

DigiSET – The Academy of Digitally Sustainable European Teacher

Project Number: 101249272

ERASMUS-EDU-2025-PEX-TEACH-ACA

Teachers' Competences for Digital Sustainability in Romania

A survey amongst (future) teachers

Authors: Ana-Cristina Lemnaru, Ana Ioana Popescu (POLITEHNICA Bucharest)

Date: 30.08.2026

Version: 0.4



Licence: This report is available under CC BY 4.0 International
(see <https://creativecommons.org/licenses/by/4.0/>)

License



This work is licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0 International), see <https://creativecommons.org/licenses/by/4.0/deed>. When using this work, you must provide appropriate credit by including the name of the original author(s), the title of the work, the year of publication, and a clear reference to the project DigiSET (Erasmus+ 101249272). Particularly images and figures originating from third parties that are properly cited are excluded from this license.

Funding



Funded by the European Union. Views and opinions expressed are, however, those of the author(s) only and do not necessarily reflect those of the European Union or EACEA.

Neither the European Union nor the granting authority can be held responsible for them.

Project contribution to Agenda 2030



Acknowledgment

This report is a deliverable of the project 'DigiSET - The Academy of Digitally Sustainable European Teacher', funded within the Erasmus+ Programme with applicant Universität für Weiterbildung Krems and Grant Agreement No. 101249272.

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 authors of this report acknowledge that the paper was reviewed, edited, and refined with the assistance of ChatGPT (mod 5.4 T), Claude Opus (4.8 T), Gemini (3.1 T) and DeepL, complementing the human editorial process. The human authors critically assessed and validated the content to maintain academic rigour. 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.

Recommended Citation

Ana Cristina Lemnaru, Ana Ioana Popescu (2026). Teachers' Competences for Digital Sustainability in Romania. A survey amongst (future) teachers. DigiSET project (WP 2). September 18, 2026. DOI: 10.5281/zenodo.22828013

Abstract

This report presents the results of the DigiSET teacher survey conducted in Romania, 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 during 2026 using an online questionnaire based on existing scales (DigCompEdu Check-In, TAICS, ATOER) and project-specific items [exact collection period to be confirmed by the Romanian team]. A total of 209 responses were received, of which 195 were included in the analysis following data cleaning. Respondents were primarily women (93.3%) and either pre-service teachers still training to become educators (61.4%) or in-service teachers at public/state-funded schools (35.5%), with a distinctly bimodal teaching-experience profile (50.6% with no experience at all, 22.9% with more than 20 years).

Key findings indicate that participants reported the highest self-perceived competence in protecting learners’ personal data and in general AI knowledge, and the lowest in AI-supported assessment (using AI to grade assignments was the single weakest item overall) and in tasks that hand digital agency to learners themselves. Regarding ESD, agreement with sustainability-related values and practices was consistently high (72.9–92.0%) and markedly stronger than digital or AI competence. For OER, competence was the weakest of the four domains, driven mainly by unfamiliarity rather than disagreement. Among the four DigiSET-specific topics, respondents showed the highest confidence in inclusive digital practices and the lowest in adaptive/personalised AI use. The most pressing professional development needs identified were inclusive digital teaching, ethical/responsible AI use, and OER creation, while the most frequently reported barrier was lack of time (63.7%).

The findings should be interpreted in light of the non-probability, self-selected nature of the sample (93.3% women; 61.4% pre-service teachers), the self-reported nature of the competence data, and methodological format differences between sections noted in the project’s methodology report (Keser Aschenberger et al., 2026). 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 Romania.

Content

Abstract	3
1. Introduction	6
2. Methodology.....	6
2.1. Survey development, ethics and analysis.....	7
2.2. Sampling strategy and data collection.....	7
2.2.1. Target population and recruitment process	7
2.2.2. Number of responses and data collection period	7
3. Demographic profile of respondents.....	7
3.1. Gender and age (B6, B7).....	7
3.2. Status of respondents (B1)	8
3.3. School levels taught or expected to teach (B2).....	9
3.4. Subjects currently taught or expected to be taught (B3)	9
3.5. Teaching Experiences (B4).....	10
4. Results.....	11
4.1. Self-perceived digital teaching competence.....	11
4.1.1. Professional engagement (D1-D4).....	11
4.1.2. Digital resources (D5-D7).....	12
4.1.3. Teaching and learning (D8-D11)	12
4.1.4. Assessment (D12-D14).....	13
4.1.5. Empowering learners (D15-D17).....	13
4.1.6. Facilitating learners' digital competence (D18-D22).....	14
4.2. Self-perceived AI competence.....	14
4.2.1. AI knowledge (A1-A4)	15
4.2.2. AI pedagogy (A5-A8).....	15
4.2.3. AI assessment (A9-A12).....	15
4.2.4. AI ethics (A13-A16).....	16
4.2.5. AI human-centred education (A17-A20).....	16
4.2.6. AI professional engagement (A21-A24).....	17
4.3. Self-perceived education for sustainable development (ESD) competence...	17
4.3.1. Systems and critical thinking (S1-S3)	18
4.3.2. Pedagogical practice for ESD (S4-S7).....	18
4.3.3. Values and responsibility (S8-S10).....	18
4.3.4. Reflective and action-oriented practice (S11-S13).....	19
4.4. Self-perceived Open Educational Resource (OER) competence (O1-O5).....	19

4.5. Self-perceived competences for specific DigiSET topics	20
4.5.1. Adaptive AI use (AD1, AD2)	20
4.5.2. Gender bias in AI (GD1, GD2)	21
4.5.3. Inclusive practices for students with learning disabilities (I1, I2).....	21
4.5.4. System Thinking (S1-S3).....	21
4.6. Challenges faced in integrating digital teaching and sustainability in teaching, needed competences and existing barriers.....	22
4.6.1. Challenges faced in integrating digital technologies and sustainability into teaching (Q1).....	22
4.6.2. Competences that would help to address these challenge (Q2)	22
4.6.3. Professional development needs related to digital and sustainable teaching (P1)	23
4.6.4. Main barriers to professional development (P2)	24
4.6.5. Additional Insights and comments (if) (Q3)	24
5. Discussion	25
5.1. Key results concerning teachers' competences	25
5.1.1. Teachers' competence in digital teaching, AI, ESD and OER.....	25
5.1.2. Teachers' competence concerning the four DigiSET topics	25
5.1.3. Teachers' learning needs and interest.....	25
5.2. Contextualisation within the national framework and current state of research	26
5.3. Limitations	26
6. Implications	27
6.1. Implication for DigiSET	27
6.2. Additional insights	27
References.....	28

1. Introduction

This section provides the background and rationale for the DigiSET survey conducted in Romania, 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 knowledge, skills, and 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 Romania 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.

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 Romania, 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).

No additional country-specific statistical analyses beyond those described in the DigiSET survey methodology report were carried out for this report. All percentages and figures presented in Sections 3 and 4 were computed directly from the cleaned Romanian dataset (n = 195; see Table 1).

2.2. Sampling strategy and data collection

2.2.1. Target population and recruitment process

Recruitment was carried out through professional networks and social media groups (rather than a formal sampling frame drawn from school or institutional records). Participation was voluntary and anonymous, and no additional eligibility criteria were applied beyond being a current or prospective teacher in Romania. Based on the achieved sample, recruitment appears to have reached both pre-service/student teachers (61.4% of respondents) and in-service teachers across primary, secondary and vocational levels, working predominantly in public/state-funded schools (35.5%).

2.2.2. Number of responses and data collection period

Table 1 details the responses of the teacher survey: of 209 total responses received, 13 contained no answered questions and 1 contained answers to only one or two questions; these were excluded, leaving 195 responses included in the analysis reported below.

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

Responses and used data	
Total	209
No questions answered	13
Only one or two questions	1
Included in the analysis (n)	195

3. Demographic profile of respondents

This section presents the demographic characteristics of the survey participants in Romania, including gender, age, professional status, school levels, subjects taught, and teaching experience, thereby providing the context for interpreting the subsequent findings.

3.1. Gender and age (B6, B7)

Table 2 shows the gender distribution of the 164 respondents who answered this question (31 missing). The sample is overwhelmingly female (93.3%; n = 153), with

4.9% (n = 8) identifying as men and 1.8% (n = 3) preferring not to say; no respondent selected “non-binary/another gender identity.” This pronounced gender skew is discussed further in relation to national teacher workforce statistics in Section 5.3.

Gender	n	%
Woman	153	93.3%
Man	8	4.9%
Prefer not to say	3	1.8%
Total (valid; n = 195, 31 missing)	164	100%

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

Respondents' ages ranged from 19 to 64 years (n = 149 valid responses; 46 missing). The mean age was 33.4 years (median = 31.0, SD = 12.39). The distribution is right-skewed with a pronounced peak in the 20–24 age band, which alone accounts for roughly a third of valid responses, consistent with the large share of respondents still training to become teachers (see Figure 2). A second, flatter cluster of respondents spans the 40–55 range, while very few respondents are aged under 20 or over 60.

Age of Participants

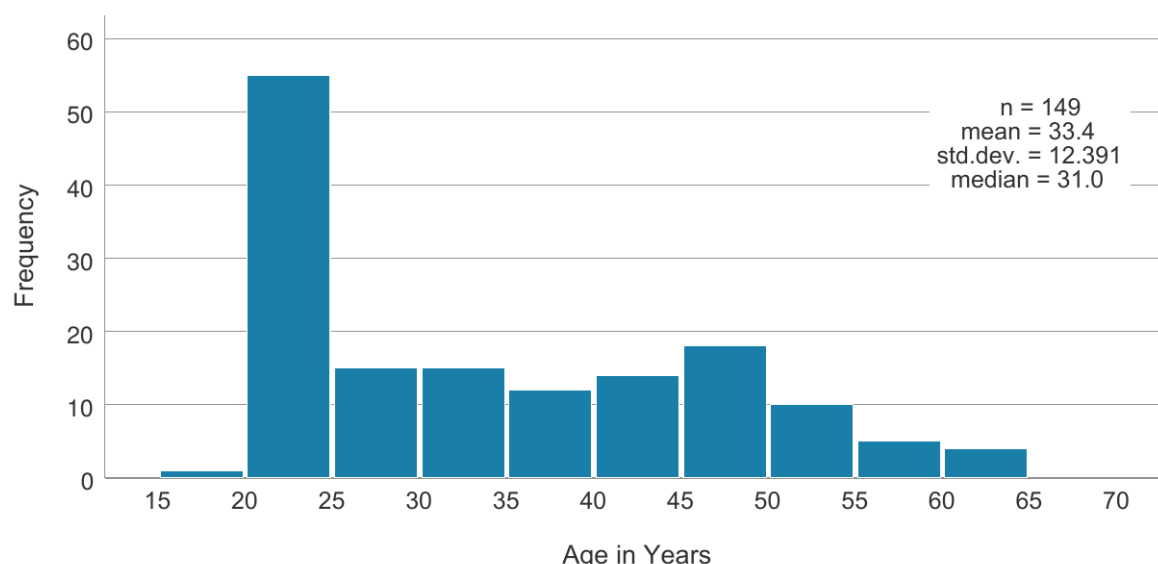
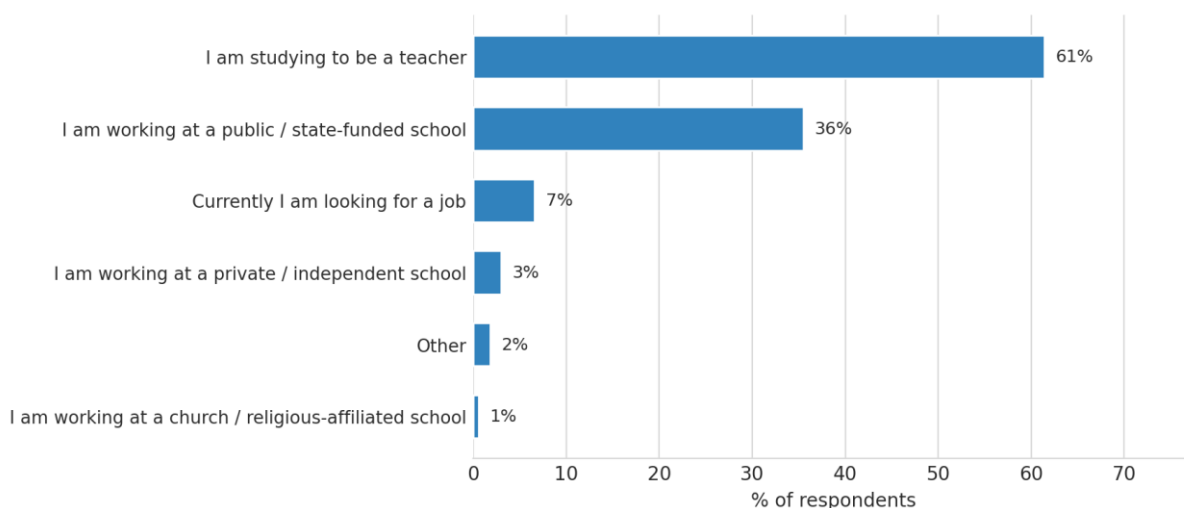


Figure 1: “Age of participants.”

Note: Responses to the DigiSET teacher survey in Romania.

3.2. Status of respondents (B1)

The sample is dominated by respondents still studying to become teachers (61.4%), followed by those already working at a public/state-funded school (35.5%). Smaller shares work in private (3.0%) or church-affiliated schools (0.6%), or are currently looking for a job (6.6%). This pre-service/in-service split shapes much of the demographic profile reported below (age, teaching experience) and should be kept in mind when interpreting competence results, since roughly six in ten respondents have not yet entered classroom practice.



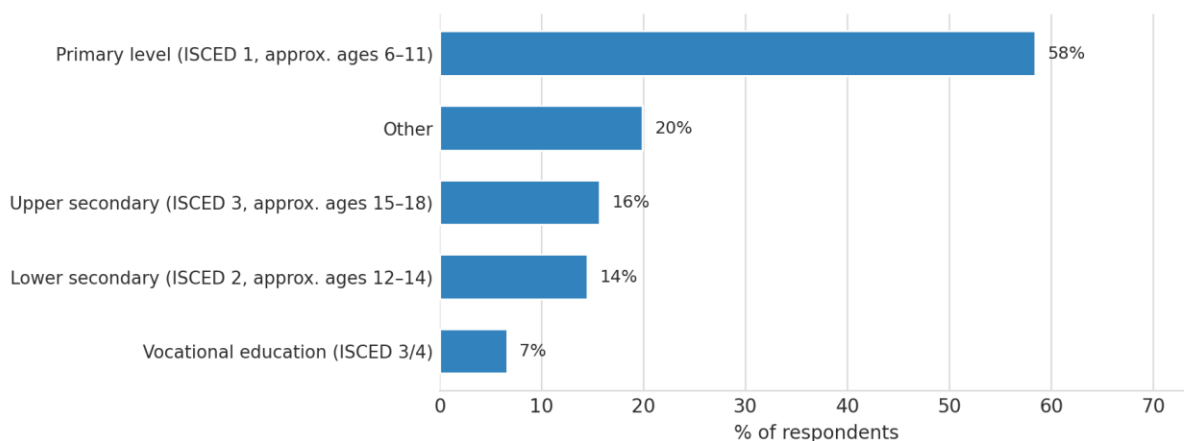
Note: multiple responses were allowed; totals exceed 100%.

Figure 2: “Current status of participants.”

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

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

Primary level (ISCED 1) is the most frequently reported teaching level (58.4%), followed by upper secondary (15.7%) and lower secondary (14.5%); vocational education is comparatively rare (6.6%). Almost one in five respondents (19.9%) selected “Other”; the free-text entries for this option show that most of these are, in fact, pre-school/early-childhood educators (“nivel preșcolar”, “Educație timpurie”), a level not offered as a distinct option in the questionnaire. This suggests the true share of early-childhood respondents is higher than the ISCED categories alone convey.



Note: multiple responses were allowed; totals exceed 100%.

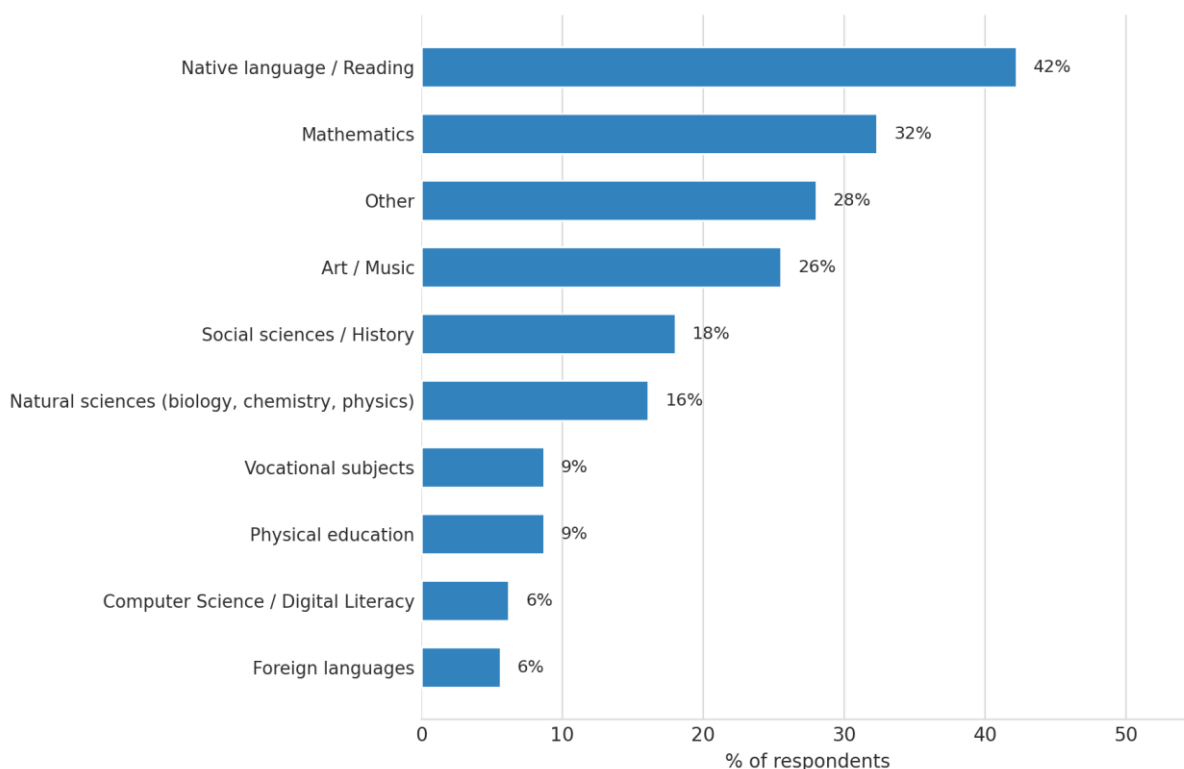
Figure 3: “School levels taught or expected to be taught by participants.”

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

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

Native language/Reading (42.2%) and Mathematics (32.3%) are the most frequently taught subjects, followed by Art/Music (25.5%) and Social sciences/History (18.0%).

Computer Science/Digital Literacy is the least frequently taught subject in the sample (6.2%), alongside Foreign languages (5.6%). The high “Other” share (28.0%) again reflects the sizeable pre-school subgroup, who reported teaching “all subjects” typical of early-childhood settings rather than a single discipline.



Note: multiple responses were allowed; totals exceed 100%.

Figure 4: “Subjects currently taught or expected to be taught by participants.”

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

3.5. Teaching Experiences (B4)

Teaching experience shows a distinctly bimodal pattern: half of the respondents (50.6%) report no teaching experience at all – consistent with the large pre-service subgroup – while almost a quarter (22.9%) report more than 20 years of experience. The intermediate experience bands are comparatively empty (1–5 years: 13.3%; less than 1 year: 7.2%; 6–10 years: 4.2%; 16–20 years: 1.8%; 11–15 years: 0%), meaning the sample captures two contrasting groups – those about to enter the profession and long-serving veterans – while under-representing teachers in the middle of their careers.

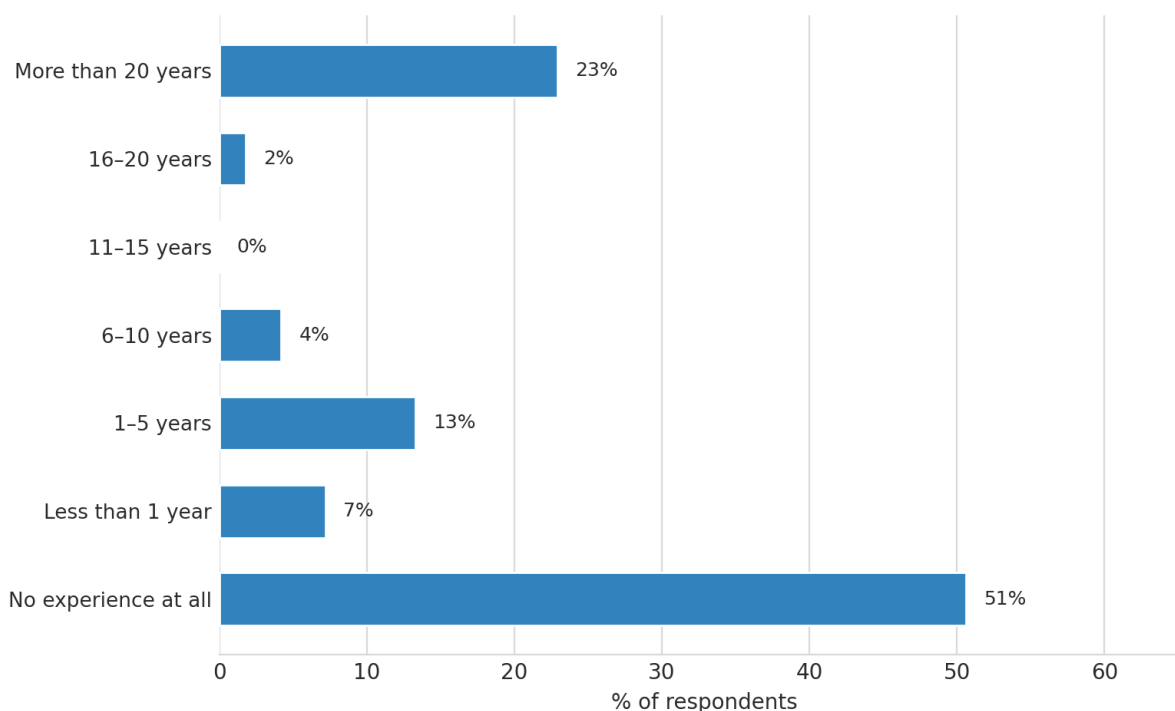


Figure 5: “Teaching experience of participants.”

Note: Responses to the DigiSET teacher survey in Romania.

4. Results

This section reports the findings of the DigiSET teacher survey in Romania 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

Across the six DigCompEdu-based subdomains examined below (Figures 6–11), respondents report the strongest digital teaching competence in protecting personal data and communicating professionally, and the weakest in assessment-related practices and in tasks that hand digital agency to learners themselves.

4.1.1. Professional engagement (D1-D4)

Self-perceived professional engagement is generally strong: at least seven in ten respondents report using digital channels to communicate (80.0% often/always) and actively developing their own digital competence (83.5% often/always) often or always. The comparatively weakest item in this area is awareness of and participation in online training opportunities, where only 24.6% report “always” doing so and 7.7% report doing so only “rarely” — suggesting that, while teachers use digital channels confidently day-to-day, structured continuous professional development uptake lags behind.

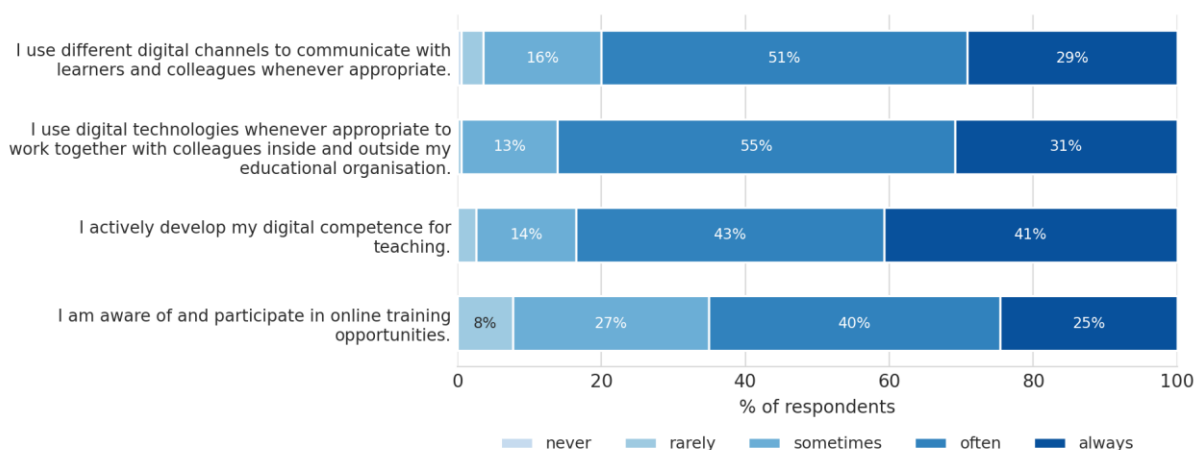


Figure 6: “Self-perceived digital teaching competence – professional engagement.”

Note: Responses to the DigiSET teacher survey in Romania. The items were adapted from the DigCompEdu CheckIn questionnaire, area “professional engagement” (JRC, n.d., p. 11ff).

4.1.2. Digital resources (D5-D7)

Protecting personal data (e.g., exam results, grades) is the strongest item in this area, with 65.5% of respondents reporting they “always” do so. Searching for and selecting digital resources is also frequent (43.3% always). Creating or adapting one's own digital resources is comparatively the weakest item (29.9% always; 6.7% rarely), pointing to stronger consumption than creation of digital teaching materials.

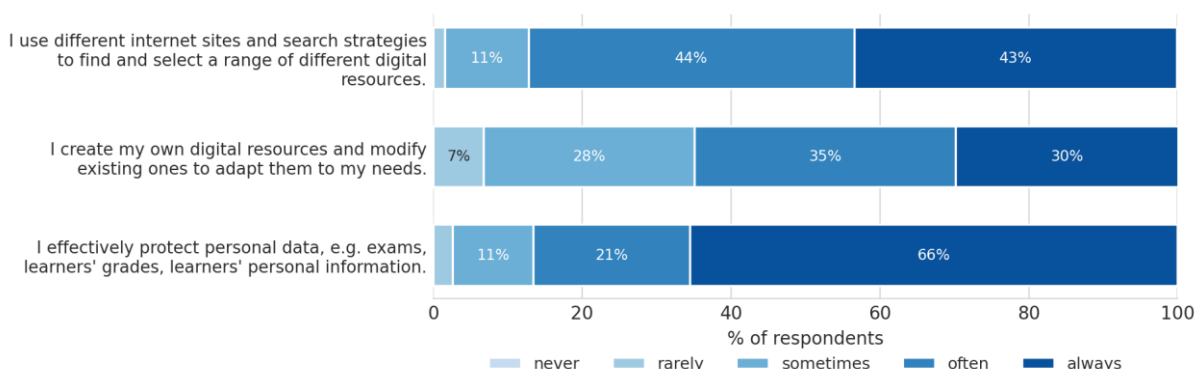


Figure 7: “Self-perceived digital teaching competence – digital resources.”

Note: Responses to the DigiSET teacher survey in Romania. The items were adapted from the DigCompEdu CheckIn questionnaire, area “digital resources” (JRC, n.d., p. 17ff).

4.1.3. Teaching and learning (D8-D11)

Deliberately considering how, when and why to use digital technology with added value is the strongest item (49.5% always). By contrast, having learners use digital technologies collaboratively in groups to accomplish tasks is markedly weaker (21.6% always; 34.0% only “sometimes”), as is having learners plan, document and monitor their own learning digitally (19.1% always; 30.9% sometimes) – indicating that teachers are more confident directing their own digital practice than delegating digital agency to learners.

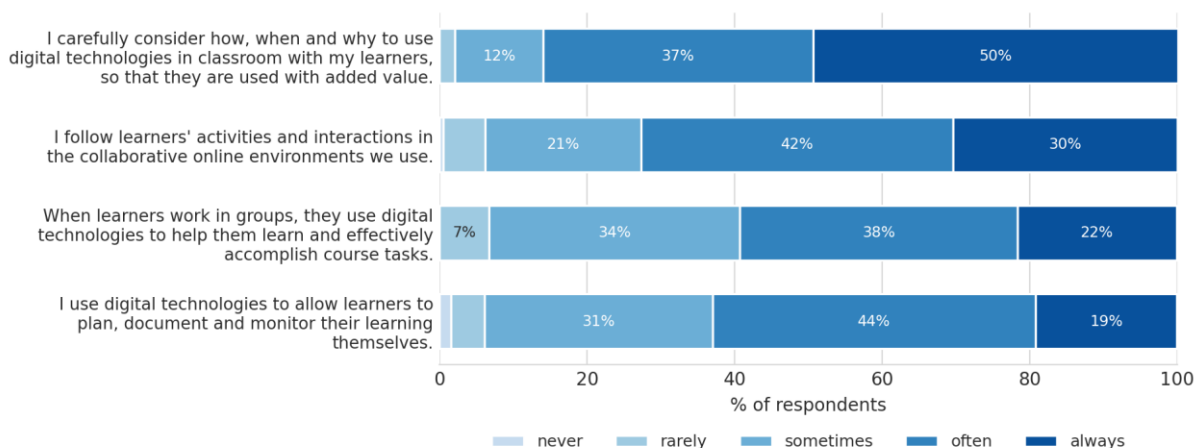


Figure 8: “Self-perceived digital teaching competence – teaching and learning.”

Note: Responses to the DigiSET teacher survey in Romania. The items were adapted from the DigCompEdu CheckIn questionnaire, area “teaching and learning” (JRC, n.d., p. 21ff).

4.1.4. Assessment (D12-D14)

Assessment is one of the comparatively weaker areas of digital teaching competence overall. Using digital tools to identify learners who need additional support is the strongest of the three items (32.5% always), while using digital assessment tools to monitor progress (14.9% always; 33.0% only sometimes) and using digital technologies to provide effective feedback (19.6% always) both show a large share of “sometimes” responses, suggesting digital assessment practice is more occasional than routine for many respondents.

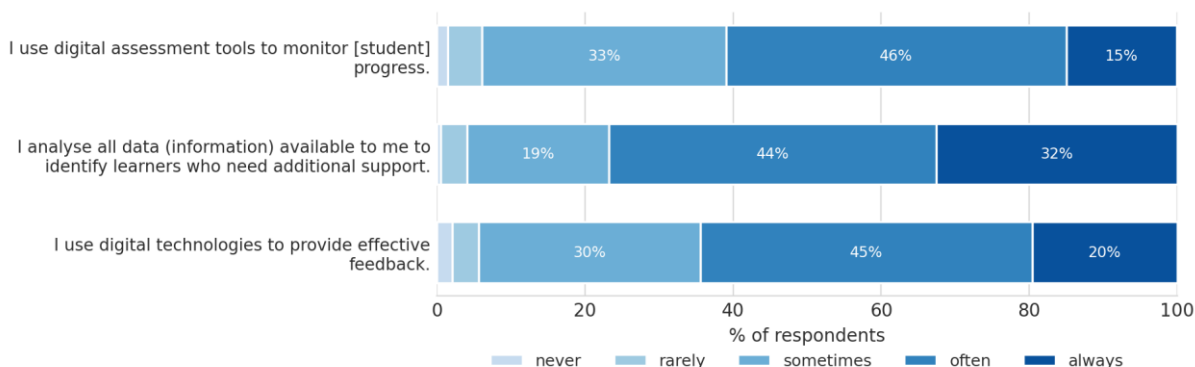


Figure 9: “Self-perceived digital teaching competence – assessment.”

Note: Responses to the DigiSET teacher survey in Romania. The items were adapted from the DigCompEdu CheckIn questionnaire, area “assessment” (JRC, n.d., p. 27ff).

4.1.5. Empowering learners (D15-D17)

Addressing potential practical or technical difficulties when designing digital assignments is the strongest item (36.6% always; 74.7% often/always combined). Offering personalised learning opportunities (25.4% always) and enabling active learner participation via digital technologies (27.6% always) are somewhat less frequent but still solidly represented, with the bulk of responses in the “often” category.

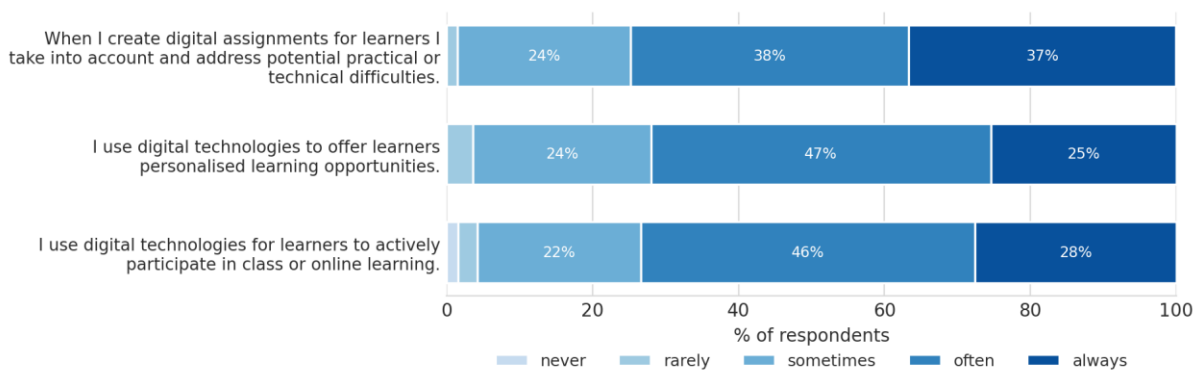


Figure 10: “Self-perceived digital teaching competence – empowering learners.”

Note: Responses to the DigiSET teacher survey in Romania. The items were adapted from the DigCompEdu CheckIn questionnaire, area “empowering learners” (JRC, n.d., p. 32ff).

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

Teaching learners to use digital technology safely and responsibly is the strongest item in this area (39.9% always). Setting up assignments that require learners to create digital content is clearly the weakest item in the entire digital-teaching-competence section (13.5% always; 3.6% never; 14.5% rarely; over half of responses at “sometimes” or below), and setting up collaborative/communicative digital tasks is similarly modest (20.1% always; 39.2% sometimes). Facilitating learners' own digital content creation stands out as a priority gap.

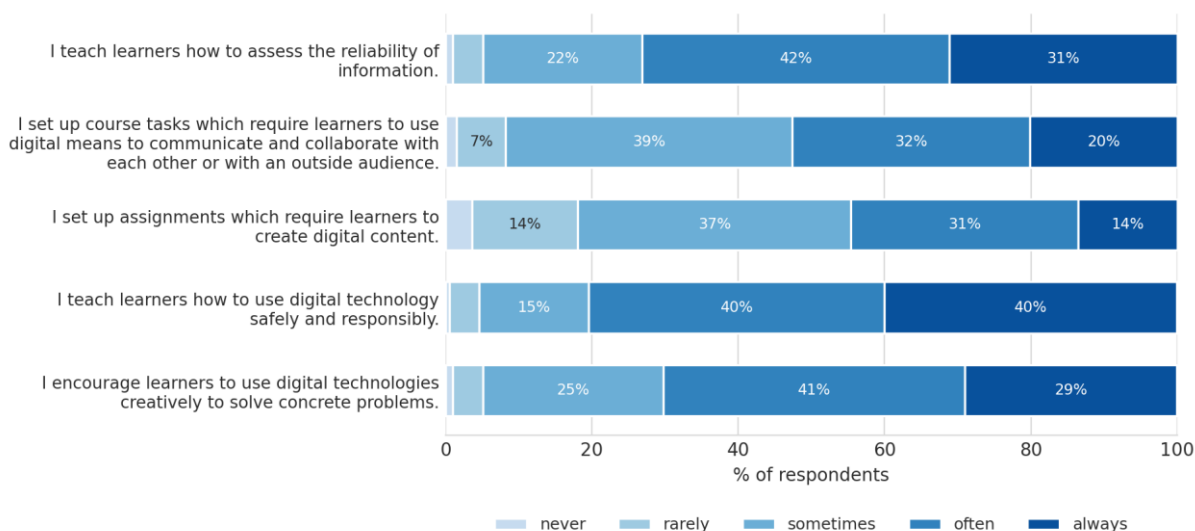


Figure 11: “Self-perceived digital teaching competence – facilitating learners’ digital competence.”

Note: Responses to the DigiSET teacher survey in Romania. The items were adapted from the DigCompEdu CheckIn questionnaire, area “facilitating learners’ digital competence” (JRC, n.d., p. 37ff).

4.2. Self-perceived AI competence

Across the six TAICS-based subdomains examined below (Figures 12–17), general AI knowledge and individual AI-supported teaching are consistently rated higher than more specialised or collegial dimensions of AI use, such as generative-AI literacy, AI-assisted assessment, and mentoring colleagues in AI-supported teaching.

4.2.1. AI knowledge (A1-A4)

Explaining what AI is shows the highest confidence in this area (61.6% very/completely confident), while explaining what generative AI specifically is shows the lowest (only 9.8% completely confident; 4.4% not confident at all; 18.0% only slightly confident). This gap suggests teachers' general AI literacy outpaces their familiarity with generative AI tools specifically.

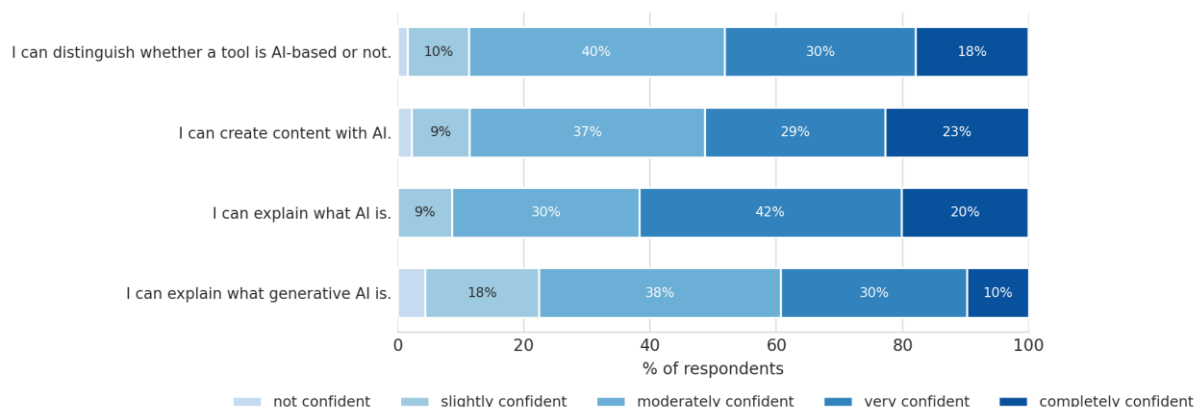


Figure 12: “Self-perceived AI competence – AI knowledge.”

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

4.2.2. AI pedagogy (A5-A8)

Confidence in choosing an AI tool that enhances one's own teaching (49.5% very/completely confident) is higher than confidence in helping colleagues design AI-supported learning activities (only 10.3% completely confident; 17.9% only slightly confident), indicating that individual AI-pedagogy skills are ahead of peer-mentoring capacity in this area.

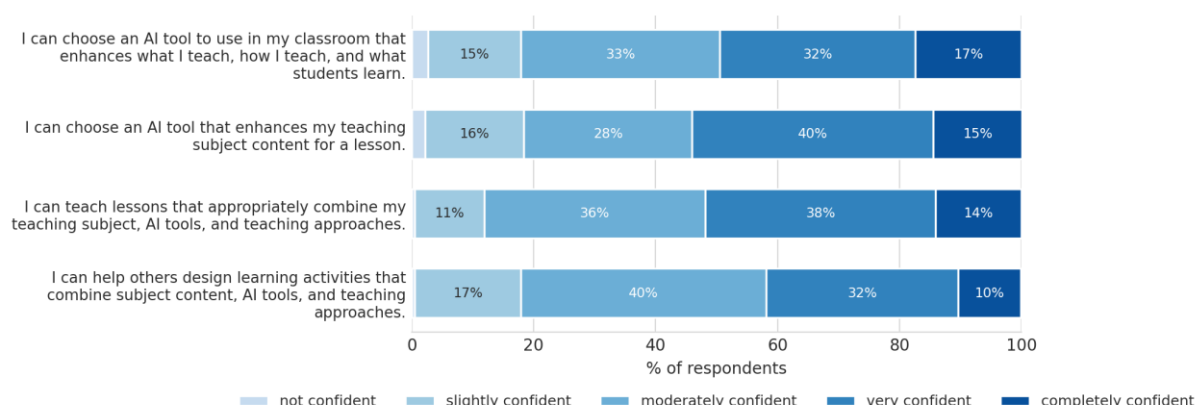


Figure 13: “Self-perceived AI competence – AI pedagogy.”

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

4.2.3. AI assessment (A9-A12)

AI assessment shows the lowest confidence levels of the four core AI dimensions. Using an AI tool to foster assessment for learning is the relative high point (47.6% very/completely confident), while using an AI tool to grade an assignment is the single

weakest item across the entire AI-competence section (only 8.6% completely confident; 6.5% not confident at all; 28.1% not confident or only slightly confident combined).

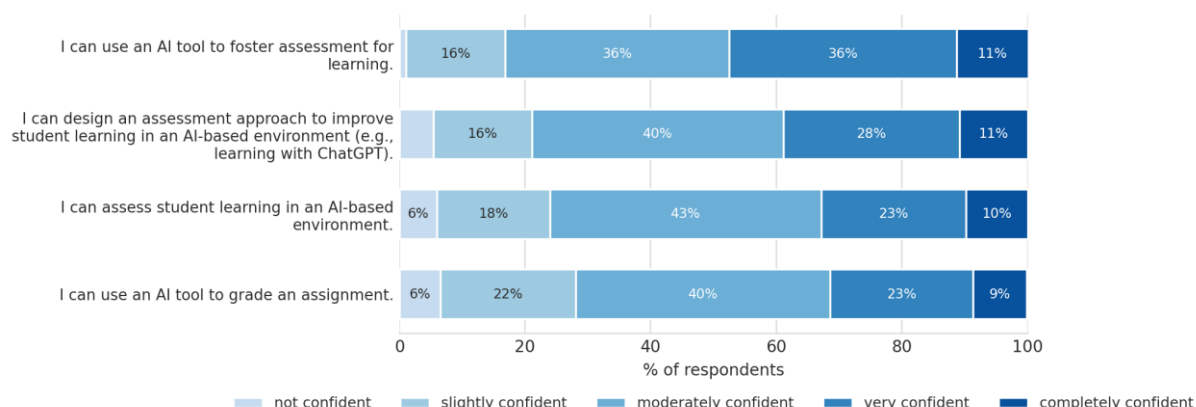


Figure 14: “Self-perceived AI competence – AI assessment.”

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

4.2.4. AI ethics (A13-A16)

Teaching students AI-related ethics is the strongest item (49.2% very/completely confident). Ensuring one's own health and well-being while using AI tools is the weakest (8.6% not confident at all – the highest “not confident” rate in this area – and only 12.4% completely confident), suggesting more attention is needed on the personal, wellbeing-related dimension of AI use rather than only its instructional-ethics dimension.

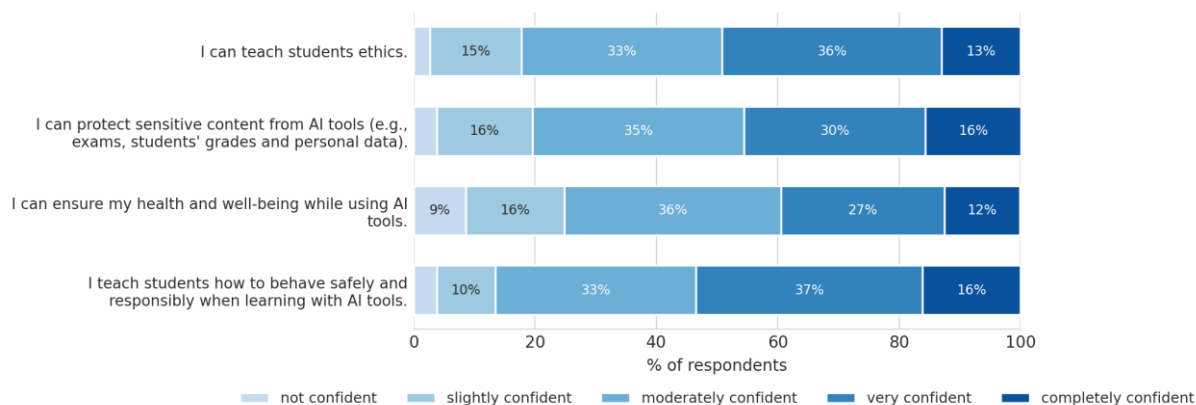


Figure 15: “Self-perceived AI competence – AI ethics.”

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

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

Assessing the risks of an AI tool shows the highest confidence in this area (55.5% very/completely confident), slightly ahead of assessing its benefits (47.0%). Recognising that humans are responsible for AI bias is comparatively the softest item (39.1% only “moderately confident”, with just 12.0% completely confident), suggesting

a more superficial engagement with the human-accountability dimension of AI ethics than with practical risk/benefit assessment.

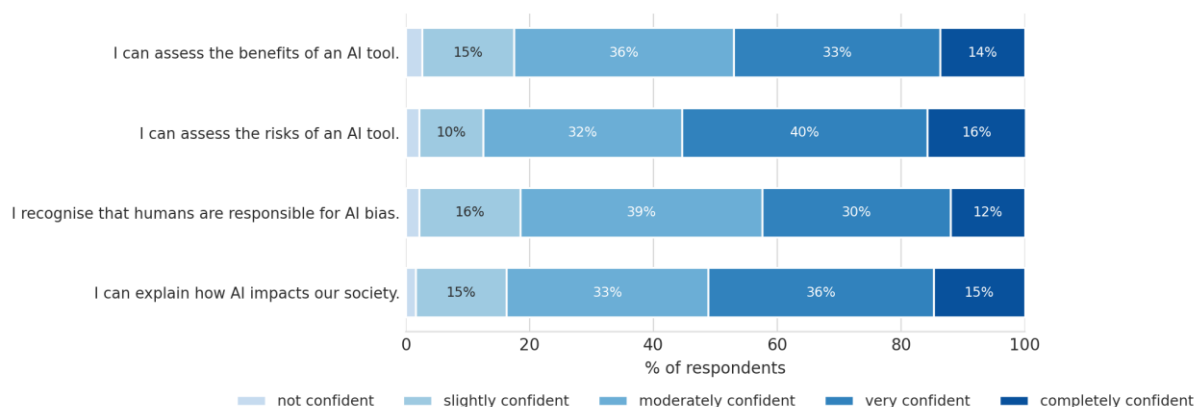


Figure 16: “Self-perceived AI competence – human-centred education”.

Note: Responses to the DigiSET teacher survey in Romania. The items were adapted from Chiu, Ahmad, & Çoban (2025), section “human-centred education”.

4.2.6. AI professional engagement (A21-A24)

Using search strategies to find AI tools is the most confidently reported item (42.2% very/completely confident). Actively enjoying helping colleagues design AI-supported learning activities is the weakest (only 12.5% completely confident; 4.9% not confident at all – the highest “not confident” share of the four items), echoing the same individual-use vs. peer-mentoring gap seen in AI pedagogy (Figure 13).

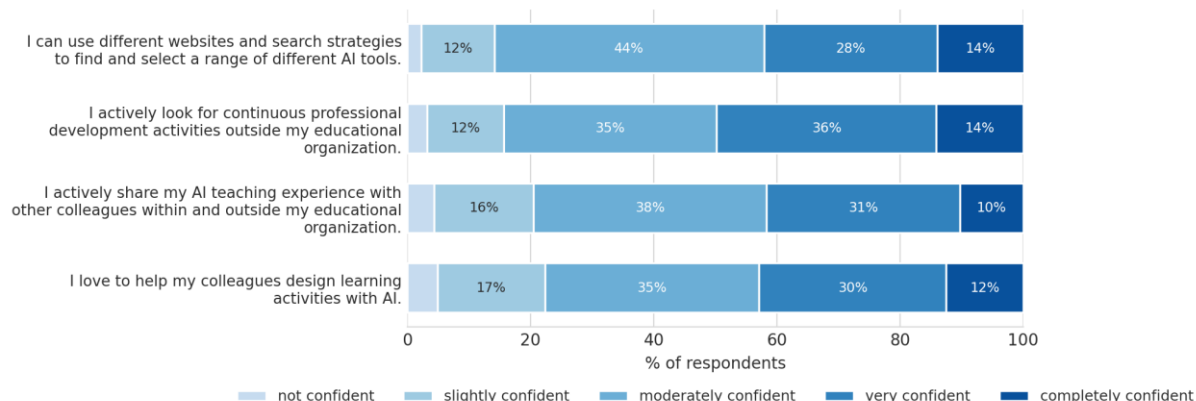


Figure 17: “Self-perceived AI competence – professional engagement”.

Note: Responses to the DigiSET teacher survey in Romania. The items were adapted from Chiu, Ahmad, & Çoban (2025), section “professional engagement”.

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

Across the ESD subdomains examined below (Figures 18–20, and Figure 25 in Section 4.5.4), agreement is consistently high and considerably higher than the confidence levels reported for AI or digital teaching competence, indicating that respondents feel more assured about the values and principles of sustainability education than about applying digital tools within it.

4.3.1. Systems and critical thinking (S1-S3)

The questions on systems and critical thinking are presented in 4.5. (p. 20ff) as they are specifically addressing a DigiSET core topic.

4.3.2. Pedagogical practice for ESD (S4-S7)

Agreement is consistently high across all four items in this area (72.9–80.7% agree/strongly agree). Designing learning activities that promote active engagement with sustainability challenges is the strongest (80.7% agree/strongly agree), while using digital technologies specifically to engage learners with real-world sustainability challenges is comparatively the softest (72.9% agree/strongly agree; the highest combined neutral/disagree share of the four items) – suggesting that general ESD pedagogy is somewhat ahead of its digitally-mediated variant.

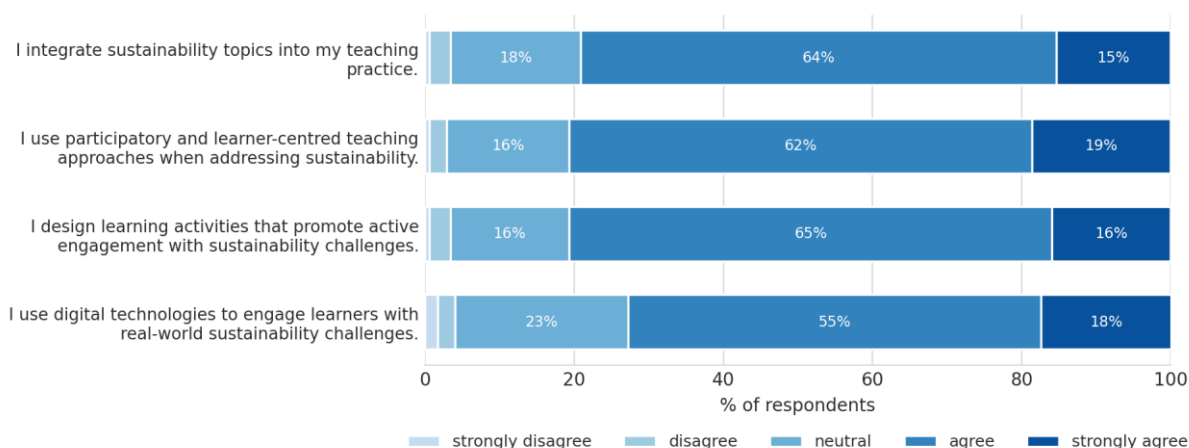


Figure 18: “Self-perceived ESD competence – pedagogical practice for ESD.”

Note: Responses to the DigiSET teacher survey in Romania. The items were created for the DigiSET survey.

4.3.3. Values and responsibility (S8-S10)

This is the strongest ESD subdomain in the whole survey: promoting values such as responsibility, equity and respect for diversity reaches 92.0% agreement (36.9% strongly agree), with virtually no disagreement (0.6% strongly disagree, 0% disagree). Encouraging ethical reflection (87.5% agree/strongly agree) and supporting learners' sense of responsibility (88.0%) are similarly strong, indicating a robust values-based orientation among respondents.

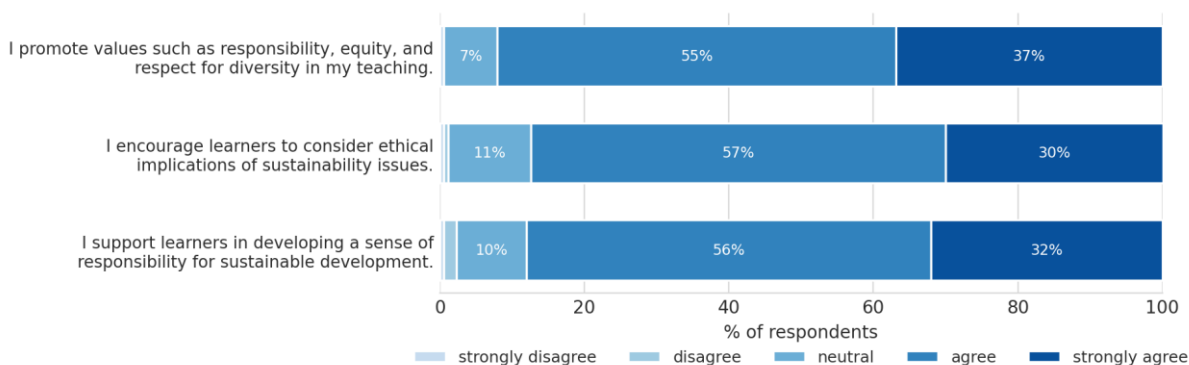


Figure 19: “Self-perceived ESD competence – values and responsibility.”

Note: Responses to the DigiSET teacher survey in Romania. The items were created for the DigiSET survey.

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

Reflecting on one's own teaching practice in relation to sustainability is strong (85.3% agree/strongly agree). Feeling confident facilitating discussions on complex or controversial sustainability issues is comparatively the weakest item (78.5% agree/strongly agree; 18.1% neutral – the highest neutral share in this subdomain), suggesting that discussing contested sustainability topics in class is somewhat less comfortable than reflective or applied practice.

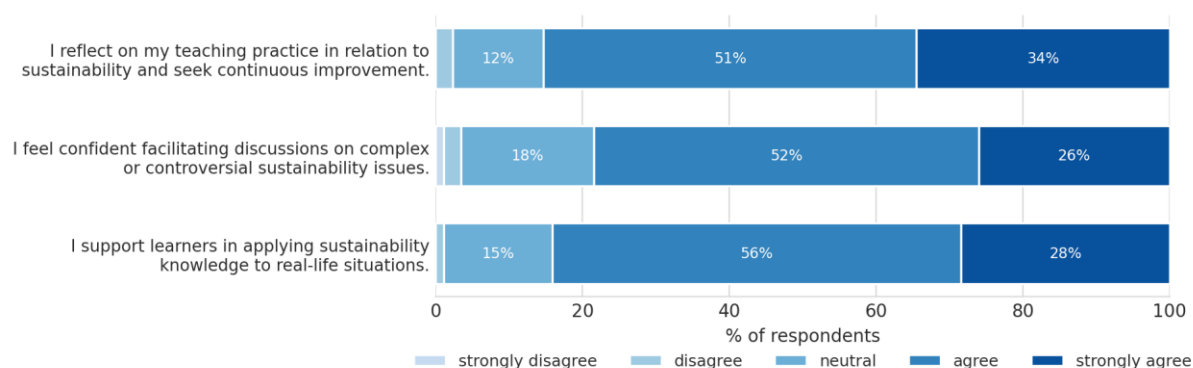


Figure 20: “Self-perceived ESD competence – reflective and action-oriented practices.”

Note: Responses to the DigiSET teacher survey in Romania. The items were created for the DigiSET survey.

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

Open Educational Resources form the weakest of the four core competence domains overall, and the domain with the most “neutral” responses in the survey. Adopting OER because they fulfil academic requirements is the relative strength (63.8% agree/strongly agree), while prior experience of using OER is the softest item (49.4% agree/strongly agree; 39.5% neutral – the highest neutral rate of any item in the survey; 11.1% disagree/strongly disagree) – pointing to a sizeable group of teachers who are simply unfamiliar with OER rather than confidently positive or negative about them.

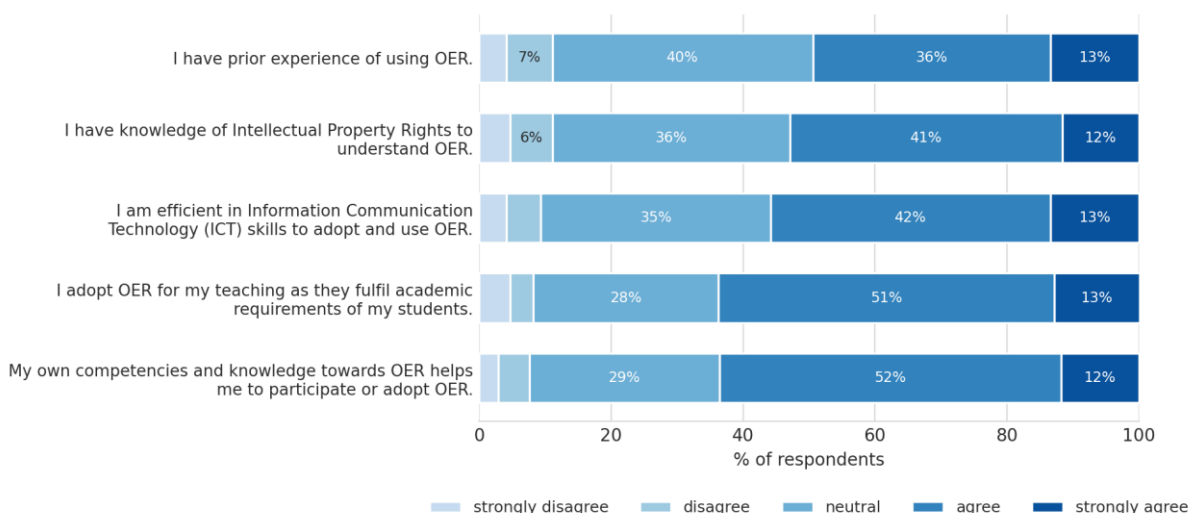


Figure 21: “Self-perceived OER competence.”

Note: Responses to the DigiSET teacher survey in Romania. The items are a subset of those used by Mishra et al. (2016).

4.5. Self-perceived competences for specific DigiSET topics

The following four subsections (4.5.1–4.5.4) examine self-perceived competence in the four topics singled out as core DigiSET priorities: adaptive/differentiated AI use, gender bias in AI, inclusive digital practice, and systems/critical thinking for sustainability. Of these, adaptive AI use and gender bias in AI show the lowest confidence levels, indicating the greatest need for targeted training attention.

4.5.1. Adaptive AI use (AD1, AD2)

Confidence in both adaptive-AI items clusters heavily around “moderately confident” (35.5% and 38.8% respectively), with very few respondents reporting “completely confident” (8.2% and 9.8%). Knowing how to use AI for differentiated instruction is marginally stronger than using AI tools to personalise learning overall, but both results place adaptive AI use among the least mature competence areas identified in the survey.

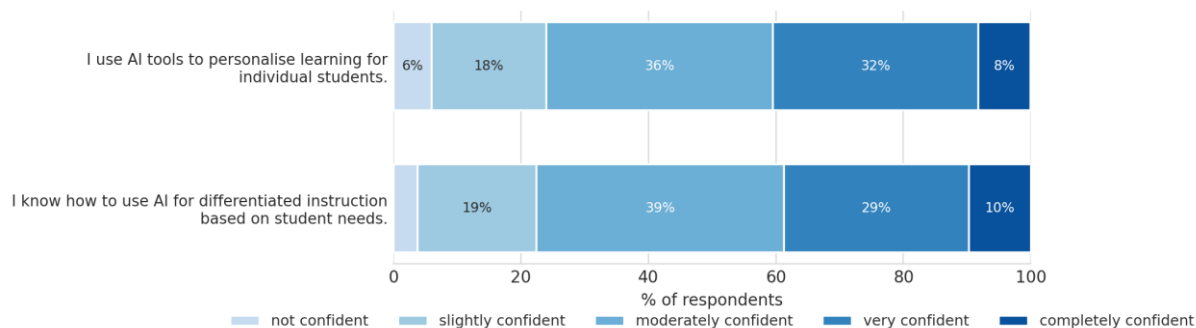


Figure 22: “Adaptive AI use.”

Note: Responses to the DigiSET teacher survey in Romania. The items were created for the DigiSET survey.

4.5.2. Gender bias in AI (GD1, GD2)

Awareness of gender bias in AI-generated content (45.7% very/completely confident) is somewhat ahead of knowing how to address gender stereotypes when using AI in teaching (39.0% very/completely confident), indicating that recognising the problem is more developed than having concrete strategies to act on it.

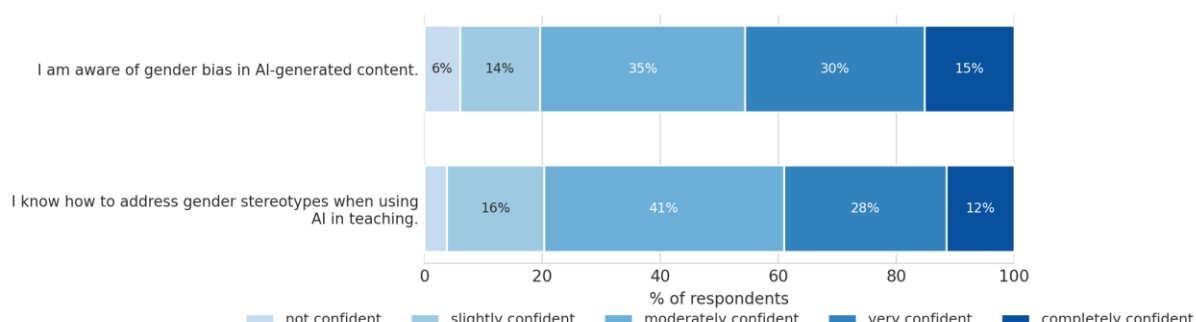


Figure 23: “Gender bias in AI.”

Note: Responses to the DigiSET teacher survey in Romania. The items were created for the DigiSET survey.

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

Inclusive digital practice is comparatively one of the more confidently reported DigiSET-specific topics: adapting digital learning materials for students with special educational needs reaches 36.6% “always” – the highest single “always” rate among all four DigiSET-specific topics – while using digital tools to support students with learning difficulties is also solid (65.4% often/always combined).

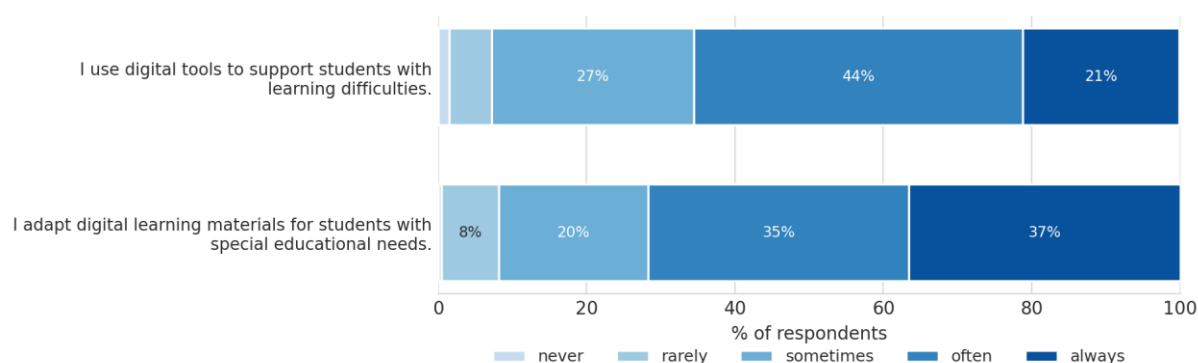


Figure 24: “Inclusive practices.”

Note: Responses to the DigiSET teacher survey in Romania. The items were created for the DigiSET survey.

4.5.4. System Thinking (S1-S3)

As in the other ESD subdomains, agreement is consistently high (77.7–81.9% agree/strongly agree across the three items). Supporting learners in analysing complex sustainability problems from multiple perspectives shows the lowest “strongly agree” share of the three (16.9%, against 19.8–20.9% for the other two items), suggesting that multi-perspective critical analysis is marginally more demanding for respondents than general systems-thinking awareness.

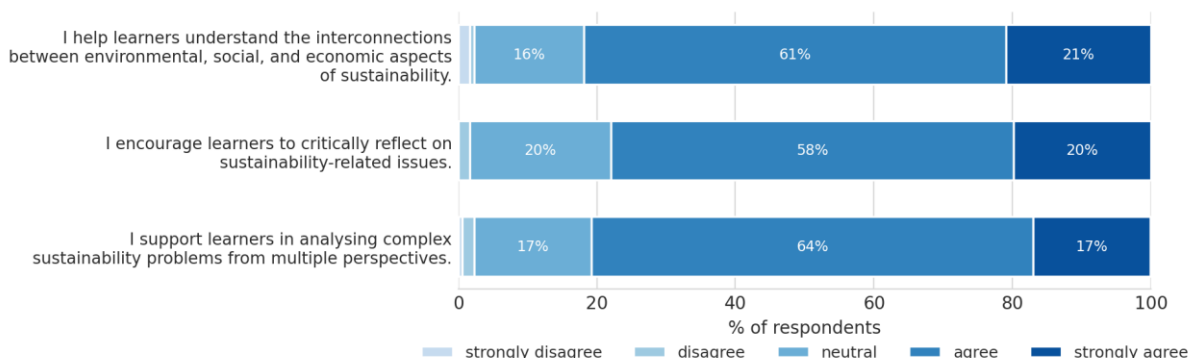


Figure 25: “Education for sustainable development – systems and critical thinking.”

Note: Responses to the DigiSET teacher survey in Romania. The 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 teachers’ faced challenge in integrating digital teaching and sustainability in teaching, professional development needs related to digital and sustainable teaching.

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

Analysis of the 112 responses to this open question (114 mentions in total) identifies lack of digital infrastructure and resources – insufficient equipment, unstable internet access, or platforms that are hard to use – as the most frequently mentioned challenge (raised in roughly two in five responses), for example: “Lack of adequate digital infrastructure – limited access to devices (laptops, tablets, projectors); poor internet connection; educational platforms that are underdeveloped or difficult to use.” Lack of time was the second most common theme (about one in three responses), typically framed as insufficient time to prepare digital/sustainability-oriented lessons and to attend training. A further recurring theme (about one in six responses) was the difficulty of adapting to learners’ differing digital competence levels within the same class. A smaller number of responses raised AI-specific concerns, including academic integrity and data-privacy risks (“AI risks and data security – integrating artificial intelligence raises challenges around academic integrity (plagiarism) and the confidentiality of students’ data”) and the difficulty of detecting AI-generated content. A few responses also pointed to a tension between digital tools and genuine environmental sustainability: “One challenge is balancing the use of technology with genuine environmental education. Although I’ve done away with a lot of paper, I notice that devices break down quickly and become waste, which contradicts the lessons about the environment ... I feel constant pressure to learn new platforms and find ‘green’ teaching methods, all within an already overloaded schedule.” About one in twelve respondents reported facing no particular challenges or indicated they were not currently teaching.

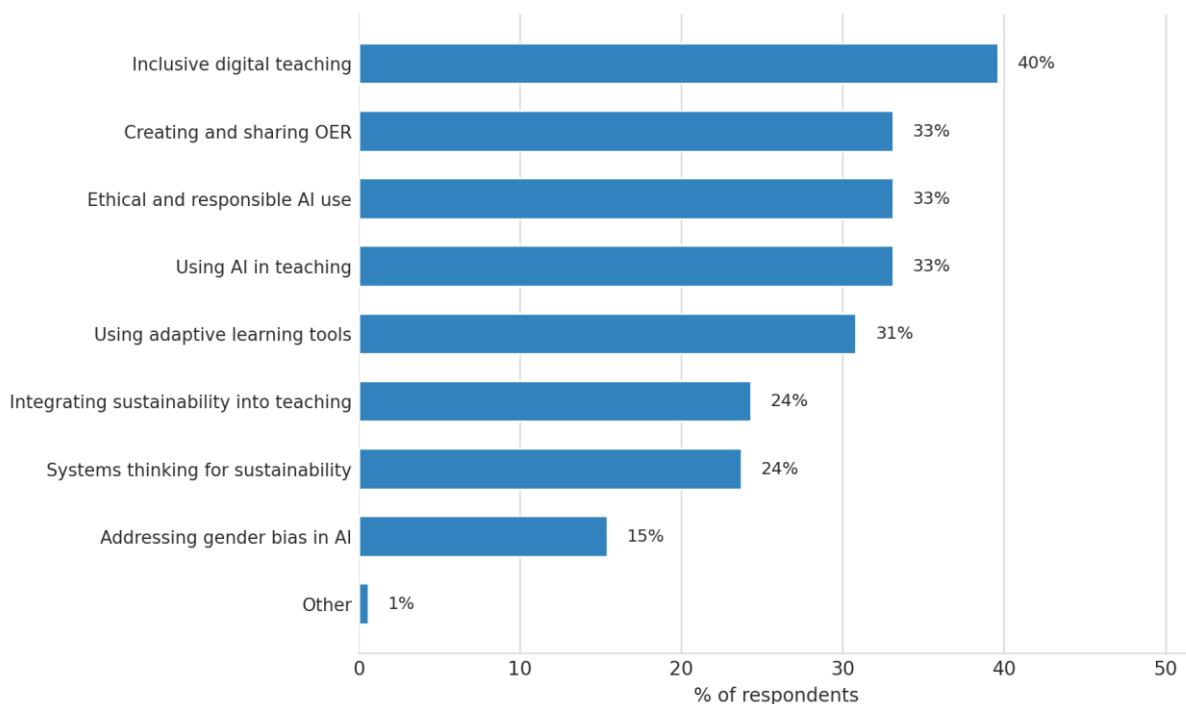
4.6.2. Competences that would help to address these challenge (Q2)

Across the 99 responses to this question (105 mentions), the dominant request by far (over half of responses) was simply for stronger “digital competences” in a broad

sense – familiarity with educational platforms, creating interactive digital content, and using digital tools more efficiently. About a quarter of responses specifically requested more training courses/professional development opportunities, and roughly one in five referenced competences linked specifically to sustainability education (e.g., interdisciplinary lesson design integrating ecology). A smaller group (about one in ten) named AI-specific competences, including using AI tools appropriately and ethically. Several responses connected digital and sustainability competence directly, for instance: “Designing digital educational content – the competence to create one’s own interactive and durable materials (open educational resources), not merely to consume digital content”, and “applied digital competences that go beyond technical use and extend to naturally integrating them into ecology lessons; better skills for selecting resources, so that I choose only tools that consume little energy and do not quickly become obsolete.” One respondent linked digital and critical-thinking competence to combating misinformation about the environment: “The ability to teach students to filter environmental and technological information from a digital information stream saturated with fake news.” A few respondents noted the question did not apply to them (e.g., not currently teaching).

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

Inclusive digital teaching is the most frequently requested training area (39.6%), followed by ethical/responsible AI use, using AI in teaching, and creating/sharing OER (each 33.1%). Addressing gender bias in AI is the least frequently requested (15.4%). These priorities align closely with the competence gaps identified in Section 4: OER (Figure 21) and AI application in assessment (Figure 14) were among the weakest measured competences, and both feature among the top-requested training areas here.



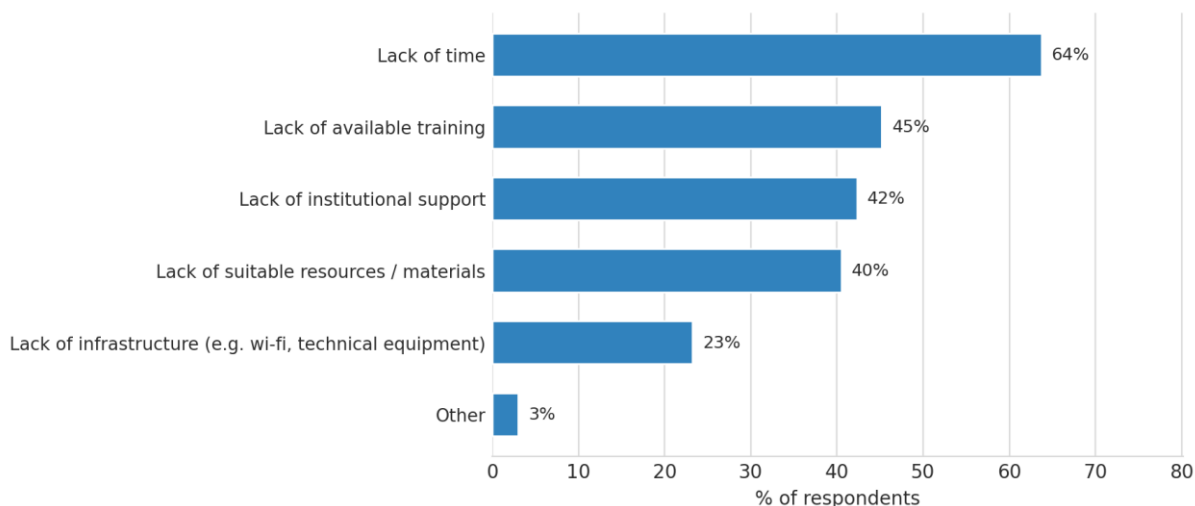
Note: multiple responses were allowed; totals exceed 100%.

Figure 26: “Most needed training areas.”

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

4.6.4. Main barriers to professional development (P2)

Lack of time is by far the most frequently cited barrier to professional development (63.7%), well ahead of lack of available training (45.2%), lack of institutional support (42.3%) and lack of suitable resources/materials (40.5%). Infrastructure limitations (e.g., wi-fi, equipment) are reported least often among the listed barriers (23.2%), though they still affect close to a quarter of respondents.



Note: multiple responses were allowed; totals exceed 100%.

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

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

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

The large majority of responses to this final open question indicated no further comments. Among those who did add insights, the most recurring theme was a call for stronger institutional and practical support – durable equipment, technical support, and communities of practice for sharing what works in the classroom – rather than further theoretical guidance, exemplified by: “The system needs to provide real support through durable equipment and time for training, not just theories that are difficult to apply. Digital equipment needs recycling plans and constant technical support to be useful. Sustainability only becomes a reality if technology is a long-term help, not an additional burden for teachers”, and “We need communities of practice where we can share what really works in the classroom, beyond screens and numbers.” A second recurring concern was cost, particularly of software licences (“There are many good tools, but the licenses are expensive”). Several respondents also cautioned against over-reliance on technology, emphasising that it should support rather than replace the human, formative role of the teacher: “technology should be used as a support tool for the educational act, without replacing the human component, direct interaction, and the formative role of the teacher.”

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 is strongest in individual, teacher-directed practice – protecting learner data (Fig. 7) and communicating professionally (Fig. 6) – and weakest wherever digital agency is handed to learners, such as assessment (Fig. 9) and learner-led digital content creation (Fig. 11). AI competence shows a similar pattern at a lower overall level: general AI knowledge (Fig. 12) and individual AI-supported teaching (Fig. 13) outpace generative-AI literacy, AI-assisted assessment (Fig. 14), and especially mentoring colleagues in AI use – using AI to grade an assignment is the single weakest item in the whole dataset. ESD competence is markedly stronger and more consistent (72.9–92.0% agreement, Figs. 18–20), suggesting sustainability values are held more firmly than digital fluency. OER is the weakest domain overall, driven mainly by unfamiliarity rather than disagreement (39.5% neutral on prior OER use, Fig. 21). Part of the gap between ESD and the other domains likely reflects the response-format difference flagged in the methodology report (Keser Aschenberger et al., 2026, §2.8) – ESD items used an agreement scale where digital/AI items used a confidence scale – so direct numerical comparison across domains should be treated with caution.

5.1.2. Teachers' competence concerning the four DigiSET topics

Among the four DigiSET-specific topics, confidence is lowest for adaptive AI use (Fig. 22; only 8–10% “completely confident”), echoing the AI-assessment gap noted above – teachers are least confident precisely where AI must be tailored to individual learners. Gender bias in AI (Fig. 23) is only slightly stronger, and mainly on the awareness side (45.7%) rather than in knowing concrete strategies to act on it (39.0%). Inclusive digital practice (Fig. 24) is the strongest of the four topics, while systems/critical thinking for sustainability (Fig. 25) mirrors the high ESD agreement seen elsewhere. Adaptive AI use therefore stands out as the topic with the greatest need for targeted intervention.

5.1.3. Teachers' learning needs and interest

The open-ended responses converge with the closed-item results: the most frequent challenges (Q1) were lack of digital infrastructure/resources and lack of time, followed by differing digital competence levels among learners. Desired competences (Q2) centred overwhelmingly on “digital competences” broadly, with recurring calls for AI- and sustainability-specific training. These map onto the top training requests (P1): inclusive digital teaching (39.6%) and, jointly, ethical/responsible AI use, AI in teaching, and OER creation (33.1% each) – precisely the domains identified as weakest above. The dominant barrier (P2) was again lack of time (63.7%). Together, these results imply that DigiSET training should (1) prioritise OER and AI-assessment

content, (2) be delivered in short, modular formats that respect teachers' limited time, and (3) remain accessible to both pre-service and in-service teachers.

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

Romania's SMART.Edu Strategy for the Digitalisation of Education 2021–2027 (Ministry of Education) names initial and continuing teacher training for digital education as a priority pillar, which resonates with respondents' own top-ranked training request and with the time/infrastructure barriers reported here. The Ministry has also begun piloting AI use in schools (2025) and is developing an AI-in-education strategy, but this remains emergent – consistent with the comparatively low and unevenly distributed AI confidence found in this survey, particularly for adaptive/personalised AI use. No dedicated national OER strategy was identified, which may partly explain why OER emerged as the weakest overall competence domain.

5.3. Limitations

The sample is heavily skewed towards women (93.3% of the 164 respondents who answered this item), well above the roughly 79% female share reported for Romania's post-secondary non-tertiary teachers in 2024 (Eurostat) and the 73% EU average across primary and secondary teachers – meaning results should not be read as representative of male teachers' views. The bimodal experience distribution (50.6% with no teaching experience vs. 22.9% with 20+ years) reflects the fact that a majority of respondents (61.4%) were still training to become teachers; findings on in-service practice therefore likely under-represent early- and mid-career teachers. Around 180 individuals were directly invited, yet 209 responses were received in total; because the survey link was also shared onward through the professional-network and social-media channels described in Section 2.2.1, actual reach exceeded the initial invitee list, so the number of responses cannot be meaningfully compared against the number of individuals invited for this sample. Given these skews, findings should be treated as indicative rather than population-representative.

Recruitment relied on convenience/self-selected sampling via professional networks and social media groups rather than a formal sampling frame. Self-selection likely favours digitally engaged, motivated respondents, which may inflate competence and engagement scores relative to the wider teacher population. All competence measures are self-reported rather than objectively tested, so results reflect perceived rather than demonstrated competence. As noted in 5.1.1, the methodology report (Keser Aschenberger et al., 2026, §2.8) documents response-format mismatches (confidence vs. agreement scales) and terminological inconsistencies ("learners" vs. "students") that may affect comparability across sections. Whether particular teacher groups (e.g., rural schools, specific regions, private schools) were systematically underrepresented cannot be assessed from the data available for this report, since region/locality was not captured by the survey; no translation or adaptation issues were encountered in preparing the Romanian instrument. Taken together, these limitations mean the findings should inform, rather than definitively determine, training priorities.

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 Romania, the following implications should influence the DigiSET project.

6.1. Implication for DigiSET

The clearest DigiSET priorities emerging from this survey are open educational resources and AI-in-assessment/adaptive-AI use, since these show both the lowest self-perceived competence (5.1.1–5.1.2) and concrete respondent-reported demand (inclusive digital teaching, ethical/responsible AI, and OER creation were the top requested training areas, Fig. 26). Because the most-cited barrier is lack of time (63.7%, Fig. 27) rather than lack of motivation, training should be modular, short-format and directly classroom-applicable, and accessible to both pre-service and in-service teachers given the bimodal experience profile of this sample. For Romania specifically, the DigiSET Framework of Learning Outcomes should give explicit attention to: (1) moving teachers from consuming to creating OER; (2) building confidence in using AI for assessment and for adaptive/personalised instruction, not only general AI literacy; and (3) equipping teachers to delegate digital agency to learners, currently the weakest digital-teaching item identified (Fig. 11).

6.2. Additional insights

For national policymakers, the SMART.Edu Strategy's teacher-training pillar could be strengthened by explicitly funding OER-creation and AI-assessment training, and by addressing the infrastructure and connectivity gaps repeatedly cited as barriers (Q1, P2). For school leadership, protecting dedicated, timetabled time for digital/AI training – rather than relying on teachers' own time – directly addresses the single most-cited barrier in this sample. For teacher-education institutions, embedding OER creation and AI-assisted assessment into initial teacher training (relevant given 61.4% of respondents are still pre-service) could close the competence gap before teachers enter the classroom. Two questions warrant further investigation: whether the strong ESD values reported here (Section 4.3) translate into classroom practice once teachers gain more digital/AI confidence, and how the pronounced gender imbalance of this sample (93.3% women) relates to gendered patterns in Romania's wider teaching workforce. Given that similarly low adaptive-AI and OER confidence may plausibly appear across the DigiSET consortium, these two areas seem strong candidates for common cross-country training modules, pending confirmation once comparative results across all national reports are available.

References

Chiu, T. K., Ahmad, Z., & Çoban, M. (2025). Development and validation of teacher artificial intelligence (AI) competence self-efficacy (TAICS) scale. *Education and Information Technologies*, 30(5), 6667-6685. URL: <https://link.springer.com/article/10.1007/s10639-024-13094-z>

Eurostat (2024). Secondary education statistics. *Statistics Explained*. European Commission. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Secondary_education_statistics

Joint Research Centre of the European Commission (n.d.). DigComEdu CheckIn . Self-reflection tool. URL: https://www.metared.org/content/dam/metared/pdf/Check_In_DigCompEdu_Self_Relection_Tool.pdf (2026-06-25)

Keser Aschenberger, F., Mair, B., Schön, S., Oral, D., Dulay, S., Eşfer, S., & Guraziu, E. (2026). Teachers' Competences for Digital Sustainability: Survey Methodology. Design, Translation and Processing of the DigiSET Teacher Survey per Country. DigiSET report (WP2), July 15, 2026. DigiSET project | Graz University of Technology. <https://doi.org/10.3217/dyr1y-trk05>

Ministerul Educației (2021). SMART.Edu – Strategia privind digitalizarea educației din România 2021–2027. <https://www.smart.edu.ro/>

Ministerul Educației (2025). Inteligența Artificială, testată în mediul educațional românesc. https://www.edu.ro/press_rel_23_2025

Mishra, S., Sharma, M., Sharma, R.C., Singh, A. and Thakur, A. (2016). Development of a Scale to Measure Faculty Attitude towards Open Educational Resources. In: *Open Praxis*, 8(1), pp. 55-69. URL: <https://doi.org/10.5944/openpraxis.8.1.236>.