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WP2 – COUNTRY REPORT

ITALY

Teacher Competences for Sustainable Digital Literacy:
National Context, Policies, and Professional Development

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Content

1. National Policy Framework for Digital and Sustainable Education

The reviewed national sources show that Italy has developed a substantial policy infrastructure for digital transformation in education, while sustainability, inclusion, openness and AI are entering the policy space through partially different routes. This section examines how this policy strands affect teachers and whether they already form a coherent vision of sustainable digital literacy for the teaching profession.

1.1 Digital Education Strategy and Teacher Competences

Italy's digital education policy has been anchored for a decade in the Piano Nazionale Scuola Digitale (PNSD), which is presented by the Ministry as the main programming instrument for the digital transformation of the Italian school system. The PNSD was introduced within Law 107/2015 and is structured around 35 actions distributed across:

- connectivity,
- environments and tools,
- competences and contents,
- training and accompaniment.

This architecture is important because it frames teachers not merely as users of technology, but as key actors in organizational and pedagogical innovation.

A second major driver is Piano Scuola 4.0, adopted within the National Recovery and Resilience Plan. The plan links investment in innovative classrooms and advanced laboratories with a methodological transformation of teaching and learning.

At implementation level, the national training environment Scuola Futura and its digital-transition pathways give this policy direction a concrete professional-development infrastructure. The evidence therefore shows that digital teacher competence in Italy is strongly supported through national strategy and CPD (Continuing Professional Development), even if it is not codified in a single teacher-specific statutory framework.

1.2 Sustainability in Education Policy

In Italy, sustainability is embedded above all through the civic education framework. Law 92/2019 established civic education as a transversal teaching area and explicitly included digital citizenship among its core components. This is a significant starting point because it connects education for democratic participation, sustainable development, and digital citizenship within the curriculum space.

The 2024 national guidelines for civic education strengthen this direction by explicitly connecting civic education with sustainability and by referring to the European competence frameworks GreenComp and LifeComp. The reviewed sources show that sustainability is therefore present in national education policy, but mainly through curricular and cross-curricular logic rather than through dedicated teacher competence architecture focused on sustainable digital literacy.

1.3 AI in Education Policy

Italy now operates in a more explicit AI policy environment than in the early years of the PNSD. At national level, the Italian Strategy for Artificial Intelligence 2024-2026 provides an updated framework for AI development and identifies training as one of its macro-areas (Agenzia per l'Italia Digitale - AgID, 2024). In education specifically, the Ministry's 2025 Guidelines for the Introduction of Artificial Intelligence in Educational Institutions provide principles and operational indications for schools.

The evidence suggests that AI in education is increasingly visible in Italy, but teacher competences for AI are still more strongly supported through guidance and emerging CPD than through a fully consolidated national profession-specific standard. This appears especially true for issues such as bias awareness, fairness, adaptive learning, and environmentally sustainable AI use, which are relevant to DigiSET but only partially formalized in the reviewed national sources.

1.4. Open Educational Resources (OER) in Education Policy

Italy does not appear to have a dedicated national OER policy of the same visibility and normativity as UNESCO's Recommendation on Open Educational Resources. However, the reviewed evidence shows that the national ecosystem includes important enabling conditions for openness. INDIRE (Istituto Nazionale di Documentazione Innovazione e Ricerca Educative - National Institute for Documentation, Innovation and Educational Research) supports documentation, dissemination and reuse of innovation practices, while professional-learning environments increasingly encourage resource sharing, collaborative design and digital content adaptation.

This means that OER-related practices are present in the Italian context, but they remain more practice-driven than policy-driven.

1.5 Gap Analysis: Sustainable Digital Literacy

From a DigiSET perspective, the key implication is that teachers can already access and share resources, but OER creation, licensing, adaptation and reuse are not yet consistently foregrounded as a core and explicit dimension of teacher professionalism.

Overall, the Italian policy landscape is rich in relevant priorities, but still only partially integrates digital education, sustainability, inclusion, openness and AI into a coherent teacher-focused vision of sustainable digital literacy. Digital transformation is strongly represented through the PNSD, Piano Scuola 4.0, and national CPD infrastructures. Sustainability is visible through civic education. Inclusion is deeply rooted in the system. AI is now entering school policy more explicitly. Yet these strands remain only partly connected.

- A first policy gap therefore concerns integration: digital education and sustainability are both visible, but not yet systematically translated into combined teacher competences for designing learning that is simultaneously digital, inclusive, critical and sustainability oriented.
- A second gap concerns AI literacy for teachers, especially regarding ethical and bias-aware AI use.
- A third concerns OER professionalism: openness exists more as an enabling culture than as a fully explicit professional expectation.

The evidence therefore suggests that Italy offers good conditions for DigiSET uptake, but also clear space for added value through integration.

2. Teacher competence frameworks in use

The policy context outlined above provides the background against which teacher competences are currently interpreted and operationalized in Italy. The next step is therefore to examine which competence frameworks are used, explicitly or implicitly, to guide teacher development.

2.1 National teacher competence standards

In Italy, teacher competences are not organized through a single comprehensive national framework. Rather, they emerge from a combination of regulatory provisions, qualification pathways, induction requirements, and framework-informed CPD opportunities. This applies both to the long-standing pathway for primary education teachers under the five-year Scienze della Formazione Primaria degree and to the current university qualification routes for secondary teachers.

As a result, digital competences are positioned less through one statutory teacher standards grid and more through policy and training infrastructures. The reviewed national sources show that DigCompEdu has become the most visible operational reference for teacher development in Italy, especially through digital-transition training under the Piano Nazionale Scuola Digitale Piano Scuola 4.0 and the national training platform Scuola Futura.

2.2 Adoption of European frameworks

The evidence suggests that Italy has not made the main European and international frameworks legally mandatory as a unified national system for teachers. However, several are clearly used as recommended references in policy guidance, curricular discourse, or national teacher training.

DigCompEdu is the strongest and most systematic case. GreenComp, LifeComp and EntreComp are visible in more selective ways, while the AI Competency Framework for Teachers is the most recent and least institutionalized but is already echoed in Ministry AI guidance and emerging CPD.

Framework	Adoption Level	Notes
DigCompEdu (2017)	Recommended	Explicitly used in national digital-transition training and visible in Scuola Futura resources and course offers.
GreenComp (2022)	Recommended	Visible in civic education guidance and in dedicated national CPD offers but not embedded as a universal teacher standard.
LifeComp (2020)	Recommended	Referenced in civic education and transversal competence discourse, with selective use in teacher development contexts.
EntreComp (2016)	Recommended	Visible above all in entrepreneurship-related education and PCTO guidance, with more limited reach across the whole profession.
AI Competence Framework for Teachers (UNESCO, 2024)	Recommended	Already cited in Ministry AI guidance and echoed in emerging CPD but not yet embedded as a stable national teacher standard.

Table: Overview of Adoption Level in Italy

2.3 Gaps in current competence frameworks

Overall, the Italian framework landscape is characterized less by the absence of references than by their fragmentation across domains, with DigCompEdu currently appearing as the most visible and operational reference for teacher development. GreenComp, LifeComp and EntreComp are present in the policy environment, but not yet as the backbone of one unified teacher's competence architecture.

The evidence suggests that the least developed areas, from a DigiSET perspective, concern OER creation, adaptation and sharing; systems thinking for sustainability as a mainstream pedagogical competence; ethical and bias-aware AI use; and the integration of digital pedagogy, inclusion and sustainability into one coherent professional profile. In other words, Italy already has many relevant reference points, but they remain only partially integrated.

3. Initial Teacher Education (ITE) and Continuous Professional Development (CPD) and its Certification

If competence frameworks define the reference language for teacher professionalism, teacher initial education and professional development determine how these competences are actually supported in practice. This section therefore examines ITE, CPD and current forms of certification and recognition.

3.1 Initial Teacher Education (ITE) provision

In Italy, universities represent the main providers responsible for the delivery and certification of teacher qualification programs, particularly for lower and upper secondary education:

- For pre-primary and primary school teachers, qualification is embedded in the five-year single-cycle master's degree in Scienze della Formazione Primaria. In accordance with national regulations (MIUR, 2010) the program provides credits in "Educational technologies" with a focus on methodological and technical skills.
- For lower and upper secondary school teachers, the current framework has been redefined by the reform of teacher education introduced by Legislative Decree No. 36/2022, which amended the system originally established by Legislative Decree No. 59/2017. The reform has been implemented through the Prime Ministerial Decree of 4 August 2023, which defines the structure of the new initial teacher education programs.

According to this framework, access to teaching requires both a disciplinary qualification (a master's degree corresponding to the relevant teaching subject, and the completion of a university-based initial teacher education pathway.

The standard pathway consists of a 60 ECTS (CFU/CFA) qualification program, delivered by universities and institutions accredited by the Ministry of University and Research. These programmes integrate disciplinary knowledge with pedagogical, didactic and methodological competences required for teaching. Transitional pathways of 30 or 36 ECTS are also foreseen during the implementation phase of the reform. Also, in this case credits in "Educational technologies" are scheduled and focused mainly on methodological issues.

Studies recognize that alongside traditional university, those online accredited by the Ministry of university and research are experiencing a notable increase in enrolment (Minerva et al., 2024; ANVUR, 2023). The increase is also due to the number of enrolled training teachers asking for flexible learning pathways and certifications. As big providers these institutions contribute to transform teachers' culture and uses in relation to online learning and technologies, specifically in the need to learn how to use digital tools.

A specific pathway exists for special education teachers (docenti di sostegno), who must complete an additional university specialization program. This pathway is regulated by Ministerial Decree No. 249/2010 and further specified by the Ministerial Decree of 30 September 2011, which defines the organisational framework for the specialisation courses for support teaching activities. Within these programs, attention is given to the use of Information and Communication Technologies (ICT) and assistive technologies to support inclusive education. Training activities typically include the use of digital accessibility tools, technologies supporting students with disabilities and strategies for designing inclusive learning environments supported by digital resources. The new reform of these programs

carries on a change in the curriculum with the elimination of these specific credits. (Ministerial Decree No. 75/2025 - Annex A)

The reviewed evidence shows that digital pedagogy is the strongest and most explicit DigiSET- related area in ITE. National regulations have formally inserted educational technology into ITE (Ministero dell'Istruzione, dell'Universita e della Ricerca, 2021). By contrast, education for sustainable development, AI in education and OER creation do not appear as equally explicit and universal compulsory curricular blocks across all teacher pathways. This does not mean they are absent from all university provision, but rather that they are not visible as standardised national requirements in the reviewed core regulations.

Aspect	Adoption Level	Notes
Education for Sustainable Development	Optionally	Relevant to curriculum and civic education but not clearly codified as a distinct compulsory ITE block for all teacher pathways.
Digital Pedagogy	Mandatory	National regulations explicitly include digital teaching methodologies and coding within teacher education.
AI in education	Not available	No clear evidence in the reviewed national ITE regulations of a compulsory AI-in-education component for all pre-service teachers.
OER creation	Not available	No clear evidence in the reviewed national ITE regulations of an explicit compulsory OER-creation component.

Table: Overview of Adoption Level of Digitally Sustainable Teaching Topics in Initial Teacher Education in Italy

3.2 Continuous Professional Development (CPD) opportunities

Italy has a more developed and visible CPD ecosystem than ITE in the areas relevant to DigiSET.

- Scuola Futura is the key national platform for school staff training linked to the digital transition and the National Recovery and Resilience Plan.
- SOFIA (Sistema Operativo per la Formazione e le Iniziative di Aggiornamento dei docenti), a national digital platform, acts as the system for recognised training offers and accredited providers.
- INDIRE (Istituto Nazionale di Documentazione, Innovazione e Ricerca Educativa), eTwinning and territorial training teams also contribute to the ecosystem.

Digital pedagogy is strongly supported in CPD, although not universally mandatory for all in-service teachers. The strongest compulsory element is the induction and probation year for newly appointed teachers, which includes mandatory training. At the same time, the evidence shows that sustainability, AI and inclusive digital teaching are increasingly visible in national course offers, while OER-related development is present more indirectly through collaborative design, documentation and selected courses rather than through a stable dedicated OER strand.

Aspect	Adoption Level	Notes
Education for Sustainable Development	Optionally	Present in national and platform-based CPD offers, including GreenComp-related training, but not systematically mandatory for all teachers.
Digital Pedagogy	Optionally	Very strong national offer and partly compulsory for neo-appointed teachers, but not universally mandatory for all in-service teachers.

AI in education	Optionally	Clearly emerging in national CPD offers, especially Scuola Futura, but not yet a system-wide compulsory area.
OER creation	Optionally	Present in some courses and in resource-sharing environments but still limited as an explicit CPD strand.

Table: Overview of Adoption Level of Digitally Sustainable Teaching Topics in Continuous Professional Development in Italy

3.3 Certification and recognition

Certification and recognition in the Italian teacher-development system operate through several parallel devices rather than one single national teacher micro-credential framework. In ITE, qualification is linked to nationally regulated university pathways. In CPD, recognized activities are channelled through SOFIA and through the evidence systems associated with national platforms such as Scuola Futura.

The evidence suggests that Italy shows practical signs of a micro-credential logic - especially through modular courses, badges, attendance certificates and platform-based traceability - but has not yet fully translated this into a coherent, nationwide teacher micro-credential architecture explicitly linked to sustainable digital teaching competences. This makes national CPD flexible and scalable, but also somewhat fragmented in recognition terms.

3.4 Gaps in current ITE/CDP

An interesting initiative in this field is led by Open Education Italia, an informal network of experts and teachers. In 2021 the network developed “The Italian guide to open education” in which are presented and discussed main aspects of Open Educational Resources (OER). The guide refers to the Ministerial Decree n°781 of the year 2013 that supports the development and the adoption of OER. The Decree invites publishers, content providers, schools, universities, teacher associations, committed to educational innovation, to develop a common, open, interoperable, and expandable software framework, in line with the state of the art and international best practices.

Overall, the Italian system provides stronger support through CPD than through ITE in the DigiSET-related areas, especially in digital pedagogy and inclusion, while AI, sustainability and OER-related competences remain more unevenly supported. The strongest areas are digital transition, general digital pedagogy, and inclusive teaching, especially in continuing professional development.

The least developed areas are those that require integration across domains rather than isolated treatment. In particular, the evidence suggests weaker systematization in AI as a pedagogical and ethical competence for all teachers, OER creation and open-sharing practices as a professional standard, systems thinking for sustainability, and the explicit integration of sustainability, digital pedagogy and inclusion into a single competence profile.

4. Analysis of the Four DigiSET Thematic Areas

The analysis of ITE and CPD shows which areas are supported in the Italian system. The following section examines the national context in relation to the four DigiSET thematic areas, which function as applied domains for teacher competence development.

4.1 Gender-unbiased AI in teaching

4.1.1 Policy context and structural framing

The Italian policy landscape for this thematic area is shaped by two intersecting but largely separate domains: AI ethics in education and gender equality in schooling. The key national

reference on the AI side is Decreto Ministeriale n. 166 of 9 August 2025 (Ministero dell'Istruzione e del Merito [MIM], 2025), which frames AI adoption in schools around five guiding principles — human-centredness, equity, responsible innovation, sustainability, and protection of rights — and explicitly requires schools to monitor biases and ensure equal opportunities for all students. The document is available in full at the MIM official portal and navigable via the UNICA platform.

Two limitations in this framing are analytically significant for DigiSET. First, the Guidelines address bias as a technical risk management issue for institutional deployers, rather than as a pedagogical competence that teachers must develop to evaluate AI tools critically and design learning environments that counteract stereotypes. Second, gender bias is not identified as a distinct form of bias: the document uses the term generically, despite well-evidenced patterns of gender stereotyping embedded in large language models (UNESCO, 2024).

4.1.2 Gender equality in education: the institutional strand

Italy's gender equality architecture in education is anchored in the Strategia nazionale per la parità di genere 2021–2026 (Presidenza del Consiglio dei Ministri, 2021), which commits to promoting girls' and women's inclusion in STEM (Science, Technology, Engineering, and Mathematics) and combating gender stereotypes in educational choices. The urgency of this direction is confirmed by data: according to the EU Education and Training Monitor 2025 (European Commission, 2025), women represent only 15.7% of ICT enrolments in Italian higher education — below the EU average of 20.3% — and Italy records one of the largest gender gaps in mathematics in Europe, with boys twice as likely as girls to expect careers in science or engineering even among top performers. Within the PNRR, Investment 3.1 'Nuove competenze e nuovi linguaggi' allocates €1.1 billion specifically to promote gender equality in STEM across all school cycles, coordinated jointly by the Ministry of Education and the Dipartimento per le Pari Opportunità.

4.1.3 CPD offer: what exists and what is still missing

At the CPD level, two national offers address the gender literacy strand directly but without engaging AI. The Scuola Futura MOOC (Massive Online Open Courses) "Educazione di genere: teoria, formazione e applicazione nel contesto scolastico" (Scuola Futura, n.d.a) covers theoretical foundations of gender education, stereotypes, and inclusive classroom strategies, targeting teachers at DigCompEdu level A1. More recently, the "Educare all'uguaglianza di genere, fin dall'infanzia" course, developed jointly by the Fondazione Giulia Cecchettin and the Università di Firenze and piloted in Tuscany, Veneto, and Puglia from May 2026 (Il Sole 24 Ore, 2026), constitutes the first national CPD course on gender equality education for teachers and awards a certificate valid for mandatory professional updating. Neither course engages with AI systems, algorithmic representations, or the intersection of digital tools and gender stereotyping.

On the AI literacy side, the AI4T project ("Artificial Intelligence for and by Teachers"), an Erasmus+-funded pilot coordinated nationally by MIM with CNR-ITD and INDIRE (Scuola Futura, n.d.b), developed teachers' foundational AI competence in 350 European schools. The Fondazione Mondo Digitale (2025–2026) offers MIM-accredited programmes combining responsible AI use with initiatives to engage girls in STEM through hackathons and mentorship. Both offer relevant AI literacy content but do not address gender bias as a specific pedagogical dimension.

4.1.4 Research evidence on teacher readiness

Available Italian research confirms that teacher readiness for critical AI use, including bias awareness, remains limited. Petrucco et al. (2025), in a mixed-method study of 1,223 teachers across 572 schools in the Veneto region, found widespread confusion about the educational applications of generative AI and a general need for further CPD; crucially, gender bias awareness did not emerge as a competence area in the professional discourse of any respondent group. At the systemic level, the European Institute for Gender Equality (2023) places Italy at a Gender Equality Index score of 68.2 out of 100, below the EU average, while Italy's ICILS 2022 (International Computer and Information Literacy Study), results show that the gender gap in mathematics — a key predictor of ICT orientation — remains among the largest in Europe (European Commission, 2025).

4.1.5 Analytical conclusion and DigiSET implications

The evidence reveals two active but parallel tracks. The AI ethics strand — centred on DM 166/2025, the Italian Strategy for Artificial Intelligence 2024–2026 (Agenzia per l'Italia Digitale [AgID], 2024), and the AI4T project — provides a national framework for responsible AI adoption, but treats bias as a generic technical risk rather than a gender-specific pedagogical concern. The gender equality strand — centred on the National Strategy for Gender Equality, PNRR Investment 3.1, and the available CPD courses — provides a basis for gender literacy in teaching but does not extend to AI systems or algorithmic representations.

The integrated competence — the ability to understand how AI systems encode gender bias, evaluate tools for representational equity, and design teaching that critically interrogates algorithmic stereotypes — is not yet addressed by any dedicated national policy instrument, CPD course, or statutory teacher standard in Italy. This evidenced absence is itself a valuable finding for the DigiSET framework: the thematic area of gender-unbiased AI does not merely add content to existing Italian teacher development but proposes a new integration not yet theorised or operationalised in the national professional context. DigiSET therefore has a clear and substantiated added-value role in developing, piloting, and disseminating this competence.

4.2 Systems thinking for sustainability in education

4.2.1 The curricular foundation: Civic Education and sustainability

The primary institutional entry point for sustainability in Italian schooling is Legge 20 agosto 2019, n. 92 (Repubblica Italiana, 2019), which made civic education compulsory across all school levels with a minimum of 33 hours per year, organised around three conceptual nuclei: Constitution and legality; sustainable development and environmental education; and digital citizenship. The framework was substantially updated by Decreto Ministeriale n. 183 of 7 September 2024 (Ministero dell'Istruzione e del Merito [MIM], 2024a), available at the MIM portal, which introduced nationally defined competence targets mandatory from the school year 2024/2025 and frames sustainability as an interdisciplinary area connecting natural sciences, geography, economics, and history. A further step is Decreto Ministeriale n. 14/2024, which for the first time makes sustainability-related competences formally certifiable outcomes of compulsory schooling, requiring schools to certify student behaviours and attitudes consistent with Agenda 2030 at the end of lower secondary education.

4.2.2 GreenComp as a reference framework: presence and limitations

Italy has engaged explicitly with the GreenComp framework (European Commission, Joint Research Centre [JRC], 2022), whose four competence areas include systems thinking — the ability to understand the interdependence of social, ecological, and economic systems and reason about their long-term dynamics — as well as futures literacy, the capacity to critically imagine alternative futures. The Eurydice 2024 report Learning for Sustainability in Europe (European Commission, Education, Audiovisual and Culture Executive Agency [EACEA]/Eurydice, 2024) places Italy among the sixteen education systems that do not reference futures literacy in their national curriculum documents, and identifies systems thinking and futures literacy as the least developed GreenComp competences in the Italian system — a finding confirmed by Italian research (Pettenati, 2025), which draws on both the Eurydice data and the IEA ICCS 2022 study to show that these gaps are structural: Italian sustainability education has historically emphasised values and environmental knowledge rather than action competence and transformative thinking. Systems thinking is referenced in the national curriculum (Ministero della Pubblica Istruzione, 2012) primarily through civic education but is absent from teacher competence frameworks and ITE standards.

4.2.3 The values-action gap: empirical evidence

The empirical evidence reinforces this structural reading. According to the IEA ICCS 2022 (International Civic and Citizenship Education Study) study (INVALSI, 2023), Italian eighth-graders performed above the EU average in civic and citizenship education (523 points versus 511), positioning Italy as a relatively strong performer in the domain that hosts sustainability content.

However, the Education and Training Monitor 2024 (European Commission, 2024) identifies a values-action gap of nearly 60 percentage points in Italy — one of the largest in Europe — between students who endorse sustainability values and those who act on them. This points to a pedagogical deficit in the translation from awareness to systemic agency and strongly suggests that Italian schooling develops sustainability knowledge more effectively than the practice-oriented, complexity-aware dimensions of systems thinking that GreenComp treats as essential.

4.2.4 CPD provision: what exists nationally

The principal national CPD offer is the Scuola Futura MOOC 'GreenComp e didattica: possibili connessioni' (Scuola Futura, 2024), available at the Scuola Futura platform, which covers all four GreenComp areas, presents interdisciplinary pedagogical approaches including a GreenComp–DigComp integration module, and is accessible to all school levels including adult education. It is currently the only national pathway that translates GreenComp systematically into teacher-facing CPD. At the project level, the Erasmus+-funded GreenComp4Adapt initiative (2024–2026) involves Italian partner schools in embedding GreenComp competences through civic engagement and local climate action, and a published Italian case study (Liverano et al., 2024) documents its implementation in a school in Taranto. Both confirm that GreenComp is entering Italian practice, though uptake remains project-dependent rather than systemic.

4.2.5 Systems thinking in teacher competence frameworks: an evidenced absence

The Eurydice 2024 report (European Commission, EACEA/Eurydice, 2024) documents that sustainability competences — including systems thinking — are not included in teacher competence frameworks or ITE standards in Italy or in most European systems, and that DigCompEdu is far more widely embedded in teacher standards than any sustainability framework. This is confirmed by the national ITE regulations: neither the Decreto Interministeriale n. 1216/2021 governing secondary teacher qualification (Ministero dell'Istruzione, dell'Università e della Ricerca [MIUR] & Ministero dell'Università e della Ricerca [MUR], 2021) nor DM 249/2010 governing primary teacher qualification (Ministero dell'Università e della Ricerca [MUR], 2010) specify systems thinking or sustainability-oriented pedagogy as mandatory competence areas. A teacher can therefore qualify and practise in Italy without having developed the professional sustainability competences they are simultaneously expected to teach.

4.2.6 Analytical conclusion and DigiSET implications

The Italian evidence for this thematic area differs from Section 4.1 in one important respect: the relevant policy foundations exist. Law 92/2019, DM 183/2024, and DM 14/2024 provide a statutory entry point for sustainability at curriculum level; the Scuola Futura GreenComp MOOC translates the European framework into national CPD; and school-level practice is growing. The limitations are those of depth and integration rather than absence: systems thinking and futures literacy are underrepresented relative to the values and knowledge dimensions of GreenComp; GreenComp is not embedded in teacher competence frameworks or ITE standards; and the CPD offer, while real, has not achieved the continuity of a mainstreamed national professional standard, as evidenced by the persistent 60% values-action gap among students.

DigiSET's contribution in this area is therefore to deepen and operationalise an existing priority rather than introduce a new one. Specifically, it can embed systems thinking and futures literacy as explicit teacher competence targets, addressing the gap identified by the Eurydice 2024 report; integrate sustainability systems thinking with digital pedagogy and responsible AI use — a combination neither the GreenComp MOOC nor the AI4T project currently addresses; and offer a progression-based learning path that moves teachers from sustainability awareness, where Italy is relatively strong, toward systemic analysis and pedagogical action, where the evidence consistently identifies underperformance.

4.3 AI for adaptive learning

4.3.1 Policy framing: AI as a personalisation and equity tool

The Italian policy framework has explicitly positioned adaptive and personalised learning as a primary pedagogical rationale for AI adoption. DM n. 166 of 9 August 2025 (Ministero dell'Istruzione e del Merito [MIM], 2025), available via the UNICA platform, identifies AI-supported personalisation, intelligent tutoring, and adaptive feedback as core legitimate uses of AI in schools, distinguishing three domains of application: AI in the service of students, AI to support teachers, and AI to support school management. The Italian Strategy for Artificial Intelligence 2024–2026 (Agenzia per l'Italia Digitale [AgID], 2024) reinforces this by identifying education and training as a strategic macro-area, backed by a €1 billion national fund aligned with the EU AI Act's risk-based framework.

Both instruments explicitly connect AI-for-learning to equity goals. The OECD–Fondazione Agnelli paper (2025) on AI adoption in the Italian education system frames AI as a strategic tool for three persistent equity challenges: preventing dropout, reducing the mathematics gender gap, and supporting students with an immigrant background. This confirms that the Italian institutional reading of adaptive AI is already moving beyond generic efficiency claims toward differentiated pedagogical design and social inclusion — a framing directly aligned with the DigiSET competence profile.

4.3.2 Concrete practice: the national AI pilot and Scuola Futura pathways

At classroom level, the most significant national initiative is the government pilot launched in September 2024, which placed AI virtual assistants on tablets and computers in 15 classrooms across four regions to test personalisation of pacing, identification of weak learning areas, and reduction of administrative burden for teachers (Euronews, 2024; Airtics Education, 2024). Results are being monitored by the Ministry with a view to national expansion. Two Scuola Futura CPD pathways directly support this thematic area. IA_Lab per costruire nuove competenze (Scuola Futura, n.d.c) is a laboratory-based course aligned to the UNESCO AI Competency Framework for Teachers (UNESCO, 2024), structured around four modules — AI ethics, human-centred mindset, AI system design, and AI techniques — of which data literacy and AI application design are directly relevant to designing adaptive learning environments. Insegnare con l'IA: dalla teoria alla pratica attiva (Scuola Futura, n.d.d), aligned to DM 166/2025, is more explicitly practice-oriented, developing competences for creating differentiated instructional materials with generative AI, designing AI-supported lessons, and integrating AI-based assessment tools. A national competition (MIM, 2024c) has further encouraged school-level experimentation with AI-based pedagogy.

4.3.3 Teacher readiness: empirical evidence on the gap

Despite policy momentum and a growing CPD offer, empirical evidence consistently shows significant teacher unreadiness for AI-based adaptive learning. A GoStudent survey (2025) found that while 81% of Italian students already use AI, only 34% of teachers feel adequately prepared to use it in teaching, and only 28% of students learn about AI in a structured way at school. Petrucco et al. (2025), in a mixed-method study of 1,223 teachers across 572 Veneto schools, confirm widespread confusion about generative AI's educational applications and a clear need for further CPD, with readiness varying significantly by age, school level, and subject area.

This gap is also consistent with direct practice-based evidence gathered by CivicaMente through the teacher training course A scuola di Artificial Intelligence: capire e utilizzare l'intelligenza artificiale. In this context, the issue was not simply limited use of generative AI in professional practice, but rather a recurrent pattern of distorted use shaped by limited awareness of how generative AI — and large language models in particular — work. Many teachers approached these systems as if they were conventional search engines, expecting immediate factual retrieval rather than probabilistic language generation that requires interpretation, validation and iterative prompting. This misunderstanding had clear pedagogical implications: in several cases, teachers did not initially recognise the possibility that AI-generated outputs could contain plausible but inaccurate information. While subject experts could sometimes detect such errors, students would often lack the disciplinary knowledge needed to do so, especially when interacting with AI-generated educational personae, such as simulated historical figures answering questions. A further recurrent pattern concerned the strong preference for tools able to generate immediate,

ready-to-use outputs — lesson plans, worksheets, scripts or teaching materials — with limited inclination to engage in a more dialogic and reflective interaction with AI systems. Taken together, these observations suggest that the critical issue is not only access to AI tools, but the need to develop a more informed, critical and pedagogically grounded understanding of their functioning, limits and educational affordances.

Cinganotto and Montanucci (2025) further document that over 70% of Italian teachers rate training in inclusion and personalised learning as highly or very highly important, while half consider their existing preparation insufficient for managing heterogeneous classrooms; 84.5% agree that AI advances require a fundamental rethinking of the teacher's role. A second structural risk is identified by a study published in the Italian Economic Journal (2025): digital divides in AI adoption persist across Italian regions and schools, reflecting north-south socioeconomic disparities, with southern regions showing significantly lower AI adoption and digital skills — a pattern that warns AI-based adaptive learning could reinforce rather than reduce educational inequalities without equity-oriented teacher training.

4.3.4 The pedagogical competence gap: what is still missing

Three specific gaps remain clearly evidenced. First, no national teacher competence standard defines what an Italian teacher must be able to do when designing, selecting, or critically evaluating AI tools for adaptive learning. The MIM guidelines and AI Strategy articulate what AI can do in principle; neither specifies the professional competences teachers need to exercise informed pedagogical agency in AI-enriched classrooms. The UNESCO AI Competency Framework for Teachers (2024) provides an internationally recognised reference for this, and IA_Lab begins to operationalise its foundational level, but integration into Italian statutory teacher competence frameworks has not yet occurred.

Second, the connection between AI for adaptive learning and inclusive education is only partially developed: AI upskilling pathways do not systematically address SEN (Special Educational Needs) pedagogy, and SEN teacher development pathways do not integrate AI tools. Third, the cognitive risk dimension of AI-assisted learning — specifically the risk that passive AI use produces an illusion of competence while weakening metacognitive capacity and transfer — receives limited attention in the Italian CPD landscape (Italian Economic Journal, 2025). The competence to distinguish AI use that augments learning from AI use that substitutes for it is absent from current national CPD frameworks.

4.3.5 Analytical conclusion and DigiSET implications

Of the four DigiSET thematic areas, AI for adaptive learning has the most dynamic national momentum in Italy: government pilots are underway, two concrete CPD pathways are directly relevant, the OECD–Fondazione Agnelli paper provides an equity-framed policy roadmap, and teacher demand for further training in personalisation is empirically well documented. The Italian context therefore offers strong foundations to build on.

What DigiSET can provide that national provision currently cannot is a competence framework that defines what teachers should know, be able to do, and value when deploying AI for adaptive learning responsibly — integrating inclusive pedagogy, equity in AI access, and the critical ethics of human-AI interaction — and a training model that moves from awareness and upskilling into professional-standard practice, assessment, and transferable documentation. The three evidenced gaps — absent competence standard, disconnected SEN-AI strand, and unaddressed cognitive risk — mark the specific space DigiSET occupies in the Italian professional context.

4.4 Inclusive teaching practices and learning difficulties

4.4.1 Italy's legislative architecture for inclusion: a unique European position

Inclusive education is the most deeply institutionalised of the four DigiSET thematic areas in the Italian context. Italy is, uniquely in Europe, the only country to have achieved 99.6% inclusion of learners with disabilities in mainstream classrooms: by law, there are no special schools or

separate classes in the Italian state system, a structural commitment rooted in legislation dating to the 1970s (European Agency for Special Needs and Inclusive Education [EASNIE], n.d.a). The current legislative architecture rests on Law 104/1992 (Repubblica Italiana, 1992), the main framework law for disability rights; Law 170/2010 (Repubblica Italiana, 2010), which formally recognised Specific Learning Disabilities (dyslexia, dysgraphia, dysorthography, dyscalculia) as conditions requiring compensatory tools and personalised plans; and the Ministerial Directive of 27 December 2012 (Ministero dell'Istruzione, dell'Università e della Ricerca [MIUR], 2012) on special educational needs, which extended inclusive provisions to all students with temporary or permanent difficulties, including sociocultural or linguistic disadvantage. This three-tier system — students with certified disabilities, students with special needs, and students with specific learning disorders— has made the management of learning diversity a structural and universal dimension of Italian teaching, not a specialist concern.

The framework was substantially reformed by D.Lgs. 66/2017 (as amended by D.Lgs. 96/2019 and D.I. 182/2020, revised by D.I. 153/2023; Repubblica Italiana, 2017), which introduced the International Classification of Functioning based profile and established the individual educational plan as the legally required annual planning document for each student with a certified disability, elaborated by the inter-institutional operative working groups. Most recently, D.Lgs. 62/2024 (Repubblica Italiana, 2024) revised disability certification procedures and extended the concept of the life project, repositioning the Individual educational plan within a longer-term vision of student autonomy and participation.

4.4.2 The support teacher crisis: a structural tension in the inclusion system

Despite this unrivalled legislative commitment, the Italian inclusion system faces a critical structural tension: a chronic shortage of specialised insegnanti di sostegno (support teachers), with over 100,000 posts filled annually by temporary supply teachers whose professional preparation is incomplete. The government response was law decree n. 71/2024 (converted into Law n. 106/2024), which created two extraordinary specialisation pathways, detailed at the MIM specialisation portal: Article 6 opened 40-credit pathways via INDIRE and universities for approximately 85,000 teachers with three or more years of supply experience; Article 7 created parallel pathways for around 11,000 teachers holding foreign qualifications awaiting Italian recognition. Both were extended to 2026, with 37,000 places authorised for that year alone — confirming the depth of the shortage (Ministero dell'Istruzione e del Merito [MIM], 2024d).

The DigiSET significance is twofold. First, inclusive teaching in Italy is formally universal but practically dependent on a cohort of teachers whose professional preparation is incomplete — a substantial CPD need that DigiSET's inclusive digital pedagogy focus is well positioned to address. Second, because the operative working group model distributes individual educational plan co-responsibility across the entire class teaching team, all teachers working with special needs students are nominally responsible for inclusive design, yet the CPD landscape does not consistently support all class teachers in developing inclusive digital competences.

4.4.3 CPD provision for inclusive teaching: strengths and coverage

Italy has a relatively well-developed CPD ecosystem for inclusive education. The European Agency for Special Needs and Inclusive Education (EASNIE) documents that in-service training covers early risk identification, didactic strategies for special needs student, assessment adaptation, and co-teaching models, organised by MIM, territorial school networks, universities, and accredited external providers (EASNIE, n.d.b). Schools retain significant CPD autonomy under Presidential Decree n. 275/1999 (Repubblica Italiana, 1999), meaning depth and coherence of provision varies considerably across institutions and regions. The most systemic national provision is the mandatory specialisation course, now supplemented by the INDIRE-led pathways under DL 71/2024, which represent the largest current national investment in inclusive teacher preparation. The Scuola Futura platform contributes through its Insegnare con l'IA course (see Section 4.3), which includes the design of digital tools for inclusive lessons. Research by Cinganotto and Montanucci (2025) confirms that over 70% of Italian teachers rate training in inclusion and personalised learning as high or very high in importance, while half consider their current

preparation insufficient for managing classroom heterogeneity — confirming that universal inclusion creates universal demand for inclusive competences, but CPD supply has not kept pace.

4.4.4 Research on inclusive teaching practice: what the evidence shows

Italian research on inclusive practice provides a partially critical picture. Demo and Dell'Anna (2020) document a significant risk of role fragmentation between subject teachers and support teachers, with subject teachers tending to delegate full responsibility for students with disabilities to the support teacher — a "delegation model" in which inclusion is physically present but pedagogically partial. The same study identifies an important counterweight: in classes that successfully implement a collaborative, whole-class approach, teachers use a wider variety of pedagogical methods overall, including active learning, cooperative learning, and laboratory approaches. The presence of students with disabilities, managed through an authentically inclusive model, acts as a quality multiplier for all learners — what the literature describes as a Universal Design for Learning (UDL) effect. This finding directly supports DigiSET's positioning of inclusive digital teaching not as a compensatory specialisation but as a quality competence for every teacher.

4.4.5 Digital tools and AI in inclusive education: an emerging but uneven connection

Law 170/2010 has embedded digital technology in Italian inclusive education for over a decade through the mandate to provide strumenti compensativi (compensatory tools — text-to-speech, digital concept maps, voice synthesizers, calculators) for students with special needs. More recently, DM 166/2025 (MIM, 2025) identifies AI-supported personalisation and adaptive tutoring as educational opportunities relevant to all learners, and the OECD–Fondazione Agnelli paper (OECD & Fondazione Giovanni Agnelli, 2025) frames AI as a tool for supporting students with immigrant backgrounds and reducing learning disparities.

However, three gaps remain. The insegnante di sostegno model has not been systematically integrated with AI-supported pedagogy in any national CPD framework: The mandatory specialisation course focuses on legal, psychological, and pedagogical dimensions of disability with limited dedicated attention to digital instructional design. The compensatory tool tradition, while legally secure, reflects a remedial individual-deficit logic rather than a Universal Design approach benefiting all learners by design. And, as noted in Section 4.3, no teacher competence standard yet defines what all teachers should be able to do when deploying AI in inclusive, mixed-ability classrooms.

4.4.6 Analytical conclusion and DigiSET implications

Section 4.4 presents the most complex analytical picture of the four thematic areas. Italy is simultaneously the European benchmark for inclusive education — legislatively, structurally, and institutionally — and a system facing documented challenges in the quality of inclusive practice, the professionalisation of inclusive teacher competences, and the integration of digital tools with inclusion pedagogy. These are not contradictory but complementary findings: Italy's mature system is precisely capable of articulating its own gaps.

For DigiSET, three implications follow. First, the Italian inclusive education tradition should be engaged on its own terms: the legislative vocabulary is institutionally embedded and should be reflected in how DigiSET frames its competences for Italian teachers, not treated as background. Second, DigiSET's primary added value lies in bridging inclusive pedagogy with digital design: the professional competence to create digitally supported, AI-informed learning environments for heterogeneous classrooms is not systematically developed by any current national CPD provision, and that is the space DigiSET can occupy. Third, given that the operative working group model places individual educational plan co-responsibility on all class teachers, DigiSET's training design must explicitly address both support teachers and subject teachers as a shared audience — treating inclusive digital teaching as the exclusive domain of specialist personnel would miss the structural reality of Italian classrooms.

5. Innovative practices and case studies

The thematic analysis identifies the main strengths and gaps of the Italian context. These findings are complemented by selected case studies that illustrate how teachers develop competences through concrete professional-learning models and innovation practices.

The three selected cases represent complementary models of teacher professional development in Italy: a community-of-practice and innovation-transfer model, a framework-based sustainability CPD model, and a structured AI upskilling model. Taken together, they provide a balanced picture of how teachers in Italy develop competences relevant to the profile of the Digitally Sustainable European Teacher.

5.1 Case Study 1: "Avanguardie Educative" (INDIRE)

Organisation/Project	INDIRE's "Avanguardie Educative" was launched with a network of founding schools and developed into a national movement aimed at identifying, supporting, disseminating and systematizing innovative and transferable school practices.
Main Dimensions Addressed	This case primarily addresses digital pedagogy, methodological innovation, documentation, professional collaboration, and transferability of innovation. Although not a sustainability-specific initiative in the narrow sense, it is highly relevant to DigiSET because it treats innovation as something that must be sustainable, replicable and community-supported.
Teacher Competences Developed	Teachers develop competences in active pedagogy, digital resource integration, collaborative design, reflective practice, and innovation transfer.
Learning Approach	The model combines seminars, school visits, webinars, downloadable resources, researcher support, coaching, and an online environment operating according to the logic of a community of practice.
Transferability to DigiSET	This is highly transferable to DigiSET because it demonstrates how teacher competence development can be sustained through peer exchange, coaching, shared resources, documentation, and school-to-school transfer.

The "Avanguardie Educative" initiative, promoted by INDIRE, was launched as a network of founding schools and has progressively developed into a national movement aimed at identifying, supporting, disseminating, and systematizing innovative and transferable school practices.

The case primarily addresses the following dimensions:

- digital pedagogy,
- methodological innovation,
- documentation of practices,
- professional collaboration,
- transferability of innovation.

Although it is not specifically focused on sustainability in a narrow sense, the initiative is highly relevant to the DigiSET framework, as it approaches innovation as a process that must be sustainable, replicable, and supported by a professional community.

In terms of teacher competences, the project contributes to the development of:

- active pedagogy,
- integration of digital resources,
- collaborative design,
- reflective practice,
- innovation transfer.

The learning approach combines multiple formats, including seminars, school visits, webinars, downloadable resources, researcher support, coaching, and an online environment structured according to the logic of a community of practice.

Regarding transferability to DigiSET, the case is particularly relevant, as it demonstrates how teacher competence development can be sustained through:

- peer exchange,
- Coaching,
- shared resources,
- documentation processes,
- chool-to-school transfer mechanisms.

Overall, the initiative provides a structured example of how innovation in education can be supported and scaled through collaboration, documentation, and community-based practices.

5.2 Case Study 2: "EducazioneDigitale.it - Piattaforma digitale per docenti"

Organisation/Project	*EducazioneDigitale.it* is a project of CivicaMente and is a free digital platform for teachers at all school levels, offering training tools, pedagogical resources and interactive content for curricular and extracurricular teaching. The platform explicitly positions itself as a space designed to support teachers through digital resources, thematic pathways and classroom-oriented materials. Nowadays the platform counts over 131.000 Italian teachers registered and active.
Main Dimensions Addressed	This case primarily addresses digital pedagogy, continuous teacher professional development, interdisciplinary teaching, and the use of interactive digital resources in classroom practice. The platform offers training, orientation, tutoring, discussion and competence development, and it also includes environments for creating lessons, managing classes and accessing ready-made teaching materials.
Teacher Competences Developed	Teachers using the platform are supported in developing competences related to the pedagogical use of digital content, interdisciplinary lesson planning, classroom resource selection, and the integration of interactive tools into teaching practice.
Learning Approach	The learning approach is best described as a platform-based continuous professional support model. Rather than operating only through isolated courses, EducazioneDigitale.it provides teachers with ongoing access to tools, thematic resources, digital materials and lesson/class-management functions.
Transferability to DigiSET	This case is transferable to DigiSET because it illustrates how a national digital platform can support teachers not only through content delivery, but through an ecosystem of resources, guidance,

	classroom application, and professional continuity. It is relevant to DigiSET in relation to modular resource access, support for interdisciplinary teaching, and the practical integration of digital materials into everyday schoolwork.

EducazioneDigitale.it, a project developed by CivicaMente, is a free digital platform designed for teachers at all school levels. It provides training tools, pedagogical resources, and interactive content to support both curricular and extracurricular teaching. The platform is explicitly conceived as a space to support teachers through digital resources, thematic pathways, and classroom-oriented materials, and currently counts over 131,000 registered and active Italian teachers.

The case primarily addresses the following dimensions:

- digital pedagogy,
- continuous teacher professional development,
- interdisciplinary teaching,
- use of interactive digital resources in classroom practice.

The platform offers a range of functions, including training, orientation, tutoring, discussion, and competence development, as well as environments for lesson creation, class management, and access to ready-made teaching materials.

In terms of teacher competences, the platform supports the development of:

- pedagogical use of digital content,
- interdisciplinary lesson planning,
- selection of classroom resources,
- integration of interactive tools into teaching practice.

The learning approach can be described as a platform-based model of continuous professional support. Rather than relying on isolated training courses, EducazioneDigitale.it provides ongoing access to tools, thematic resources, digital materials, and functionalities for lesson design and class management.

Regarding transferability to DigiSET, this case is particularly relevant as it illustrates how a national digital platform can support teachers not only through content delivery, but through a broader ecosystem that includes resources, guidance, classroom application, and professional continuity. It is especially aligned with DigiSET in relation to modular access to resources, support for interdisciplinary teaching, and the practical integration of digital materials into everyday school practice.

5.3 Case Study 3: “GreenComp e didattica: possibili connessioni” (Scuola Futura)

Organisation/Project	This Scuola Futura MOOC, delivered within the national PNRR training ecosystem, is addressed to teachers nationwide and translates GreenComp into a teacher-facing CPD pathway.
Main Dimensions Addressed	The case addresses systems of thinking for sustainability, interdisciplinary curriculum design, and framework-informed teacher development.
Teacher Competences Developed	Teachers are supported in understanding and operationalizing the GreenComp areas, including embracing complexity, systems thinking, critical thinking, and sustainability-oriented action.

Learning Approach	The course uses a scalable asynchronous MOOC model.
Transferability to DigiSET	The case is directly transferable because it shows how a European competence framework can be turned into a modular, accessible, and curriculum-oriented teacher-training pathway.

The Scuola Futura MOOC, delivered within the national PNRR training ecosystem, is a nationwide initiative addressed to teachers and designed to translate the GreenComp framework into a teacher-facing continuous professional development (CPD) pathway.

The case primarily addresses the following dimensions:

- systems thinking for sustainability,
- interdisciplinary curriculum design,
  framework-informed teacher development.

In terms of teacher competences, the course supports teachers in:

- understanding the GreenComp framework,
- operationalizing its key areas, including embracing complexity,
- applying systems thinking,
- developing critical thinking,
  promoting sustainability-oriented action.

The learning approach is based on a scalable asynchronous MOOC model, allowing broad access and flexible participation within a structured training pathway.

Regarding transferability to DigiSET, the case is directly relevant as it demonstrates how a European competence framework can be translated into a modular, accessible, and curriculum-oriented teacher training pathway.

5.4 Case Study 4: "IA_Lab per costruire nuove competenze" (Scuola Futura)

Organisation/Project	"IA_Lab per costruire nuove competenze" is a national online training pathway addressed to teachers and facilitated by the territorial training teams. It is explicitly based on the AI Competency Framework for Teachers developed by UNESCO (UNESCO, 2024).
Main Dimensions Addressed	The case addresses critical and pedagogical AI literacy, ethics of AI, human-centred AI, data literacy, and classroom-oriented AI application.
Teacher Competences Developed	Teachers develop competences in understanding AI concepts, applying ethical principles, designing teaching uses of AI, and integrating AI into professional learning through a lab-based model.
Learning Approach	The course is based on guided practical experiences.
Transferability to DigiSET	The case is highly relevant because it shows how an international competence framework can be operationalized in a national teacher-training pathway focused on responsible AI use, practice-based learning, and guided experimentation. Overall, the selected cases show that Italy already offers important enabling models for teacher development, but that these models still

	operate more as complementary strands than as parts of one integrated competence architecture.

The “IA_Lab per costruire nuove competenze” initiative is a national online training pathway addressed to teachers and facilitated by territorial training teams. It is explicitly based on the AI Competency Framework for Teachers developed by UNESCO (UNESCO, 2024).

The case primarily addresses the following dimensions:

- critical and pedagogical AI literacy,
- ethics of AI,
- human-centred AI,
- data literacy,
- classroom-oriented AI application.

In terms of teacher competences, the pathway supports teachers in:

- understanding core AI concepts,
- applying ethical principles related to AI,
- designing teaching uses of AI,
  integrating AI into professional learning through a lab-based model.

The learning approach is based on guided practical experiences, structured around a laboratory model that emphasizes application and experimentation.

Regarding transferability to DigiSET, the case is highly relevant as it demonstrates how an international competence framework can be operationalized within a national teacher-training pathway focused on responsible AI use, practice-based learning, and guided experimentation.

Overall, the selected cases show that Italy already provides important enabling models for teacher development, although these currently operate more as complementary strands rather than as components of a fully integrated competence architecture.

6. Conclusions and Implications

Taken together, the selected cases help translate the Italian evidence from description into design implications. The final section therefore synthesises the national findings into competence implications, recommendations for the DigiSET framework, and suggestions for training design and integration.

6.1 Competence Implications for the Digitally Sustainable Teacher

The Italian evidence does not point to a single unified national competence model for teachers. Instead, it points to a landscape of converging but still partly fragmented strands, in which digital pedagogy, inclusion, sustainability, openness and AI-related development are all visible, but not yet fully integrated into one coherent professional profile. In this context, the concept of the Digitally Sustainable European Teacher is especially relevant because it offers a way to connect these existing priorities into a transferable and practice-oriented competence model.

The four DigiSET thematic areas are clearly reflected in the competence profile emerging from the Italian evidence. Gender-unbiased and ethical AI use, systems thinking for sustainability, AI-supported adaptive learning, and inclusive teaching practices do not appear as isolated domains; rather, they point to an integrated model of teacher professionalism in which teachers design

learning environments that are digitally informed, ethically grounded, inclusive, sustainability-oriented and shareable within professional communities.

6.1.1 Emerging Competence Areas

- Critical and ethical AI literacy

A first emerging competence area is the ability to understand AI, evaluate its educational usefulness and risks, and use it responsibly in teaching. The UNESCO AI Competency Framework for Teachers provides a strong reference for this area and Italian AI-related CPD already shows that such a framework can be translated into modular teacher learning.

- Inclusive digital learning design

A second competence area concerns the design of digitally supported learning environments that are inclusive, differentiated, and responsive to learner diversity. This area is strongly aligned with the DigCompEdu focus on empowering learners and with the Italian tradition of inclusive education (European Commission, 2017).

- Systems thinking for sustainability in teaching

A third competence area is the ability to integrate sustainability into teaching through complexity-aware and interdisciplinary approaches. GreenComp gives a strong European reference here, while the Italian sustainability CPD landscape shows emerging operationalization.

- OER creation, adaptation and sharing

A fourth competence area is the capacity to create, adapt, and share digital and open educational resources. DigCompEdu treats digital resources as a core area of educator competence, and the Italian evidence suggests that this dimension would benefit from stronger explicit professional recognition.

6.1.2 Underdeveloped Competences

The reviewed evidence suggests that ethical and bias-aware AI use remains underdeveloped as a stable professional competence area, especially regarding gender bias, fairness, transparency and critical scrutiny of AI-generated outputs. A second underdeveloped area is interdisciplinary sustainability teaching through systems thinking: GreenComp is visible in the Italian landscape, but still not mainstreamed across the whole profession. A third is teacher autonomy in creating and openly sharing educational resources, including attention to OER licensing, adaptation and reuse.

6.2 Recommendations and Implications for DigiSET Framework Development

6.2.1 Implications for the Competence Framework

Based on the Italian evidence, the DigiSET competence framework should include at least five connected clusters: digital pedagogy, ethical and critical AI competence, inclusive digital learning design, systems thinking for sustainability, and OER creation, adaptation and sharing. There is also a need to include, transversally to the above-mentioned clusters, the development of creative thinking in the use of AI and other digital technologies. DigCompEdu provides a strong reference for digital pedagogy, GreenComp for sustainability competences, and the UNESCO AI Competency Framework for AI-related teacher professionalism. The evidence supports an integrative rather than additive approach: these areas are most valuable when treated as mutually reinforcing parts of one professional profile.

Each competence area should be defined through a balanced combination of knowledge, skills, and attitudes. This is consistent with the logic of the European and UNESCO frameworks that already inform the Italian context and responds directly to the main system-level gap identified in the report: the insufficient integration of relevant priorities into one coherent competence architecture.

6.2.2 Implications for Learning Outcomes

The DigiSET learning outcomes should be demonstrable and practice oriented. In the Italian context, relevant outcomes would include the ability to design learning activities using AI creatively, responsibly, evaluate AI tools for pedagogical usefulness and bias-related risks, integrate sustainability concepts across subjects using creative and systems thinking, adapt teaching using digital tools for diverse learners, and create, adapt and share digital or OER materials collaboratively.

The outcomes should also be progression-based. DigCompEdu, GreenComp and the UNESCO AI framework all work with structured competence architectures rather than one-off attainment statements, and the Italian evidence suggests that teachers benefit most when training moves from conceptual understanding to application, evaluation and creation.

6.2.3 Implications for Training Design

The Italian evidence strongly supports a practice-based, modular and community-oriented training design. Avanguardie Educative shows the value of coaching, peer exchange and innovation transfer; the GreenComp MOOC shows the scalability of framework-based national CPD; and IA_Lab shows the effectiveness of laboratory components and guided experimentation. DigiSET training should therefore combine conceptual input with production tasks, collaborative design, testing, and reflective revision.

Training should also include resource-production components, because DigiSET is explicitly linked to OER development and to the broader logic of moving from conceptual learning to situated application. In the Italian context, the strongest models are those in which teachers are supported not only in understanding concepts, but also in adapting, documenting and sharing what they produce.

6.3 Potential for National Integration

In Italy, DigiSET is most likely to be integrated first through Continuous Professional Development rather than through the core structure of Initial Teacher Education. The national ecosystem already includes scalable and framework-aware teacher development environments, such as Scuola Futura and innovation-oriented structures like INDIRE networks, which are more immediately compatible with DigiSET's modular and competence-based design.

The main enablers are already visible: established digital-pedagogy references, a strong inclusion tradition, scalable online CPD formats, and growing national readiness for sustainability and AI-related teacher development.

The main barriers concern fragmentation across domains, uneven depth of uptake, and the still-limited formalisation of OER professionalism and bias-aware AI use. DigiSET's contribution in Italy would therefore be strongest if it functions as an integrative framework rather than as a replacement for existing references.

6.4 Key Findings Summary

The Italian context is characterised by strong support for digital pedagogy, a highly structured tradition of inclusive teaching, growing activity in AI-related teacher development, and an emerging but less fully embedded engagement with sustainability competence frameworks. The reviewed evidence does not point to a single unified national competence model for teachers; instead, it points to a landscape of converging but still partly fragmented strands.

In the Italian context, DigiSET is most valuable not because it introduces entirely new priorities, but because it connects already visible priorities - digital pedagogy, inclusion, sustainability and AI - into a coherent, practice-oriented and transferable competence profile for teachers. Its strongest contribution would therefore lie in transforming a fragmented landscape of relevant initiatives, frameworks and training opportunities into a more integrated model of teacher professionalism centred on responsible digital innovation, sustainability, openness and equity.

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