



STIAEM

Slow Tech Innovation

AI, Ethics and
New Teaching Methods

NATIONAL REPORT SPAIN



1474



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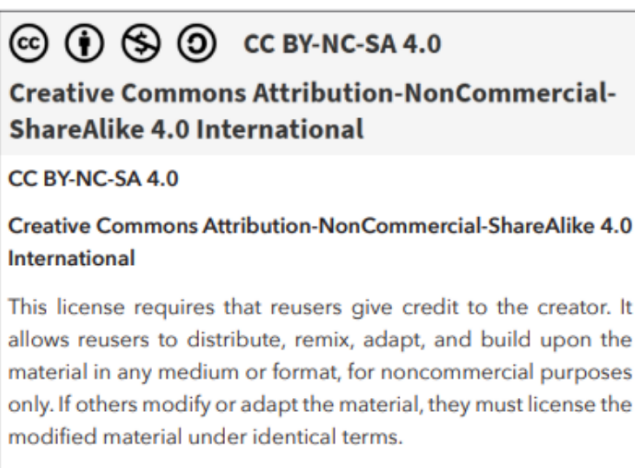
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PROJECT STIAEM INFORMATION

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Università di Foggia
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Scienze della Formazione



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Table of Contents for the National Report

Preface

1. Introduction and Methodology

- 1.1 Objectives of the National Report
- 1.2 Description of the Sample
- 1.3 Data Collection Instruments (Surveys, semi-structured interview protocols)

2. National Context of AI in Education

- 2.1 Current Policies, Regulations, and Ministerial Guidelines
- 2.2 Digital Infrastructure and Technological Readiness of the Pilot Schools

3. Data Standardization and Quantitative Analysis

- 3.1 Data Pre-processing
- 3.2 Descriptive Analysis
- 3.3 Comparative and Correlational Analysis
- 3.4 Advanced Quantitative Modelling

4. Qualitative Analysis and Dilemma Scenarios (SJT)

- 4.1 Thematic Analysis and Content Coding of Focus Groups/Interviews
- 4.2 Analysis of Dilemma
- 4.3 Triangulation

5. Case Studies

- 5.1 Selection and Description of 2-3 National Best Practices on the Use of AI
- 5.2 Analysis of Pedagogical Outcomes and Student Engagement in the Presented Cases

6. Conclusions and Recommendations

- 6.1 Main Training Gaps and Identified Needs
- 6.2 Operational Suggestions and Requirements for the Development of AI-based Pedagogical Models

References

Preface

This volume offers a systematic, empirically grounded, and large-scale mapping of Artificial Intelligence within the Spanish secondary education system. This National Report constitutes a scientific and strategic deliverable developed under Action 2 of Work Package 2 (WP2) of the international Erasmus+ STIAEM consortium (Slow Tech Innovation: AI, Ethics, and New Teaching Methods - 2025-1-IT02-KA220-SCH-000365213). Through a computational and psychometric survey conducted on a sample of 303 students aged between 14 and 19 years and 142 secondary school teachers (ISCED levels 2 and 3), this research directly responds to the priorities of the European Commission's Digital Education Action Plan (2021–2027). By providing robust evidence on AI literacy, ethical awareness, and educational practices, the report contributes to the development of a stable knowledge base capable of supporting the responsible digital transformation of schools.

The epistemological horizon guiding the architecture of this research departs from technological determinism and from narratives that frame educational innovation primarily through the lens of efficiency, productivity, or technological acceleration. The conceptual framework of the report is firmly anchored in the Slow Tech paradigm and in human-in-the-loop pedagogical approaches that promote reflective, critical, and ethically sustainable forms of technological integration centred on human agency. The primary objective is to challenge the assumption that AI Literacy can be reduced to technical proficiency in the use of generative software. Instead, literacy is understood as a multidimensional competence encompassing affective, cognitive, behavioural, and ethical dimensions, and as a fundamental prerequisite for active, democratic, and responsible digital citizenship capable of governing emerging technologies without passively surrendering to automation or market-driven imperatives.

From a methodological perspective, the rigor of the study is guaranteed by an integrated approach that combines quantitative precision with qualitative depth. The research moves beyond simple descriptive statistics by employing advanced inferential analyses to identify hidden relationships between variables, explore significant predictors of ethical awareness, and map characteristic profiles of students and teachers in relation to Artificial Intelligence. This statistical framework is complemented by qualitative evidence gathered through interviews and focus groups, allowing numerical findings to be interpreted in light of participants' lived experiences, concerns, expectations, and everyday educational realities. In this way, data become not merely indicators of technological adoption but a lens through which to understand the cultural and pedagogical transformations currently taking place in Spanish schools.

To move beyond declarative attitudes and explore actual ethical reasoning, the research incorporates Situational Judgment Tests (SJTs), which place participants in realistic educational scenarios involving the use of Artificial Intelligence. These scenarios are organised around three major international challenges. The first concerns autonomy in the face of automation and evaluates students' capacity to critically assess AI-generated outputs while examining teachers' concerns regarding the delegation of educational tasks to intelligent systems. The second focuses on the educational relationship and digital privacy, exploring participants' attitudes towards personal data protection, surveillance, and the preservation of meaningful human interactions in technology-mediated learning environments. The third addresses civic and ecological responsibility, investigating awareness of the environmental, social, and ethical consequences of AI systems, including issues related to electronic waste, energy consumption, algorithmic bias, and responsible innovation.

The results emerging from this national mapping reveal a landscape characterised by both opportunity and tension. On the one hand, Spanish teachers and students demonstrate relatively high levels of digital literacy and a widespread familiarity with AI tools. Technology is increasingly integrated into educational practices, particularly as a support mechanism for learning, information seeking, content generation, and academic tasks. On the other hand, the findings highlight important gaps between technological adoption and ethical reflection. While students report frequent engagement with AI applications and generally positive attitudes towards their educational value, ethical awareness and ethical decision-making remain comparatively weaker dimensions, suggesting that practical use often develops more rapidly than critical understanding.

The analyses further challenge several common assumptions surrounding AI adoption in education. Differences associated with age and gender appear less influential than patterns of

actual AI use and engagement. Across the student sample, familiarity with AI is consistently associated with higher levels of AI literacy, digital competence, and ethical awareness. However, greater exposure to AI tools does not automatically translate into stronger ethical reasoning. Similarly, among teachers, confidence in AI competence emerges as a positive predictor of ethical decision-making, whereas anxiety towards AI is associated with lower levels of ethical engagement. These findings suggest that the development of responsible AI practices depends not only on access to technology but also on opportunities for critical reflection, ethical discussion, and guided educational experiences.

Ultimately, this report seeks to provide reliable evidence for policymakers, educational leaders, teacher educators, and schools navigating the challenges of digital transformation. Its findings are aligned with the principles of human oversight, transparency, accountability, and risk awareness established by the European Artificial Intelligence Act (AI Act). Rather than advocating the uncritical adoption of technological solutions, the report offers a methodological compass for integrating Artificial Intelligence into educational settings in ways that strengthen pedagogical quality, democratic participation, and human development.

The evidence presented throughout these pages rejects the vision of education as a space subordinated to the commercial logic of technological acceleration and instead reaffirms the need for a human-centred, ethically governed, and socially responsible approach to innovation. In this sense, the data presented here should not be understood as a final destination but as a foundation for future action. They provide the empirical basis upon which the STIAEM project will design, implement, and evaluate new educational materials, teacher training programmes, and pedagogical interventions aimed at fostering a robust, ethical, sustainable, and replicable model of AI integration in schools.

1. Introduction and Methodology

1.1 Objectives of the National Report

The primary objective of this report is to map the current state of Artificial Intelligence (AI) integration in Spanish secondary education, providing a comprehensive overview of teachers' and students' AI literacy, digital literacy, and ethical awareness. In line with the priorities established by the European Commission's Digital Education Action Plan (2021–2027), the study seeks to move beyond a purely technological perspective and examine how educational actors understand, use, and critically evaluate AI within teaching and learning processes.

The theoretical framework underpinning the research is rooted in the Slow Tech paradigm (Patrignani & Whitehouse, 2014) and the human-in-the-loop approach (Benanti, 2022), both of which advocate for a reflective, ethical, and human-centred integration of technology in education. From this perspective, AI literacy is understood not merely as technical competence but as a multidimensional construct encompassing cognitive, affective, behavioural, and ethical dimensions, which are essential for the development of active, democratic, and responsible digital citizenship.

A further objective of the report is to examine the concept of Slow Tech Attitude, understood as the set of reflective, ethical, and pedagogical dispositions that guide the responsible use of AI in educational contexts. Particular attention is devoted to issues such as critical thinking, cognitive autonomy, ethical decision-making, and the growing phenomenon of cognitive offloading, whereby individuals increasingly delegate reasoning and problem-solving processes to intelligent systems. The study therefore explores how teachers and students balance the opportunities offered by AI with the need to preserve human judgement, creativity, and educational values.

To address these objectives, the research adopts a mixed-methods approach combining quantitative and qualitative data collection. Special attention is given to participants' ethical reasoning through the use of Situational Judgment Tests (SJTs), which explore three key areas of international relevance: professional autonomy in the face of automation, the protection of educational relationships and online privacy, and civic and ecological responsibility in the use of AI systems.

Ultimately, this report provides a robust empirical foundation for the development of the future STIAEM Pedagogical Model, as well as for the design and implementation of the project's training activities and MOOCs. By generating evidence-based knowledge on AI adoption and ethical awareness, the study aims to support the creation of sustainable, responsible, and human-centred approaches to AI integration in education, in alignment with the principles established by the European AI Act.

1.2 Description of the Sample

A non-probability convenience sampling strategy was employed, drawing on the school networks of the project partners. In order to ensure cross-country comparability, minimum participation thresholds were considered.

The quantitative phase of the study involved a total of 142 secondary school teachers (ISCED levels 2 and 3) and 303 students aged between 14 and 19. In addition, qualitative data were collected through focus groups, involving 5 secondary school teachers, 5 secondary school students, and 5 experts in the field of education and technology. This mixed-methods approach allows for a comprehensive analysis of the research topic, combining quantitative data to identify general trends with qualitative insights that provide a deeper understanding of participants' perceptions, experiences, and attitudes.

The following figures provide an initial visual overview of the main demographic and background characteristics of the Spanish teacher sample, including the educational levels taught and participants' relationship with technology. These descriptive results offer a

preliminary understanding of the profile of the respondents and the context in which AI-related perceptions and practices are situated. However, a more detailed presentation and analysis of the quantitative findings, including frequencies, inferential statistics, and relationships between variables, will be provided later in Section 3. Data Standardization and Quantitative Analysis.

Figure 1. Gender distribution of the Spanish teachers' sample (N=142)

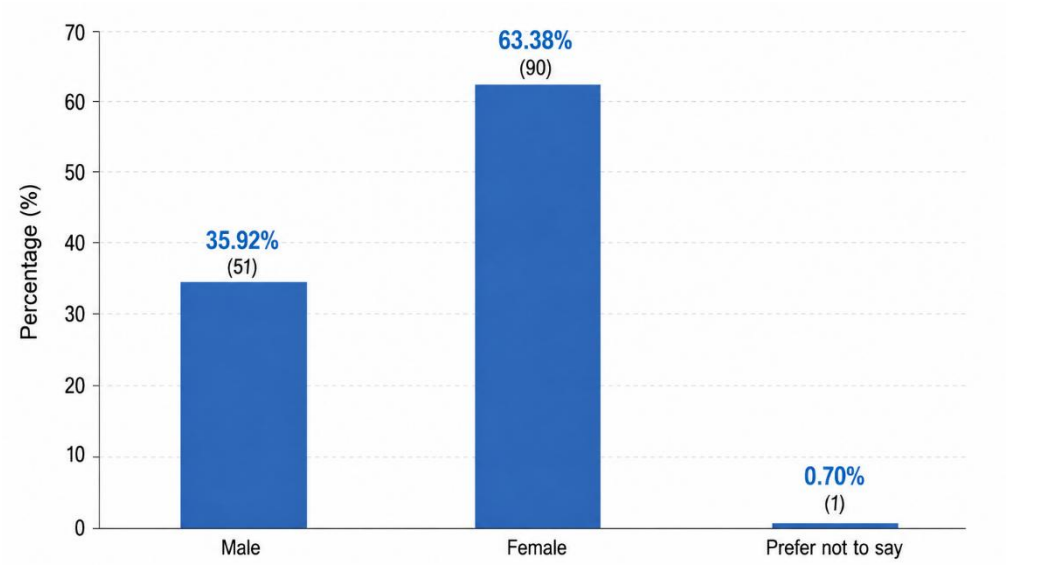


Figure 2. Age distribution of the Spanish teachers' sample (N=142)

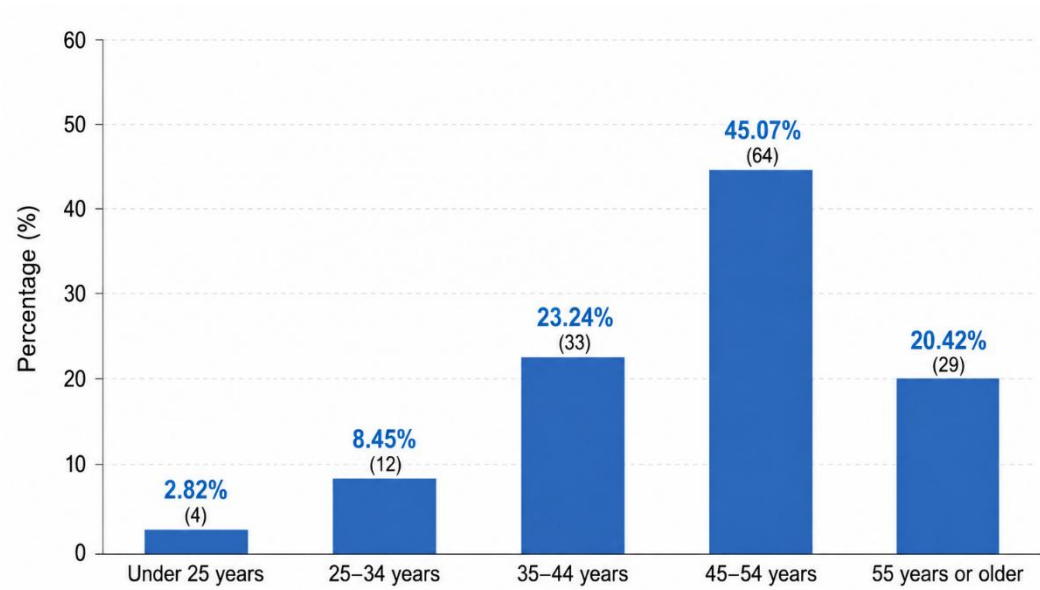
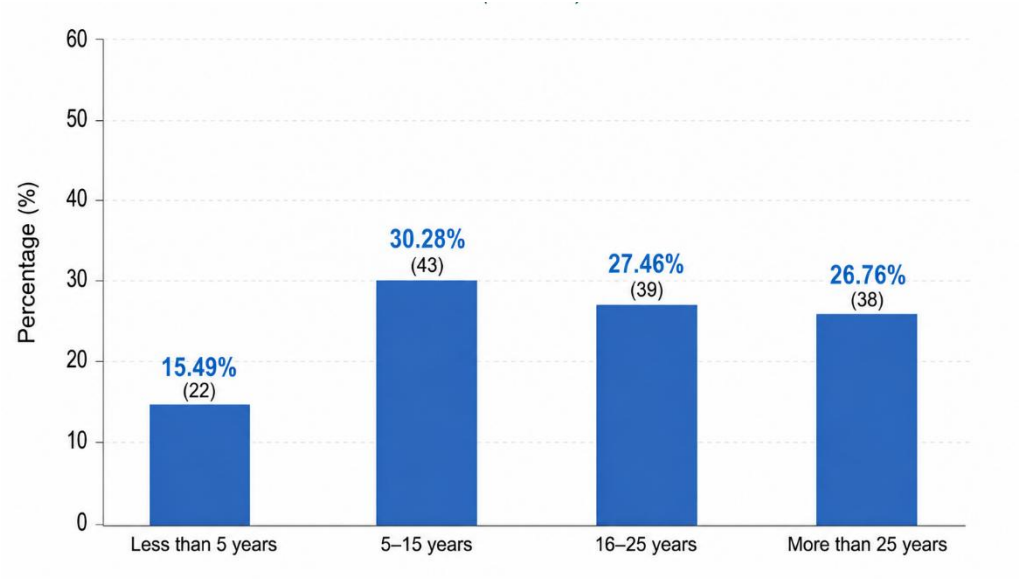


Figure 3. Teaching experience of the Spanish teachers' sample (N= 142)



Figures 4 and 5. Educational profile and relationship with technology among Spanish teachers

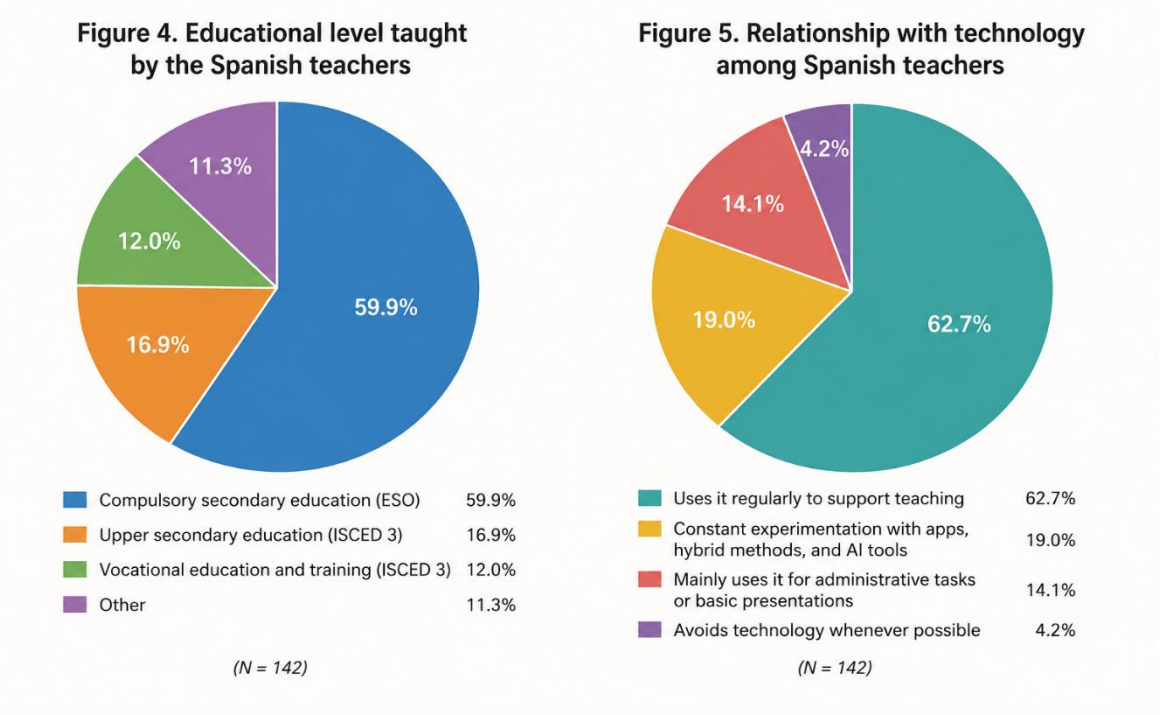


Figure 6. Gender distribution of the Spanish students' sample (N=303)

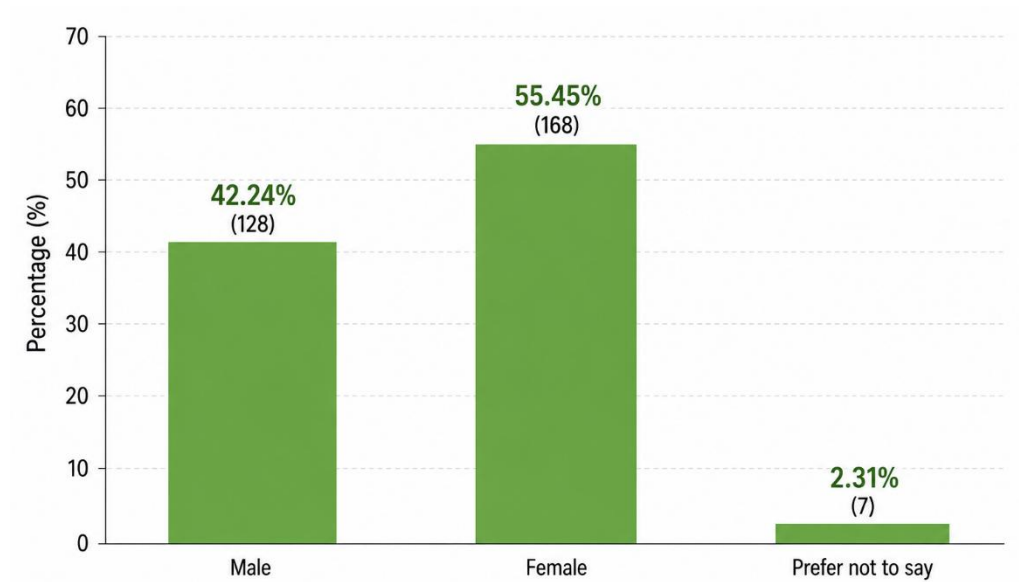
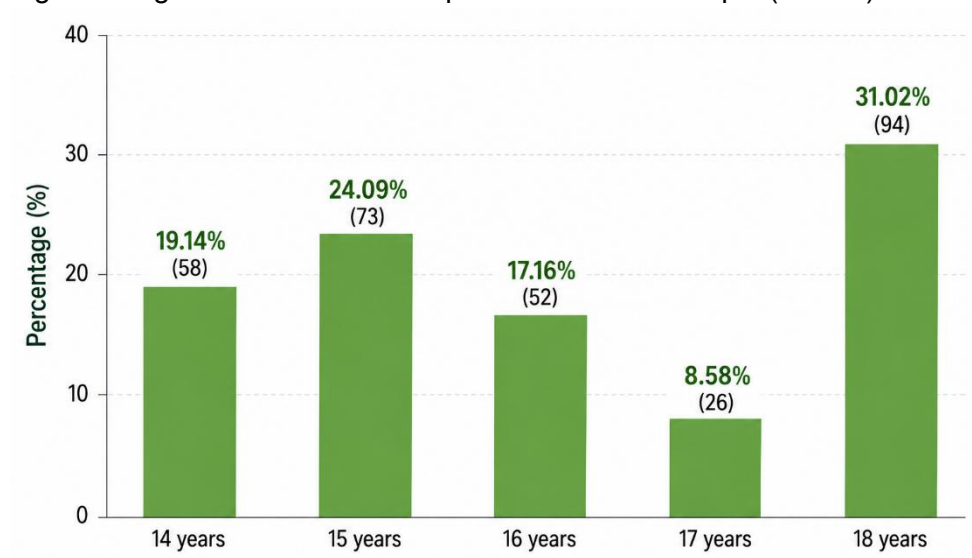
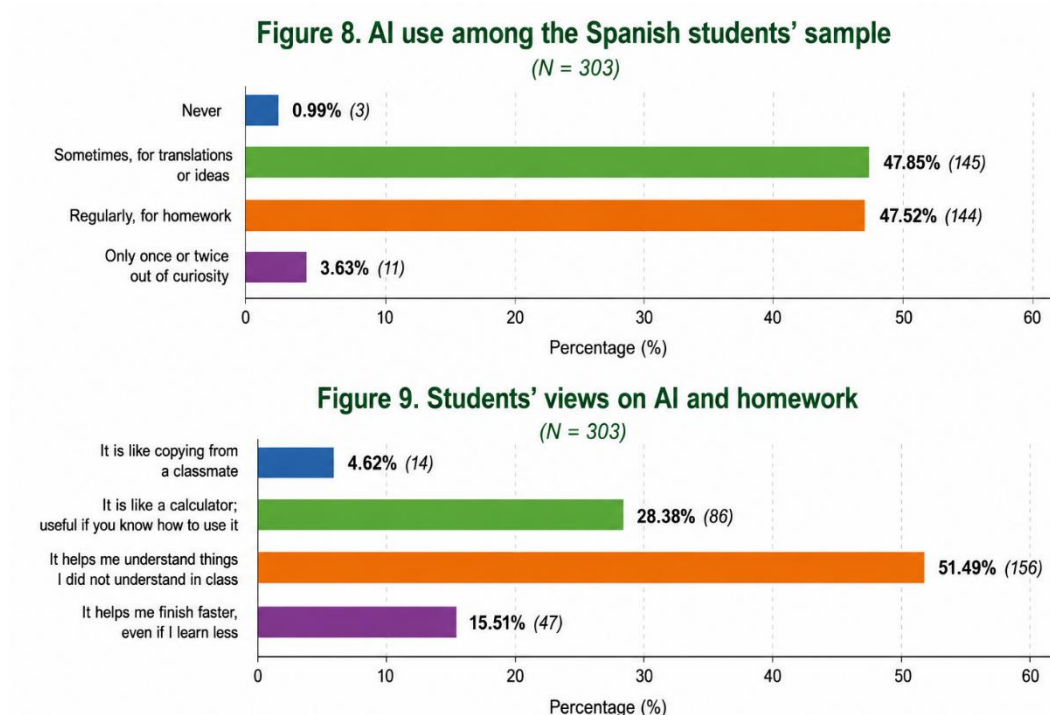


Figure 7. Age distribution of the Spanish students' sample (N=303)



Figures 8 and 9. AI use and relationship with technology among Spanish students



1.3 Data Collection Instruments (Survey, Semi-Structured Interview Protocols)

The project adopts a sequential explanatory mixed-methods design (QUAN–qual), in which the quantitative phase is followed by a qualitative phase aimed at further explaining and contextualising the results.

The quantitative component involved 142 secondary school teachers (ISCED levels 2 and 3) and 303 students aged between 14 and 19. Data were collected through online surveys based on validated instruments, including MAILS (Measuring AI Literacy Skills), DigComp 3.0 (Digital Competence Framework), and specific Slow Tech-related scales such as AIEAS (AI Ethical Awareness Scale) and SATAI (Scale of Attitudes Towards Artificial Intelligence). The data were subsequently processed through standardised procedures, including data pre-processing, descriptive statistics, and comparative and correlational analyses (e.g., ANOVA, t-tests, and regression models).

The qualitative phase was designed to complement and deepen the interpretation of the quantitative findings. It included focus groups with 5 secondary school teachers, 5 secondary school students, and 5 experts in the field of education and technology. In addition, qualitative instruments comprised semi-structured interview protocols and Situational Judgement Tests (SJTs), which presented real-life ethical dilemmas (e.g., efficiency vs. equity, personalization vs. privacy, autonomy vs. assistance) in order to capture participants' decision-making processes and “ethics in action”.

Finally, a triangulation process was conducted to integrate quantitative trends with qualitative insights, providing a more comprehensive and nuanced understanding of the integration of Artificial Intelligence in educational contexts.

2. National context on AI in education

2.1 Current ministerial policies, regulations and guidelines

The integration of Artificial Intelligence (AI) within the Spanish education system is currently undergoing a phase of rapid transformation and significant disruption, largely driven by the emergence of generative AI (Cordón, 2023). This process goes beyond technological innovation, representing a broader reconfiguration of traditional pedagogical models that affects educational management, teaching practices, and learning processes (Del Valle, 2025).

a) National Regulatory and Strategic Framework

At the national level, educational policy regarding AI is embedded within broader strategic and legislative frameworks:

- **National Artificial Intelligence Strategy (ENIA):** Published in 2020, it establishes that the use of data must not harm individuals or violate fundamental rights, emphasising data governance and system accountability as key principles (Gobierno de España, 2020; Alonso-Rodríguez, 2024).
- **European Union Artificial Intelligence Act (AI Act):** As an EU Member State, Spain aligns its regulatory framework with the AI Act, which classifies AI applications in education as “high-risk” (Cordón, 2023; Miao et al., 2021). This classification entails strict requirements related to safety, transparency, traceability, and human oversight (Higueras-Rodríguez et al., 2026).
- **Data Protection:** Compliance with the General Data Protection Regulation (GDPR) is mandatory, particularly in educational settings involving minors and the processing of sensitive data (Higueras-Rodríguez et al., 2026; Miao et al., 2021).

b) Alignment with International Frameworks and Humanistic Vision

The Spanish context demonstrates a clear intention to align with international frameworks, although implementation remains uneven across institutions (OECD, 2021; Miao et al., 2021).

- **UNESCO Guidelines:** Spain aligns with Sustainable Development Goal 4 (SDG 4) of the 2030 Agenda, promoting inclusive, equitable, and quality education. In line with UNESCO principles, AI is conceived as a tool that should serve the common good and remain under human control, enhancing rather than replacing teachers’ and learners’ capabilities (Flores-Vivar & García-Peñalvo, 2023).
- **DigComp 3.0 / DigCompEdu:** The European frameworks for digital competence for citizens and educators serve as key references for teacher training (Estrada-Molina et al., 2025). However, existing research highlights a significant gap between policy guidelines and institutional practice, as many training programmes remain focused on instrumental uses of technology, neglecting critical aspects such as algorithmic ethics and digital accessibility (Redecker & Punie, 2017; Rivera-Vargas, 2025).
- **AI4K12:** Although recognised as a valuable framework for AI literacy and curriculum design from early educational stages, its implementation in the Spanish curriculum remains limited and uneven (UNESCO, 2019; Estrada-Molina et al., 2025; Higueras-

Rodríguez et al., 2026).

c) The “Slow Tech” Paradigm and Human-Centred Innovation (STIAEM)

The emerging *Slow Tech* paradigm, framed within the STIAEM (Slow Tech Innovation in Education Model), promotes a human-centred and reflective approach to technology integration. This perspective emphasises:

- prioritising human well-being over technological acceleration
- assessing potential cognitive and mental health risks associated with intensive AI use
- fostering autonomy and critical thinking
- preventing cognitive dependency and over-reliance on intelligent systems

d) Identified Challenges and Gaps

Despite the existence of a solid regulatory framework, several challenges hinder the effective and ethical implementation of AI in the national education system:

- **Institutional Heterogeneity:** There is significant variability in AI-related training and implementation across institutions, leading to unequal learning opportunities depending on local policies rather than a cohesive national strategy (Higuera-Rodríguez et al., 2026).
- **Lack of Focus on Ethics and Digital Rights:** Current training provision tends to prioritise efficiency and productivity, often overlooking key issues such as algorithmic bias, privacy, and digital rights (Higuera-Rodríguez et al., 2026)
- **Fragmented Teacher Training:** A shortage of specialised personnel in digital legislation and AI governance limits the development of institutional protocols for auditing and regulating AI systems (Cordón, 2023).

While official discourse and ministerial policies in Spain promote a humanistic and ethical vision aligned with European and UNESCO frameworks (Cordón, 2023), practical implementation still requires a shift from predominantly instrumental uses of AI (European Union, 2024) towards a more participatory governance model and a critically informed pedagogical approach (Sangwa, 2025; Sebire, 2025).

2.2 Digital Infrastructure and Technological Readiness of Experimental Schools

The analysis goes beyond the mere availability of digital infrastructure to examine how supports the effective and responsible use of technology in educational contexts. In particular, it considers the potential risks associated with an excessive or uncritical adoption of digital tools, often referred to as “digital accelerationism”.

In line with the *Slow Tech* paradigm, the analysis explores whether existing infrastructure enables a sustainable, balanced, and reflective integration of technology. It also assesses whether schools are prepared to move from an “implicit” (unconscious or uncritical) use of digital tools towards a more “explicit”, informed, and critical engagement with AI-driven systems and algorithms.

Furthermore, the report examines whether the national educational discourse incorporates key dimensions such as sustainability (Clean IT), equity (Fair IT), and human well-being (Good IT) as guiding principles for technology integration in education.

3. Data standardization and quantitative analysis

3.1 Data pre-processing

3.1.1. Alignment with the Master Codebook

For both the teachers' and students' samples, the datasets were standardized in accordance with the Master Codebook. Variable names were reviewed to ensure they were suitable for quantitative analysis. Likewise, sociodemographic and educational variables were harmonized, incorporating references based on the ISCED classification.

3.1.2. Variable harmonization and scale preparation

For the teachers' sample, the scales and composite variables were prepared following the framework proposed by Işık et al. (2024). Accordingly, the dimensions AI Competence, AI Anxiety, AI Usefulness, General Digital Literacy, and Ethical Decision Making were identified. In this process, item TCH_ANX_30 was reverse-coded prior to the analysis, and scenarios SD01–SD03 were recoded on a 0–3 scale for descriptive and inferential analyses.

As for the students' sample, scale preparation followed the ABCE model proposed by Ng et al. (2024), resulting in a grouping of variables into the dimensions Affective, Behavioural, Cognitive, Ethical, Digital Literacy, and Ethical Awareness. As in the teachers' sample, scenarios SD04–SD06 were transformed into ordinal variables with scores ranging from 0 to 3.

Table 1. Summary of data pre-processing steps

Sample	Step	Variables / dimensions
Teachers	Alignment with the Master Codebook	TP, TCH, DIG, SD variables
Teachers	Variable harmonization	Background variables
Teachers	Scale preparation	AI Competence, AI Anxiety, AI Usefulness, General Digital Literacy, Ethical Decision Making
Teachers	Reverse coding	TCH_ANX_30
Teachers	Scenario recoding	SD01–SD03
Students	Alignment with the Master Codebook	SP, AILQ, DIG, SD variables
Students	Variable harmonization	Background variables
Students	Scale preparation	Affective, Behavioural, Cognitive, Ethical, Digital Literacy, Ethical Awareness
Students	Scenario recoding	SD04–SD06

3.2 Descriptive Analysis (Frequencies, Means, Standard Deviations for AI Literacy and Ethical Awareness)

3.2.1. Frequencies of the main background variables

Frequencies and percentages were calculated in both samples for the main background variables. In the case of the teachers' sample, the variables considered were gender, age, teaching experience, the educational level at which they teach, specialty, and relationship with technology. For the students' sample, gender, age, frequency of AI tool use, and perceptions of AI use in academic tasks were analysed.

Tables 2 and 3 present the results for teachers and students, respectively. The teachers' sample shows a predominance of women and a concentration of participants in the 45–54 age group. Most teachers reported using technology regularly to support their teaching, and Humanities

and Arts was the most represented specialty area. The students' sample also shows a slight female majority, as well as a notable presence of 15- and 18-year-old students. Most students reported using AI at least occasionally, mainly to obtain ideas, translations, or support with schoolwork.

Table 2. Main background characteristics of the Spanish teachers' sample

Variable	Category	n	%
Gender	Male	51	35.92
	Female	90	63.38
	Prefer not to say	1	0.70
Age group	Under 25 years	4	2.82
	25–34 years	12	8.45
	35–44 years	33	23.24
	45–54 years	64	45.07
	55 years or older	29	20.42
Teaching experience	Less than 5 years	22	15.49
	5–15 years	43	30.28
	16–25 years	39	27.46
	More than 25 years	38	26.76
Education level taught	Upper secondary education (ISCED 3)	24	16.90
	Compulsory secondary education (ESO)	85	59.86
	Vocational education and training (ISCED 3)	17	11.97
	Other	16	11.27
Specialty	Special education / attention to diversity	14	9.86
	Social sciences	13	9.15
	Physical education	6	4.23
	Humanities and arts	57	40.14
	STEM	39	27.46
	Other	13	9.15
Relation with technology	Constant experimentation with apps, hybrid methods, and AI tools	27	19.01
	Avoids technology whenever possible	6	4.23
	Mainly uses it for administrative tasks or basic presentations	20	14.08

	Uses it regularly to support teaching	89	62.68
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Table 2 presents the main background characteristics of the Spanish teacher sample (N = 142). The sample is predominantly composed of female teachers (63.4%), while male teachers account for 35.9% of respondents and only one participant preferred not to disclose their gender. Regarding age, the largest group is between 45 and 54 years old (45.1%), followed by those aged 35–44 years (23.2%) and 55 years or older (20.4%). This distribution indicates that the sample is largely composed of mid-career and senior professionals, providing perspectives grounded in substantial teaching experience.

The teaching experience profile is relatively balanced across categories, although teachers with 5–15 years of experience represent the largest group (30.3%). Respondents with 16–25 years (27.5%) and more than 25 years of experience (26.8%) are also well represented, while early-career teachers with less than five years of experience account for 15.5% of the sample. This diversity in professional trajectories offers a broad representation of teaching perspectives across different career stages.

Most participants teach in Compulsory Secondary Education (ESO) (59.9%), followed by Upper Secondary Education (16.9%) and Vocational Education and Training (12.0%). In terms of specialty, Humanities and Arts teachers constitute the largest group (40.1%), while STEM teachers represent more than a quarter of the sample (27.5%). The remaining participants are distributed across Special Education and Attention to Diversity (9.9%), Social Sciences (9.2%), Physical Education (4.2%), and other fields (9.2%). This disciplinary diversity contributes to a comprehensive understanding of educational practices and attitudes across different subject areas.

With regard to the relationship with technology, the findings reveal a strong integration of digital tools into teaching practices. Nearly two-thirds of respondents (62.7%) report using technology regularly to support teaching, and a further 19.0% describe themselves as continuously experimenting with new applications, hybrid methodologies, and artificial intelligence tools. In contrast, only 4.2% indicate that they avoid technology whenever possible. These results suggest a highly positive disposition towards educational technology among Spanish teachers, with a substantial proportion actively engaging in innovative digital practices. Overall, the sample can be characterised as an experienced and technologically engaged teaching workforce, providing a solid basis for analysing teachers' perceptions and experiences within the STIAEM project.

Table 3. Main background characteristics of the Spanish students' sample

Variable	Category	n	%
Gender	Male	128	42.24
	Female	168	55.45
	Prefer not to say	7	2.31
Age	14 years	58	19.14
	15 years	73	24.09
	16 years	52	17.16
	17 years	26	8.58
	18 years	94	31.02

AI use	Never	3	0.99
	Sometimes, for translations or ideas	145	47.85
	Regularly, for homework	144	47.52
	Only once or twice out of curiosity	11	3.63
AI and homework	It is like copying from a classmate	14	4.62
	It is like a calculator; useful if you know how to use it	86	28.38
	It helps me understand things I did not understand in class	156	51.49
	It helps me finish faster, even if I learn less	47	15.51

The data presented in Table 3 for the students' sample show a majority of women (55.45%), although less marked than in the teachers' sample. The age distribution is concentrated mainly among 15-year-olds (24.09%) and 18-year-olds (31.02%). Regarding AI use, most students reported using it sometimes, for translations or ideas (47.85%), or regularly, for homework (47.52%), while the group reporting no use at all was very small (0.99%). In addition, the most frequent response concerning the use of AI in schoolwork was it helps me understand things I did not understand in class (51.49%), suggesting a predominantly supportive perception of AI in learning.

3.2.2. Means and standard deviations for AI Literacy and Ethical Awareness

Means and standard deviations were calculated for the main dimensions in both the teachers' and students' samples. In the teachers' sample, the descriptive statistics were organized around the dimensions of AI Competence, AI Anxiety, AI Usefulness, Digital Literacy, and Ethical Decision Making. In the students' sample, the dimensions considered were Affective, Behavioural, Cognitive, Ethical, Digital Literacy, and Ethical Awareness.

As shown in Table 4, the highest mean scores in the teachers' sample correspond to AI Competence ($M = 3.31$, $SD = 0.77$), AI Usefulness ($M = 3.22$, $SD = 0.84$), and Digital Literacy ($M = 3.14$, $SD = 0.77$), whereas AI Anxiety shows a lower mean score ($M = 2.52$, $SD = 0.81$). In turn, Ethical Decision Making shows a mean score of 2.01 ($SD = 0.58$) on a recoded scale ranging from 0 to 3.

In the students' sample, the dimension with the highest mean score is Ethical ($M = 4.05$, $SD = 0.68$), followed by Digital Literacy ($M = 3.31$, $SD = 0.55$), Cognitive ($M = 3.19$, $SD = 0.69$), and Affective ($M = 3.17$, $SD = 0.70$). The lowest scores are observed in Behavioural ($M = 2.61$, $SD = 0.73$) and Ethical Awareness ($M = 1.81$, $SD = 0.54$), the latter also calculated on a recoded 0–3 scale.

Table 4. Means and standard deviations for AI literacy and ethical awareness dimensions

Sample	Dimension	n	Mean	SD
Teachers	AI Competence	142	3.31	0.77
	AI Anxiety	142	2.52	0.81
	AI Usefulness	142	3.22	0.84
	Digital Literacy	142	3.14	0.77
	Ethical Decision Making	142	2.01	0.58
Students	Affective	303	3.17	0.70
	Behavioural	303	2.61	0.73

	Cognitive	303	3.19	0.69
	Ethical	303	4.05	0.68
	Digital Literacy	303	3.31	0.55
	Ethical Awareness	303	1.81	0.54

3.3 Comparative and Correlational Analysis (ANOVA, T-test, Pearson/Regression Models)

3.3.1. Pearson correlations

Pearson correlations were calculated to examine the relationship between the main AI literacy dimensions and the ethical outcome variables in both samples. In the teachers' sample, the associations between AI Competence, AI Anxiety, AI Usefulness, and Digital Literacy and Ethical Decision Making were analysed. In the students' sample, the relationships between the Affective, Behavioural, Cognitive, Ethical, and Digital Literacy dimensions and Ethical Awareness were examined.

As shown in Table 5, in the teachers' sample the correlations with Ethical Decision Making were generally weak. Positive associations were observed for AI Competence ($r = 0.12$, $p = 0.159$), AI Usefulness ($r = 0.15$, $p = 0.068$), and Digital Literacy ($r = 0.11$, $p = 0.212$), although none of these reached statistical significance. By contrast, the relationship with AI Anxiety was negative and statistically significant ($r = -0.18$, $p = 0.032$).

In the students' sample, Ethical Awareness showed negative and statistically significant correlations with the Affective ($r = -0.14$, $p = 0.015$) and Cognitive ($r = -0.14$, $p = 0.013$) dimensions. The association with Behavioural was also negative, although it did not reach statistical significance ($r = -0.11$, $p = 0.062$). By contrast, the correlations with Ethical ($r = 0.09$, $p = 0.116$) and Digital Literacy ($r = 0.03$, $p = 0.544$) were positive, but not statistically significant.

Table 5. Pearson correlations between the main dimensions and the ethical outcome variables

Sample	Outcome variable	Predictor	r	p
Teachers	Ethical Decision Making	AI Competence	0.12	0.159
		AI Anxiety	-0.18	0.032
		AI Usefulness	0.15	0.068
		Digital Literacy	0.11	0.212
Students	Ethical Awareness	Affective	-0.14	0.015
		Behavioural	-0.11	0.062
		Cognitive	-0.14	0.013
		Ethical	0.09	0.116
		Digital Literacy	0.03	0.544

3.3.2. Multiple linear regression models

Multiple linear regression models were estimated to examine the extent to which the main AI literacy dimensions predicted the ethical outcome variables in both samples. In the teachers' sample, the dependent variable was Ethical Decision Making, whereas in the students' sample the outcome variable was Ethical Awareness.

As reported in Table 6, in the teachers' sample the overall model was not statistically significant, $F(4, 137) = 1.519$, $p = 0.200$, and explained a small proportion of the variance ($R^2 = 0.042$; adjusted $R^2 = 0.015$). None of the predictors included in the model made a statistically significant contribution to the prediction of Ethical Decision Making.

In the students' sample, the regression model was statistically significant, $F(5, 297) = 3.916$, $p = 0.002$, although its explanatory power was modest ($R^2 = 0.062$; adjusted $R^2 = 0.046$). In this case, the Cognitive ($B = -0.152$, $p = 0.010$) and Ethical ($B = 0.138$, $p = 0.007$) dimensions showed significant associations with Ethical Awareness, whereas Affective, Behavioural, and Digital Literacy did not reach statistical significance in the final model.

Table 6. Multiple linear regression models

Sample	Outcome variable	Predictor	B	SE	t	p
Teachers	Ethical Decision Making	AI Competence	-0.040	0.097	-0.411	0.682
		AI Anxiety	-0.097	0.072	-1.355	0.178
		AI Usefulness	0.067	0.082	0.811	0.419
		Digital Literacy	0.066	0.075	0.883	0.379
Students	Ethical Awareness	Affective	-0.116	0.062	-1.865	0.063
		Behavioural	0.038	0.060	0.639	0.523
		Cognitive	-0.152	0.058	-2.610	0.010
		Ethical	0.138	0.051	2.705	0.007
		Digital Literacy	0.080	0.062	1.280	0.202

Note. Teachers: $R^2 = 0.042$, adjusted $R^2 = 0.015$, $F(4, 137) = 1.519$, $p = 0.200$. Students: $R^2 = 0.062$, adjusted $R^2 = 0.046$, $F(5, 297) = 3.916$, $p = 0.002$.

Multiple linear regression models were estimated to examine the extent to which the main AI literacy dimensions predicted the ethical outcome variables in both samples. In the teachers' sample, the dependent variable was Ethical Decision Making, whereas in the students' sample the outcome variable was Ethical Awareness.

As reported in Table 6, in the teachers' sample the overall model was not statistically significant, $F(4, 137) = 1.519$, $p = 0.200$, and explained a small proportion of the variance ($R^2 = 0.042$; adjusted $R^2 = 0.015$). None of the predictors included in the model made a statistically significant contribution to the prediction of Ethical Decision Making.

In the students' sample, the regression model was statistically significant, $F(5, 297) = 3.916$, $p = 0.002$, although its explanatory power was modest ($R^2 = 0.062$; adjusted $R^2 = 0.046$). In this case, the Cognitive ($B = -0.152$, $p = 0.010$) and Ethical ($B = 0.138$, $p = 0.007$) dimensions showed significant associations with Ethical Awareness, whereas Affective, Behavioural, and Digital Literacy did not reach statistical significance in the final model.

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3.3.3. Group comparisons: t-test and ANOVA

Group comparison tests were conducted using t-tests and ANOVA in order to explore possible differences in the main dimensions according to background variables. In the teachers' sample, the t-test was applied by gender, while ANOVA was conducted according to age, teaching experience, educational level, and specialty. In the students' sample, the t-test was used for gender comparisons, whereas ANOVA was performed according to age, frequency of AI use, and perceptions of AI use in schoolwork.

In the teachers' sample, no statistically significant differences were observed either in the gender comparisons or in the analyses of variance conducted for the remaining background variables. Consequently, the dimensions of AI Competence, AI Anxiety, AI Usefulness, Digital Literacy,

and Ethical Decision Making showed a relatively homogeneous pattern across the different groups considered.

By contrast, several statistically significant differences were identified in the students' sample, as summarized in Table 7. In the gender comparisons, significant differences were found in Affective, Behavioural, Ethical, and Ethical Awareness. Likewise, the analyses of variance revealed significant differences associated with age in the Affective, Behavioural, and Cognitive dimensions; with AI use in most of the dimensions analysed; and with opinions about AI use in academic tasks in Affective, Behavioural, Cognitive, and Ethical. Overall, these results suggest greater internal variability in the students' sample than in the teachers' sample.

Table 7. Summary of significant group comparisons in the students' samples

Grouping variable	Dependent variable	Test	Statistic	p
Gender	Affective	t-test	3.917	< .001
Gender	Behavioural	t-test	4.268	< .001
Gender	Ethical	t-test	-2.146	.33
Gender	Ethical Awareness	t-test	-2.614	.09
Age	Affective	ANOVA	6.685	< .001
Age	Behavioural	ANOVA	8.663	< .001
Age	Cognitive	ANOVA	3.404	.10
AI Use	Affective	ANOVA	14.256	< .001
AI Use	Behavioural	ANOVA	12.744	< .001
AI Use	Cognitive	ANOVA	8.132	< .001
AI Use	Ethical	ANOVA	2.665	.48
AI Use	Digital Literacy	ANOVA	2.719	.45
AI Use	Ethical Awareness	ANOVA	4.858	.03
AI Homework Opinion	Affective	ANOVA	3.047	.29
AI Homework Opinion	Behavioural	ANOVA	5.992	< .001
AI Homework Opinion	Cognitive	ANOVA	3.444	.17
AI Homework Opinion	Ethical	ANOVA	2.945	.33

Overall, the analyses conducted for the Spanish teachers' and students' samples made it possible to standardize the datasets, validate the measurement structure, and examine both descriptive and inferential patterns across the main dimensions of AI literacy and ethical outcomes. While the teachers' sample showed a more homogeneous profile across the variables analysed, the students' sample revealed greater internal variability, particularly in the comparative and predictive analyses.

4. Qualitative Analysis and Dilemma Scenarios (SJT)

4.1 Thematic Analysis and Coding of Focus Group/Interview Content

Due to time constraints and the extensive amount of quantitative data that had to be previously collected and analysed, the qualitative phase of the study was limited to a small exploratory

sample. Interview recordings were collected from:

- 5 secondary school teachers
- 5 secondary school students
- 5 Stakeholders

A pilot qualitative analysis was conducted with the interviews of secondary school teachers in order to identify preliminary themes, perceptions, and emerging concerns regarding the use of AI in education. However, the current qualitative sample is still limited and should not be considered representative at national level. Therefore, before extending the analysis to the remaining participant groups, it is recommended to enlarge the sample in order to ensure greater validity, reliability, and robustness of the findings included in the National Report.

4.2 Analysis of Dilemma Scenarios

ACQUAD 7 (Huber & Gürtler, 2013) was used to analyse and interpret the data collected in the open questions in the questionnaire, since according to Iglesias et al. (2014) it has the “capacity to combine the processes of interpretation and codification” and also permits “a deductive and inductive strategy” (p. 172).

The analysis followed these phases:

- First, a list was drawn up with the recurring concepts of the answers.
- Next, the frequency levels of each concept were identified.
- After this, the most iterative concepts were regrouped into codes and subcodes.
- Finally, frequencies and percentages were analysed.

The qualitative analysis also intends to quantify the importance of the issues that emerge using an absolute frequency (AF) and the percentage (%AF) in relation to the information gathered. The calculation of the absolute frequencies of the different codes shows their relative importance from the perspective of the participants.

4.2.1 Teacher Section

CODES		AF	AF%
BARRIERS / FEARS	LOSS OF CONTROL	3	3,3
	LEADS TO STANDARDIZATION	1	1,1 2,2
	SUBSTITUTION IN SOME WAYS (ROLE OF TEACHERS)	2	3,3 3,3 1,1
	LACK OF SKILLS FOR USE	3	
	LACK OF TIME TO LEARN	3	
	SPEED OF OBSOLESCENCE	1	
AI BENEFITS	ADAPTIVE TO DIVERSITY	4	4,4
	REDUCES MECHANICAL WORK	3 4	3,3 4,4
	QUICK / FAST	3	3,3
	REDUCES ADMINISTRATIVE WORK		
AI DRAWBACKS	HALLUCINATIONS	1	1,1
	CREATES GREATER ECONOMIC DIVIDE	1	1,1
RISKS TO MENTAL	AI IS USED AS A REAL	2	2,2

HEALTH FOR STUDENTS	PERSON	1	1,1
	AUGMENTS PREVIOUS PATHOLOGIES		
RISKS TO COGNITIVE HEALTH FOR STUDENTS	IT ELIMINATES CRITICAL THINKING	3 1	3,3 1,1
	IT CREATES IMMEDIACY	4	4,4
	URNS LEARNING PROCESS INTO COPY AND PASTE / LOSS OF COMPLEX REASONING	1	1,1
	LOSS OF CALCULATION SKILLS		
WHAT IS ETHICAL AI	SUSTAINABLE	4	4,4
	ETHICAL	5	5,5
	CRITICAL BEHAVIOUR	2	2,2
	MORE HUMAN	2	2,2
	REFLECTIVE	4	4,4
EFFICIENCY	TIME SAVING	5	5,
EQUITY	UNEQUAL ACCESS TO AI	2	2,2
	DIFFERENT AI PLATFORMS	2	2,2
	AI UNRELIABLE /BIAS	3	3,3
PERSONALIZATION BENEFITS OF AI FOR TEACHERS	ASSESSMENT	2	2,2
	ADAPTIVE EXERCISES FOR DIVERSE STUDENTS	5	5,5
AUTONOMY (FOR CENTRES)	BETTER ORGANIZATION	1	1
	OPTIMIZE DATA MANAGEMENT	1	1
PRIVACY OF STUDENTS	DIFFICULT TO MONITOR	4	4,4
	IMPOSSIBLE TO MONITOR	1	1
PEDAGOGICAL MODEL OF AI	SLOW-TECH WITH CRITICAL THINKING	4	4,4
	ECOLOGICAL/ SUSTAINABLE	2 1	2,2 1
	LIMITED AUTONOMY		
TOTALS		92	100%

The thematic analysis reveals an ambivalent perception of AI among teachers. On the one hand, participants recognize its potential to improve efficiency, reduce administrative workload, and personalize learning processes. On the other hand, significant concerns emerge regarding cognitive dependency, loss of critical thinking, ethical implications, unequal access, and the potential weakening of the teacher's role. Overall, the findings suggest that teachers advocate for a reflective, ethical, and human-centered integration of AI within education.

4.2.2 Student Section

Table 2. Thematic analysis of students.

THEMATIC AREAS	CODES	AF	AF%
BARRIERS / FEARS	BEING CAUGHT FOR (INAPPROPRIATE) AI USE	5	8,1
	HALLUCINATIONS	5	8,1
	FALSE INFORMATION	5	8,1
	NO CLEAR PROTOCOLS FOR AI USE	5	8,1
AI BENEFITS	USEFUL AS A GUIDE/SUPPORT FOR DAILY TASKS	4	6,5
	USEFUL FOR REVISION TASKS	1	1,6
	USEFUL FOR GENERAL INFORMATION/QUESTIONS	1	1,6
	CAN PROVOKE FURTHER INTEREST ON TOPICS	1	1,6
	FAST/ TIME SAVING	4	6,5
AI DRAWBACKS	SHORTCUT TO COMPLETING TASKS	2	3,2
	FALSE INFORMATION	5	8,1
	PRIVACY ISSUES	4	6,5
	NOT INTUITIVE/ISSUES WITH PROMPTS	1	1,6
	NON-ETHICAL USE	2	3,2
	HIGH COSTS	1	1,6
SUSTAINABILITY	ELEVATED COSTS	2	3,2
	NEED TO KEEP UP WITH LATEST MODEL	1	1,6
	OBSOLESCENCE	1	1,6
RISKS TO COGNITIVE AND MENTAL HEALTH FOR STUDENTS	ALTERS CRITICAL THINKING	1	1,6
	RELIEVES STRESS ABOUT GRADES	1	1,6
	IMPERSONAL	1	1,6
	EASY SOLUTION FOR LAZINESS	1	1,6
PEDAGOGICAL MODEL OF AI	TEACHERS GUIDING STUDENTS IN AI USE	3	4,8
	FOCUS ON FILTERING INFORMATION	2	3,2

	NEED FOR DIFFERENT ASSESSMENT STRATEGIES	1	1,6
	NEED FOR NEW TYPES OF ASSIGNMENTS	2	3,2
TOTALS		62	100%

The thematic analysis revealed that students held a nuanced and critical view of AI, recognizing both its potential benefits and associated risks. The most frequently reported concerns were related to barriers and fears surrounding AI use, particularly being accused of inappropriate AI use, the presence of hallucinations, false information, and the lack of clear institutional protocols (each AF = 5; 8.1%). These findings suggest that students are not only concerned about the reliability of AI-generated content but also about the uncertainty surrounding its acceptable use in educational settings.

Regarding the perceived benefits of AI, students primarily viewed it as a support tool for everyday academic tasks and as a means of saving time (AF = 4; 6.5%). Less frequently, participants highlighted its usefulness for revision, obtaining general information, and stimulating further interest in a topic (AF = 1; 1.6%). This indicates that students tend to adopt a pragmatic perspective, valuing AI mainly for its efficiency and assistance functions.

At the same time, students identified several drawbacks associated with AI use. The most salient concerns were the risk of receiving false information (AF = 5; 8.1%) and privacy-related issues (AF = 4; 6.5%). Other concerns included the possibility of using AI as a shortcut to complete assignments, difficulties in crafting effective prompts, ethical issues, and the economic costs associated with advanced AI tools. These responses demonstrate an awareness of both technical limitations and ethical implications.

The sustainability dimension received comparatively less attention, although some participants expressed concerns about the financial costs of AI tools, the need to continuously adapt to newer models, and technological obsolescence. This suggests that long-term sustainability issues are not yet a primary concern for most students.

Interestingly, references to cognitive and mental health implications were relatively scarce. However, students raised issues such as the potential impact of AI on critical thinking, the risk of encouraging intellectual passivity, and the impersonal nature of AI-mediated interactions. Conversely, one participant noted that AI could reduce stress related to academic performance, illustrating the ambivalent perceptions students hold regarding its influence on learning.

Finally, students emphasized the need for a pedagogical model that integrates AI into education in a guided and responsible manner. The most recurrent suggestions included a stronger role for teachers in supporting AI use (AF = 3; 4.8%), the development of information-filtering skills, and the implementation of new assessment strategies and assignment formats. These findings indicate that students do not view AI as a replacement for teaching but rather as a tool that requires pedagogical mediation, critical literacy, and institutional guidance.

4.2.3 Stakeholders Section

Table 3. Thematic analysis of stakeholders.

THEMATIC AREAS	CODES	AF	AF%
TECHNOLOGY AND THE FUTURE	PERSONAL DECISION TO USE AI/ CONFIDENCE EQUALS USE	4	5,3
	NOT A TREND/ PERMANENT CHANGE	5	6,6 6,6
	NOT REGULATED/UNCLEAR PROTOCOLS	5	
	NEED FOR ADEQUATE TRAINING PROGRAMS	5	6,6
SLOW TECH	SPEED IS AN ADDED VALUE	5	6,6
	NEED FOR ETHICS	5	6,6
CLEAN IT	AMBIVALENT ABOUT COSTS	3	3,9
	UNAWARE OF COSTS	2	2,6
EFFICIENCY	SPEED IS AN ADDED VALUE	5	6,6
EQUITY/FAIRNESS	NEED FOR MANUAL REVISION	5	6,6
PRIVACY OF STUDENTS	DIFFICULTIES TO SAFEGUARD/ CAUTION NEEDED	5	6,6
	UNAWARE OF POSSIBLE SAFEGUARDS	5	6,6
PEDAGOGICAL MODEL OF AI	EU CONTROL OF PLATFORMS	1	1,25
	EU CONTROL OF AI MODELS	1	1,25
	ECOLOGICAL/ SUSTAINABLE	3	3,9
	ETHICAL	5	6,6
CHALLENGES FOR TEACHING	STUDENT COGNITIVE DISCONNECT	4	5,3
	STUDENT LOSS OF REFLECTIVE CAPACITIES	3	3,9
	NEED FOR CHANGES IN TEACHING-LEARNING STRATEGIES	5	6,6
TOTALS		76	100%

The thematic analysis of stakeholders revealed a predominantly strategic and future-oriented perspective on the integration of artificial intelligence in education. Participants generally viewed AI as a permanent technological transformation rather than a passing trend (AF = 5; 6.6%), emphasizing the need for adequate training programs, clear regulations, and institutional protocols to guide its implementation. The recurring references to uncertainty regarding regulation and governance suggest that stakeholders perceive a significant gap between the rapid development of AI technologies and the educational frameworks required to manage them effectively.

Within the theme of technology and the future, participants highlighted the importance of individual confidence and willingness to engage with AI as factors influencing adoption (AF = 4; 5.3%). At the same time, they recognized the added value of AI in terms of speed and efficiency (AF = 5; 6.6%), while expressing ambivalent views regarding its economic costs and demonstrating limited awareness of the financial implications associated with AI systems. These findings suggest that stakeholders acknowledge the practical benefits of AI but remain uncertain about its long-term sustainability and economic impact.

Efficiency emerged as a key perceived advantage, with stakeholders consistently identifying speed as one of the most valuable characteristics of AI tools (AF = 5; 6.6%). However, this efficiency-oriented perspective was balanced by concerns about fairness, reliability, and the continued need for human oversight. In particular, participants stressed the importance of manual review processes to ensure accuracy and equity in AI-supported educational practices (AF = 5; 6.6%).

Privacy and data protection constituted another prominent theme. Stakeholders expressed concern about the challenges involved in safeguarding students' personal data (AF = 5; 6.6%) and acknowledged limited awareness of existing mechanisms or safeguards that could mitigate these risks (AF = 5; 6.6%). This finding points to a need for greater digital literacy and institutional guidance regarding data governance and responsible AI use in educational contexts.

From a pedagogical perspective, stakeholders highlighted the necessity of rethinking educational practices in response to AI. The most frequently mentioned issue was the need to modify teaching and learning strategies (AF = 5; 6.6%), accompanied by concerns about students' potential cognitive disengagement (AF = 4; 5.3%) and loss of reflective capacities (AF = 3; 3.9%). These perceptions suggest that stakeholders view AI not merely as a technological tool but as a factor capable of transforming the nature of learning itself, requiring pedagogical adaptation to preserve critical thinking and meaningful engagement.

Finally, ethical and governance-related concerns were recurrent throughout the dataset. Participants emphasized the need for ethical frameworks to guide AI use, while some advocated for stronger European oversight of AI platforms and models. Although these issues were mentioned less frequently, they reflect a broader concern regarding accountability, transparency, and the societal implications of AI adoption in education.

Overall, the findings indicate that stakeholders adopt a cautiously optimistic stance toward AI. While they recognize its potential to enhance efficiency and support educational processes, they simultaneously stress the need for regulation, ethical governance, teacher training, data

protection, and pedagogical innovation. Unlike students, whose perceptions focused primarily on practical benefits and risks, stakeholders tended to frame AI as a systemic challenge requiring institutional and educational transformation.

4.3 Triangulation (Integration of Qualitative Results with Quantitative Trends)

The recorded interviews were analyzed and codified. The codes show how different participants view the use of AI and gives greater detail by identifying additional features related to: AI Anxiety, AI Competence (including benefits and drawbacks), AI Usefulness, Digital Literacy and AI pedagogy models.

To start, the use of AI does produce some fears. Teachers do feel a loss of control and that there is in some ways a substitution in the role of teachers. Other fears and barriers include standardization and the speed of obsolescence which reflects that the lack of skills for use and of time to learn are key factors in this category. In the category regarding risks to cognitive health for students, teachers pinpoint more features that include: the elimination of critical thinking, it creates immediacy, it turns learning process into copy and paste with the loss of complex reasoning and there is also a loss of calculation skills. There are general benefits to the use of AI such as: adaptive to diversity, it reduces mechanical work, it saves time and reduces administrative work. In addition, the personalization benefits of AI for teachers includes the possibility of individualized assessment.

In the case of students, their fears are associated with being caught for (inappropriate) AI use as there are no clear protocols for AI use at most educational centres. AI hallucinations and false information are additional codes that show the awareness of students of the unreliability of information generated by AI. Students have identified AI benefits related to the teaching learning processes: it is useful as a guide/support for daily tasks, for revision tasks, for general information/questions. Other items indicate that it is fast/ time saving and that it can provoke further interest on topics. It is important to note that the pedagogical model of AI focuses on teachers guiding students in AI use, and filtering information. Students have also identified the need for different assessment strategies and for new types of assignments.

The expert group are more directly aligned with the use of AI as personal decision which correlated directly with confidence in using AI. They also highlight that AI is not a trend it is a permanent change which at the moment is not regulated, there are unclear protocols and there is a need for adequate training programs. The pedagogical model in this case calls for the intervention of the EU to create platforms and models that do not rely on supranational organizations. This would enable greater control over the ethics and sustainability of AI use.

Data triangulation across students, teachers, and stakeholders revealed both convergences and differences in perceptions of AI in education. A common concern shared by all three groups was the need for critical and responsible AI use, particularly regarding the risks associated with inaccurate information, overreliance on AI systems, and the potential erosion of students' critical thinking skills. Likewise, participants across groups recognized the efficiency benefits of AI, especially its capacity to save time and support educational tasks.

However, each group approached AI from a different perspective. Students primarily focused on practical issues related to everyday use, including concerns about hallucinations, false information, academic integrity, and the lack of clear protocols governing AI use. Teachers adopted a predominantly pedagogical perspective, emphasizing both the opportunities offered by AI for personalization and inclusion and the risks it poses to deep learning, critical thinking, equity, and student privacy. In contrast, stakeholders framed AI as a broader institutional and societal challenge, highlighting the need for regulation, governance frameworks, ethical oversight, training programs, and systemic changes in teaching and assessment practices.

Taken together, these findings suggest a continuum of concerns that ranges from AI use

(students), to AI integration in teaching and learning processes (teachers), to AI governance and regulation (stakeholders). This convergence supports the view that successful AI implementation in education requires not only technological adoption but also pedagogical transformation, institutional guidance, and ethical governance frameworks.

5. Case Studies

5.1 Selection and Description of a National Case Study on the Use of AI

As examples of good practices in the use of Artificial Intelligence from the academic sphere, we present three university research projects related to language and literature education that incorporate innovative activities and may be particularly relevant within the framework of the STIAEM project.

AI-READ is a research project co-directed by José Manuel de Amo, Professor of Language and Literature Education at the University of Almería, and Gemma Lluch, Professor of Catalan Philology at the University of Valencia. Funded by the Spanish Ministry of Science, Innovation and Universities, the project, entitled “*Educational Transformation: Exploring the Impact of Artificial Intelligence on University Students’ Reading and Writing Education*” (PID2023-151419OB-I00), focuses on analysing the impact of Artificial Intelligence on academic writing. Its main objective is to generate frontier knowledge in an emerging field of research: the influence of disruptive technologies such as AI on the development of university students’ communicative competence. The project investigates how generative AI is transforming academic literacy practices and seeks to identify both the opportunities and challenges associated with its integration into higher education. The project website includes several recent and significant publications, among them:

- Amo, J. M. de, & Baldrich, K. (2026). *La alfabetización académica asistida por inteligencia artificial generativa: impacto en la calidad de la escritura disciplinaria*. *Pixel-Bit. Revista de Medios y Educación*, 75. <https://doi.org/10.12795/pixelbit.113712>
- Sanz-Tejeda, A., Domínguez-Oller, J. C., Baldaquí-Escandell, J. M., Gómez-Díaz, R., & García-Rodríguez, A. (2026). *The impact of generative AI on academic reading and writing: A synthesis of recent evidence (2023–2025)*. *Frontiers in Education*, 10. <https://doi.org/10.3389/feduc.2025.1711718>

KOSMOLIT: Literary Education, Artificial Intelligence and Scientific Culture in Teacher Education is an educational innovation project at the University of Valencia coordinated by Professor Jerónimo Méndez Cabrera and Professor Dominika Fajkišová. The initiative constitutes a concrete example of the development of educational content for children through the use of Artificial Intelligence, with the aim of creating pedagogically meaningful narratives for Primary Education classrooms. The project explores the potential of AI as a resource for language and literary education while fostering creativity, inclusion, and scientific culture in teacher education. Recent publications associated with the project include:

- Fajkišová, D., Méndez Cabrera, J., & Ballester Roca, J. (2025). *La percepción de la lectura literaria en alumnado de Primaria: un estudio cualitativo en cuatro escuelas europeas*. In *Investigación y formación del profesorado para la educación lingüística y literaria* (pp. 15–31). Graó.
- Méndez Cabrera, J., & Fajkišová, D. (2025). *La inteligencia artificial como recurso inclusivo para la gamificación de la educación lectora y literaria*. *EduTec: Revista Electrónica de Tecnología Educativa*, 93. <https://doi.org/10.21556/EDUTEC.2025.93.4051>

The emerging research project **LUMINARIA (Reading and Multimodal Uses of Children’s**

Graphic Narratives), developed at the University of Alicante and led by Professor Sebastián Miras, aims to create a corpus of Spanish-language visual narratives centred on picturebooks and to develop a digital platform incorporating a specialised educational chatbot. The project, fully described on its website, is designed to support professionals involved in children's reading mediation by facilitating the selection, analysis, and pedagogical use of graphic narratives. By combining academic research with technological tools, LUMINARIA responds to the need to systematise and increase the visibility of visual narratives within the Spanish-speaking context while promoting visual and critical literacy among children. Recent publications related to the project include:

- Rovira-Collado, J., Miras, S., Mateo-Guillen, C., & Ruiz-Bañuls, M. (2025). *Creativity and writing with generative artificial intelligence in the master's degree in teacher training*. *Frontiers in Education*, 10. <https://doi.org/10.3389/FEDUC.2025.1700268>
- Ribes-Lafoz, M. A., Miras, S., Cañamares-Torrijos, C., & Rovira-Collado, J. (2026). *Mario Benedetti 5.0: preguntas para la inteligencia artificial*. *Revista Colombiana de Educación*, 98. <https://doi.org/10.17227/RCE.NUM98-22920>

These three initiatives represent distinct approaches among the many university research and educational innovation projects currently being developed in Spain. Nevertheless, all three can serve as valuable models for the implementation of the *Slow Tech* philosophy in the integration of Artificial Intelligence across educational levels. In the case of AI-READ, the widespread use of AI in academic writing is acknowledged and critically examined in order to promote transparent, ethical, and educationally beneficial practices. KOSMOLIT provides a practical example of how AI-generated content can be meaningfully incorporated into Primary Education classrooms to support language and literary learning. Finally, although LUMINARIA is not exclusively focused on Artificial Intelligence, one of its core outputs is the development of a specialised AI-powered assistant designed to facilitate access to the knowledge generated by the project on multimodal reading and graphic narratives. Moreover, the coordinator of LUMINARIA is also a member of the STIAEM consortium, ensuring that the project is fully aligned with the pedagogical principles and ethical foundations underpinning STIAEM.

Other national initiatives in Spain can currently be identified as examples of good practices regarding the responsible and educational use of Artificial Intelligence.

a) One of the most significant developments is the creation of the **Agencia Española de Supervisión de Inteligencia Artificial (AESIA)** in A Coruña, which became the first Spanish and European public agency specifically dedicated to the supervision and regulation of Artificial Intelligence. The agency was established to promote the ethical, safe, and transparent use of AI technologies.

b) Another relevant example is the work developed by the **Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado (INTEF)**, which has played a leading role in integrating AI-related competencies into Spain's teacher training framework. Through its *Guide on the Use of Artificial Intelligence in Education*, developed in collaboration with educational experts and public educational institutions, INTEF promotes digital and AI literacy among teachers while providing practical recommendations for the pedagogical use of AI in schools. The guidelines also address the responsible interaction of students with AI systems, emphasizing critical thinking, ethical and transparent use, digital citizenship, and the protection of privacy and personal data. As such, they constitute one of the most significant national references for supporting the safe and educationally meaningful integration of Artificial Intelligence into Spanish education. <https://code.intef.es/wp-content/uploads/2025/11/Guide-on-the-use-of-artificial-intelligence-in-education INTEF 2024.pdf?>

c) **PHYSIA – Physics-Informed Artificial Intelligence for Scientific and Industrial Innovation**

PHYSIA is an ambitious research project funded through the prestigious European Research Council (ERC) Advanced Grant programme. The project will be carried out over a five-year period within the Applied Mechanics and Bioengineering Research Group at the Aragón Institute for Engineering Research (I3A), University of Zaragoza, through the Chair of the Spanish National Artificial Intelligence Strategy.

The initiative aims to establish the foundations for a new generation of Artificial Intelligence systems capable of understanding and interacting with the physical world by integrating the laws of physics directly into machine learning models. By combining advances in AI with scientific knowledge, PHYSIA seeks to overcome some of the limitations of current data-driven approaches and develop more reliable, interpretable, and efficient intelligent systems.

Beyond its scientific contribution, the project explores innovative applications in industrial design, engineering processes, and the emerging field of the industrial metaverse. The research is being conducted by a multidisciplinary team and will create new opportunities for early-career researchers in areas related to Artificial Intelligence, engineering, and computational sciences.

The project also reflects the strong research performance of the University of Zaragoza, which has secured 27 ERC grants since 2009, positioning it among the leading Spanish universities in terms of participation and success in Horizon Europe research programmes.

d) First FP–UNIZAR Award – “AI, the New Study Companion”

The First FP–UNIZAR Award, entitled “*AI: The New Study Companion*”, represents an educational initiative designed to promote critical reflection on the role of Artificial Intelligence in learning processes. The competition encourages vocational education and training (VET) students to explore the opportunities, challenges, and ethical implications of AI as a tool for academic support and lifelong learning.

Through project-based activities, participants are invited to analyse how AI can enhance study practices, facilitate access to information, and support personalised learning, while also considering potential risks related to overreliance on technology, academic integrity, and critical thinking. As such, the initiative contributes to the development of AI literacy and responsible digital citizenship among young learners.

5.2 Analysis of the Experiment's Pedagogical and Empirical Results

The creation of the *Agencia Española de Supervisión de Inteligencia Artificial* (AESIA) represents a pioneering initiative at European level, as Spain became the first European country to establish a dedicated AI supervisory agency. According to the agency, its main objective is to minimize the risks that AI may pose to safety, health, and fundamental rights (Agencia Española de Supervisión de Inteligencia Artificial, 2025). This initiative contributes to the development of a safer and more ethically regulated educational and technological environment.

At the educational level, the *Instituto Nacional de Tecnologías Educativas y de Formación del Profesorado* (INTEF) has promoted teacher training programmes focused on the pedagogical use of AI tools such as OpenAI's ChatGPT. Teachers are trained to help secondary school students identify hallucinations, misinformation, and errors generated by AI systems. Furthermore, AI tools are increasingly used to reduce teachers' administrative workload through the creation of assessment rubrics, adaptive learning materials, and personalized resources for students with specific learning difficulties. This allows teachers to dedicate more time to emotional support, mentoring, and student guidance (INTEF, 2026).

Finally, the national protocol developed by the Ministry of Education promotes a critical and reflective interaction with AI among secondary school students. Rather than using AI

simply to complete assignments, students are encouraged to use it as a debate tutor and reflective learning assistant. Additionally, regions such as Community of Madrid, Catalonia, and Andalucia have incorporated teaching units that help students analyse gender and racial bias in social media platforms such as TikTok and Instagram (INTEF, 2026). These practices foster critical digital literacy, ethical awareness, and active student engagement in the analysis of AI-related social issues.

6. Conclusions and Recommendations

- **6.1 Main Training Gaps and Identified Needs**

The findings of the study reveal that, although Artificial Intelligence is increasingly present in secondary education, important training gaps and structural needs still remain among teachers, students, and educational institutions.

One of the main challenges identified is the lack of specific teacher training in the pedagogical, ethical, critical, balanced, and sustainable use of AI tools. Many teachers acknowledge the potential benefits of AI for reducing administrative workload and supporting personalized learning; however, they also express concerns regarding the lack of digital competencies, insufficient time for training, and the rapid evolution of AI technologies. These limitations may contribute to insecurity and resistance toward the integration of AI in educational contexts.

The study also highlights the need to strengthen students' critical digital literacy. Participants expressed concerns about risks such as overdependence on AI, loss of critical thinking, superficial learning processes, and difficulties in identifying misinformation or AI-generated hallucinations. Consequently, there is a growing need to develop educational strategies that promote reflective, ethical, balanced, and autonomous uses of AI among students.

In addition, inequalities in access to AI technologies and differences between educational centres represent an important challenge for educational equity. The findings suggest that schools require clearer institutional guidelines, accessible technological resources, and coordinated national policies to ensure inclusive, balanced, and responsible AI implementation.

Finally, the results underline the importance of addressing ethical dimensions such as privacy protection, algorithmic bias, sustainability, and the preservation of human-centred pedagogical approaches.

- **6.2 Operational Suggestions and Requirements for the Development of AI-based Pedagogical Models**

Based on the findings obtained, several operational recommendations can be proposed for the development of AI-based pedagogical models in secondary education.

First, it is recommended to promote comprehensive teacher training programmes focused not only on technical AI skills but also on critical thinking, ethical awareness, digital safety, and pedagogical innovation. Teacher training should include practical guidance on how to integrate AI tools into classroom activities while maintaining active and reflective learning methodologies.

Second, AI should be incorporated as a support tool rather than as a substitute for teachers or students' cognitive processes. Educational models should encourage the use of AI for

tutoring, feedback, adaptive learning, and administrative support, while preserving students' autonomy, creativity, and critical reasoning abilities.

Third, national and regional educational authorities should continue developing clear ethical and pedagogical frameworks that regulate the use of AI in schools. These frameworks should prioritize:

- a) Data privacy and student protection,
- b) Transparency in AI use,
- c) Reduction of algorithmic bias,
- d) and Equitable access to technological resources.

Moreover, educational institutions should adopt “human-centred” and “slow-tech” approaches that promote reflective and sustainable uses of AI instead of excessive technological dependence.

Finally, future research should expand both quantitative and qualitative samples in order to obtain more representative evidence regarding the long-term pedagogical impact of AI in secondary education. Stronger triangulation between quantitative trends and qualitative experiences would contribute to the development of more reliable and evidence-based educational policies.

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APPENDIX I

a) Qualitative Analysis: Interviews

Protocol for focus groups and semi-structured interviews - TEACHERS

1. Introduction and warm-up (10 min)

- Brief presentation of the "Slow Tech Innovation" project objectives.
- Informed consent and reassurance on data anonymity.

2. Perception of AI: resistances and opportunities (15 min)

- Question 1: What are the main barriers or fears (e.g., "fear of replacement", lack of skills) that you encounter in the adoption of AI in your school?
- Question 2: Conversely, in which specific areas do you believe AI can offer the greatest opportunities to improve teaching quality?

3. Ethical impact and well-being - Slow Tech paradigm (15 min)

- Question 3: Considering the "Slow Tech" approach (which prioritizes human well-being over technological acceleration), what risks do you see in the daily use of AI for students' mental and cognitive health?
- Question 4: Do you feel the need for clearer guidelines for ethical use? If so, on which specific aspects?

4. Guided discussion on ethical dilemmas - (20 min) *(Present the scenarios to the participants to stimulate qualitative debate on the reasons for their choices)*

- Scenario A (Efficiency vs. Equity): Discussion on algorithmic bias in automated grading. Prompt: Is a discriminatory margin of error acceptable in exchange for significant time savings for the teacher?
- Scenario B (Personalization vs. Privacy): Discussion on datafication. Prompt: What is the ethical limit in yielding students' behavioral data and emotions in exchange for hyper-personalized study paths?
- Scenario C (Autonomy vs. Assistance): Discussion on human agency. Prompt: If a student uses AI to structure an essay but writes the content themselves, is it a future skill or plagiarism?

5. Closing and recommendations (10 min)

- Question 5: What do you think should be the fundamental characteristics of an AI-based pedagogical model to be truly useful and sustainable for teachers?

APPENDIX II

Protocol for focus groups and semi-structured interviews - STUDENTS (WP2)

1. Introduction and warm-up (10 min)

- Brief presentation of the "Slow Tech Innovation" project (language adapted to the target audience).
- Informed consent (with possible reference to parental authorization) and reassurance of anonymity.

2. Perception of AI: habits and opportunities (15 min)

- **Question 1:** For which school or personal study activities do you use AI the most? What difficulties or fears do you encounter (e.g., fear of getting false information, fear of being accused of cheating)?
- **Question 2:** In which areas do you think AI is a valuable tool that helps you learn better, overcome blocks, or be more creative?

3. Ethical impact and well-being - Slow Tech paradigm (15 min)

- **Question 3:** The "Slow Tech" approach centers on human well-being over the speed of technology. Using AI frequently for homework, do you fear it might make your critical thinking "lazy" or create anxiety/addiction?
- **Question 4:** Do you feel a lack of clear rules at school about what is "allowed" and what is not regarding the use of AI? Would you like more precise guidelines from teachers?

4. Guided discussion on ethical dilemmas (20 min) (Real scenarios adapted for qualitative debate)

- **Scenario A (Academic Integrity & AI Hallucinations):** *(Read the scenario of the upcoming essay deadline with the AI-invented citation).*

Prompt: Which decision would you make among the proposed options (submit, cut, generalize, ask for an extension) and *why*? How do you handle the pressure of grades when you realize that the AI might have "hallucinated" data?

- **Scenario B (Data Privacy vs. Social Pressure):** *(Read the scenario of the viral app requiring sensitive data to avoid being excluded from the group).*

Prompt: What would you do and *why*? In your daily choices, how much does the fear of missing out (FOMO) weigh against the importance of protecting your personal data and photos?

- **Scenario C (Slow Tech & Planned Obsolescence):** *(Read the scenario of the two-year-old smartphone being slow compared to the new model with AI).*

Prompt: Which option would you choose and *why*? How much do you feel the need to have the latest available technology at the expense of repair or reuse?

5. Closing and recommendations (10 min)

- **Question 5:** What is the most important thing you would like your teachers or the school to understand about how your generation experiences and uses Artificial Intelligence?



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