. Self-reported training needs may not always correspond to actual competence gaps. For example, gender bias in AI was among the areas in which respondents reported the lowest confidence, yet it was the least frequently selected training priority. This suggests that limited demand for training may sometimes reflect limited awareness of a competence area rather than a lack of need. Therefore, the findings should not be used to interpret lower training interest simply as low teacher motivation.
- f. Teachers who are already interested in digital technologies or professional development may have been more likely to participate and complete the survey while the teachers with lower digital engagement or more limited access to online professional networks may be underrepresented. As a result, some of the reported competence levels and positive orientations towards digital teaching may be somewhat higher than those in the wider teacher population.

g. Some reported practices may reflect not only teachers' competence but also their opportunity to apply that competence. The use of adaptive AI, personalised learning, digital assessment or inclusive digital materials may depend on access to appropriate tools, infrastructure, class size, curriculum demands and institutional support. Therefore, lower reported use should not automatically be interpreted as lower individual competence.

h. Generative AI tools, educational applications and national policies are evolving rapidly, meaning that teachers' familiarity, confidence and practices may change within relatively short periods. The findings therefore provide a snapshot of teacher perceptions during a period of rapid transition rather than a stable picture of AI competence.

i. Apparent gaps between policy expectations and teacher readiness should not necessarily be interpreted as resistance to change.

j. Familiarity with a technology or resource should also not be equated with pedagogical competence.

k. There is no single "Turkish teacher" profile

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 Turkey, the following implications should influence the DigiSET project.

6.1. Implication for DigiSET

The findings suggest that the DigiSET Teacher Academy should place *particular emphasis on the pedagogical use of AI, inclusive and personalised digital teaching, ethical AI use*, sustainability in education, and OER-related knowledge and practice. Of course, training on AI should move beyond basic awareness towards designing AI-supported learning and assessment, selecting appropriate tools, recognising risks and bias, and using AI for differentiated learning. Similarly, inclusive digital teaching should include practical opportunities to adapt materials to different learner needs, while OER training should address not only resource use but also licensing, adaptation, and sharing.

The design of the training should also respond to the barriers reported by teachers. Since lack of time, suitable resources, and available training were among the most common barriers, learning opportunities should be modular, flexible, and closely connected to classroom practice. Ready-to-use and adaptable resources, authentic examples, and collaborative design activities could reduce additional workload while supporting practical competence development. For Türkiye, the DigiSET learning outcomes should therefore emphasise pedagogical decision-making, ethical judgement, inclusive design, sustainability integration, and open resource practices rather than technical tool use alone.

6.2. Additional insights

- ★ At the national policy level, professional development should give greater priority to the pedagogical use of AI, inclusive digital teaching, sustainability integration, and ethical AI use, which were among the most frequently reported training needs. Training opportunities should also be designed in ways that respond to the main barriers identified by teachers, particularly limited time, lack of suitable resources, and insufficient access to relevant training. At school level, administrators can support teachers by allocating time for professional learning and by facilitating access to appropriate digital resources and training opportunities.
- ★ Cross-country comparison of the survey results could therefore help distinguish common European training needs from priorities that require more context-specific responses.
- ★ Future research can complement self-reported competence with performance-based assessments and examine differences across regions, school types, teaching experience, and pre-service and in-service teacher groups?

Some reflections from the research team's experiences in the context before the data collection period :

“The challenge is no longer simply to make education digital, but to make digital education pedagogically meaningful, inclusive and sustainable.”

“Access to resources is not the same as the capacity to use them openly, critically and responsibly.”

“Digital access does not automatically mean digital readiness.”

“Knowing a technology is not the same as knowing how to teach with it.”

“Competence is not the same as confidence, and confidence is not the same as practice.”

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