

DigiSET – The Academy of Digitally Sustainable European Teacher

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Teachers' Competences and Needs for Digital Sustainability in Europe

A survey amongst (future) teachers from eight European countries

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Disclaimer on Methodology and Authorship

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

Disclaimer on AI usage

Based on Academic Integrity and Transparency in AI-assisted Research and Specification Framework (Bozkurt, 2024, DOI: 10.55982/openpraxis.16.1.654), the authors of this report acknowledge that it was drafted with the assistance of Lumo (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 consolidated results of the DigiSET teacher survey conducted across eight European countries — Austria, Bulgaria, Ireland, Italy, Norway, Romania, Spain, and Türkiye — as part of the Erasmus+ project “DigiSET – The Academy of Digitally Sustainable European Teacher” (101249272). The survey aimed to assess (future) teachers' self-perceived competences in digital teaching, artificial intelligence (AI), education for sustainable development (ESD), and open educational resources (OER), as well as their perceptions on four DigiSET-specific topics: adaptive AI use, gender bias in AI, inclusive practices for students with learning difficulties, and systems thinking for sustainability. Data were collected between May and June 2026 using an online questionnaire based on existing scales (DigCompEdu Check-In, TAICS, ATOER) and project-specific items. The report synthesises findings, providing cross-country comparisons and highlighting both shared patterns and context-specific differences across the diverse educational landscapes represented in the study. Applying the background of exploratory and descriptive analyses, first indications suggest that teachers rate their ESD competences most favourably, followed by digital teaching competences, while AI and OER competences received considerably lower ratings, with AI showing the highest proportion of respondents indicating no prior knowledge. AI and ESD competences appeared largely independent ($r = 0.37$), whereas digital teaching and AI competences showed a relatively stronger association ($r = 0.66$), tentatively suggesting that AI-related and sustainability-related competence development may require parallel rather than sequential approaches. Among the reported training needs, 'Using AI in teaching' was selected most frequently (43%), followed by 'Creating and sharing OER' (33%), while time constraints emerged as the dominant perceived barrier to continuous professional development (53%). Across all competence domains, emerging patterns point to a perceived implementation gap between teachers' values and beliefs on the one hand and their reported pedagogical practice on the other. However, given convenience sampling and substantial differences in national sample compositions, these findings are not generalisable beyond this research; they can serve as a heuristic basis for shaping the DigiSET training programme and as a starting point for future confirmatory research.

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1. Introduction

The DigiSET project (The Academy of Digitally Sustainable European Teacher) represents a transformative initiative which seeks to address 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 primary and post-primary teachers, providing learning resources and materials to equip teachers with the competences to create, use, and adapt Open Educational Resources (OERs), digital technologies, and AI algorithms. DigiSET aims to enhance the digital skills of European educators, aligning with the DigCompEdu, LifeComp, and GreenComp frameworks. It addresses the specific need for teacher upskilling in digital technologies through comprehensive training and a supportive community of practice, fostering a sustainable education system across Europe.

The project utilises a 'mixed method' approach to data gathering qualitative and quantitative using policy reviews, focus groups and surveys. The survey was implemented across the DigiSET partner countries Austria, Bulgaria, Ireland, Italy, Norway, Romania, Spain, and Türkiye. To ensure that the DigiSET training program effectively meets the needs of educators across diverse national contexts, the survey sought to be part of a comprehensive needs analyses conducted in all participating DigiSET countries. The data presented in this report serves as the empirical foundation for understanding the status of digital and sustainability teaching competences at a European level, identifying specific barriers to integration across different educational systems, and validating the requirements for the development of training modules. By synthesising findings from all eight countries, this report enables a limited type of cross-national comparisons and provides a holistic view of the challenges and opportunities facing digitally sustainable teacher development in Europe today.

A particular emphasis of this analysis lies in understanding the specific needs of teachers, deriving actionable insights for the DigiSET competence framework, and determining implications for the design of DigiSET educational offerings. This includes developing recommendations for how modules and courses can be structured to align with the needs of teachers, ensuring relevance across national contexts. A central goal was to identify areas of corresponding demand that persist across countries, thereby enabling the design of training provisions that address shared priorities while remaining adaptable to local educational systems.

2. Methodology

This section describes the methodological approach underlying the DigiSET online teacher survey questionnaire used across the eight partner countries, including the survey development, sampling strategy, data collection procedures, and analytical methods employed.

2.1. Survey development and ethics

A detailed description of the questionnaire design and the analysis is given in a report by DigiSET (Keser Aschenberger et al., 2026). The survey was developed to evaluate (future) teachers' self-perceived competences across four main domains: digital teaching competence (drawing on the DigCompEdu Check-In, JRC), AI competence (drawing on the TAICS scale, Chiu et al., 2025), education for sustainable development (ESD), and open educational resources (OER, drawing on the ATOER scale, Mishra et al., 2016). The instrument also included project-specific items exploring four DigiSET thematic priorities: adaptive AI use, gender bias in AI, systems thinking, and inclusive practices.

A rigorous translation and adaptation process was undertaken to ensure methodological consistency and preserve the direct comparability of survey findings across all participating organisations. Beyond literal, word-for-word translation, a functional approach was used to retain the intended meaning of complex constructs within each national context (see Keser Aschenberger et al., 2026).

Ethical guidelines were followed throughout the research process, including informed consent procedures, data protection measures, and confidentiality protocols aligned with GDPR standards (see Keser Aschenberger et al., 2026, p. 15). Ethical approval for the “DigiSET Project: The Academy of Digitally Sustainable European Teacher” was granted by the Bahçeşehir University (BAU) Scientific Research and Publication Ethics Committee on 30 April 2026 (approval number: 2026/04). Each partner retained responsibility for implementation of ethical guidelines locally and as appropriate.

2.2. Sampling strategy and data collection

2.2.1. Target population and recruitment process

The surveys in all eight participating partners’ countries — Austria, Bulgaria, Ireland, Italy, Norway, Romania, Spain, and Türkiye — were conducted independently within each national context in the local languages. While a common questionnaire framework was maintained across all sites, the recruitment strategies were adapted to local conditions and depended heavily on the networks and capacities of the respective DigiSET partner organisations involved in each country. This decentralised approach meant that a range of participant groups were reached with varying degrees of ease. This was depending on the specific networks, partnerships, channels available locally, a form of convenient sampling. For example, in some contexts it was easier to reach teacher education students through university partnerships, while in other cases practising teachers from specific subject areas were more readily accessible through professional networks and school collaborations. This variation reflects the diverse DigiSET consortium of partners and the educational landscapes across Europe and highlights how the recruitment process was shaped by the institutional contexts in which each DigiSET partner operated. For detailed information on the specific sampling strategies and participant in each country, please check the respective country survey reports (Eşfer, Dulay & Süzan, 2026; Giampolo et al., 2026; Kenny, 2026; Lemnaru & Popescu, 2026; Savova & Peykova, 2026; Schön et al., 2026; Sola, 2026). Although a convenience sampling logic was used, efforts were made to maintain sufficient sample representativeness within each country to enable data alignment and meaningful cross-national analysis.

2.2.2. Responses and data collection period

All partners were required to secure at least 100 responses, amounting to a cumulative target of 800 responses across the eight participating partners’ countries. This objective was substantially exceeded, with 1.854 participants initiating the questionnaire. For some partners, it was not a major problem, whereas for others, it was a significant challenge, not least due to the time schedule and constraints associated with the survey. Austria and Norway, together with Bulgaria and Ireland, are among the relatively small countries participating in the DigiSET project. Unlike some other partners, the Austrian and Norwegian teams had no existing datasets, contact lists, or newsletters that would have enabled them to reach large numbers of teachers and student teachers easily. These limitations made participant sampling considerably more challenging. Austria ultimately reached the recruitment target, but only through substantial effort, while Norway recruited a small sample of $n=37$ participants.

As shown in Table 1 a notable proportion of responses had to be excluded — either because no questions were answered at all, or the respondents did not complete at least one entire

set of questions on a particular topic — leaving a total of N=1.378 valid questionnaires for the country analyses, representing approximately 74.3% of all responses. Although the survey utilised convenience sampling, the final sample of N=1,378 completed responses represents a substantial dataset for exploratory educational research. The achieved sample size substantially exceeded the consortium target of n=800 respondents and provides a rich evidence base for identifying descriptive trends across diverse educational settings and national contexts.

Table 1: Survey Responses, Data Exclusions, and Final Country Analysis Sample for DigiSET Survey

Responses and used data	AT	BU	IR	IT	NO	RO	ES	TU	SUM
Total	152	318	221	283	37	209	165	469	1854
No questions answered	45	93	54	52	10	13	26	167	460
No full block of questions answered	1	2	2	2	2	1	0	6	16
Included in the country analysis (n)	106	223	165	229	25	195	139	296	1378

Figure 1 shows the number of respondents per countries that were used in the analysis and the differences between the countries.

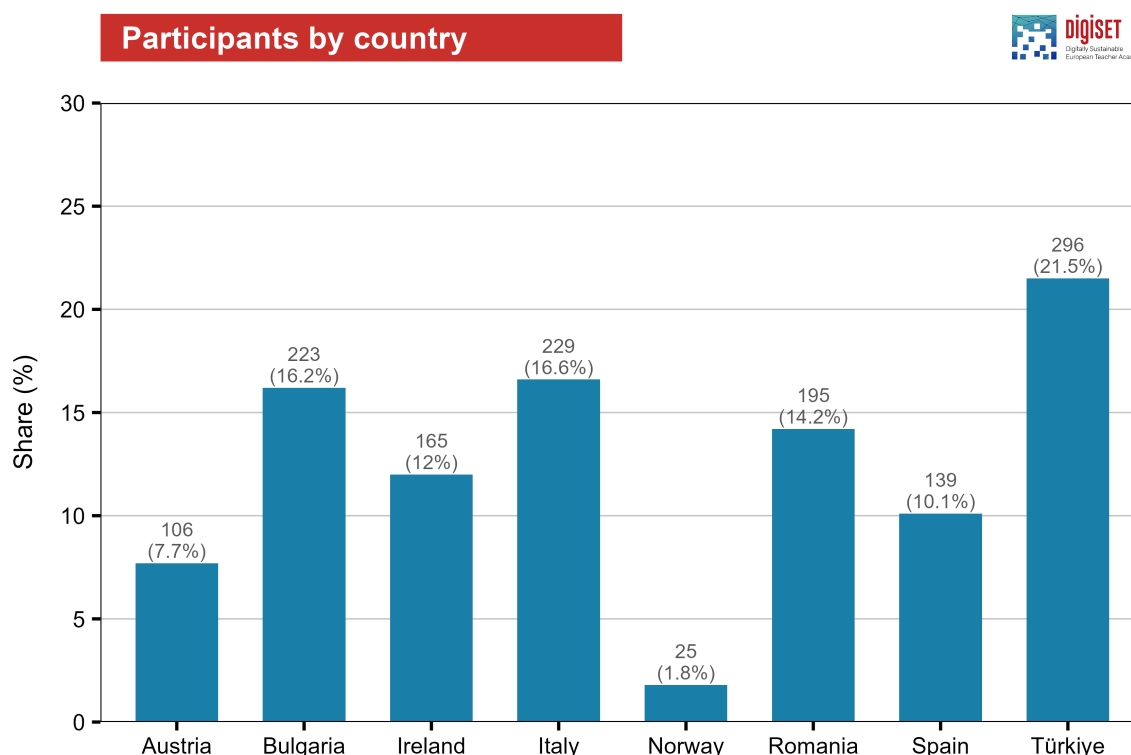


Figure 1: Number of responses included in the analyses per country (n=1.378).

The data collection period was over eight weeks from May to June 2026, with shorter periods for some countries. It should be noted these are very busy months for teachers with preparations for national examinations and end of term assessments, school events and administrative duties.

2.3 Data processes and analyses

For this European-level analysis, the questionnaire was administered consistently across all eight partner countries (Austria, Bulgaria, Ireland, Italy, Norway, Romania, Spain, and Türkiye). The subsequent analyses followed standardised procedures to support cross-

national description while remaining sensitive to contextual differences between educational systems.

It is important to reiterate that the analyses presented herein are primarily descriptive and exploratory. Given the sampling design, no claim is made that observed differences between countries or subgroups are statistically generalisable beyond the research scope of the project. The primary aim is to provide an initial, comparable overview of patterns within the DigiSET dataset, serving as a foundation for hypothesis generation and future inferential studies.

2.3.1 Data preparation and missing data

Prior to analysis, the extent and pattern of missing data were examined for all variables retained in the European dataset. Cases in which respondents answered no questions at all or did not complete at least one full item set on a given topic, were excluded from the analysis sample (see Section 2.2.1, Table 1). Open-ended responses provided in the respective partner languages (Q1–Q3) and free-text entries in “Other” categories were likewise excluded from the present report. These responses require translation and contextualisation against the country-level findings, which were still ongoing at the time of writing. Multiple-choice items (e.g. training needs and barriers) were coded as selected versus not selected for descriptive reporting.

2.3.2 Index construction and reliability

For each of the four competence domains – Digital Teaching (DT), Artificial Intelligence (AI), Education for Sustainable Development (ESD), and Open Educational Resources (OER) – a mean index was computed as the arithmetic mean of all items belonging to the respective domain. Prior to index construction, the internal consistency of each item set was evaluated using Cronbach’s alpha (Table 2). Values above .70 were considered acceptable, values above .80 good, and values above .90 excellent (George & Mallery, 2003).

Table 2: Cronbach’s Alpha and statistics for each scale.

DT competence index		ESD competence index	
Items	22	Items	13
n	1294	n	1039
Cronbachs Alpha	0.944	Cronbachs Alpha	0.950
AI competence index		OER competence index	
Items	24	Items	5
n	1142	n	1037
Cronbachs Alpha	0.977	Cronbachs Alpha	0.941

Cronbach’s alpha was uniformly high across all four indices (exceeding .94), indicating strong internal consistency. Item-level diagnostics were additionally inspected to assess whether excluding individual items would further improve reliability; this was not the case for any index, and all items were therefore retained. The resulting indices preserve the original 1–5 response scale of the constituent items, with higher values indicating higher self-reported competence.

2.3.3 Descriptive and exploratory analyses

Sample composition and sample size vary considerably across partner countries, reflecting different access pathways used to reach respondents. Against this background, the analyses presented in this report are descriptive and exploratory in nature and do not aim at statistically generalisable cross-national inference. Accordingly, no claim is made that

observed differences between countries or subgroups are statistically generalisable beyond the present sample. The aim is rather to provide an initial, comparable picture of patterns in the DigiSET data; more inferential or model-based analyses may be pursued in subsequent work.

Within this exploratory framework, the following analyses were conducted and are reported in the subsequent sections. First, frequency distributions were computed for single- and multiple-choice items and summarised in tables and corresponding graphical displays. Second, country differences in the four competence indices were examined descriptively using boxplots, complemented by basic country-level summary statistics (e.g. means, medians, and sample sizes). Third, associations among the four indices were inspected through pairwise correlations and visualised as a correlation heatmap. Fourth, co-occurrence patterns between selected training needs (P1) and perceived barriers (P2) were explored using lift-based comparisons, which contrast the share of a given barrier among respondents who selected a particular training need with the corresponding share among those who did not. Fifth, for selected training needs, lollipop plots were used to display selection rates across subgroups defined by competence levels and background characteristics (e.g. country, subjects taught, employment status, teaching experience, and school levels taught), with the overall selection rate serving as a reference line.

3. Demographic profile of respondents

This section presents the demographic characteristics of all survey respondents from the range of partner countries.

3.1 Gender and age (B6, B7)

A majority of the respondents (73,9%) are female, 23,1% male and 2,8% preferred not to say (see Figure 2). The predominance of female respondents broadly reflects the gender composition of the teaching profession across many European education systems, although this proportion varies considerably by educational sector and national context.

Consequently, the sample may provide a particularly strong insight into the perspectives of female educators regarding digital sustainability and AI integration.

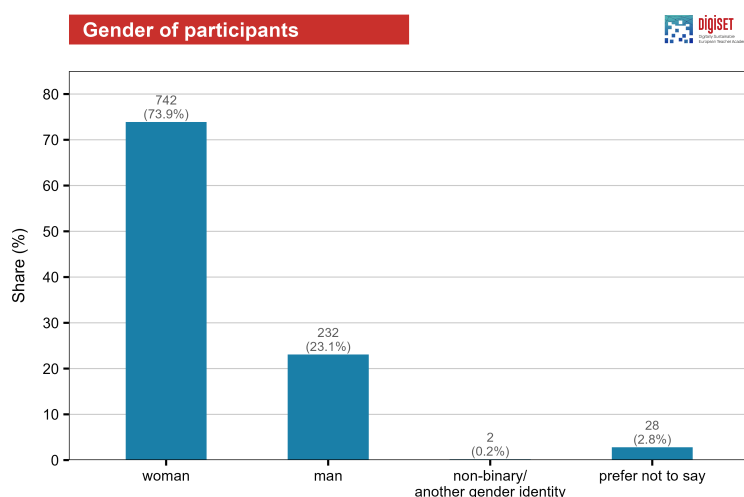


Figure 2: Gender of participants at DigiSET teacher survey (n=1.004).

The mean age of respondents in the DigiSET survey is 45 years (see Figure 3). The largest age cohort comprises individuals aged 45 to under 50 years, with approximately 160 participants. Overall, the proportion of respondents increases steadily up to this peak age group before declining in older cohorts. A notable deviation from this pattern occurs among younger adults: the 20- to under 25-year-old age group stands out as particularly well-represented, with nearly 80 participants.

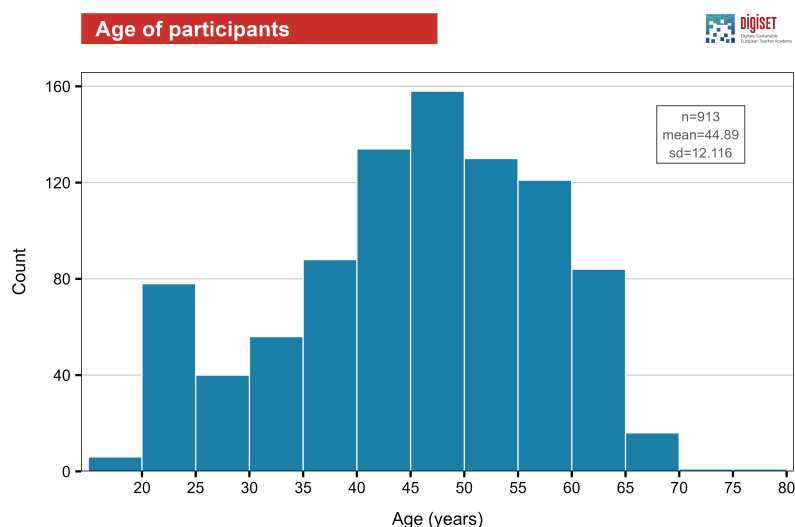


Figure 3: Age of participants (n=913).

3.2. Status of respondents (B1)

Figure 4 shows the work/study status of the respondents. Two thirds work at a public or state-funded school (66%), 17% are studying to be a teacher. 12% are working in a private or independent school, 1% in a religious-affiliated or church school. 4% are currently looking for a job, and 8% declares “Other”. In the case of the Austrian survey, e.g. some answered that they work at universities and train teachers or are researchers in the field (Schön et al., 2026, part 3.2).

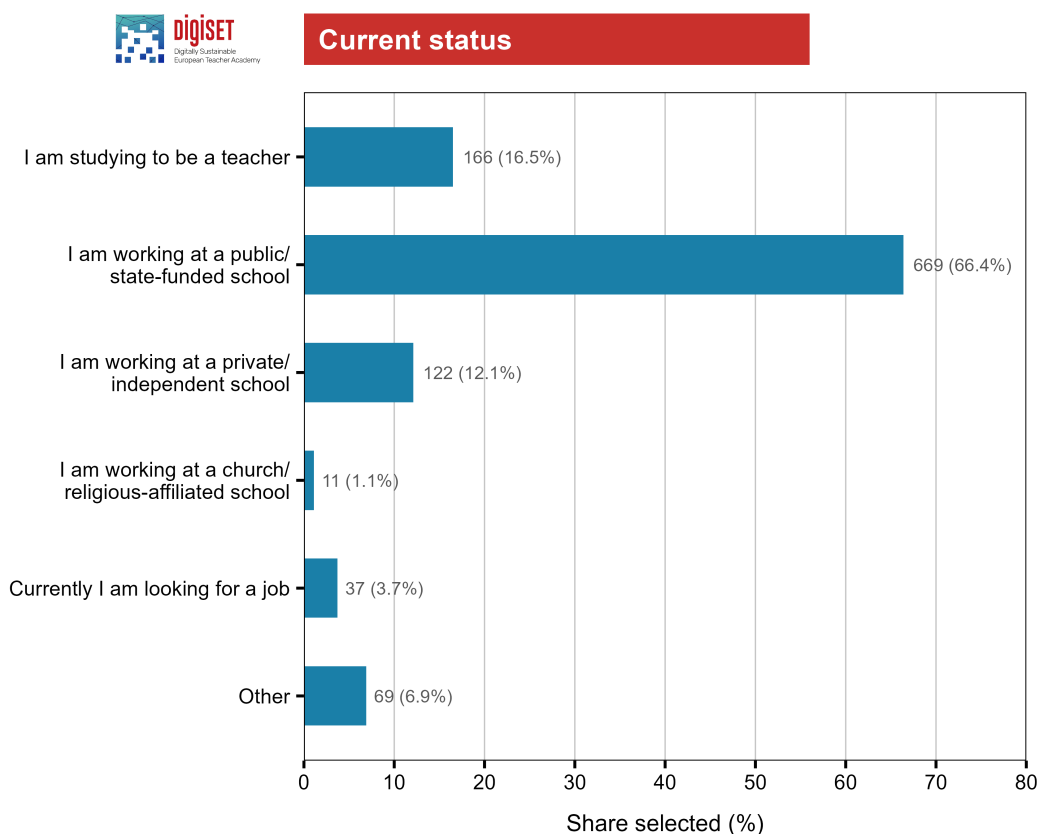


Figure 4: Work/study status of participants (n=1.007).

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

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

Figure 5 shows that most respondents teach in secondary school level (36% lower secondary, 35% upper secondary), 23% teach in primary level and 18% in vocational education. 12% chose (additionally) the “Other” option and commented e.g. that they work at the university.

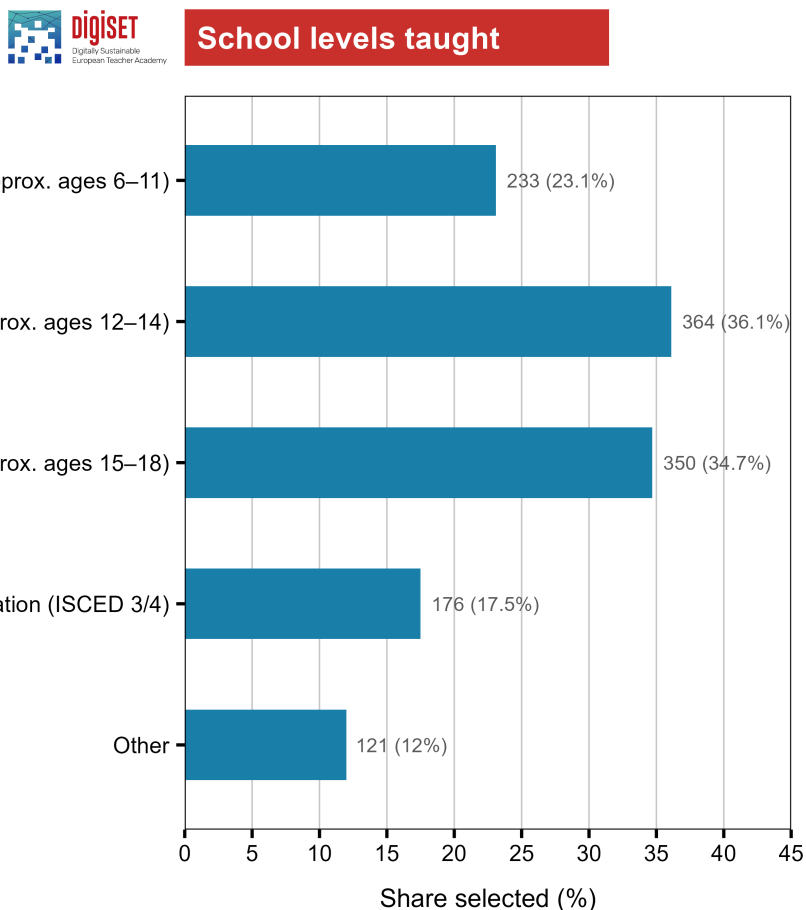


Figure 5: School levels taught or expected to be taught by participants (n=1.008).

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

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

Figure 6 shows which school subjects the respondents currently teach or intend to teach in the future. The most frequently reported options include mathematics (25%), followed by the option “others” (23%). Third ranked are the native language (23%) and natural sciences (18%), closely followed by computer science or, where applicable, related specialist IT-related subjects at 16%. 16% teach vocational subjects, 14% social science/history, and 14% foreign languages. 13% teach arts and music, and 8% physical education (sports).

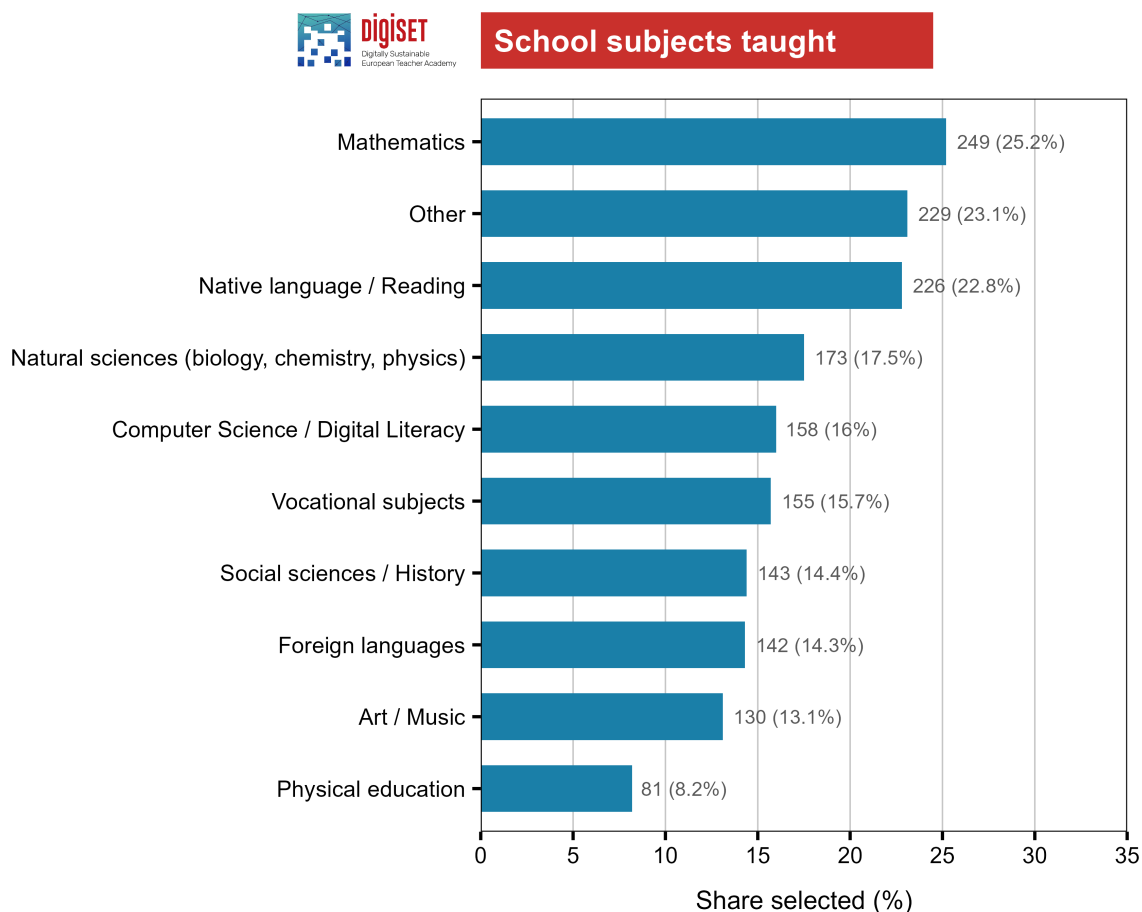


Figure 6: Subjects currently taught or expected to be taught by participants (n=990).

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

3.5. Teaching experiences (B4)

Figure 7 shows the teaching experience within the sample; 11% have no prior teaching experience, 5% have less than one year, and 39% report over 20 years of professional experience. The remaining 49% occupy the intermediate range between one and under 20 years of teaching. The significant representation of highly experienced educators suggests that many respondents have witnessed multiple waves of educational innovation and reform. Their perceptions regarding AI, sustainability and digital teaching therefore offer valuable insights into how emerging technologies are being interpreted by experienced practitioners.

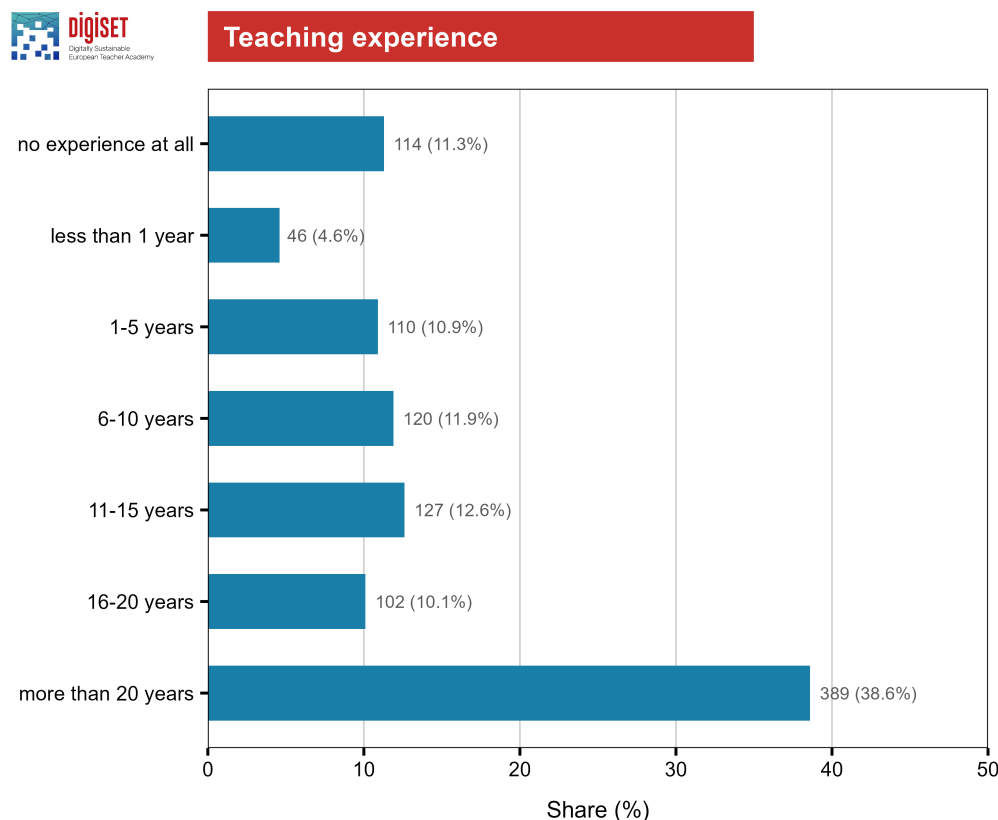


Figure 7: Teaching experiences of participants (n=1.008).

3.6 Comparison of selected sample characteristics across countries

The analyses presented in the preceding sections have revealed considerable differences between the data-sets received from participating countries, not only concerning the number of respondents but also regarding the composition of the respective samples. These country-specific variations, along with additional limitations noted in the individual survey reports from each partners' country (Eşfer, Dulay & Süzan, 2026; Giampolo et al., 2026; Kenny, 2026; Lemnaru & Popescu, 2026; Savova & Peykova, 2026; Schön et al., 2026; Sola, 2026) should be taken into account when interpreting subsequent cross-national comparisons.

To highlight the most salient differences in profiles across the DigiSET partner countries, the following cross-national comparison focuses on selected sample characteristics rather than providing exhaustive distributions for all demographic variables.

Table 3 summarises the key characteristics of the country data sets. Rather than presenting complete category breakdowns, this focused approach highlights where the country samples diverge most notably, thereby characterising the distinct profiles of educators participating in the DigiSET study across different national contexts.

Table 3: Selected participant characteristics according to country

Selected characteristics	AT	BU	IR	IT	NO	RO	ES	TU	Overall
Females (%)	67	83	72	75	50	93	50	71	74
Average age	40	50	48	56	46	33	45	42	45
Currently studying (%)	29	1	2	1	0	61	23	4	17
Public or state school (%)	54	91	82	94	89	35	15	77	66
Private school (%)	8	2	2	5	11	3	50	18	12
Primary level (%)	8	32	7	22	11	58	5	17	23
Upper secondary (%)	52	35	50	55	17	16	15	31	35
Vocational track (%)	25	18	28	3	39	7	57	2	18
Computer sciences / digital literacy (%)	45	13	17	14	22	6	24	9	16
No teaching experiences (%)	18	0	1	0	0	50	9	2	11
> 20 y teaching experiences (%)	39	49	49	60	44	23	15	34	39

Several noteworthy patterns emerge from this comparison. Regarding teaching experience, the samples vary markedly: Romania stands out with half of all respondents reporting no prior teaching experience (50%), which is substantially higher than the overall average (11%). In contrast, Bulgaria, Italy, and Norway recorded no respondents without teaching experience. At the opposite end, Italy shows the highest proportion of highly experienced teachers (60% with over 20 years of experience), compared to only 15% in Spain.

Concerning subject specialisation, Austria has the highest proportion of respondents teaching computer science or digital literacy (45%)—nearly three times the overall average (16%). This is particularly relevant when interpreting the comparatively high self-reported digital teaching competences of Austrian participants, as subject expertise may strongly correlate with digital self-efficacy. Spain also exceeds the average (24%), whereas Romania shows a notably low share (6%).

Regarding school level, Spain stands out with the highest proportion of vocational education teachers (57%), while Romania is dominated by primary-level educators (58%). This difference is significant given that digital integration requirements and training needs may differ substantially between vocational and primary contexts. Italy, Ireland, and Austria show strong representation at the upper secondary level (55%, 50%, and 52% respectively), suggesting a more adolescent-focused sample.

Employment status reveals further heterogeneity. Romania again deviates significantly, with 61% of respondents currently studying—far exceeding all other countries—and only 35% working in public/state-funded schools. In contrast, Italy (94%), Norway (89%), and Bulgaria (91%) show overwhelmingly public-sector participation. Spain, conversely, is the only country where the majority of respondents work in private schools (50%). These differences are crucial for interpreting training readiness and institutional support structures.

Turning to gender and age, the overall sample is predominantly female (74%), though proportions vary considerably, ranging from 50% in Norway and Spain to 93% in Romania. The average age across all countries is 45 years, with Italy having the oldest respondents (56 years) and Romania the youngest (33 years). While these demographic factors are informative, their direct relevance to competence levels is likely mediated by the aforementioned variables (experience, subject, school level) rather than acting as independent predictors.

The following overview summarises the most notable particularities of each country sample and their potential relevance for interpreting cross-national findings:

- Austria (AT): The proportion of respondents teaching computer science or digital literacy is exceptionally high (45% vs. 16% overall average) and there are more students as average.
- Bulgaria (BU): The sample is characterised by older, experienced teachers (average age 50; 49% with over 20 years of experience) with virtually no representation of early-career educators.
- Ireland (IR): The sample is well-balanced across all examined dimensions and closely resembles the overall averages.
- Italy (IT): The sample comprises the highest proportion of highly experienced teachers (60% with over 20 years of experience).
- Norway (NO): The Norwegian data set does not include any students.
- Romania (RO): This sample diverges most substantially from all others: 61% of respondents are currently studying, 50% have no prior teaching experience, the average age is the lowest (33 years), and only 35% work in public/state-funded schools. The proportion of CS/digital literacy teachers is notably low (6%).
- Spain (ES): Distinctive features include the highest proportion of vocational education teachers (57% vs. 18% overall) and the highest share of private-school respondents (50% vs. 12% overall). Additionally, Spain has the lowest proportion of teachers with over 20 years of experience (15%).
- Türkiye (TU): The Turkish sample aligns reasonably well with the overall averages across most indicators. No major particularities were identified.

4. Results

This section reports the findings of the DigiSET teacher survey across four core competence domains — digital teaching (DT), 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. After this, we will descriptively describe the characteristics of respondents according to their training needs.

Neither the overall results nor the country-level results are representative. The findings are based on self-reported data from a convenience sample that varies substantially across countries. They should therefore be interpreted as descriptive patterns within this sample, not as generalizable findings about teachers in the participating countries. These analyses do not support conclusions about causal relationships.

4.1. Self-perceived competences of teachers: Insights, comparison and correlations of indices

4.1.1. Comparison of the 4 indices for digital teaching, AI, ESD and OER

Although the four scales are not directly comparable due to differences in response formats, an aggregate cross-country comparison provides valuable insight into presumed disparities in self-assessed competences (see Figure 8). Accordingly, respondents in the DigiSET study rate their ESD competences most favourably overall, followed by digital teaching competences. OER and AI competences receive considerably lower ratings in comparison, with AI exhibiting the highest proportion of respondents explicitly indicating no prior knowledge in this domain.

Examining these findings in relation to identified training needs, it is evident that respondents with low competence scores are present across all countries and all four domains. However, such cases are notably more frequent in the areas of AI and OER.

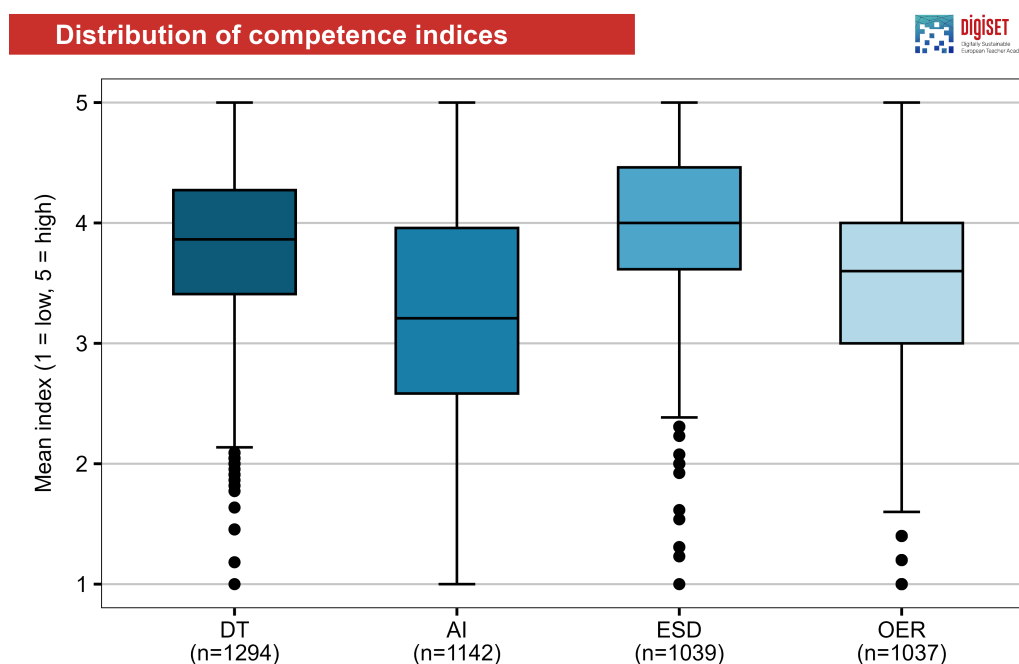


Figure 8: Self-perceived digital competences according to the DigiSET survey – boxplots of the digital teaching, AI, ESD and OER competence indices.

Note: More details in the table in the Annex.

4.1.2. Correlations between digital teaching, AI, ESD and OER indices

Figure 9 presents a correlation heatmap illustrating the interrelationships among the four competence indices. All pairwise correlations are statistically significant ($p < .01$). The strongest association is observed between Digital Teaching and AI ($r = 0.66$), suggesting that educators who report higher digital teaching competences also tend to report higher AI competences, reflecting substantial overlap in foundational digital literacy. Moderate correlations are found between AI and OER ($r = 0.57$) and between Digital Teaching and OER ($r = 0.51$), indicating that these domains share some common underlying competences but also retain considerable independence. The weakest association is found between AI and ESD competences ($r = 0.37$). Although statistically significant, this correlation is notably lower than the others, indicating that within this sample the two domains are only weakly related. Self-perceived ESD competence does not meaningfully co-vary with AI competence; whether the two domains are substantively independent in the broader teacher population would require further research. Overall, the correlation pattern suggests that while foundational digital competences cluster together to some degree, emerging and specialised domains such as AI, OER, and ESD to retain considerable independence. It suggests that domain-specific training approaches may be worth considering within the DigiSET framework. From a curriculum design perspective, the moderate-to-strong relationship between digital teaching and AI competence suggests that AI capability development is likely to build upon existing digital pedagogical. In contrast, the comparatively weak association between AI and ESD competence suggests that sustainability and AI represent largely distinct educational knowledge domains, each requiring dedicated professional learning opportunities.

Competence indices correlations

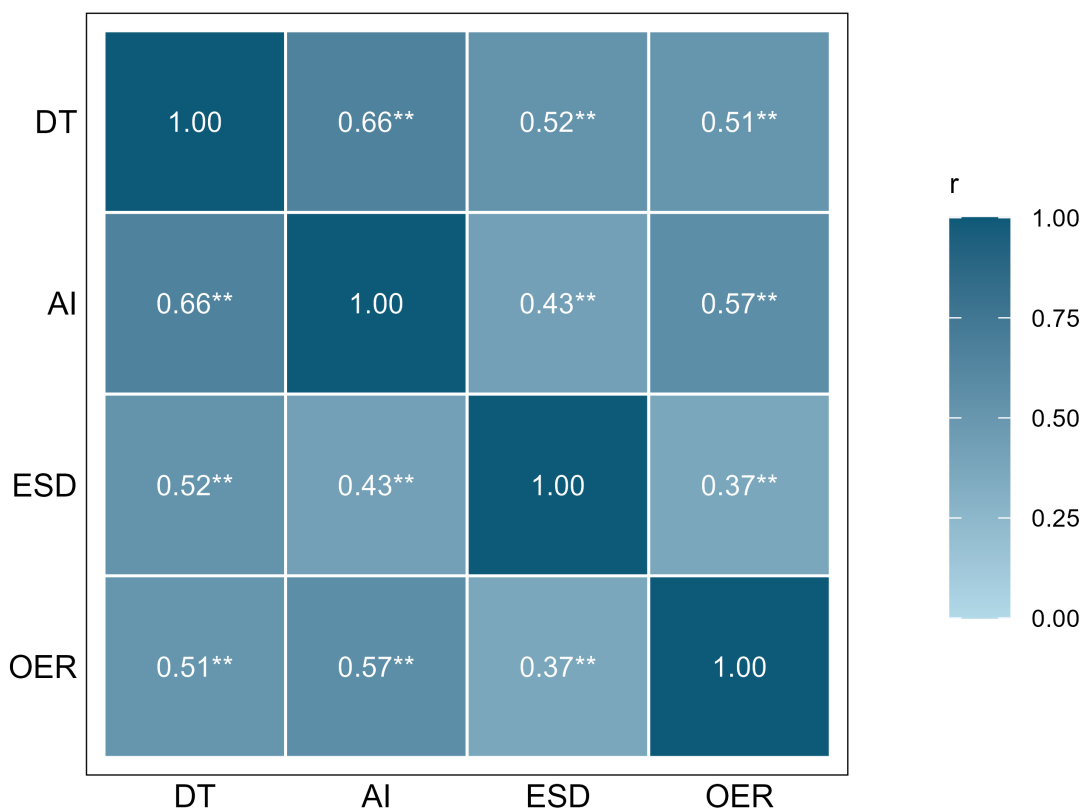


Figure 9: Self-perceived digital competences – heatmap of correlations of the indices.

4.1.3. Indices details

The DigiSET teacher survey assesses four core competence areas—Digital Teaching (DT), AI, ESD, and OER—with the first three indices composed of multiple sub-scales allowing for nuanced profiling of specific strengths and gaps. While DT, AI, and ESD capture broader competence dimensions through several items, the OER index is more focused, relying on just five items that cover essential aspects from technical handling to licensing knowledge. This chapter introduces the sub-scale structures of DT, AI, and ESD, followed by an overview of the five OER items to provide detailed insight into each domain's operationalization and findings across countries.

Digital Teaching subscales

Within the Digital Teaching (DT) index (see Figure 10), the sub-dimension Digital Resources shows the highest median, indicating that teachers feel most confident in this area — using search strategies to find and select digital resources (D5), creating and modifying materials (D6), and protecting personal data (D7). By contrast, the Assessment sub-dimension is markedly less frequently applied: digital assessment tools to monitor learner progress (D12), data analysis to identify students needing additional support (D13), and digital technologies for effective feedback (D14) are deployed far less routinely than resource-oriented activities such as lesson preparation. This gap suggests that while teachers are comfortable sourcing and adapting digital content, the integration of digital tools for evaluative and analytical purposes is reportedly practiced far less often — a pattern that points to a possible competence gap which warrants closer examination.

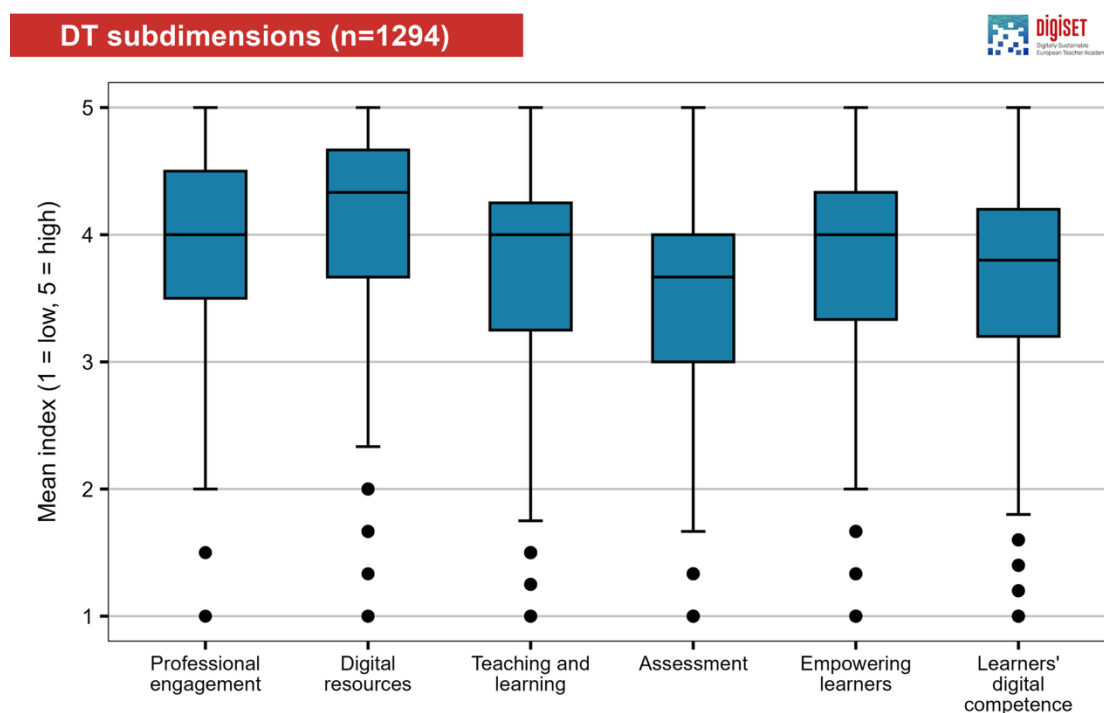


Figure 10: Self-perceived digital competences according to the DigiSET survey – subdimensions of the digital teaching index

AI subdimensions

Within the AI index, the subdimensions show overlapping ranges and relatively similar median values (see Figure 11). Boxplot analysis indicates that AI Assessment and AI Pedagogy display the lowest median scores among all subdimensions. These are the only two subdimensions directly addressing AI use in classroom teaching contexts. In details, for the AI Pedagogy subdimension, the items cover explicit classroom use of AI: selecting suitable AI tools to enhance teaching (A5), enriching subject content through AI tools (A6),

didactically meaningful integration of subject content, AI tools, and teaching methods (A7), as well as supporting others in designing corresponding learning activities (A8). These items directly address concrete, practice-oriented integration of AI in the teaching-learning process — and it is precisely here that the greatest competence deficits emerge.

In the dimension of AI Assessment, a larger proportion of respondents report lower confidence compared to other subdimensions.

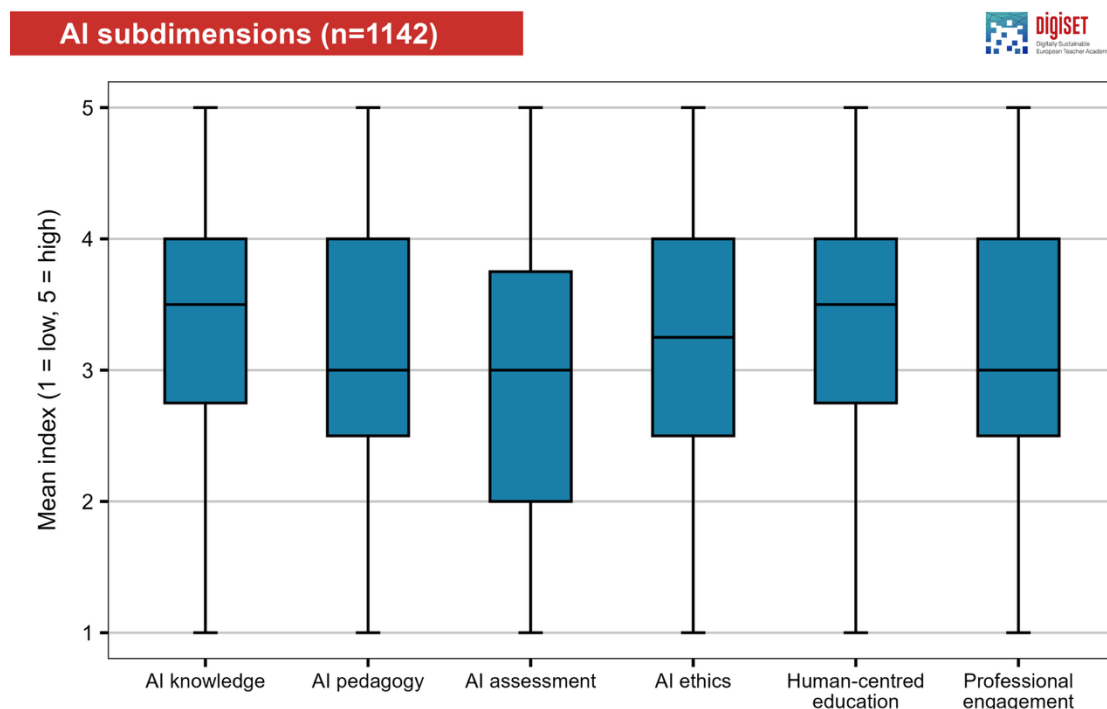


Figure 11: Self-perceived digital competences according to the DigiSET survey – subscales of the AI index

ESD subdimensions

Regarding the ESD sub-dimensions in Figure 12, the data reveal a clear pattern: the ‘Values’ sub-dimension has the highest ratings of all three ESD sub-dimensions, with a large proportion of respondents reporting very high values. This means that teachers rate themselves as very strong in terms of their personal values and beliefs regarding sustainability. However, this overview also shows that implementation in the classroom – the ‘Pedagogy’ sub-dimension – receives the lowest rating in comparison (when compared with the three sub-dimensions ‘Values’, ‘Systems’ and ‘Critical Thinking & Reflection’). This reflects a gap between beliefs and their practical implementation, a pattern that parallels well-known TALIS findings on the gap between attitudes and practice (OECD, 2025).

It should be noted that, across all ESD sub-dimensions, there are respondents who do not agree with the statements at all.

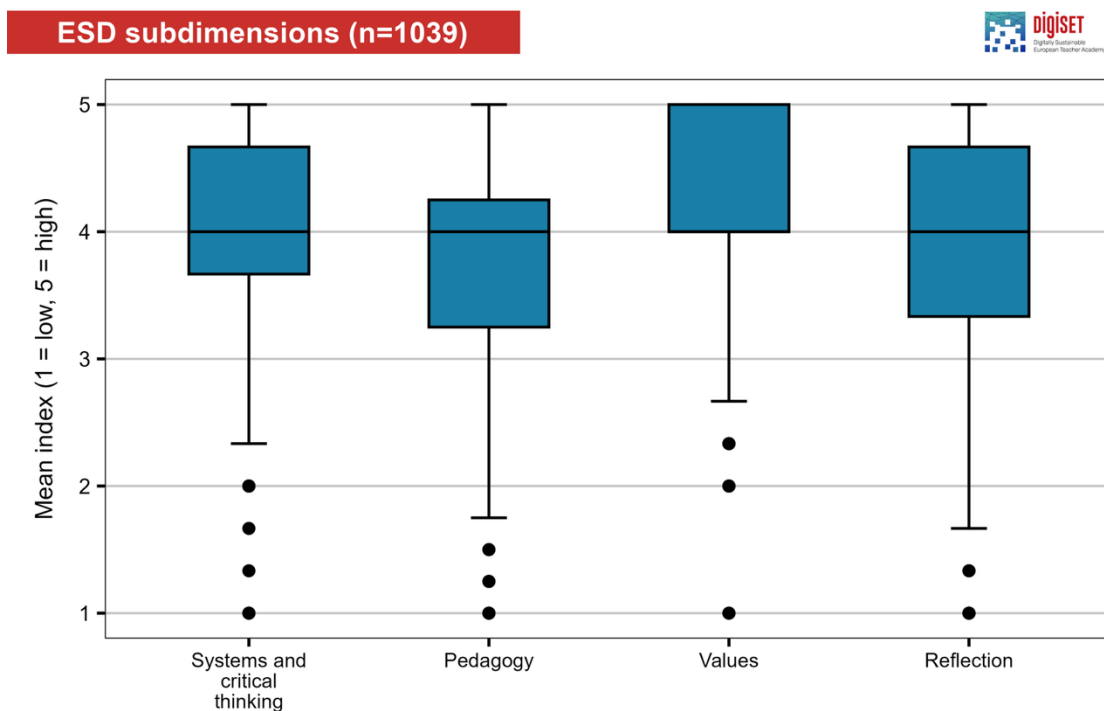


Figure 12: Self-perceived digital competences according to the DigiSET survey – subscales of the ESD index

OER items

To complement the detailed presentation of the indices, we displayed the distribution across individual OER items in Figure 13. As expected — given the high Cronbach's alpha (see 2.3.2.) — there are no substantial differences between the individual items.

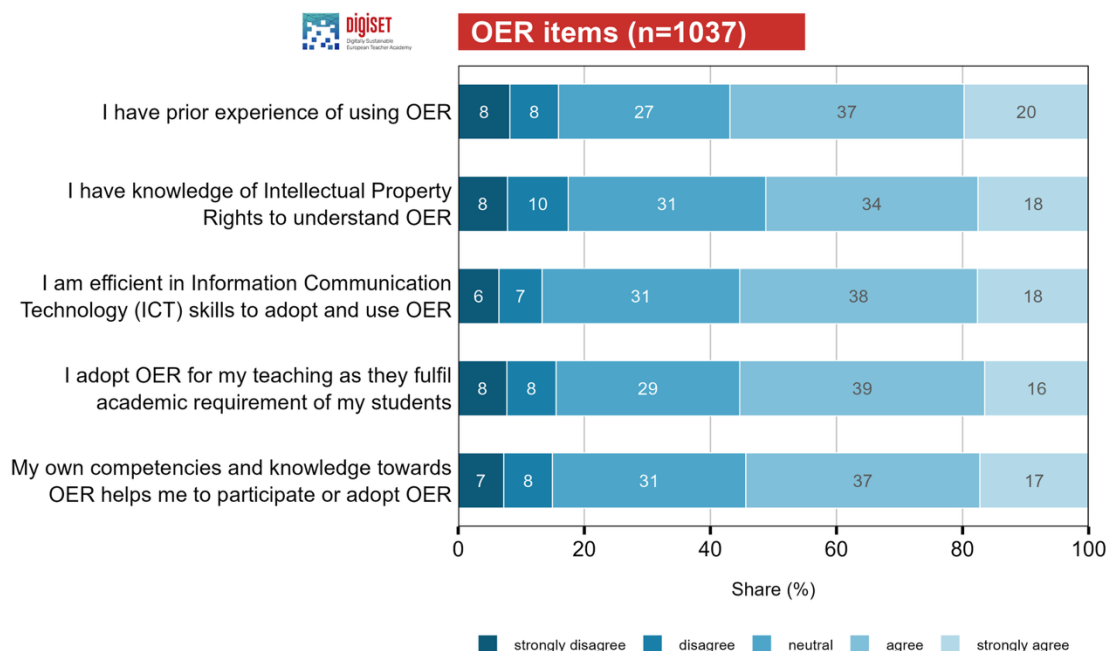


Figure 13: Self-perceived digital competences according to the DigiSET survey – OER items

4.2. Comparison of competence indices per country

This analysis provides a descriptive comparison within the surveyed sample only. Inferential claims regarding the broader population of teachers in the participating countries are not warranted given the sampling design. Due to the substantially smaller sample size for Norway, which reduces the statistical reliability and interpretability of results, the corresponding boxplot is rendered in grey to signal this limitation to the reader. Consequently, Norwegian results will not be discussed in detail in the following sections. Tables are provided in the annex.

The following boxplots in Figure 14 to 17 provide a visual summary of the distribution of each competence index, displaying the median (central line), interquartile range (the box spanning the 25th to 75th percentile), and whiskers that extend to show the overall spread of the data. Outliers are marked individually as points beyond the whiskers, allowing readers to quickly identify central tendencies, variability, and extreme values across country samples.

4.2.1. Digital teaching competence indices

Figure 14 shows the digital teaching competence indices for all DigiSET countries. In accordance with the analysis, respondents from Spain rate their digital teaching competences particularly highly (median 4.41) compared to participants from other countries, yielding the highest median. The second-highest median values are observed in the responses from Romania (median 4.00). Conversely, participants from Ireland report the lowest median, indicating a comparatively lower level of self-assessed competence in this domain.

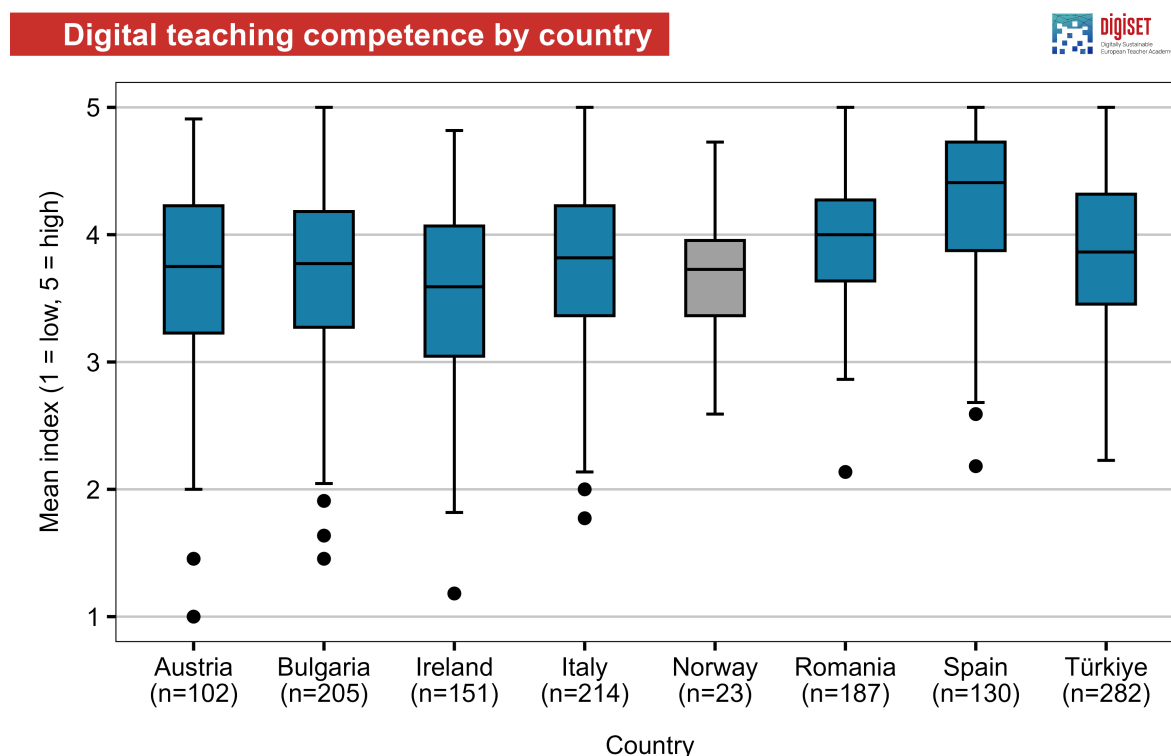


Figure 14: Digital teaching competence indices by country in the DigiSET survey.

Given the 1–5 scale employed, a median above 4 indicates that the majority of teachers in these samples perceive their competences as good to very good. However, the considerable spread of the distributions below this threshold also indicates that a substantial proportion of teachers rate their competences as moderate or low, underscoring the continued need for targeted professional development in this area.

4.2.2. Teaching with AI competence indices

A similar pattern emerges for self-perceived competences regarding AI and its pedagogical integration as shown in Figure 15. Spanish participants again report the highest median (3.63) and Ireland the lowest (2.83), though the distribution displays greater spread compared to digital teaching competences.

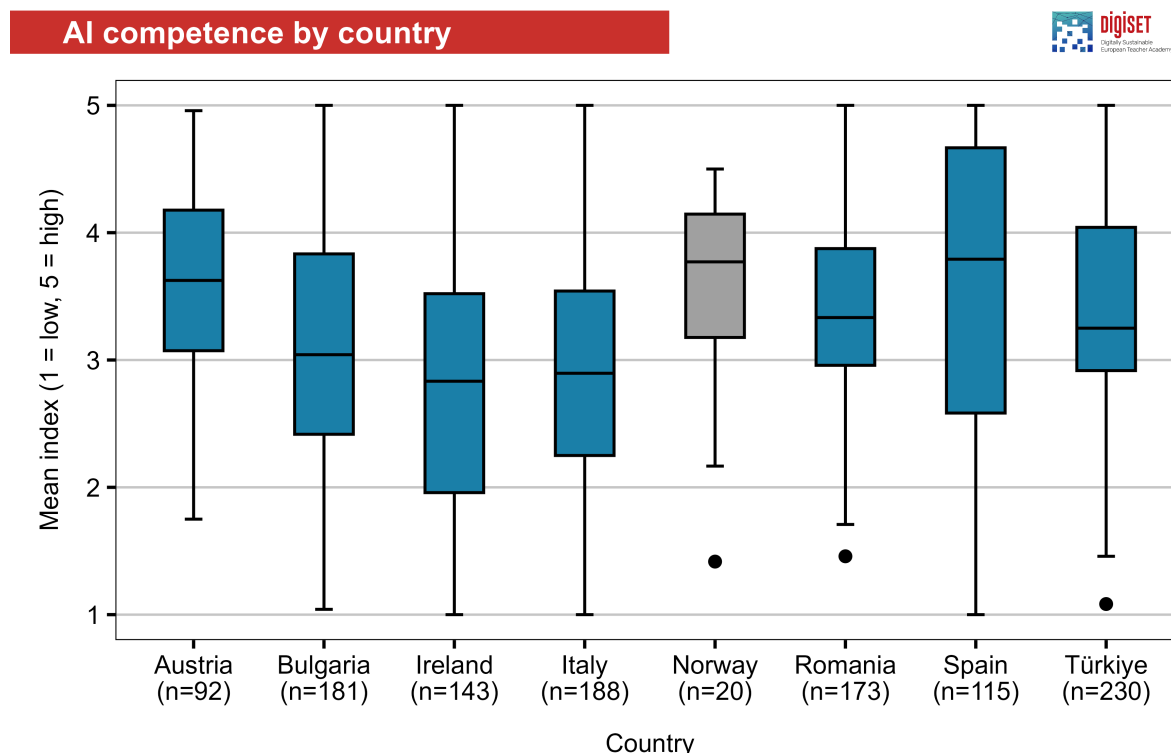


Figure 15: AI competence indices by country in the DigiSET survey.

This wider variability reflects the novel nature of AI as an educational topic, with a notable share of respondents indicating limited or no prior knowledge. As anticipated, emerging domains such as AI reveal a more pronounced competence gap, highlighting the necessity for differentiated training pathways that address both foundational and advanced needs. The substantial variability observed in AI competence scores suggests that respondents (teachers) cannot be considered a homogeneous population regarding AI readiness. Instead, the findings indicate the emergence of distinct groups of early adopters, competent practitioners, and those still at the awareness stage of AI engagement. This pattern aligns with innovation diffusion theory and supports the need for differentiated professional learning pathways.

4.2.3. ESD competence indices

When examining self-perceived competences for teaching sustainability or implementing ESD, two clear leading countries emerge (see Figure 16): Spanish respondents (median: 4.46) and, additionally, Italian respondents (median: 4.31). Both countries display markedly higher boxplot distributions compared to the respondents in Ireland (median: 3.54), indicating that the central tendency and overall range of responses—including medians and interquartile ranges—are shifted toward higher ratings. In other words, the majority of respondents in Spain and Italy rate their ESD competences more favourably than their counterparts in Ireland.

Competence in ESD by country

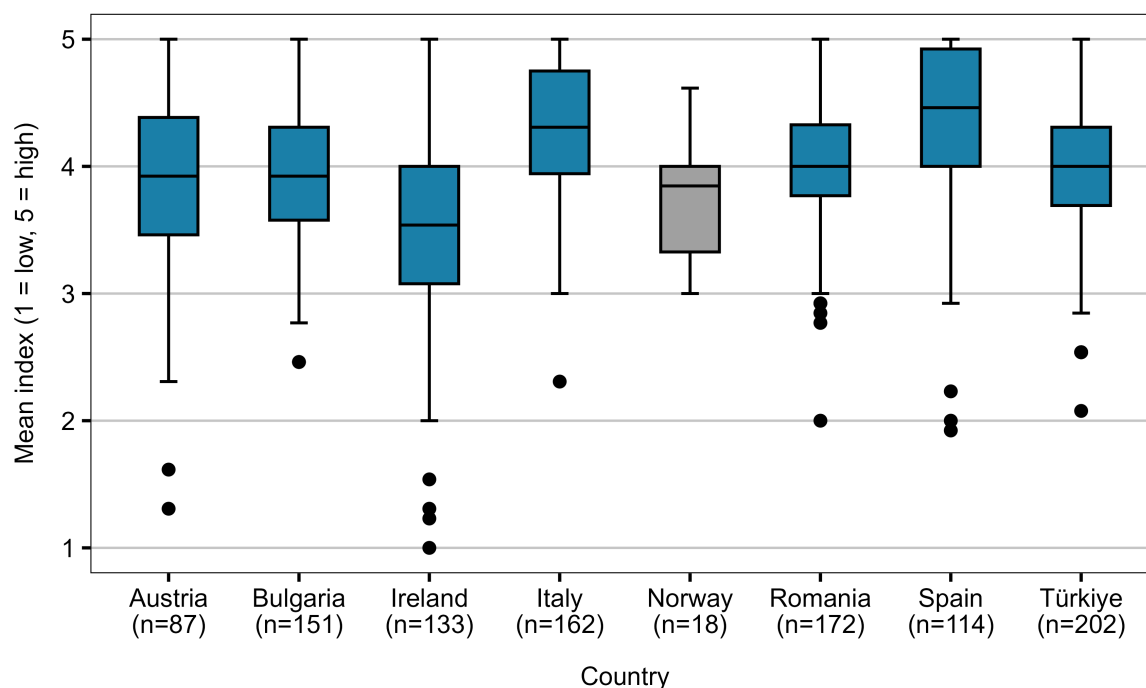


Figure 16: ESD competence indices by country in the DigiSET survey.

4.2.4. OER competence indices

Regarding OER-related competences, respondents from Spain again report the highest comparative values with a median of 3.80, this time tied with participants from Austria. Here again, the Irish participants have the lowest self-perceived OER competence median. Figure 17 shows as well that the overlaps of the boxplots are bigger than in the last diagram.

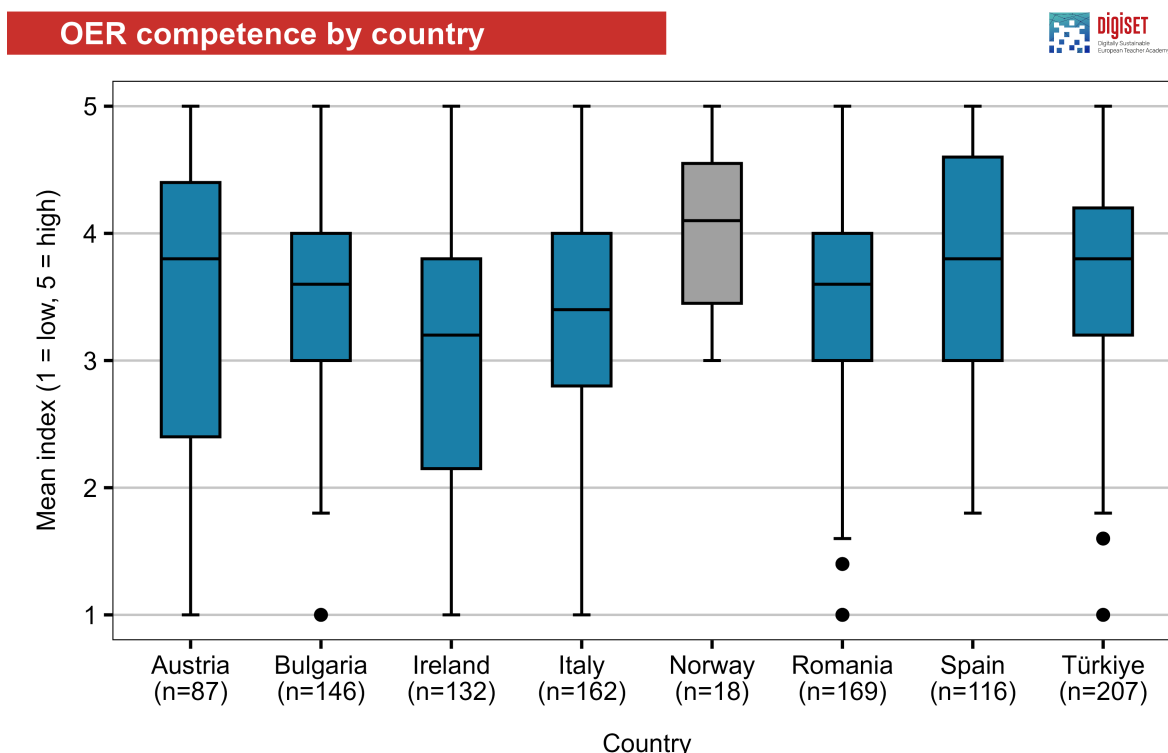


Figure 17: OER competence indices by country in the DigiSET survey.

4.3. Competences concerning the DigiSET topics

Respondents in the DigiSET survey were asked to respond to items across four thematic areas that DigiSET intends to address through its training programme (see Figure 18). These domains were: Adaptive AI use (AD1, AD2), Gender bias in AI (GD1, GD2), Inclusive practices for students with learning disabilities (I1, I2), and Systems Thinking (S1–S3). It should be noted that items were distributed across different questionnaire sections, meaning that response scales varied depending on the context in which each item was presented.

4.3.1. Inclusion and AI Integration (Items I1, I2)

Regarding the integration of digital tools to support inclusive teaching practices, survey data indicate a high level of engagement among respondents. Specifically, 58% of participants report that they utilise digital tools to support learners with learning difficulties. In contrast, 15% indicated that they either never or only rarely employ such tools. Similarly, with respect to the adaptation of learning materials for learners with special educational needs, 57% of respondents affirm that they undertake material adaptations, while 19% report doing so never or rarely.

4.3.2. AI and Adaptive Learning (Items AD1, AD2)

In the domain of AI and adaptive learning, participants were asked to assess their confidence levels regarding the application of AI tools for personalised and differentiated instruction. 35% of respondents indicated that they feel very confident or completely confident in their ability to utilise AI tools for personalised learning for students. Conversely, an equal proportion (35%) reported feeling not confident or only slightly confident. Regarding the specific statement “I know how to use AI for differentiated instruction based on student needs”, 35% of participants responded with very confident or completely confident. Meanwhile, 34% indicated not confident or slightly not confident.

4.3.3. Gender bias in AI (GD1, GD2)

In the area of gender bias in AI, participants were asked to assess their awareness and capacity to address gender-related issues in AI-generated content and teaching contexts. Regarding the statement “I am aware of gender bias in AI-generated content”, 37% of respondents indicated that they are completely confident or very confident in their awareness. By comparison, 33% reported being not confident or only slightly confident. With respect to the statement “I know how to address gender stereotypes when using AI in teaching”, 33% of participants responded with completely confident or very confident. Meanwhile, a slightly higher proportion (37%) indicated not confident or slightly confident.

4.3.4. System Thinking (S1-S3)

In the domain of Systems Thinking, three items were drawn from this section of the questionnaire. These items were also incorporated into the ESD index, though they were not analysed in detail within that broader evaluation. Regarding the statement “I help learners understand the interconnections between environmental, social, and economic aspects of sustainability”, 75% of respondents indicated they strongly agree or agree, while 5% reported they strongly disagree or disagree. For the statement “I encourage learners to critically reflect on sustainability-related issues”, 82% of participants responded with strongly agree or agree, whereas 3% indicated disagree or strongly disagree. With respect to the statement “I support learners in analysing complex sustainability problems from multiple perspectives”, 75% of respondents agreed or strongly agreed, while 4% disagreed or strongly disagreed.

DigiSET topics

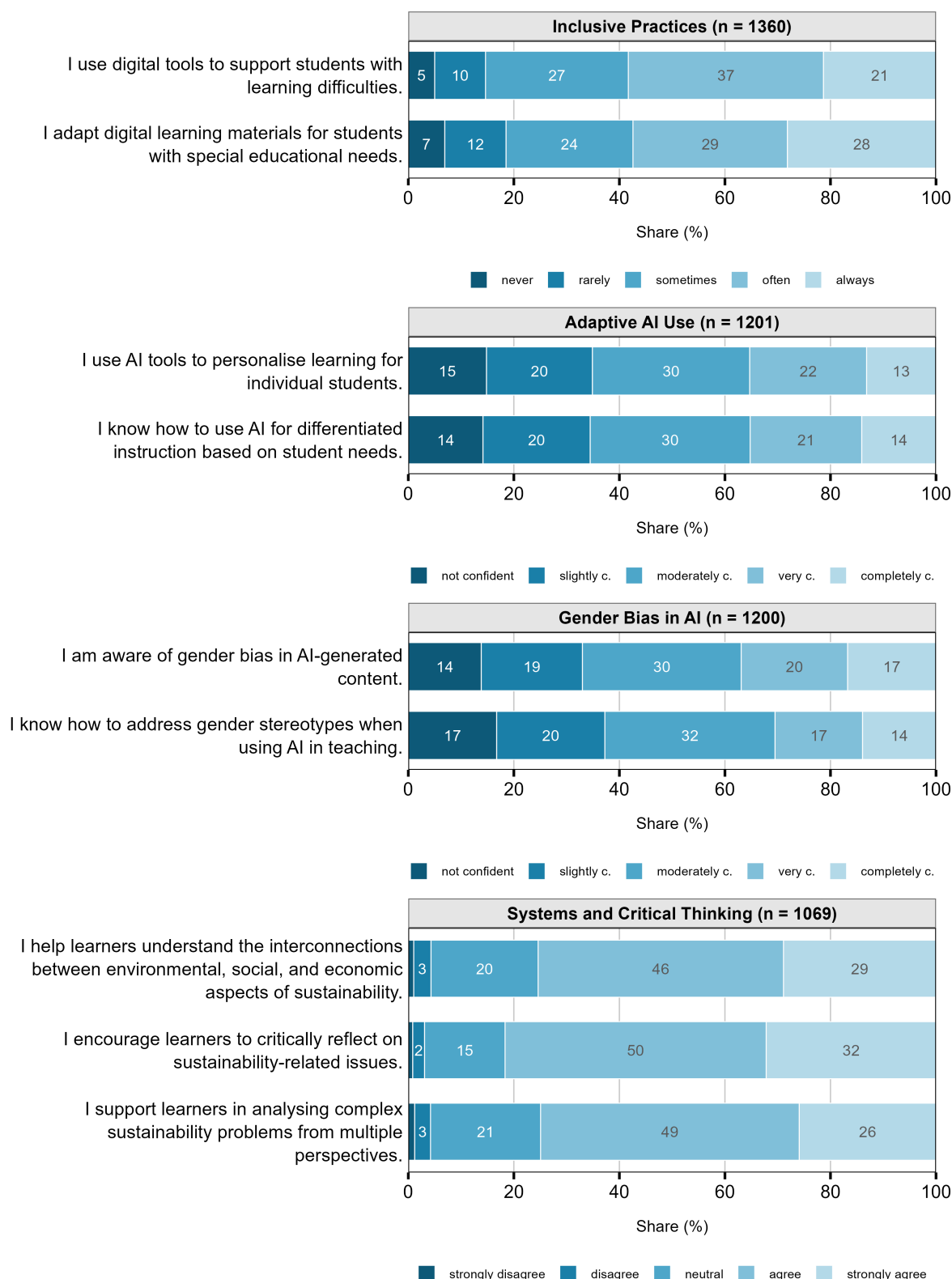


Figure 18: Competences concerning the DigiSET topics. Responses to the DigiSET teacher survey (n=1.040).

4.4. 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.

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

Figure 19 illustrates the relative demand for various training topics as reported by respondents in the DigiSET survey. The most frequently identified training need is "Using AI in teaching", selected by 43% of respondents, followed by "Creating and sharing OER" (33%), "Inclusive digital teaching" (32%), "Using adaptive learning tools" (31%), and "Ethical and responsible AI use" (29%). Less frequently mentioned topics include "Integrating sustainability into teaching" (19%) and "Systems thinking for sustainability" (19%). Although "Addressing gender bias in AI" represents a comparably specific topic, it was identified as a training need by 13% of respondents.



Figure 19: Most needed training areas. Responses to the DigiSET teacher survey (n=1.040).

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

4.4.2. Main barriers to professional development (P2)

Figure 20 presents the perceived barriers to participation in continuing professional development (CPD) reported by respondents. Time constraints emerge as the dominant obstacle, cited by over half of all participants (53%). The absence of available training programmes and suitable resources is reported by approximately one-third (34%), followed by a lack of institutional support (28%). Inadequate infrastructure, while less widespread, remains a relevant impediment for 15% of respondents—particularly within the specific thematic domains addressed by the DigiSET project.

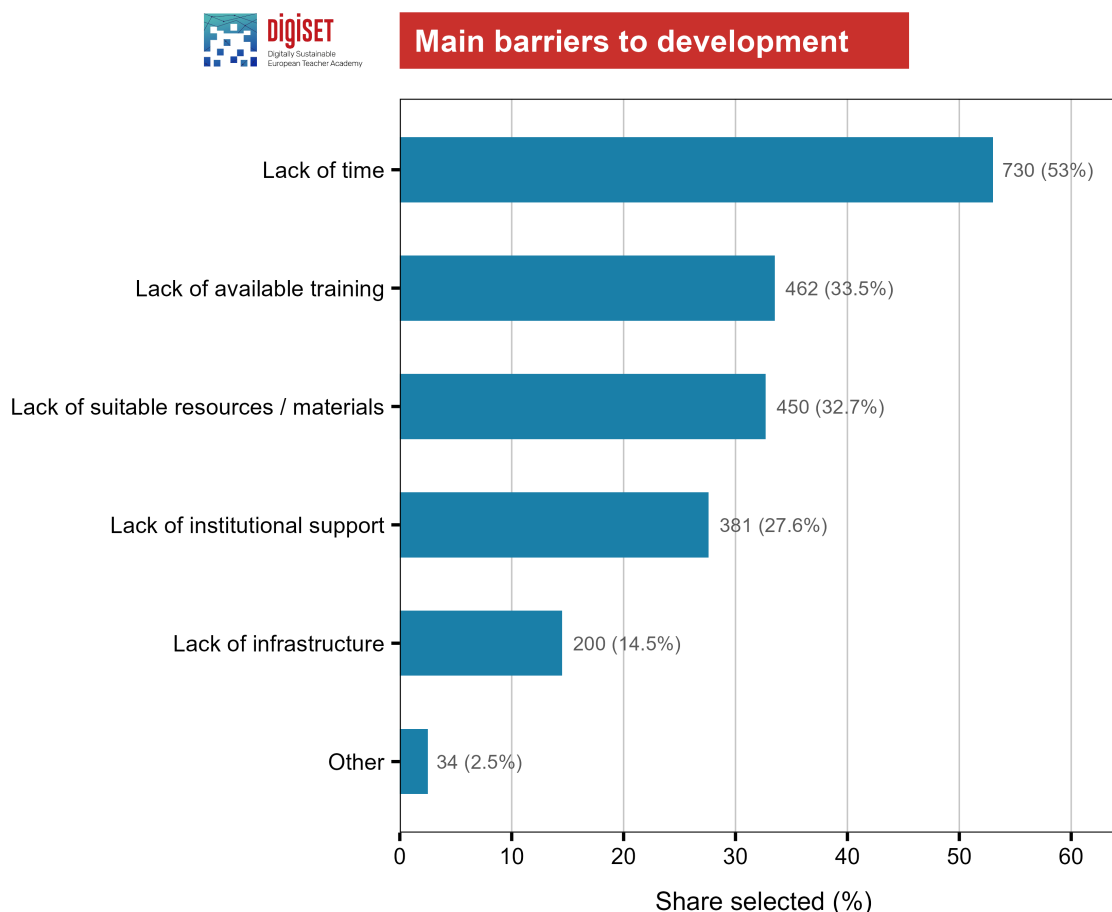


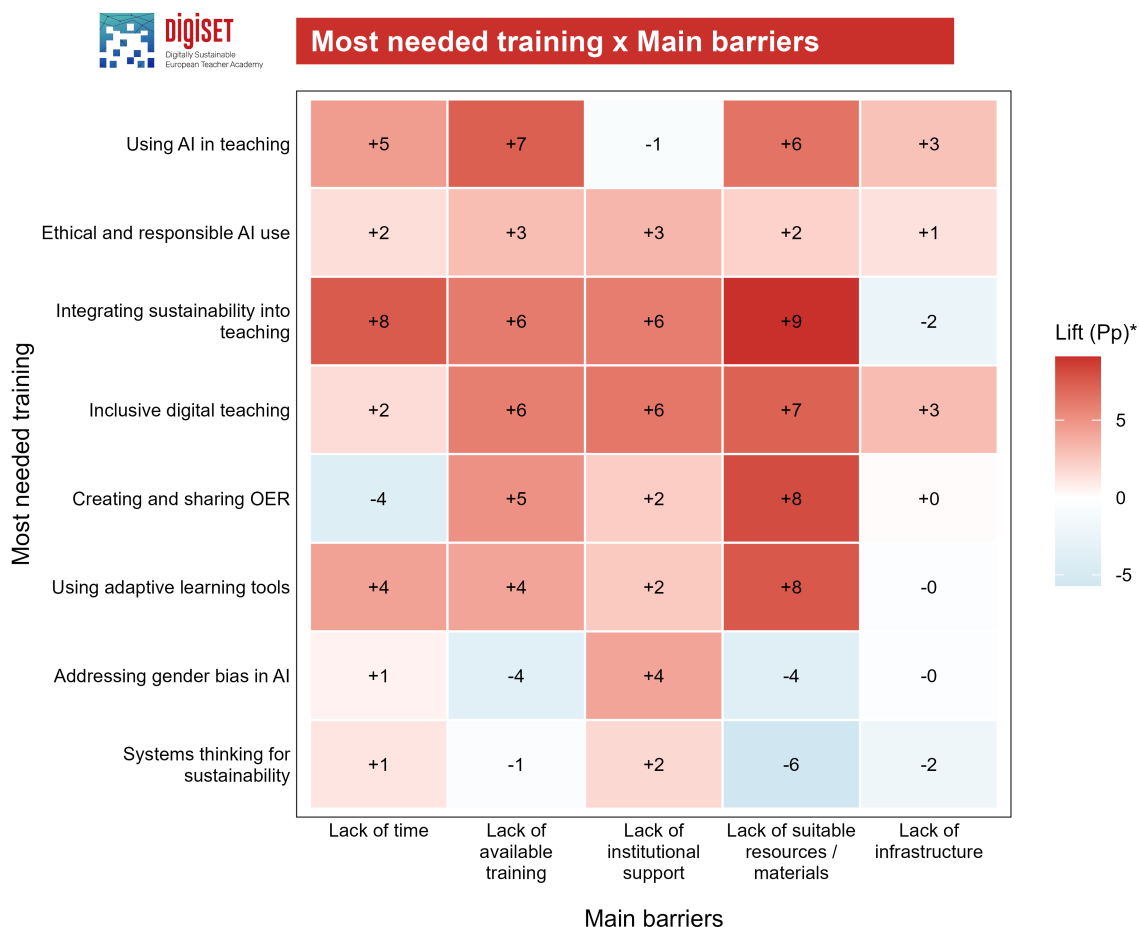
Figure 20: Main barriers to professional development in the addressed areas (n=1.040).

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

4.4.3 Priority training needs and key challenges related to main barriers

While the findings in 4.4.2 indicate that “lack of time” constitutes the predominant barrier overall, identifying topic-specific obstacles remains for developing targeted training offerings within the DigiSET framework. Accordingly, we analysed whether certain barriers are cited more frequently by individuals expressing needs for particular topics compared to those with interests in other areas.

The heat map in Figure 21 displays the difference in percentage points between the proportion selecting each barrier among respondents who indicated interest in a specific training topic versus those who did not. Positive values indicate barriers mentioned disproportionately more often by those with topic-specific training needs; negative values suggest lower relative prevalence. For instance, among respondents interested in “Using AI”, “lack of time” emerged as a barrier roughly 5 percentage points more frequently than among non-interested respondents.



* Difference in percentage points between the share selecting the barrier among those who selected the training topic and those who did not. Example: Among those who selected "Using AI", "Lack of time" was chosen about 5 percentage points more often than among those who did not. Base: at least one answer on both questions (n = 1021).

Figure 21: Heat Map for most needed trainings and main barriers. Data basis: All respondents providing valid answers to both questions (n = 1021). Responses to the DigiSET teacher survey.

Note: Multiple responses were allowed.

The analysis reveals some noteworthy patterns across the DigiSET topic areas. First, "lack of suitable resources/materials" stands out as a frequently selected barrier in five thematic areas: integrating sustainability into teaching, creating and sharing OER, using adaptive learning tools, inclusive digital teaching, and using AI in teaching. Similarly, "lack of training" is disproportionately mentioned by respondents interested in using AI in teaching, as well as those interested in integrating sustainability into teaching, inclusive digital teaching, and creating and sharing OER.

Looking at specific topics in more detail, two contrasting patterns emerge: For respondents interested in creating and sharing OER, the dominant barrier is the lack of suitable resources/materials, while lack of time carries comparatively less weight. This suggests that the primary obstacle for this group is not as often as for others scheduling but rather the availability of appropriate supportive materials. In contrast, respondents expressing interest in integrating sustainability into teaching reported barriers comparatively more frequently across the board, with the notable exception of lack of infrastructure. This indicates that individuals drawn to this topic in this sample tended to report a broader range of challenges rather than a single dominant barrier.

It is important to note that this analysis draws on pooled data across all DigiSET countries and that the observed deviations are comparatively small in magnitude. Nevertheless, these differences can provide an empirically grounded heuristic basis for prioritising the development of materials and training offerings, particularly where topic-specific barrier profiles point to targeted intervention areas.

4.5. Characteristics of respondents according to their training needs

In the DigiSET project, a training program for digitally sustainable teachers is being developed. While the core thematic areas are clearly defined, the precise delimitation and combination of focus areas remain partially flexible. In the DigiSET survey questionnaire, the topics were queried as follows (see Section 4.4.1):

- Topic "Using AI in teaching"
- Topic "Ethical and responsible AI use"
- Topic "Integrating sustainability into teaching"
- Topic "Inclusive digital teaching"
- Topic "Creating and sharing OER"
- Topic "Using adaptive learning tools"
- Topic "Addressing gender bias in AI"
- Topic "System thinking for sustainability"

Some of these topics are implemented more or less directly one to one. For example, the online training at PBUi (Virtual COIL) planned for spring 2028 will address “OERs for Gender-unbiased AI Teaching: Identifying and mitigating bias in AI educational tools”, while at UNISI (Virtual COIL) the focus will be on “OERs for Systems Thinking for Sustainability, using AI modeling to demonstrate complex sustainability systems”. For other topics, no direct transfer is possible; for instance, at TUG (In-person), an offering titled “AI-powered OERs for Adaptive Learning and Inclusion: Implementing AI for personalized learning pathways for students with learning difficulties” is planned, meaning that responses to "Using adaptive learning tools" and "Inclusive digital learning" are of particular interest here. Collectively, four of the five highest-ranked professional development needs relate directly to AI, digital teaching, or OER. This concentration may indicate that respondents perceive the digital transformation agenda as requiring more immediate support than sustainability-related pedagogical development.

For the project, it is important to better understand the characteristics of individuals who are interested in the different topics. This enables trainers and material developers to address specific needs where applicable and, pragmatically, to tailor offerings appropriately for the most interested target groups.

As a working foundation for this further development, we present below descriptive statistical analyses in the form of lollipop diagrams showing the percentages of respondents interested in each of the aforementioned topics (where multiple responses were permitted).

4.5.1. Topic “Using AI in teaching”

The first lollipop diagram (see Figure 22) shows respondents' characteristics who selected the topic "Using AI in teaching" as training need. This topic constitutes a comparatively broad thematic area that, by its nature, also tends to appeal to individuals at an entry level. This assumption is supported by the data: Interest in this topic is predominantly expressed by respondents who exhibit low composite index scores across the related domains of digital teaching, AI, OER, and ESD competences. This pattern indicates that the topic attracts an

audience with limited prior engagement in these fields rather than those already advanced in digital or AI-related teaching practices.

A noteworthy finding emerges from the country-level comparison. Despite Spain recording the highest value for “AI in Teaching” in the cross-country comparison (see Section 4.2), Spanish respondents still display a markedly high proportion of interest in this topic. This is followed by respondents from Türkiye, Ireland, and Italy. The sustained interest in Spain therefore does not appear to diminish with higher overall engagement levels, suggesting a broadly distributed demand for AI-related teaching content among Spanish educators.

With regard to school subjects taught, no substantial deviations are observed across disciplines. The sole exception is Computer Science and related subjects, where the proportion of interested respondents is notably the lowest. This is an intuitively plausible finding, as educators in these fields are likely to already possess a higher degree of AI literacy, reducing their need for introductory content on the topic.

Examining teaching experience further refines the respondent profile. Contrary to what the low index scores might initially suggest, interest appeared to stem mainly from educators with several years of professional experience, particularly in the 5–15 years bracket, as well as those teaching at the lower secondary level. This suggests that the appeal of “Using AI in Teaching” extends to practitioners seeking to integrate emerging technologies into their established teaching routines rather than to novices at the outset of their careers.

Who selected "Using AI in teaching"?

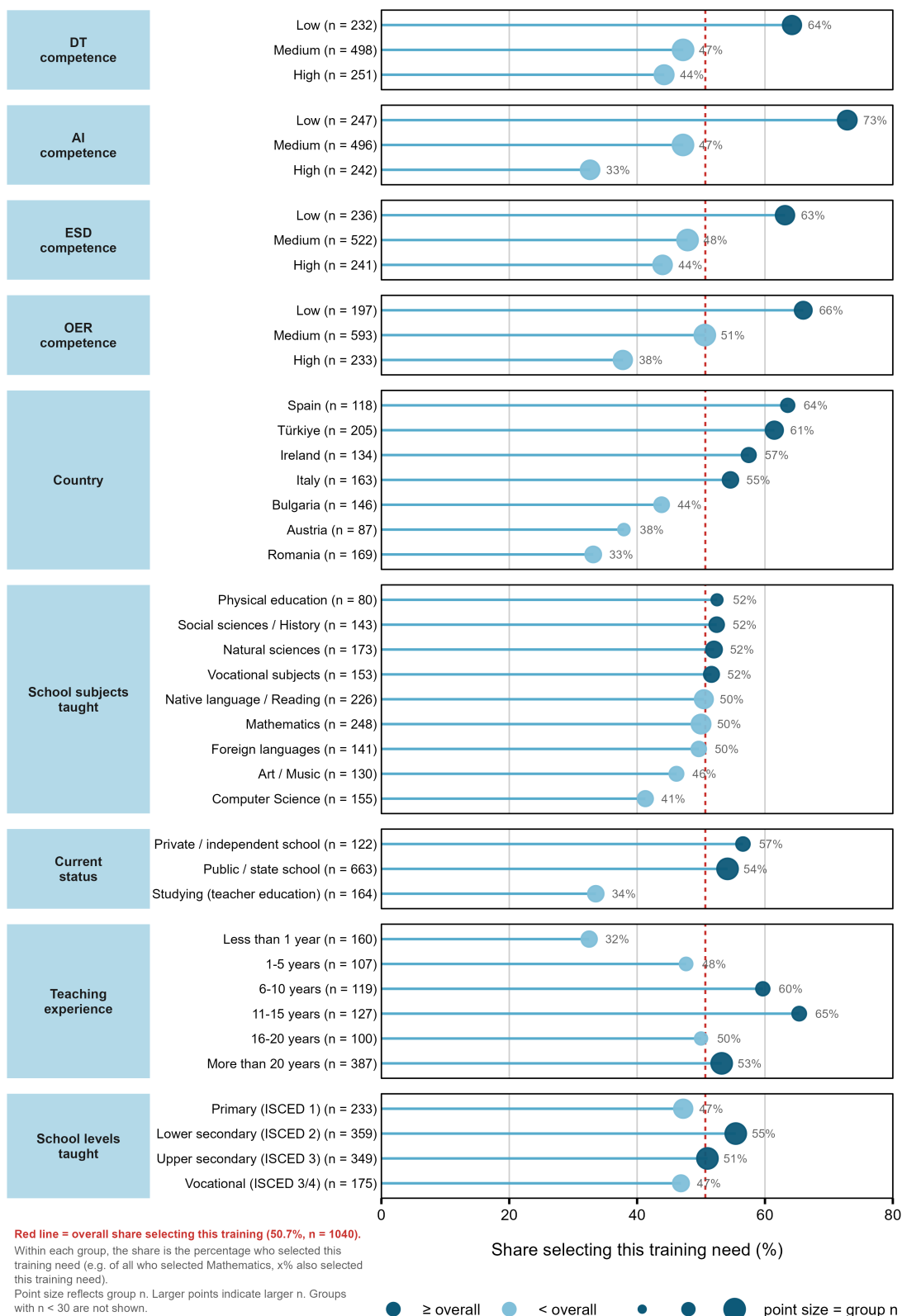


Figure 22: Lollipop diagram of respondents' characteristics who selected the topic "Using AI in teaching" as training need. Data basis: All respondents providing valid answers to this need (n = 1040).

Note: Multiple responses for needs were allowed.

4.5.2. Topic “Ethical and responsible AI use”

The topic “Ethical and responsible AI use” is selected slightly more frequently by individuals with low to medium AI competence, medium digital teaching experience, and medium OER experience, as well as low ESD) competence (see Figure 23). Specifically, respondents from Bulgaria, Ireland, and Italy show particular interest in this topic. Teachers of natural sciences and art/music are somewhat more interested than those teaching other school subjects. Additionally, this topic attracts more experienced teachers with 20 or more years of teaching experience. Vocational teachers show lower interest compared to teachers at primary and secondary school levels.

Who selected "Ethical and responsible AI use"?

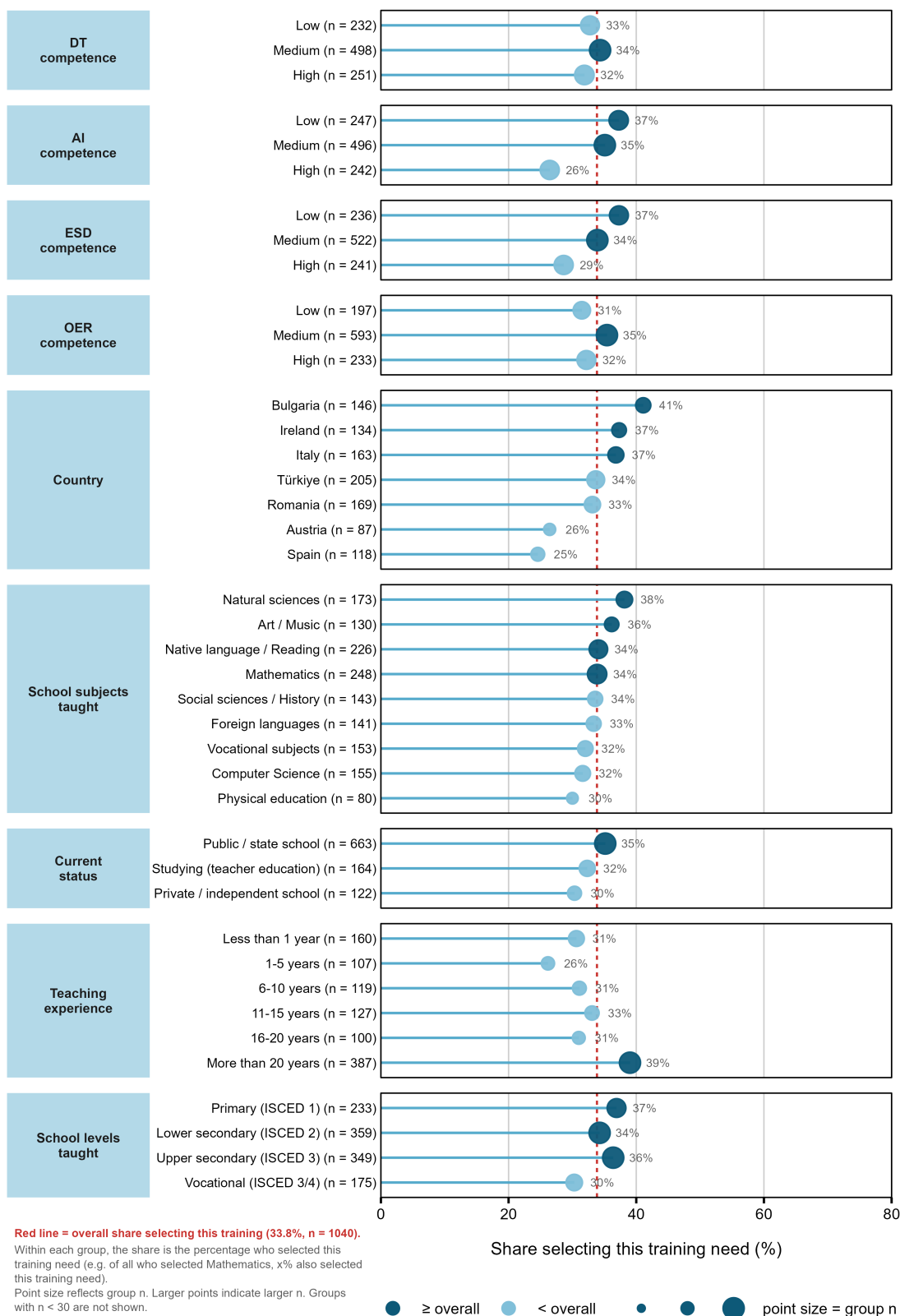


Figure 23: Lollipop diagram of respondents' characteristics who selected the topic "Ethical and responsible AI use" as training need. Data basis: All respondents providing valid answers to this need (n = 1040).

Note: Multiple responses for needs were allowed.

4.5.3. Topic “Integrating sustainability into teaching”

Figure 24 shows the respondents' characteristics who selected the topic “Integrating sustainability into teaching” as training need. Sustainability integration is of greater interest to respondents with low or medium ESD competence, as well as to those with medium Digital Teaching experience, medium OER experience, and high AI competence. It attracts respondents from Türkiye, Ireland, and Bulgaria more frequently than from other countries; specifically Spanish and Austrian respondents are less interested. Respondents who teach computer science or physical education show particular interest in this topic, whereas respondents who teach natural sciences, vocational subjects, and art/music are least interested. Among respondents with 1–5 years and 16–20 years of teaching experience, interest is higher than among other experience groups. Interest is also slightly greater among respondents who teach at primary and lower secondary school levels.

Who selected "Integrating sustainability into teaching"?

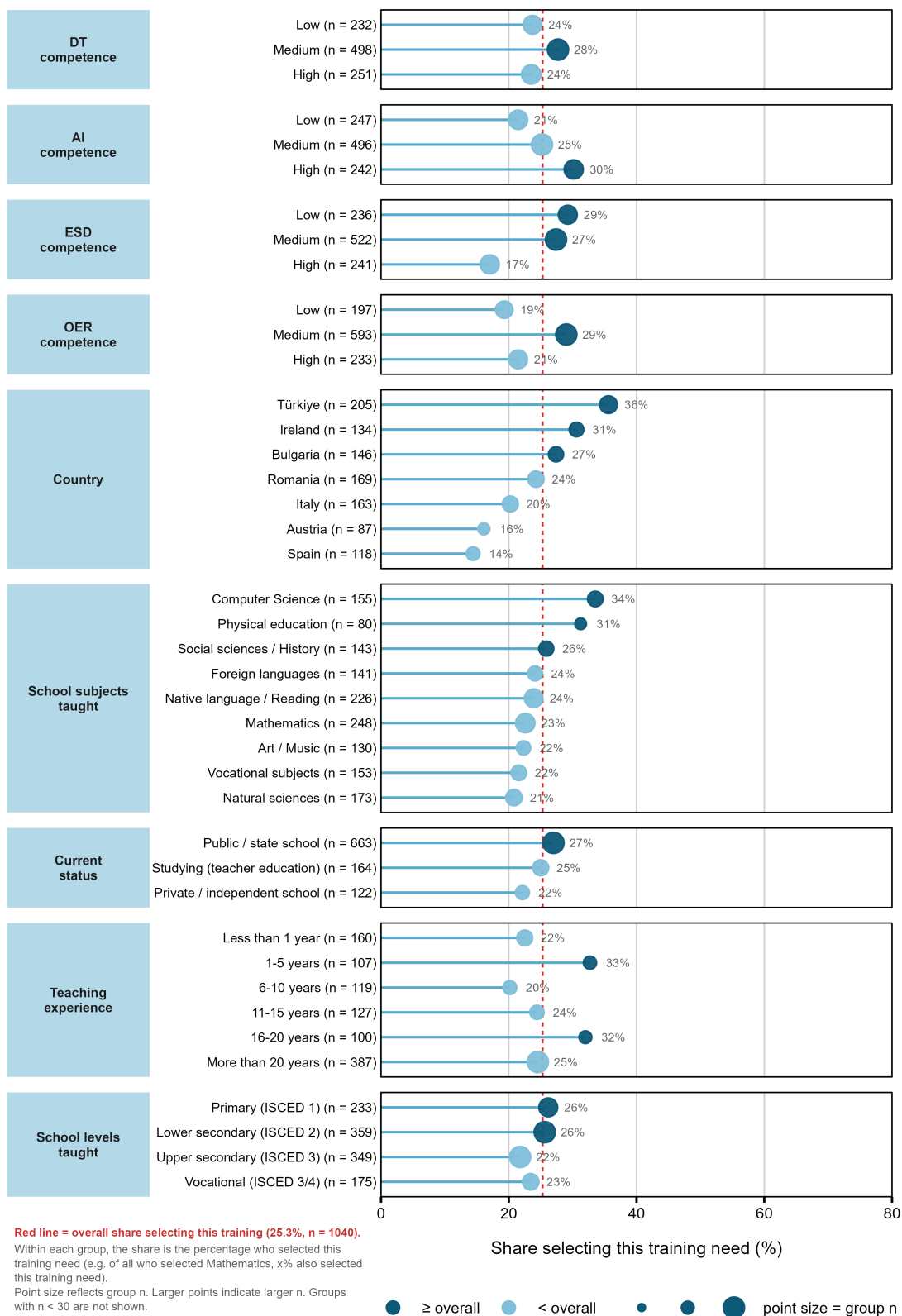


Figure 24: Lollipop diagram of respondents' characteristics who selected the topic "Integrating sustainability into teaching" as training need. Data basis: All respondents providing valid answers to this need (n = 1040).

Note: Multiple responses for needs were allowed.

4.5.4. Topic “Inclusive digital teaching”

The topic “Inclusive digital teaching” presents a highly varied but not particularly specific interest profile across the four indices in Figure 25: respondents tend toward lower digital teaching competence, higher AI competence, higher ESD competence, and either low or high OER competence. The country-level interest is more pronounced: Austrian respondents are particularly interested, followed by those from Türkiye, Romania, and Ireland. Bulgarian respondents show the lowest level of interest. Regarding school subjects, there is somewhat greater interest among teachers of natural sciences, foreign languages, and mathematics, while art/music teachers show the least interest. Early-career teachers (those with less than one year or 5–10 years of teaching experience) and those teaching at the secondary school level tend to show greater interest.

Who selected "Inclusive digital teaching"?

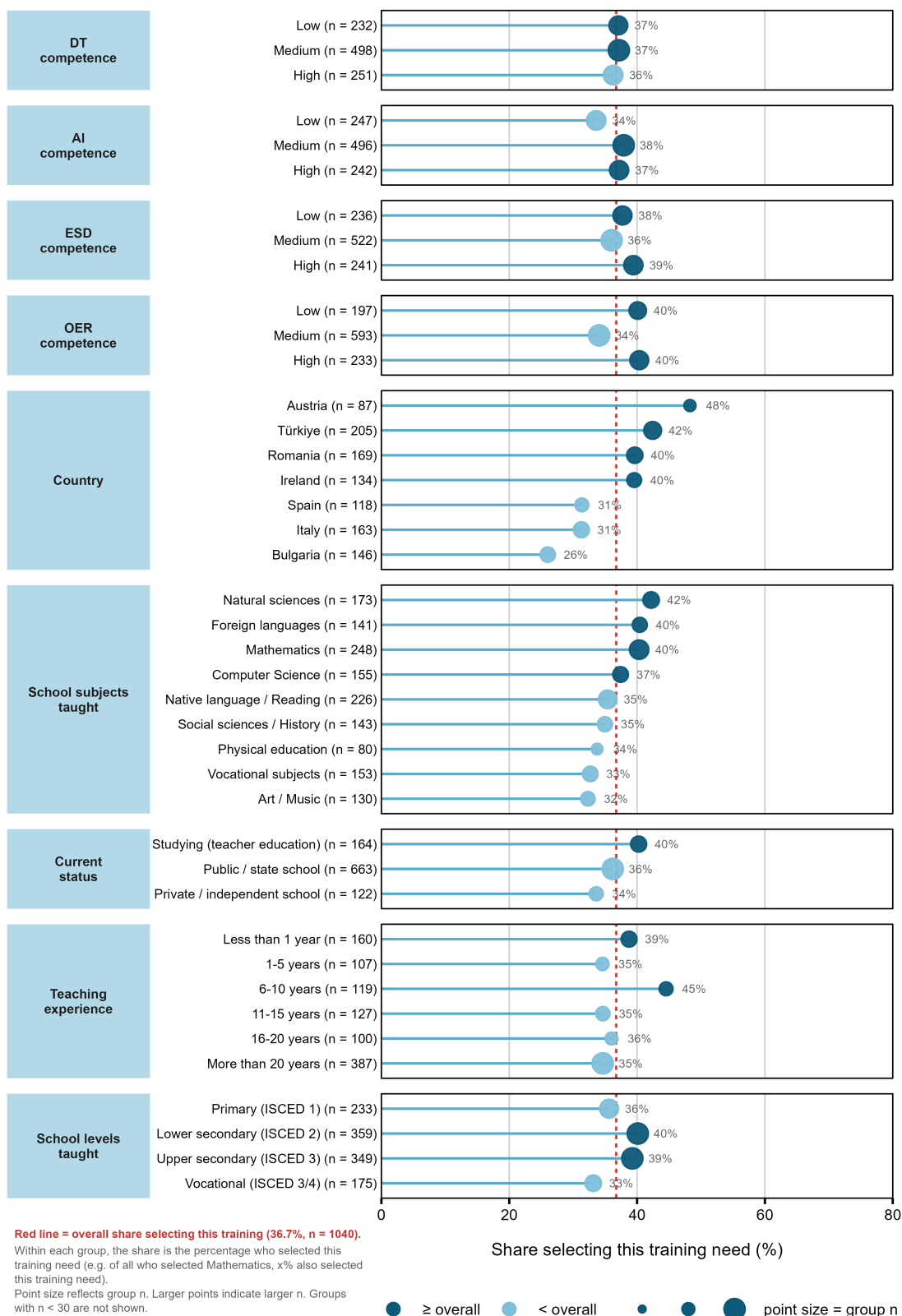


Figure 25: Lollipop diagram of respondents' characteristics who selected the topic "Inclusive digital teaching" as training need. Data basis: All respondents providing valid answers to this need (n = 1040).

Note: Multiple responses for needs were allowed.

4.5.5. Topic “Creating and sharing OER”

The topic “Creating and sharing OER” (see Figure 26) is of greatest interest to respondents with low OER competence scores, as well as to those with high or medium ESD competence. Interest is higher among respondents from Spain and Italy, whereas interest from Bulgaria and Türkiye is comparatively lower. Greater interest in this topic is shown by teachers of vocational subjects, social sciences/history, and foreign languages, while art/music and physical education teachers show the least interest. This topic is of relatively higher interest to respondents who are still studying, those working at private/independent schools, and those with short teaching experience (less than one year or 1–5 years). The group with 16–20 years of teaching experience also shows above-average interest, whereas those with 11–15 years of experience are least interested. Consistent with the pattern observed for school types and subjects, respondents working at vocational schools are more

frequently interested in the topic of creating and sharing OER.

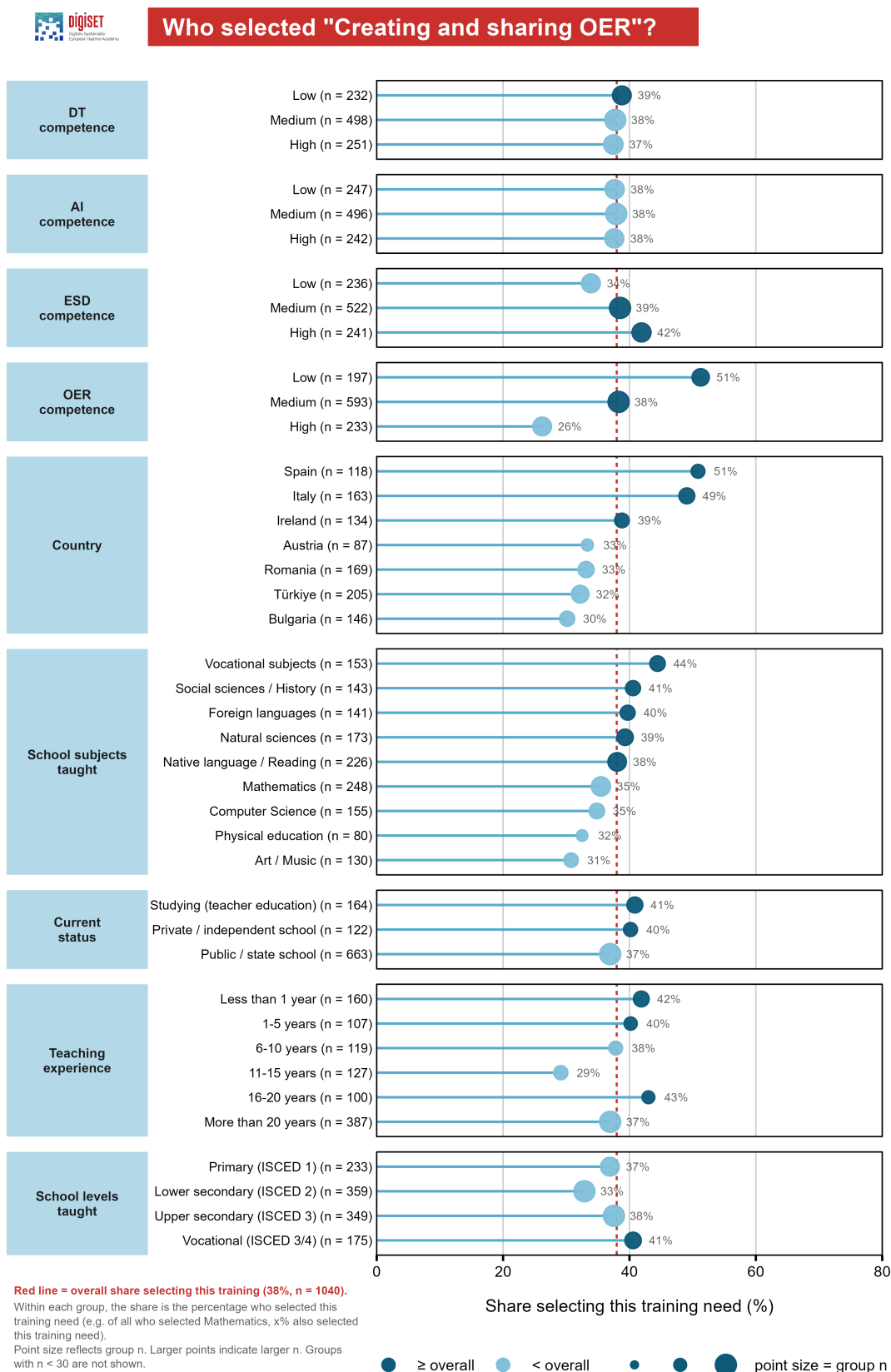


Figure 26: Lollipop diagram of respondents' characteristics who selected the topic "Creating and sharing OER" as training need. Data basis: All respondents providing valid answers to this need (n = 1040).

Note: Multiple responses for needs were allowed.

4.5.6. Topic “Using adaptive learning tools”

As shown in Figure 27, the topic “Using adaptive learning tools” appears to be of greater interest to participants with medium digital teaching competence, medium or high AI competence, high or medium ESD competence, and high or medium OER competence. Specifically, respondents from Bulgaria, Ireland, and Austria are more interested, while those from Spain and Türkiye show the least interest. People who teach vocational subjects, social sciences/history, natural sciences, and mathematics are slightly more frequently interested than those teaching art/music, foreign languages, or physical education. Teachers from public/state schools are more represented than other institutional status groups. Many have more than 20 years of experience, but there is also a substantial group of teachers with 1–10 years of experience who show greater interest in the topic than other experience groups. Interest is higher among secondary and vocational school levels compared to primary schools.

Who selected "Using adaptive learning tools"?

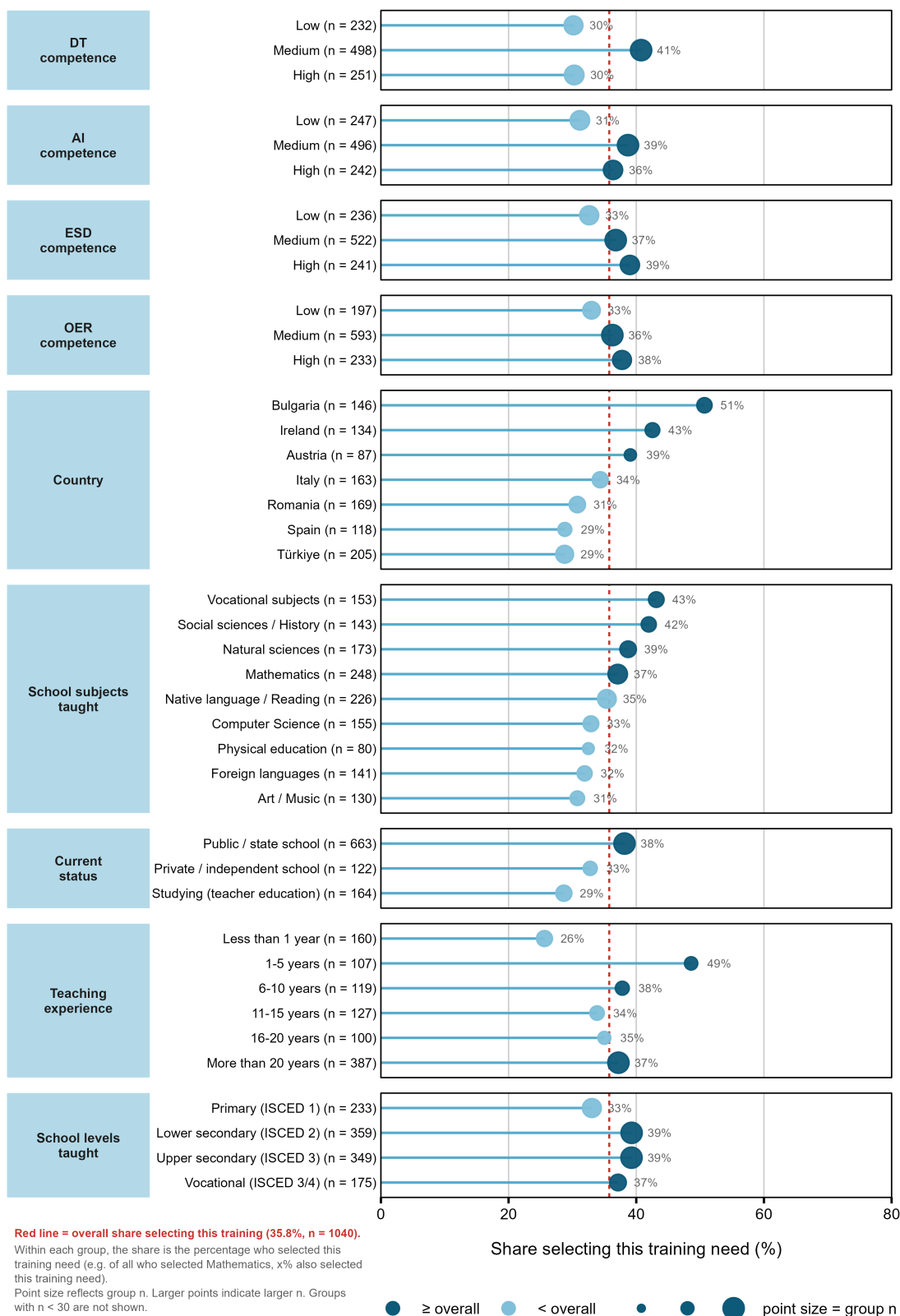


Figure 27: Lollipop diagram of respondents' characteristics who selected the topic "Using adaptive learning tools" as training need. Data basis: All respondents providing valid answers to this need (n = 1040)

Note: Multiple responses for needs were allowed.

4.5.7. Topic “Addressing gender bias in AI”

The topic “Addressing gender bias in AI” is of greater interest to people with medium and high AI competence, high Digital Teaching competence, high OER competence, as well as higher ESD competence. Specifically, respondents from Ireland and Spain are interested in the topic, while those from Bulgaria show the least interest. Regarding school subjects taught, respondents who teach art/music, physical education, social sciences/history, native language/reading, and several other subjects are more interested than average. Only respondents teaching foreign languages are less interested than average in this topic. Particularly interested groups include respondents from private/independent schools and those currently studying. Regarding teaching experience, interest is higher among those with little experience or 11–20 years of experience. Respondents with more than 20 years of teaching experience show comparatively less interest. Regarding school level, educators at vocational and primary levels are more interested.

For this topic, we additionally examined potential gender differences in responses and conducted a subgroup analysis by gender. The results indicate minimal variation across gender groups: 15.3% overall, with 15.5% for women (n=741) and 16.2% for men¹. With a range of only 0.7 percentage points between the highest and lowest values, perceptions regarding the importance of addressing gender bias in AI were largely consistent across gender groups in our sample.

¹ The fact that the overall mean lies under the two gender-specific values is due to the responses that represent learning needs/interest and are included here, but where gender is not male/female or unavailable. All persons who did not indicate male/female collectively account for 10% of the sample. These numbers are relatively small in total (2 non-binary respondents with 0%; 26 “prefer not to say” with 15.4%; 42 who omitted the gender question with 7.1%). Thus, both men and women selected this item slightly more frequently than the overall sample of all people who answered item P1 I in the DigiSET survey.

Who selected "Addressing gender bias in AI"?

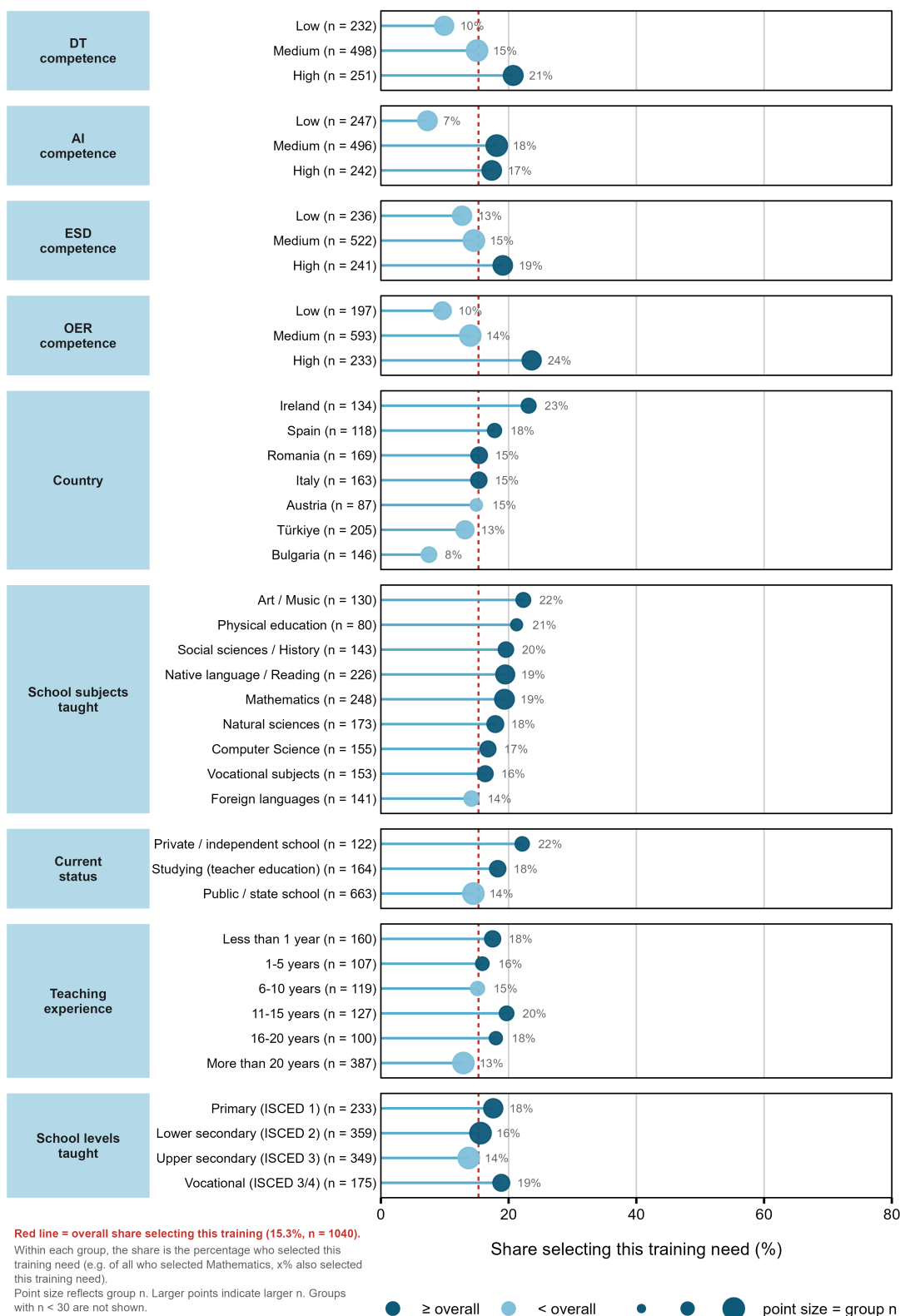


Figure 28: Lollipop diagram of respondents' characteristics who selected the topic "Addressing gender bias in AI" as training need. Data basis: All respondents providing valid answers to this need (n = 1040).

Note: Multiple responses for needs were allowed.

4.5.8. Topic “Systems thinking for sustainability”

Respondents interested in the topic “Systems Thinking for Sustainability” somewhat more frequently have medium ESD competence, tend toward higher AI and OER competence, and tend toward high or medium Digital Teaching competence. Across the DigiSET countries, the proportion is higher among Bulgarian, Austrian, Romanian, and Turkish respondents, while respondents from Spain, Italy, and Ireland are less interested. Regarding school subjects, a similar pattern emerges as for “Integrating Sustainability into Teaching”: particularly respondents who teach computer sciences, but also those who teach foreign languages and mathematics, show greater interest. Interest is notably lower among respondents who teach vocational subjects, physical education, or social sciences/history. Regarding teaching experience, the groups with more extensive experience (16 or more years) and those with very little experience (less than one year) show elevated interest. At the school level, educators in the secondary vocational sector are somewhat more frequently interested.

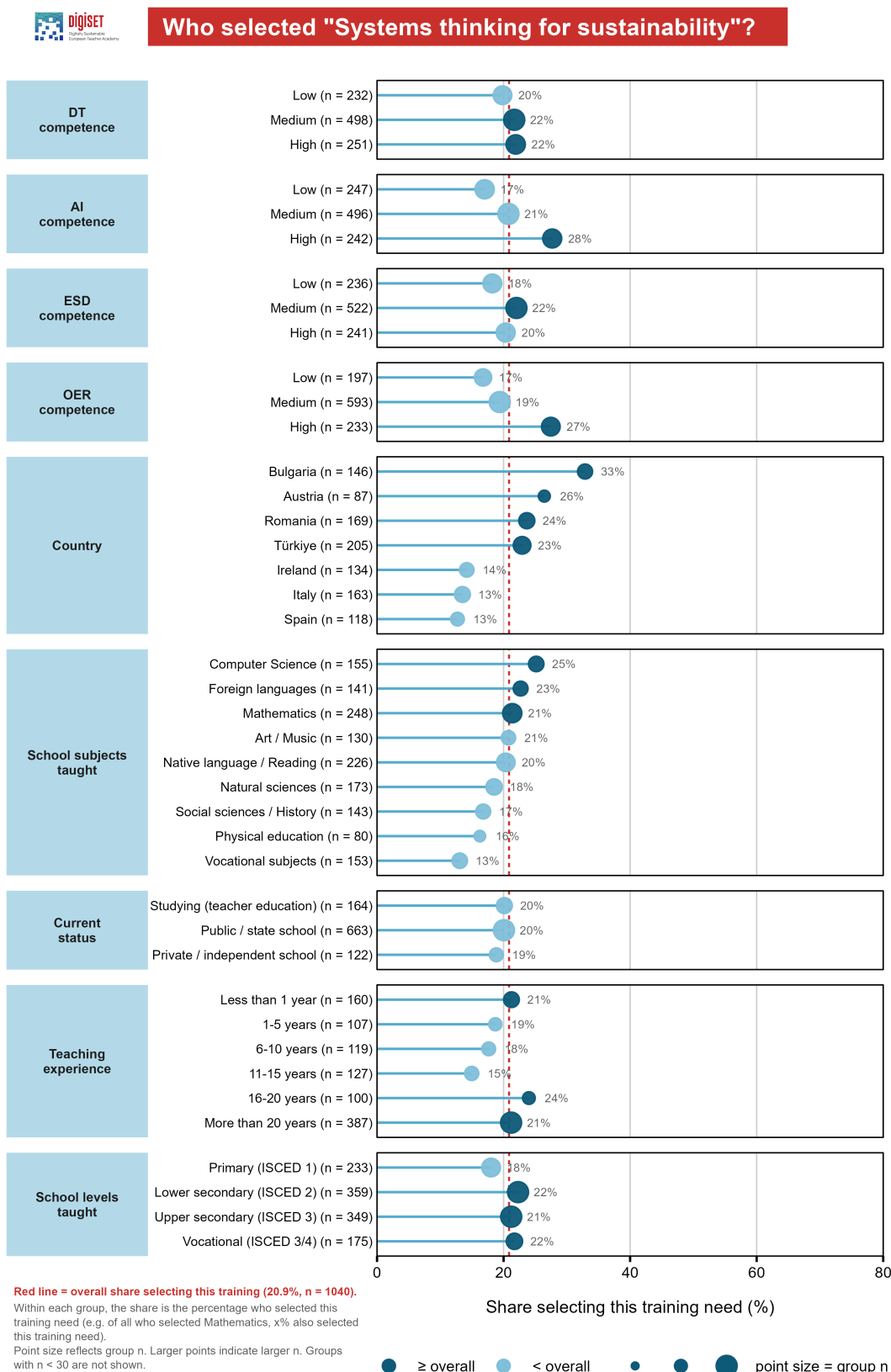


Figure 29: Lollipop diagram of respondents' characteristics who selected the topic "System thinking for sustainability" as training need. Data basis: All respondents providing valid answers to this need (n = 1040).

Note: Multiple responses for needs were allowed.

5. Discussion and implication for DigiSET and beyond

This section synthesizes and critically discusses the key findings from the DigiSET teacher survey, contextualising them within the project's goals for developing a European Academy for digitally sustainable teaching. Crucially, interpretations must account for significant methodological limitations—particularly regarding sample representativeness—which fundamentally shape how results can be generalised. Furthermore, it should be noted that the competence indices comprise only a small number of statements relating to concrete actions.

5.1. Key results concerning teachers' competences

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

Across all four competence domains, a consistent descriptive hierarchy emerged in self-perceived abilities (ESD > digital teaching > OER > AI). ESD receives the highest ratings overall (medians typically >4.0), followed by digital teaching competences (medians ~3.5–4.0). In contrast, AI and OER competences are rated considerably lower, with AI showing the largest proportion of respondents indicating no prior knowledge.

Notably, the strongest correlation exists between digital teaching and AI competence ($r = 0.66$), suggesting substantial overlap in foundational digital literacy. Conversely, AI and ESD ($r = 0.37$) are more weakly related than the others, indicating that teachers confident in sustainability education do not necessarily feel prepared for AI integration, and vice versa. This finding may represent partially distinct communities. If confirmed in further research, this would argue for parallel training pathways within DigiSET.

For OER specifically, the data indicate that while teachers possess basic IT skills, familiarity with copyright/licensing frameworks (key components of OER competence) remains limited. This points to a need for both technical and legal foundations in OER training modules.

5.1.2. Teachers' competence concerning the four DigiSET topics

When examining the four thematic focus areas defined by DigiSET, a clear hierarchy becomes apparent as shown in:

Table 4: DigiSET topics ranked according to respondents' confidence

Topic	High-confidence respondents	Low/no-confidence respondents
Systems thinking	~75–82%	~3–5%
Inclusion & AI integration	~57–58%	~15–19%
AI & adaptive learning	~35%	~34–35%
Gender bias in AI	~33–37%	~33–37%

Systems thinking stands out as the area where teachers feel most prepared, reflecting possibly greater familiarity with sustainability-related pedagogical frameworks already integrated into teacher education programs. Inclusion practices show moderate confidence levels, though approximately one-fifth report never or rarely adapting materials for learners with special educational needs—a notable gap given inclusive education's centrality to contemporary pedagogy.

For AI-related topics (adaptive learning, gender bias), the split between high and low confidence is nearly equal (~35% each). This indicates a population that is polarized: a

segment already engaging with AI tools coexists with a substantial group lacking foundational knowledge or pedagogical strategies.

Critically, the lower selection rate for specific topics like “Addressing gender bias in AI” (13% training need) should not be interpreted as lower priority. More plausibly, it may reflect a training hierarchy: respondents are likely to first seek foundational AI competences before addressing specialised ethical considerations. Once baseline capabilities are established, awareness-raising around bias and ethics can be integrated into advanced modules.

5.1.3. The implementation gap: Discrepancies between attitudes and classroom practice

While the overall competence indices suggest moderate to high self-perceived abilities, a deeper analysis of sub-dimensions reveals a critical “implementation gap”. Across all three multi-dimensional indices (Digital Teaching, AI, and ESD), teachers tended to rate their values, beliefs, and theoretical knowledge higher than their pedagogical application and assessment practices:

- ESD Domain: Teachers express strong personal commitment to sustainability values (highest sub-score), yet report the lowest confidence in translating these into concrete classroom pedagogy. This suggests that while the motivation for ESD is present, the methodological toolkit to operationalize it is missing.
- Digital Teaching & AI: Similarly, teachers feel confident in sourcing digital resources or understanding AI concepts but struggle with the advanced integration required for assessment (monitoring progress via data) and didactic design (combining tools with subject matter).

This pattern indicates that current professional development often succeeds in raising awareness and shifting mindsets but fails to provide the practical, ready-to-use strategies needed for daily teaching. The primary bottleneck may lie not in willingness but in the availability of actionable pedagogical models.

5.1.4 Independence of AI and ESD competence domains

The correlation pattern between digital teaching, AI, OER and ESD observed in the DigiSET survey reveals an important structural feature of teacher competences: while the three digitally-oriented indices (digital teaching, AI, and OER) show moderate to strong intercorrelations ($r = 0.51\text{--}0.66$), indicating they share common underlying digital literacy skills, AI and ESD operate as largely independent domains. With a correlation coefficient of $r = 0.37$, the relationship between AI competence and ESD competence is substantially weaker than any other pairwise association among the four indices, which corresponds to roughly 14% of shared variance within this sample. This should not be read as a precise estimate for the wider teacher population, given the self-report nature and the selective sample; the key takeaway is the descriptive dissociation of the two domains. Proficiency in one domain does not reliably predict proficiency in the other: Teachers who score high on ESD items may have comparable baseline AI knowledge to those scoring low, and conversely, AI-capable teachers are not necessarily equipped with sustainability pedagogy. Furthermore, this independence is compounded by the fact that even within domains where teachers feel theoretically prepared (like ESD values), the translation into practice remains weak, suggesting that 'competence' cannot be assumed from attitude alone.

Further evidence supports this interpretation of domain independence. The competence hierarchy is consistent across all countries: ESD medians consistently exceed AI scores, often by substantial margins (e.g., Spain: ESD 4.46 vs. AI 3.63; Italy: ESD 4.31 vs. AI 2.94; Türkiye: ESD 4.00 vs. AI 3.25). This gap reflects qualitatively different adoption stages rather than mere differences in magnitude. ESD-related items, such as systems thinking, received 75–82% agreement rates, indicating broad professional consensus, whereas AI-specific items (adaptive learning, gender bias awareness) produced near-even splits ($\approx 35\%$

confident vs. $\approx 35\%$ not confident), signalling active polarisation rather than gradual diffusion. Training needs appear to mirror this asymmetry: Only 19% of respondents identified “integrating sustainability into teaching” as a training need, while 43% selected “using AI in teaching”, suggesting that sustainability is widely perceived as an existing professional capability whereas AI is recognised as a novel domain requiring deliberate skill development. Finally, barrier profiles tended to diverge: Respondents interested in sustainability training reported barriers comparatively evenly distributed across all categories, while AI-interested respondents showed sharper, more concentrated peaks on specific obstacles such as lack of training” and “lack of suitable resources”.

Taken together, the independence of AI and ESD competences, their differing stages of professional integration, and their divergent barrier profiles argue for a modular, multi-entry training architecture with flexible pathways and optional bridging modules connecting the two domains where synergies exist. As discussed later in Section 5.4, sampling limitations mean these patterns reflect the aggregated sample rather than representative populations. Objective assessments and cluster analyses in future research would help validate whether these domains are truly independent.

5.2. Consequences from the results for the DigiSET project

The following recommendations are derived from exploratory, descriptive patterns in a non-probability sample. They are intended as empirically informed starting points for design decisions, to be revisited as the training programme generates feedback and further evidence becomes available. It is arguable that the findings are particularly timely given recent European policy developments. The emergence of AI literacy requirements, alongside continued implementation of GreenComp and DigCompEdu frameworks, places increasing expectations on teachers to integrate both digital and sustainability competences into their practice. The DigiSET findings suggest that professional development systems will need to support these agendas simultaneously rather than treating them as separate policy priorities.

5.2.1. Implications for the DigiSET competence framework

The survey findings offer heuristic orientation for structural decisions for the DigiSET Framework of Learning Outcomes that should shape its architecture.

- Focus on “How-to” over “Why”: The framework the framework should give priority to applied pedagogical competences over theoretical knowledge. Since values and attitudes are already high (especially in ESD), training modules should skip basic awareness-raising and focus immediately on practical implementation strategies, such as: Concrete lesson plans for integrating sustainability into specific subjects; step-by-step guides for using digital assessment tools; templates for adapting AI tools for differentiated instruction.
- The framework should organise competence around four parallel pillars rather than a hierarchical model. ESD and digital teaching form foundational enabling competences, but AI appears warranted as an independent pillar, not merely a sub-component. The weak correlation between AI and ESD competences ($r = 0.37$) is consistent with the interpretation of distinct capacity needs. OER likewise deserves separate treatment as a pillar encompassing both technical skills and legal dimensions such as copyright and licensing. While all four pillars are structurally equal, the three digitally-oriented domains (digital teaching, AI, OER) share common underlying competences and can be grouped, whereas ESD operates as an independent pillar with its own developmental trajectory.
- The four DigiSET topics function as transversal perspectives that cut across all pillars, but at different progression levels (see Table 4, p. 49). Systems thinking, given its broad professional consensus (75–82% agreement), serves as a foundational lens already familiar to many teachers. Inclusive Practices and Adaptive

AI Use represent applied competences requiring concrete pedagogical integration, positioned at the application tier. Gender bias in AI, showing the lowest awareness levels across the sample, constitutes an advanced, critically reflective perspective best positioned at the leadership tier, where it informs principled AI adoption and content evaluation. This graduated placement is intended to prevent overloading foundational modules with novel, contested topics while ensuring all four perspectives are addressed as teachers progress through the framework.

- Then, the framework should define three progression tiers—e.g. foundation, application, and leadership—but allow asynchronous entry. A teacher strong in ESD but new to AI may enter the ESD pillar at the application level while starting at foundation for AI. This flexibility acknowledges the heterogeneous starting points revealed in the survey data.
- Finally, the framework should acknowledge that AI and ESD, while independent pillars, share intersection points where cross-domain competences emerge. These intersections should be explicitly defined as bridging learning outcomes to prevent domain siloing.

In summary, the proposed structure consists of four parallel pillars (ESD, Digital, AI, OER), four transversal themes on different level (adaptive AI, bias awareness, inclusion, systems thinking) as shown in Figure 30.

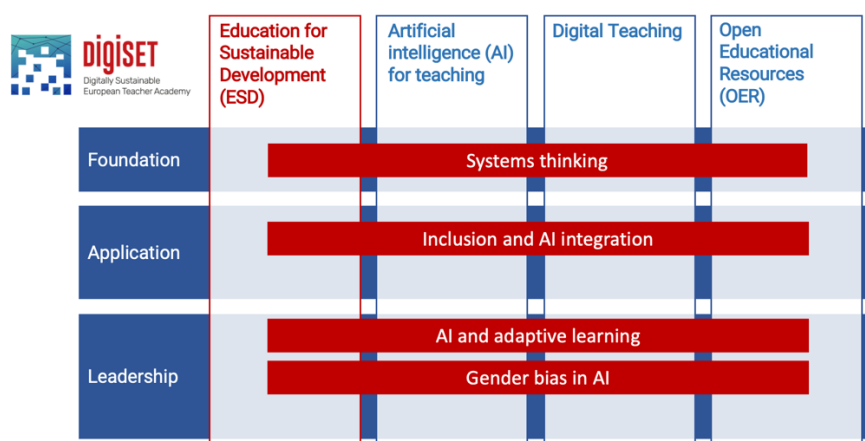


Figure 30: A sketch of the DigiSET competence framework based on results of the DigiSET survey.

5.2.2. DigiSET's multi-entry architecture

The findings argue heuristically for a flexible, multi-entry modular architecture rather than a linear "foundation-first" approach for the academy for digital sustainable teaching. Given the heterogeneity of the sample and the weak correlation between ESD and AI competences, teachers will arrive with divergent starting points.

Each pillar defines entry criteria for each tier, allowing learners to commence at the level matching their demonstrated competence. For example, a teacher with extensive sustainability experience but limited AI exposure may enter the ESD pillar at application level while beginning AI at foundation level.

Entry placement may be self-assessed ("Self Check") using a simplified competence check derived from the DigiSET survey instrument, or validated through portfolio review where institutional capacity permits. Based on self-assessment results, individualised recommendations for foundational and advanced modules could be generated.

Figure 31 shows how different starting points might be located: Teacher A is very interested and as well experienced in using AI for teaching, specifically for teaching preparation and material development and is now interested to better support students with learning challenges. Teacher B has extensive sustainability experience but limited AI exposure, for instance, might be advised to begin with AI baseline modules while skipping or refreshing ESD content.

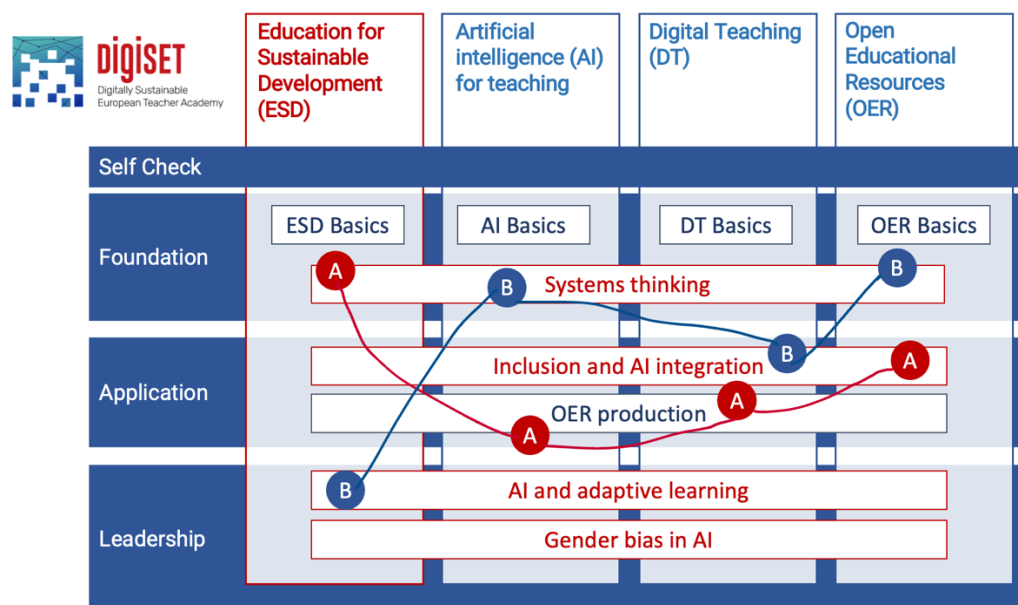


Figure 31: A sketch of the DigiSET learning offers with different entry levels for two fictive persons (A, B)

5.2.3. Material development priorities

Given that time constraints remain the dominant barrier cited by 53% of respondents, the DigiSET Academy should prioritise efficient, ready-to-use resources. Material development could focus on concrete lesson plans, prompt libraries, assessment rubrics, and vetted OER repositories — reducing preparation time while maximising practical applicability.

Adaptation of existing OER serves as a strategic convergence point: Teachers can learn to modify OER provided by DigiSET for differentiated instruction and diverse learner needs. This aligns with their existing openness to OER creation while addressing personalisation requirements through human pedagogical choices.

Given that the primary deficit lies in application (pedagogy/assessment) rather than knowledge, material development must shift focus. Instead of producing more theory-heavy handbooks on “What is AI?” or “Why Sustainability Matters” the Academy should produce:

- Adaptation Kits: Pre-made OERs that teachers can easily modify for inclusive or sustainable contexts.
- Prompt Libraries & Rubrics: Ready-made tools for AI-assisted assessment and feedback.
- Scenario-Based Learning: Case studies showing exactly how other teachers solved the “Values vs. Practice” problem.

As the data shows, time constraints (53%) and lack of materials are key barriers; providing immediate, practical solutions addresses both the skill gap and the resource barrier simultaneously.

5.2.4. Using survey data for persona development and material testing

The DigiSET survey results provide a foundation for developing learner personas that guide material design and pilot testing. Personas are archetypal representations derived from empirical data, enabling more targeted content creation and evaluation.

Based on the analyses done in section 4.5 we could use and create the personas. An exemplary persona for the topic “Gender bias in AI” topic (Section 4.5.7) is shown in Figure 32.

Persona for “Addressing Gender Bias in AI” **ENGAGED ELENA**

38 years old, social sciences teacher at a vocational school, 12 years of teaching experience.

Competence Profile: Confident in digital teaching and ESD, with medium-to-high AI and OER competence.

Motivation: Committed to inclusive, fair teaching. She encountered gender-biased AI outputs during lesson preparation and wants to address this actively but lacks concrete strategies.

Barriers: Aware of the problem but lacks suitable resources and ready-to-use methods. Time constraints require practical materials rather than theoretical frameworks.

Learning Preferences: Case-based learning, hands-on exercises with real AI outputs, and peer exchange. Would value curated bias-detection prompts and structured classroom discussion frameworks.



Figure 32: An exemplary persona for the topic “Addressing gender bias in AI”, building upon the DigiSET survey results (section 5.5.7).

Note: The persona was built with the help of the AI-tool Lumo (08/2026) and using a re-coloured portrait of Oksana Ilnicka, which is available under CC-0 (see: <https://openclipart.org/detail/355201/oksana-ilnicka>)

Similar, personas could be developed for each of the training topics and its combinations described in Sections 5.5.1–5.5.8, drawing on the corresponding respondent characteristics. This ensures that training materials are designed with specific learner configurations in mind, rather than targeting an abstract “average teacher” or using purely intuition.

Such personas per topic asked in the survey could then inform (a) creative development. For example, materials for “Elena” should prioritise practical bias-detection exercises over theoretical ethics frameworks. The personas could be used as well for pilot testing – it would be then needed to recruit teachers matching Elena’s profile to evaluate whether the content addresses her learning preferences. Similar, persona can be used to create evaluation criteria.

5.3. Additional insights and broader implications

Beyond project-specific recommendations, several findings carry wider significance for European education policy and teacher professional development frameworks. These implications remain valid despite sampling limitations, as they reflect pooled patterns that transcend country-specific recruitment artifacts.

5.3.1. AI competence development requires dedicated policy attention

The consistent finding that AI ranks lowest across all competence domains (while simultaneously generating the highest training demand) consistent with a structural gap in current teacher education. While our data cannot quantify this gap at population level, the combination of lowest self-ratings and highest training demand in the AI domain suggests:

- Clarify minimum AI literacy standards for teaching professions (distinct from general digital competences)
- Fund national AI-in-education initiatives targeting teacher training specifically
- Support cross-border knowledge exchange on effective AI pedagogical approaches

Relying on organic, bottom-up adoption may leave many teachers behind; coordinated policy investment seems necessary to close the competence gap at scale.

5.3.2. Sustainability and digital/AI education require parallel, not sequential, investment

The weak correlation between ESD and AI competences ($r = 0.37$) contradicts assumptions that progress in one domain naturally drives progress in the other. Policymakers should:

- Allocate funding streams that address both domains simultaneously rather than sequentially
- Develop bridge curricula that connect the fields without assuming teachers arrive with prior expertise in either

5.3.3. Ready-to-use, adaptive materials are as important as training itself

The finding that lack of resources/materials is a primary barrier for OER-related training (sometimes outweighing time constraints) suggests that policy investments should go beyond teacher training to include curriculum infrastructure:

- OER at high quality as input for AI tools. The open license is needed that it can be used (e.g. uploaded) in proprietary tools and that modification is allowed.
- National/regional OER repositories with vetted, context-adaptable materials
- Prompt libraries and lesson plan banks for emerging technologies (see Schön, Brünner & Ebner, in print 2027).
- Open licensing support services for educational content creators

Training without supporting materials creates frustration and low implementation rates. Both must be funded together.

5.3.4. Differentiated entry points are essential for scalability

Even though country-level comparisons are not representative, the pooled data clearly show heterogeneous starting points among teachers. One-size-fits-all training models will alienate both early adopters and those needing foundational support. National strategies should:

- Allow multiple entry pathways based on prior competence configurations
- Use competence diagnostics (not just self-assessment) to place teachers appropriately
- Provide advanced modules alongside foundations to retain engagement across experience levels

5.3.5. Time allocation for professional development must be institutionalised

With 53% of teachers citing time constraints as the dominant barrier, one systemic implication stands out: Professional development cannot rely on voluntary, unpaid engagement alone. EU member states should consider:

- Protected working hours for teacher training (e.g., dedicated days in the school year)
- Financial compensation for out-of-hours learning activities
- Micro-learning formats that integrate with daily practice rather than requiring separate time blocks

This finding aligns with established TALIS results (OECD, 2025) and is therefore not surprising, yet it remains a persistent challenge. Without institutional time structures, even high-quality training programmes will fail to achieve broad uptake.

5.3.6. Conclusion for Broader Policy

While DigiSET's immediate scope is a training academy for participating countries, the underlying challenges—time scarcity, AI competence gaps, fragmented sustainability/digital development, heterogeneous starting points. These challenges are structural features of European education systems – an interpretation supported by converging evidence (e.g., TALIS; OECD, 2026), of which the present survey offers one exploratory indicator. Addressing them requires sustained policy commitment beyond individual projects, embedding teacher upskilling into national education strategies with adequate funding, protected time, and material support. The survey provides an evidence base for such advocacy, even with acknowledged methodological limitations. The findings also reveal a broader structural tension within contemporary education systems. Teachers are increasingly expected to respond simultaneously to digital transformation, AI integration, sustainability education, inclusion, and assessment reform. Yet more than half of respondents reported a lack of time as a major barrier to professional development. This suggests that capacity constraints may represent a systemic issue rather than an individual-level challenge. Consequently, future policy interventions may need to focus not only on competence development but also on organisational conditions that enable teachers to engage with innovation in meaningful and sustainable ways.

5.4. Discussion on the generalisability and limitations of findings

Interpretation of these findings requires careful acknowledgment of significant sampling limitations. The DigiSET survey was implemented across eight partner countries using decentralised, country-specific recruitment strategies. Each consortium partner relied on their own institutional networks and channels to reach potential respondents, resulting in substantial heterogeneity in sample composition that does not reflect the actual teacher populations in these countries (see paragraph 3.6 Comparison of selected sample characteristics across countries, p. 15). What remains robust are pooled, cross-cutting patterns that transcend country-specific sampling artifacts: the overall hierarchy of competences (ESD > Digital > OER > AI), the dominant time barrier, the strong Digital-AI correlation, and the independence of AI and ESD domains. These patterns offer valid grounding for training design decisions, provided they are understood as emergent properties of the aggregated sample rather than reflections of national realities.

Beyond sampling issues, several additional limitations constrain the conclusions drawn from this survey. All competence measures rely on subjective self-assessment rather than objective testing; social desirability bias may inflate reported abilities, particularly in domains perceived as professionally valued (digital teaching, sustainability), meaning observed competence gaps may underestimate actual skill deficiencies. Instrument-related limitations further complicate interpretation: items on AI and gender bias (AD1, AD2, GD1, GD2) used a confidence scale despite being phrased as behavioural/knowledge statements, conflating self-efficacy with actual capability. Terminological variations (“learners” vs. “students”) across items may have influenced interpretation. Recruitment-related exclusions also matter: Certain teacher groups were systematically underrepresented due to network-dependent recruitment—those without digital professional networks likely had reduced access to the survey. Language and translation present additional challenges: while the questionnaire underwent translation procedures, country-specific nuances in terminology (especially around AI and sustainability concepts) may have introduced differential item functioning. Collectively, these limitations mean that absolute competence levels should be interpreted cautiously, while relative patterns (rankings, correlations, training needs) offer more reliable guidance for the DigiSET Academy's design. Future research should incorporate objective competence assessments and probability-based sampling to validate and refine these initial findings.

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Annex

Full Questionnaire (Version for Translation)

Section 1: Digital teaching competence

This section focuses on your digital teaching competences. It covers different areas of digital competence related to communication, collaboration, teaching practices, assessment, and supporting learners.

Please indicate how frequently each statement describes your current practice. If you are not currently teaching, please answer based on your training experiences and how you expect to use digital technologies in your future teaching.

	Never	Rarely	Sometimes	Often	Always
D1. I use different digital channels to communicate with learners and colleagues whenever appropriate	☐	☐	☐	☐	☐
D2. I use digital technologies whenever appropriate to work together with colleagues inside and outside my educational organisation.	☐	☐	☐	☐	☐
D3. I actively develop my digital competence for teaching	☐	☐	☐	☐	☐
D4. I am aware of and participate in online training opportunities	☐	☐	☐	☐	☐
D5. I use different internet sites and search strategies to find and select a range of different digital resources	☐	☐	☐	☐	☐
D6. I create my own digital resources and modify existing ones to adapt them to my needs	☐	☐	☐	☐	☐
D7. I effectively protect personal data, e.g. exams, learners' grades, learners' personal information	☐	☐	☐	☐	☐
D8. I carefully consider how, when and why to use digital technologies in classroom with my learners, so that they are used with added value	☐	☐	☐	☐	☐
D9. I follow learners' activities and interactions in the collaborative online environments we use	☐	☐	☐	☐	☐
D10. When learners work in groups, they use digital technologies to help them learn and effectively accomplish course tasks	☐	☐	☐	☐	☐
D11. I use digital technologies to allow learners to plan, document and monitor their learning themselves	☐	☐	☐	☐	☐

	Never	Rarely	Sometimes	Often	Always
D12. I use digital assessment tools to monitor [student] progress	☐	☐	☐	☐	☐
D13. I analyse all data (information) available to me to identify learners who need additional support	☐	☐	☐	☐	☐
D14. I use digital technologies to provide effective feedback	☐	☐	☐	☐	☐
D15. When I create digital assignments for learners I take into account and address potential practical or technical difficulties	☐	☐	☐	☐	☐
D16. I use digital technologies to offer learners personalised learning opportunities	☐	☐	☐	☐	☐
D17. I use digital technologies for learners to actively participate in class or online learning	☐	☐	☐	☐	☐
D18. I teach learners how to assess the reliability of information	☐	☐	☐	☐	☐
D19. I set up course tasks which require learners to use digital means to communicate and collaborate with each other or with an outside audience	☐	☐	☐	☐	☐
D20. I set up assignments which require learners to create digital content	☐	☐	☐	☐	☐
D21. I teach learners how to use digital technology safely and responsibly	☐	☐	☐	☐	☐
D22. I encourage learners to use digital technologies creatively to solve concrete problems	☐	☐	☐	☐	☐
I1. I use digital tools to support students with learning difficulties.	☐	☐	☐	☐	☐
I2. I adapt digital learning materials for students with special educational needs.	☐	☐	☐	☐	☐

Section 2: AI competence

The following statements relate to your confidence in using Artificial Intelligence (AI) in teaching and learning.

Please indicate how confident you feel in performing each of the following tasks. If you are not currently teaching, please answer based on your training experiences and how confident you expect to feel in your future teaching.

	Not confident	Slightly confident	Moderately confident	Very Confident	Completely confident
A1. I can distinguish whether a tool is AI-based or not.	☐	☐	☐	☐	☐
A2. I can create content with AI.	☐	☐	☐	☐	☐
A3. I can explain what AI is.	☐	☐	☐	☐	☐
A4. I can explain what generative AI is.	☐	☐	☐	☐	☐
A5. I can choose an AI tool to use in my classroom that enhances what I teach, how I teach, and what students learn	☐	☐	☐	☐	☐

	Not confident	Slightly confident	Moderately confident	Very Confident	Completely confident
A6. I can choose an AI tool that enhances my teaching subject content for a lesson.	☐	☐	☐	☐	☐
A7. I can teach lessons that appropriately combine my teaching subject, AI tools, and teaching approaches.	☐	☐	☐	☐	☐
A8. I can help others design learning activities that combine subject content, AI tools, and teaching approaches.	☐	☐	☐	☐	☐
A9. I can use an AI tool to foster assessment for learning.	☐	☐	☐	☐	☐
A10. I can design an assessment approach to improve student learning in an AI-based environment (e.g., learning with ChatGPT).	☐	☐	☐	☐	☐
A11. I can assess student learning in an AI-based environment.	☐	☐	☐	☐	☐
A12. I can use an AI tool to grade an assignment.	☐	☐	☐	☐	☐
A13. I can teach students ethics.	☐	☐	☐	☐	☐
A14. I can protect sensitive content from AI tools (e.g., exams, students' grades and personal data).	☐	☐	☐	☐	☐
A15. I can ensure my health and well-being while using AI tools.	☐	☐	☐	☐	☐
A16. I teach students how to behave safely and responsibly when learning with AI tools.	☐	☐	☐	☐	☐
A17. I can assess the benefits of an AI tool.	☐	☐	☐	☐	☐
A18. I can assess the risks of an AI tool.	☐	☐	☐	☐	☐
A19. I recognise that humans are responsible for AI bias.	☐	☐	☐	☐	☐
A20. I can explain how AI impacts our society	☐	☐	☐	☐	☐
A21. I can use different websites and search strategies to find and select a range of different AI tools.	☐	☐	☐	☐	☐
A22. I actively look for continuous professional development activities outside my educational organization.	☐	☐	☐	☐	☐
A23. I actively share my AI teaching experience with other colleagues within and outside my educational organization.	☐	☐	☐	☐	☐
A24. I love to help my colleagues design learning activities with AI.	☐	☐	☐	☐	☐
AD1. I use AI tools to personalise learning for individual students.	☐	☐	☐	☐	☐
AD2. I know how to use AI for differentiated instruction based on student needs.	☐	☐	☐	☐	☐

	Not confident	Slightly confident	Moderately confident	Very Confident	Completely confident
GD1. I am aware of gender bias in AI-generated content.	☐	☐	☐	☐	☐
GD2. I know how to address gender stereotypes when using AI in teaching.	☐	☐	☐	☐	☐

Section 3: Education for sustainable development (ESD)

The following statements relate to your teaching or intended teaching in the area of sustainability.

Please indicate how confident you feel in performing each of the following tasks. If you are not currently teaching, please answer based on your training experiences and how confident you expect to feel in your future teaching.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
S1. I help learners understand the interconnections between environmental, social, and economic aspects of sustainability.	☐	☐	☐	☐	☐
S2. I encourage learners to critically reflect on sustainability-related issues.	☐	☐	☐	☐	☐
S3. I support learners in analysing complex sustainability problems from multiple perspectives.	☐	☐	☐	☐	☐
S4. I integrate sustainability topics into my teaching practice.	☐	☐	☐	☐	☐
S5. I use participatory and learner-centred teaching approaches when addressing sustainability.	☐	☐	☐	☐	☐
S6. I design learning activities that promote active engagement with sustainability challenge	☐	☐	☐	☐	☐
S7. I use digital technologies (e.g., simulations, collaborative platforms, data visualisation tools, or AI-based applications) to engage learners with real-world sustainability challenges.	☐	☐	☐	☐	☐
S8. I promote values such as responsibility, equity, and respect for diversity in my teaching.	☐	☐	☐	☐	☐
S9. I encourage learners to consider ethical implications of sustainability issues.	☐	☐	☐	☐	☐
S10. I support learners in developing a sense of responsibility for sustainable development.	☐	☐	☐	☐	☐
S11. I reflect on my teaching practice in relation to sustainability and seek continuous improvement.	☐	☐	☐	☐	☐
S12. I feel confident facilitating discussions on complex or controversial sustainability issues.	☐	☐	☐	☐	☐
S13. I support learners in applying sustainability knowledge to real-life situations.	☐	☐	☐	☐	☐

Section 4: Open Educational Resources (OER)

The following statements relate to your experience, knowledge, and use of Open Educational Resources (OER) in your teaching or intended teaching.

Open Educational Resources (OER) are teaching and learning materials that are freely accessible and openly licensed or public domain, allowing their use, adaptation, and

sharing. Please indicate the extent to which you agree with each statement based on your current practice or, if you are not yet teaching, based on your experiences during training and how you would approach teaching in the future.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
O1. I have prior experience of using OER	☐	☐	☐	☐	☐
O2. I have knowledge of Intellectual Property Rights to understand OER	☐	☐	☐	☐	☐
O3. I am efficient in Information Communication Technology (ICT) skills to adopt and use OER	☐	☐	☐	☐	☐
O4. I adopt OER for my teaching as they fulfil academic requirement of my students	☐	☐	☐	☐	☐
O5. My own competencies and knowledge towards OER helps me to participate or adopt OER	☐	☐	☐	☐	☐

Section 5: Professional development

This section focuses on your professional development needs related to digital and sustainable teaching.

We are interested in understanding which areas you would most like to develop further, as well as any challenges you may face in accessing training or support.

Please answer the following questions based on your current situation or, if you are a pre-service teacher, based on your training experience and anticipated future needs.

P1. Which areas do you feel like you need training most?
Please select up to 3 options.

- Using AI in teaching
- Ethical and responsible AI use
- Integrating sustainability into teaching
- Inclusive digital teaching
- Creating and sharing OER
- Using adaptive learning tools
- Addressing gender bias in AI
- Systems thinking for sustainability
- Other:

P2. What are the main barriers to your professional development in these areas?
Please select up to 3 options.

- Lack of time
- Lack of available training
- Lack of institutional support
- Lack of suitable resources / materials
- Lack of infrastructure (e.g. wi-fi, technical equipment)
- Others:

Section 6: Open questions

Q1. What challenges do you currently face in integrating digital technologies and sustainability into your teaching?

Q2. What competences would help you address these challenges?

Q3. Is there anything else you would like to mention to issues presented in the survey?

Section 7: About you

Finally, we would like to ask you a few questions about your work as a teacher.

B1. What is your current status? *

Please select one or more options that apply best to your current situation.

- I am studying to be a teacher
- I am working at a public / state-funded school
- I am working at a private / independent school
- I am working at a church / religious-affiliated school
- Currently I am looking for a job
- Other:

B2. Which school levels do you currently teach/you are going to teach? *

Please select one or more options that apply best to your current or future teaching.

- Primary level (ISCED 1, approx. ages 6–11)
- Lower secondary (ISCED 2, approx. ages 12–14)
- Upper secondary (ISCED 3, approx. ages 15–18)
- Vocational education (ISCED 3/4)
- Other:

B3. Which school subjects do you currently teach or expect to teach?

Please select the options that apply best to your current or future teaching.

- Mathematics
- Natural sciences (biology, chemistry, physics)
- Foreign languages
- Native language / Reading
- Social sciences / History
- Art / Music
- Physical education
- Computer Science / Digital Literacy
- Vocational subjects
- Other:

B4. How many years of teaching experience do you have? *

Please select one option.

- No experience at all
- Less than 1 year
- 1-5 years
- 6–10 years
- 11–15 years
- 16–20 years
- More than 20 years

B5. In which country do you work or do you study?

(all European Countries named)

Please select one option.

B6. How do you identify your gender?

Please select one option.

- Woman
- Man
- Non-binary / Another gender identity
- Prefer not to say

B7. What is your age in years?

Table:

DT competence index	
Items	22
n	1294
Cronbachs Alpha	0,944
Statistics	
Mean	3,82
SD	0,677
Minimum	1,00
Q1	3,41
Median (Q2)	3,86
Q3	4,27
Maximum	5,00
ESD competence index	
Items	13
n	1039
Cronbachs Alpha	0,950
Statistics	
Mean	3,99
SD	0,674
Minimum	1,00
Q1	3,62
Median (Q2)	4,00
Q3	4,46
Maximum	5,00

AI competence index	
Items	24
n	1142
Cronbachs Alpha	0,977
Statistics	
Mean	3,24
SD	0,961
Minimum	1,00
Q1	2,58
Median (Q2)	3,21
Q3	3,96
Maximum	5,00
OER competence index	
Items	5
n	1037
Cronbachs Alpha	0,941
Statistics	
Mean	3,50
SD	0,991
Minimum	1,00
Q1	3,00
Median (Q2)	3,60
Q3	4,00
Maximum	5,00

Tables

Table: Cronbach's Alpha and statistics for each scale.

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Q1	3,00
Median (Q2)	3,60
Q3	4,00
Maximum	5,00

Table:

Table: Digital teaching competence by country

country	n	mean	median	sd	min	max
Austria	102	3,66	3,75	0,758	1,00	4,91
Bulgaria	205	3,68	3,77	0,689	1,45	5,00
Ireland	151	3,52	3,59	0,717	1,18	4,82
Italy	214	3,75	3,82	0,644	1,77	5,00
Norway	23	3,67	3,73	0,471	2,59	4,73
Romania	187	3,97	4,00	0,515	2,14	5,00
Spain	130	4,26	4,41	0,621	2,18	5,00
Türkiye	282	3,87	3,86	0,642	2,23	5,00

Table: AI competence by country

country	n	mean	median	sd	min	max
Austria	92	3,58	3,63	0,816	1,75	4,96
Bulgaria	181	3,12	3,04	0,969	1,04	5,00
Ireland	143	2,77	2,83	0,988	1,00	5,00
Italy	188	2,94	2,90	0,959	1,00	5,00
Norway	20	3,54	3,77	0,818	1,42	4,50
Romania	173	3,39	3,33	0,708	1,46	5,00
Spain	115	3,55	3,79	1,176	1,00	5,00
Türkiye	230	3,43	3,25	0,862	1,08	5,00

Table: ESD competence by country

country	n	mean	median	sd	min	max
Austria	87	3,87	3,92	0,735	1,31	5,00

Bulgaria	151	3,94	3,92	0,593	2,46	5,00
Ireland	133	3,51	3,54	0,826	1,00	5,00
Italy	162	4,29	4,31	0,531	2,31	5,00
Norway	18	3,74	3,85	0,438	3,00	4,62
Romania	172	4,03	4,00	0,536	2,00	5,00
Spain	114	4,27	4,46	0,719	1,92	5,00
Türkiye	202	4,00	4,00	0,580	2,08	5,00

Table: OER competence by country

country	n	mean	median	sd	min	max
Austria	87	3,44	3,80	1,277	1,00	5,00
Bulgaria	146	3,60	3,60	0,748	1,00	5,00
Ireland	132	2,98	3,20	1,180	1,00	5,00
Italy	162	3,23	3,40	1,091	1,00	5,00
Norway	18	4,07	4,10	0,693	3,00	5,00
Romania	169	3,56	3,60	0,821	1,00	5,00
Spain	116	3,71	3,80	0,920	1,80	5,00
Türkiye	207	3,76	3,80	0,790	1,00	5,00