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# **WP2 – COUNTRY REPORT**

## **Norway**

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

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# 1. National Policy Framework for Digital and Sustainable Education

## 1.1 Digital Education Strategy and Teacher Competences

Digital competence has been a central pillar of Norwegian education policy for more than a decade, and national strategies consistently position teachers as key agents in the digital transformation of schooling. A defining feature of the Norwegian context is that digital competence is established as one of the five basic skills in the national curriculum reform *Kunnskapsløftet 2020* (LK20), alongside reading, writing, oral skills and numeracy (Ministry of Education and Research, 2020). This curricular positioning makes digital competence a universal professional requirement for teachers across all subjects and grade levels, not a specialised or optional domain.

### National Digital Education Strategies

Norway's digital education policy has been shaped by a sequence of national strategies that foreground pedagogical use of technology rather than technology deployment alone. The White Paper *Data i skolen* (Computers in schools) from 1984 was the first broad and systematic approach, even with a strategy of using Norwegian developed computers (Tiki) as a driving force and platform for development of educational software. As a pre-MS Windows effort this was technologically futile but served as inspiration and stepping stone towards the broader implementation of the PC generation as described in Røsvik's (2014) account of the process from experiments to implementation.

The Digital Strategy for Basic Education 2017–2021, followed by its 2022 action plan, established the foundations for system-wide digitalisation in schools. These policies emphasise integration of digital tools into teaching practice, development of digital judgement and digital citizenship, safe and responsible technology use, and equitable access to digital resources across municipalities (Government of Norway, 2017; 2022).

While these strategies do not define a formal teacher competence standard, they clearly frame teachers as designers and facilitators of digital learning environments, responsible for embedding digital tools in pedagogically meaningful and ethically sound ways.

A more recent and comprehensive policy framework is the Strategy for Digital Competence and Infrastructure in Kindergartens and Schools 2023–2030, which explicitly states that employees in education must possess professional digital competence aligned with curriculum intentions. The strategy highlights inclusive digital environments, sustainability-oriented digital infrastructure, and coherent national digital foundations as preconditions for quality education. This reinforces policy expectations that teachers navigate digital tools competently, critically, and in ways that support all learners (Government of Norway, 2023).

### Teacher-Specific Framework: Professional Digital Competence (PfDK)

The first efforts to fully address computers in education came with VET oriented provisions in teacher training for business and trade since 1974 and in courses targeting computers for special needs purposes since 1978. In the VET setting it was an integrated curriculum element, whereas the use for special needs focused more on the tool aspect for learning and as a compensatory instrument. In 1981 the first half year course on digital skills for teachers as a CPD provision was initiated and with a didactical perspective at the University College for Special Needs Education. This was followed on with a second half year course primarily targeting special needs teachers focusing on assistive provisions and educational software, and with hands-on training to set up and connect actual appliances in special needs settings. The first textbook targeting digital skills and didactics for teachers was published in

accordance with these CPDs (Kristiansen, R. & Hanssen, V., 1982). In the following years teacher training colleges followed suit, but with more focus on informatics and coding.

Norway's most explicit articulation of teacher digital competence is the Professional Digital Competence Framework for Teachers (PfdK), published by the Norwegian Directorate for Education and Training (Udir) in 2017. PfdK defines the knowledge, skills and professional dispositions teachers need to integrate digital tools into instruction, select and evaluate digital resources, design learning activities, and ensure ethical, safe and privacy-conscious digital practice (Kelentrić et al., 2017).

Although PfdK is not anchored in legislation, research shows that it functions as a de facto national reference framework for both Initial Teacher Education (ITE) and Continuing Professional Development (CPD). It is widely used in curriculum design, CPD programmes and research on teacher digital professionalism (Norhagen et al., 2024; Utdanningsforskning, 2022). Importantly, PfdK conceptualises digital competence as an integral part of overall teacher professionalism, rather than as technical skill acquisition.

The framework is strongly reinforced by LK20's curricular requirement that teachers foster students' digital creativity, critical media understanding and responsible online behaviour. Together, PfdK and LK20 ensure that digital competence is embedded structurally in teachers' everyday professional practice.

### **Digitalisation in Teacher Education and Higher Education**

At the level of teacher preparation, national priorities are further reinforced by the Digitalisation Strategy for the Higher Education Sector 2021–2025 and the Long-Term Plan for Research and Higher Education 2023–2032. These strategies assign responsibility to universities and university colleges for developing digital pedagogy, strengthening data-informed teaching practices, and ensuring that graduates—including future teachers—possess the professional digital competence required by national school policy (Government of Norway, 2021; 2023).

However, empirical research highlights significant variation in how digital competence is operationalised across teacher education institutions, reflecting institutional autonomy and differing interpretations of PfdK. This variability underlines the need for clearer integration between policy expectations and pedagogical implementation (Norhagen et al., 2024).

### **AI and Emerging Technologies**

Teacher digital competence requirements are increasingly influenced by Norway's National Strategy for Artificial Intelligence (2020), which establishes ethical, human-rights-based and trustworthy principles for AI use in the public sector, including education (Government of Norway, 2020). While the strategy does not define teacher-specific AI competences, it signals growing expectations that teachers understand AI systems, engage critically with their risks and benefits, and apply them responsibly in learning contexts.

The European Commission's AI Watch analysis confirms that Norway places strong emphasis on expanding AI education, programming and computational thinking across the education system, supported by robust digital infrastructure and public-sector digital maturity (European Commission, 2024). At present, however, these developments remain more strongly articulated at system and workforce levels than at the level of teacher pedagogy.

### **Main Drivers of Digital Transformation in Teaching**

Taken together, several interlocking drivers shape digital transformation in Norwegian teaching practice. The LK20 curriculum embeds digital competence as a foundational teaching responsibility, PfdK provides a profession-specific competence framework, and national digitalisation strategies create system-level expectations for pedagogical use of

technology. In parallel, Norway's decentralised competence development model places substantial responsibility on municipalities and schools to prioritise and organise teacher professional learning (OECD, 2021).

Research evidence consistently indicates that while digital competence is strongly prioritised, its pedagogical depth and integration vary across institutions and contexts. This highlights the need for frameworks that support coherent, reflective and ethically grounded digital professionalism rather than fragmented technological upskilling (Norhagen et al., 2024).

Overall, the Norwegian policy landscape creates strong structural conditions for digital teaching. Teachers are expected not only to use digital tools proficiently, but to exercise professional judgement, design inclusive digital learning environments, and contribute to a sustainable and equitable digital education system.

## 1.2 Sustainability in Education Policy

Sustainability is structurally embedded in Norway's education policy, most notably through the national curriculum reform *Kunnskapsløftet 2020* (LK20). In LK20, sustainable development is defined as one of three interdisciplinary topics that must be addressed across all subjects, alongside democracy and citizenship and public health and life skills (Ministry of Education and Research, 2020). This positioning establishes sustainability as a cross-cutting curricular responsibility for teachers and requires integration of environmental, social, and economic perspectives within subject teaching.

### **Sustainability as an Interdisciplinary Curriculum Principle**

Research analysing LK20 shows that sustainability is primarily articulated at the level of the core curriculum, where it is framed as a foundation for responsible citizenship and societal transformation (Tesfamicael & Enge, 2024). Subject curricula vary in how explicitly sustainability is referenced; while subjects such as science and social studies address sustainability directly, others integrate it more implicitly through competences related to critical thinking, ethical reasoning, and problem-solving. This variation reflects a deliberate national curriculum approach in which sustainability is not treated as a standalone subject, but as a pervasive pedagogical orientation permeating teaching practice.

### **Alignment with Nordic and International ESD Policies**

At policy level, Norway aligns closely with Nordic and international agendas on Education for Sustainable Development (ESD). Nordic Council of Ministers analyses emphasise that education is regarded as a central instrument for achieving sustainability goals across Nordic countries, including through interdisciplinary curricula and teacher professionalism (Nordic Council of Ministers, 2024). Norway also aligns with UNESCO's ESD principles, which stress action competence, systems thinking, and interdisciplinary learning rather than content transmission alone (UNESCO, 2020).

### **Connections to Teacher Education and Professional Preparation**

Despite strong curricular expectations, multiple analyses identify a weak structural integration of sustainability pedagogy in teacher education. Comparative Nordic research highlights sustainability as an area that is less systematically embedded in Initial Teacher Education than digital competence, leaving many teachers underprepared for translating sustainability goals into concrete pedagogical practice (Nordic Council of Ministers, 2024). Teacher education research further indicates that sustainability competence requires more than subject knowledge. It involves pedagogical skills such as futures thinking, critical reflection, learner engagement with real-world complexity, and interdisciplinary curriculum design—competences that are not consistently developed within current ITE structures (Rieckmann & Barth, 2022). Empirical studies suggest that student teachers often struggle to



operationalise sustainability in subjects where curricular references are implicit rather than explicit (Tesfamicael & Enge, 2024).

### **Relationship Between Sustainability and Digital Education**

While sustainability and digital competence are both established national priorities, formal policy integration between the two remains limited. LK20's interdisciplinary structure and Norway's digital competence frameworks create potential overlap, particularly in areas such as digital citizenship, ethical reasoning, and systems thinking. However, national digital education strategies do not explicitly frame digital pedagogy as a vehicle for sustainability education, nor do they define sustainability-related digital competences for teachers.

Research nonetheless indicates that digital tools—such as simulations, data-driven inquiry, and modelling—can support sustainability learning when used pedagogically (Tesfamicael & Enge, 2024). Despite this potential, no national teacher competence framework currently integrates digital competence and sustainability into a unified professional profile, leaving a structural gap that directly aligns with DigiSET's focus on digitally sustainable teaching.

## **1.3 AI in Education Policy**

Artificial intelligence has gained increasing strategic importance in Norway's public sector, including education. The central national policy instrument is the National Strategy for Artificial Intelligence (2020), which establishes ethical, legal, and governance principles for AI use across public services, including schools (Government of Norway, 2020). Although the strategy is not education-specific, it defines overarching expectations for responsible and trustworthy AI, emphasising human rights, privacy protection, transparency, and cybersecurity. These principles apply equally to educational contexts.

At the European level, the European Commission's AI Watch analysis confirms that Norway places strong emphasis on AI competence development across the education system, including expanded training pathways in ICT, programming, and computational thinking. National AI policy supports strengthening digital and AI literacy at all education levels, but does not define teacher-specific pedagogical competences for AI use in classrooms (European Commission, 2024). As a result, AI literacy expectations for teachers remain implicit rather than formally codified.

Norway has also invested heavily in AI research with relevance for education. Government funding has supported the establishment of national AI research centres, including AI LEARN, which focuses on human–AI interaction, hybrid intelligence, and trustworthy AI systems. While these initiatives contribute research-based insights into adaptive learning, assessment, and lifelong learning, their outputs are primarily research-oriented and do not function as national guidelines for teachers (Government of Norway, 2020).

Overall, Norway currently lacks explicit national guidelines for AI use in schools or teacher-specific AI competence standards comparable to those adopted in some European countries. Existing strategies articulate ethical principles at system level but leave decisions about pedagogical application to institutions and individual teachers. Consequently, professional expectations related to AI—such as recognising algorithmic bias, interpreting AI-generated outputs, or assessing data-protection risks—are shaped indirectly through digital competence frameworks and curriculum requirements rather than through dedicated AI education policy.

A notable omission in Norwegian AI policy concerns environmental sustainability. Neither the National AI Strategy nor related digitalisation strategies address the environmental footprint of AI systems, such as energy consumption, data-centre use, or climate impacts. While AI Watch reports acknowledge investments in computing infrastructure, the environmental

consequences of AI are not framed as an educational concern, and no expectations are set for teachers to address this dimension in teaching or technology selection (European Commission, 2024). This represents a clear policy gap and a relevant point of added value for DigiSET's concept of digitally sustainable teaching.

## 1.4. Open Educational Resources (OER) in Education Policy

Norway does not currently have a unified national policy or strategy explicitly aligned with the UNESCO (2019) Recommendation on Open Educational Resources, nor does it operate a centralised OER mandate comparable to its digitalisation or sustainability strategies. At the same time, several elements of Norway's education policy and practice implicitly support open and reusable educational resources, even though these practices are not formally framed as OER.

### **Absence of a National OER Strategy**

Despite Norway's strong commitment to digital education, national strategies and curriculum documents do not explicitly reference OER, open licensing, or open pedagogical practices. Neither the Digital Strategy for Basic Education (2017–2021) nor the Strategy for Digital Competence and Infrastructure in Kindergartens and Schools (2023–2030) include provisions related to OER creation, use, or licensing. As a result, expectations for teachers concerning open educational practices are not codified at policy level.

Comparative Nordic analyses confirm that OER remains unevenly positioned across national education systems and highlight the absence of a structured OER policy in Norway, despite growing international attention to openness in education (Nordic Council of Ministers, 2024). While Norway aligns with UNESCO's broader principles on access to education and knowledge sharing, this alignment has not translated into a dedicated OER framework or implementation strategy.

### **OER-Aligned Practices Without Formal Policy Recognition**

Although there is no formal OER policy, Norway has a strong tradition of open access and publicly funded digital learning resources, particularly in non-commercial and public-sector contexts. National platforms such as Digital Norway provide freely accessible courses on digital literacy, AI awareness, and data ethics that are widely used by teachers. These resources operate according to open-access principles, but they are not licensed or conceptualised as OER and therefore do not contribute to systematic development of OER competence among teachers.

A notable example of OER-aligned practice in the Norwegian context is the National Digital Learning Arena (NDLA), a publicly funded initiative that produces digital learning resources for upper-secondary education. NDLA provides extensive collections of openly accessible materials, many of which are released under Creative Commons licences and function as Open Educational Resources in practice. NDLA plays an important role in ensuring equitable access to high-quality learning materials and includes systematic translation into minority languages.

However, NDLA is organised primarily as a centralised production and distribution model, rather than as a framework for developing teachers' competences in creating, adapting, and openly licensing educational resources. While NDLA contributes significantly to openness at system level, it does not position teachers as OER producers within Initial Teacher Education or CPD and therefore does not address OER as a recognised professional competence domain.



Similarly, Norway's national Open Science and Open Access strategies are well developed in higher education and research but have not yet been translated into school-level policies or teacher-competence frameworks related to OER.

At school level, the LK20 curriculum encourages teachers to adapt and develop local learning materials connected to students' lived experiences. This pedagogical orientation promotes teacher-authored digital resources and collaborative sharing within schools, even though such practices are not framed in terms of open licensing or reuse beyond local contexts. Research on curriculum implementation suggests that many of these materials could function as OER if open practices were more clearly supported and recognised (Tsfamicael & Enge, 2024).

### **Repositories, Funding, and Structural Support**

Norway does not operate a national OER repository, nor does it provide dedicated public funding schemes for OER development in school education. Open resources are instead distributed through project-based websites, NGO platforms, municipal portals, or short-term initiatives, which limits long-term sustainability and reuse across institutions. Nordic policy reviews identify this lack of infrastructure as a broader regional challenge and note that teacher education systems, including Norway's, do not systematically prepare teachers for open educational practice (Nordic Council of Ministers, 2024).

### **Implications for Teacher Competence and DigiSET**

Despite strong digital infrastructure and well-established teacher digital competence frameworks (notably PfDK), OER remains a practice-driven but non-codified area of teacher professionalism in Norway. There are no national expectations that teachers create openly licensed resources, engage in open pedagogical collaboration, or contribute to shared repositories.

This represents a clear policy and competence gap. For DigiSET, it also constitutes a significant opportunity: by formalising OER creation, adaptation, open licensing, and collaborative sharing as elements of sustainable digital literacy, DigiSET can address an area that is underdeveloped nationally but well aligned with Norway's values of equity, public access, and professional autonomy.

## **1.5 Gap Analysis: Sustainable Digital Literacy**

The Norwegian education policy landscape demonstrates strong and well-established frameworks for both digital competence and sustainability education. However, these domains remain largely separate in policy design and teacher competence frameworks, resulting in a clear gap in addressing *sustainable digital literacy* for teachers.

Digital competence is firmly institutionalised through national digitalisation strategies and operationalised via PfDK, which defines teachers' professional digital practice in terms of pedagogical integration, ethical use, privacy, and responsible resource management (Kelentrić et al., 2017; Government of Norway, 2023). Nevertheless, neither PfDK nor national digital education strategies explicitly incorporate sustainability principles, such as environmentally responsible digital practice or the use of digital technologies to support sustainability learning.

In parallel, sustainability is strongly embedded in the LK20 national curriculum, where sustainable development is defined as one of three interdisciplinary topics that all teachers must address across subjects (Ministry of Education and Research, 2020). Here, sustainability is primarily conceptualised as a learning objective for students, rather than as a defined professional competence for teachers. Nordic comparative analyses consistently identify sustainability pedagogy as an area with relatively weak integration in both Initial

Teacher Education and Continuous Professional Development, particularly when compared with digital competence (Nordic Council of Ministers, 2024).

Crucially, no national policy document or competence framework connects these two agendas into a unified expectation for teachers. While PfDK articulates ethical and reflective digital professionalism, it does not include competences related to sustainable digital practice, nor does sustainability policy specify how digital tools, data practices, or AI-based systems should be used pedagogically to support sustainability competences (Kelentrić et al., 2017; Tesfamicael & Enge, 2024).

A comparable gap is evident at the intersection of artificial intelligence and sustainability. Norway's National Strategy for Artificial Intelligence places strong emphasis on ethics, privacy, and responsible innovation, but it makes no reference to the environmental impacts of AI, such as energy use or infrastructure demands, and does not frame ecological sustainability as a criterion for AI use in education (Government of Norway, 2020; European Commission, 2024). As a result, sustainability considerations remain absent from AI-related expectations for teachers.

The absence of a national OER policy further reinforces this fragmentation. Despite strong digital infrastructure and widespread use of publicly funded digital learning resources, open educational practices are not recognised as a component of teacher professionalism, and open licensing, reuse, and collaborative resource development remain largely unsupported at system level (Nordic Council of Ministers, 2024).

Taken together, the analysis reveals a clear policy gap: Norway provides robust but separate frameworks for digital competence and sustainability, without articulating how teachers should integrate these domains into coherent pedagogical practice. Teachers are expected to address sustainability through curriculum requirements and digital competence through professional standards, yet lack structured guidance for developing *sustainable digital literacy*.

From a DigiSET perspective, this gap represents a significant opportunity. Norway's strong foundations in digitalisation and education policy create favourable conditions for the introduction of an integrative competence model that explicitly connects ethical digital practice, sustainability pedagogy, responsible AI use, OER creation, and inclusive digital design within a single professional identity: the Digitally Sustainable European Teacher.

## 2. Teacher competence frameworks in use

### 2.1 National teacher competence standards

Norway does not operate a single, unified statutory teacher competence standard applicable across the education system. Instead, teacher competences are defined through a combination of curriculum requirements, national strategies for teacher education, and profession-specific frameworks, with substantial autonomy granted to higher education institutions and school owners in implementation.

#### **Professional Digital Competence Framework for Teacher**

The most explicit national competence framework for teachers is the Professional Digital Competence Framework for Teachers developed by the Norwegian Directorate for Education and Training. PfDK outlines the knowledge, skills, and professional dispositions required for safe, ethical, and pedagogically meaningful integration of digital technologies in teaching (Kelentrić et al., 2017).

PfDK functions as a reference framework rather than a legally mandated standard. Empirical research shows that it is widely used in Initial Teacher Education, Continuing Professional Development, and curriculum design, and has become the de facto national point of orientation for understanding teacher digital competence (Norhagen et al., 2024; Utdanningsforskning, 2022). Importantly, the framework conceptualises digital competence as part of holistic teacher professionalism, not as technical skill acquisition.

### **Curriculum-Based Competence Expectations**

Teacher competence expectations are further shaped indirectly through the LK20 national curriculum, which defines digital competence as one of five basic skills across all subjects. This requires teachers to embed digital literacy, critical digital judgement, and safe digital practices within subject teaching, regardless of discipline or educational level (Ministry of Education and Research, 2020). Although LK20 is formally a curriculum for student learning, it establishes implicit professional requirements for teachers.

### **Teacher Education and Higher Education Policy**

At the level of teacher preparation, responsibilities are reinforced by national strategies for higher education. The Digitalisation Strategy for the Higher Education Sector 2021–2025 and the Long-Term Plan for Research and Higher Education 2023–2032 assign responsibility to universities and university colleges for developing digital pedagogy and ensuring that graduates, including future teachers, meet nationally defined expectations for professional digital competence (Government of Norway, 2021; 2023).

Research nevertheless highlights considerable variation in how digital competence is operationalised across teacher education institutions, reflecting differing interpretations of PfDK and institutional autonomy. This confirms that, while reference frameworks exist, implementation is uneven and not governed by a consolidated national competence standard (Norhagen et al., 2024).

### **Positioning of Digital Competence**

Digital competence occupies a central and explicit position within Norway's teacher competence landscape. It is embedded through:

- PfDK as a profession-specific reference framework,
- the LK20 curriculum through the five basic skills,
- national teacher-education policy, and
- system-level digitalisation strategies.

By contrast, sustainability, artificial intelligence, and OER-related competences are not articulated as core teacher competences within any national framework. These areas appear either as curricular objectives or system-level policy concerns, but without corresponding, clearly defined professional competence expectations for teachers. This structural imbalance identifies a clear space where DigiSET can provide added coherence and integration.

## **2.2 Adoption of European frameworks**

Norway makes extensive use of European and international competence frameworks as reference points but does not formally adopt them as binding standards. Consistent with the Norwegian governance model for education, European frameworks are recommended rather than mandated, and are selectively used in research, teacher education, and professional development where they align with national priorities such as the LK20 curriculum and the PfDK

### **DigCompEdu (2017)**

Norway has not formally adopted DigCompEdu as a national standard. However, the national Professional Digital Competence Framework for Teachers, developed in 2017, is

widely recognised as conceptually aligned with DigCompEdu. Research identifies PfDK and DigCompEdu as parallel frameworks that share comparable competence areas, pedagogical orientation, and ethical focus (Kelentrić et al., 2017; Norhagen et al., 2024). DigCompEdu is therefore used indirectly and selectively, particularly in comparative research, programme development, and CPD design, but remains non-mandatory.

### **GreenComp (2022)**

The GreenComp framework has not been adopted or adapted within Norwegian teacher competence standards. Sustainability in Norway is largely addressed through the LK20 curriculum, where sustainable development is defined as an interdisciplinary topic rather than a teacher-specific competence domain. Comparative Nordic policy analyses confirm that sustainability competences are weakly institutionalised in teacher education across the region, and there is no evidence of GreenComp being operationalised in Norwegian ITE or CPD structures (Nordic Council of Ministers, 2024; Tesfamicael & Enge, 2024).

### **LifeComp (2020)**

Norway does not explicitly reference LifeComp in national curriculum or teacher competence frameworks. While LK20 emphasises transversal competences such as critical thinking, ethical judgement, democratic participation, and life mastery, these elements are articulated through national curricular concepts rather than by adoption of the European framework. LifeComp-related competences are therefore present indirectly, but the framework itself is not used.

### **EntreComp (2016)**

Entrepreneurship and innovation appear in Norwegian education policy, particularly within vocational education and interdisciplinary curriculum work. However, EntreComp has not been adopted as a competence framework for teachers. Nordic analyses show substantial variation in how entrepreneurship education is conceptualised and implemented, with no systematic integration of EntreComp into teacher education or CPD in Norway (Nordic Council of Ministers, 2024).

### **UNESCO AI Competence Framework for Teachers (2024)**

Norway has not formally adopted the UNESCO AI Competence Framework for Teachers. The national AI Strategy (2020) establishes system-level ethical principles for AI use, but does not define teacher-specific competences. The UNESCO framework has begun to inform research activities and experimental CPD initiatives, particularly in higher education and AI literacy contexts, but remains non-binding and optional (Government of Norway, 2020; European Commission, 2024).

Framework	Adoption Level	Notes
DigCompEdu (2017)	Recommended	Conceptually aligned with PfDK; used as reference in research and CPD, not mandated
GreenComp (2022)	Not used	Sustainability addressed through LK20; no teacher-specific adoption
LifeComp (2020)	Not used	Overlapping competences present in LK20, but without framework adoption
EntreComp (2016)	Not used	Entrepreneurship addressed in curriculum, not through EntreComp
AI Competence Framework for Teachers (UNESCO, 2024)	Recommended	Influences research and emerging CPD; not embedded in policy

**Table: Overview of Adoption Level in Norway**

## 2.3 Gaps in current competence frameworks

Norway's teacher competence framework landscape is characterised by strong institutionalisation of digital competence, partial support for inclusive digital teaching, and limited integration of sustainability, OER, and AI-related competences. When assessed against the composite profile of the *Digitally Sustainable European Teacher*, existing frameworks reveal a clear imbalance between what is most developed and what remains marginal or absent.

### Most Developed Competence Areas

The strongest and most consistently articulated competence area is digital pedagogical competence. The Professional Digital Competence Framework (PfDK) provides detailed guidance on pedagogical integration of digital technologies, ethical and safe use, digital resource evaluation, and professional communication (Kelentrić et al., 2017). Its alignment with the LK20 curriculum—where digital competence is defined as a basic skill across all subjects—ensures that digital pedagogy is positioned as a core professional expectation for all teachers (Ministry of Education and Research, 2020).

Closely related to this is the emphasis on critical digital judgement, including digital citizenship, media literacy, and data protection. These dimensions are reinforced through curriculum requirements and national digitalisation strategies and are well embedded in mainstream teacher education and CPD. Together, these areas correspond strongly to DigiSET's ethical and responsible digital practice dimension.

### Partially Developed Competence Areas

Inclusive digital teaching represents a partially developed competence domain. Inclusion is a foundational principle of the Norwegian education system, and PfDK includes references to differentiation and accessibility. However, empirical research indicates that inclusive digital pedagogy is unevenly implemented across teacher education institutions, reflecting differences in institutional priorities and interpretations of national frameworks (Norhagen et al., 2024; Utdanningsforskning, 2022). As a result, inclusion is strongly endorsed in principle but only partially operationalised in digital teaching practice.

Similarly, computational thinking and basic AI awareness are present at curriculum level, particularly through requirements related to programming and digital systems. However, there is no teacher-specific AI competence standard, and national AI policy remains focused on ethical principles at system level rather than pedagogical practice. Teachers therefore encounter AI-related competences indirectly, without structured progression or clear professional expectations (Government of Norway, 2020; European Commission, 2024).

### Least Developed and Largely Absent Competence Areas

Several competence areas central to DigiSET remain weakly developed or absent from Norway's current frameworks. One of the most significant gaps concerns systems thinking for sustainability. Although sustainability is an interdisciplinary topic in LK20, research consistently shows that sustainability pedagogy is not embedded in teacher competence standards or systematically addressed in teacher education. Teachers are expected to teach sustainability, yet receive limited preparation in systems thinking, futures literacy, or interdisciplinary sustainability pedagogy (Tesfamicael & Enge, 2024; Nordic Council of Ministers, 2024).

Another underdeveloped area is Open Educational Resources (OER) and open pedagogy. There are no national OER guidelines, no open-licensing requirements in PfDK, and no structured preparation of teachers for resource sharing or collaborative knowledge production. Existing open practices are local and project-based rather than policy-driven,



leaving OER competence largely unsupported at system level (Nordic Council of Ministers, 2024).

A further gap is found in relation to the ethical and environmentally conscious use of AI. While Norway's national AI strategy emphasises privacy, human rights, and trustworthy AI, it does not address environmental sustainability or the ecological impact of AI systems, nor does it define expectations for teachers in this respect. Consequently, competences related to evaluating AI's environmental footprint or making sustainability-informed digital decisions are absent from current frameworks (Government of Norway, 2020; European Commission, 2024).

### **Synthesis in Relation to the DigiSET Profile**

Overall, Norway's competence frameworks align strongly with the digital dimension of the DigiSET profile and provide moderate support for inclusive digital pedagogy. However, they show significant gaps in integrating sustainability, OER, AI pedagogy, and environmental responsibility into a coherent professional competence model.

The most developed competence area is digital pedagogical competence as articulated through PfDK and LK20. The least developed areas are sustainable digital literacy, systems-oriented sustainability teaching, open pedagogical practice, and ethically and environmentally informed AI use. These gaps underline the need for an integrative framework—such as DigiSET—that connects digital, sustainable, inclusive, and ethical dimensions into a single professional profile for teachers.

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

This section examines how Norwegian teachers are currently prepared in Initial Teacher Education (ITE) with respect to digital competence, sustainability, artificial intelligence, and open educational practices. The analysis informs the design of the DigiSET training programme (D2.3).

### **3.1 Initial Teacher Education (ITE) provision**

Initial Teacher Education in Norway is primarily delivered by universities and university colleges, operating under national regulations while retaining substantial institutional autonomy in programme design. ITE is organised through:

- five-year integrated Master's programmes for primary and lower secondary education (grades 1–7 and 5–10),
- subject-based Master's programmes for upper secondary education, and
- specialised pathways in special educational needs (SEN).

Across these routes, digital pedagogy is the most systematically addressed competence area, while sustainability education remains uneven, AI in education is emerging but optional, and OER competence is largely absent.

### **Sustainability Education in ITE**

Although sustainable development is a mandatory interdisciplinary topic in the LK20 curriculum, research consistently identifies a weak structural integration of sustainability pedagogy in ITE. Comparative Nordic analyses show that sustainability competence is less systematically embedded in teacher education than digital competence, with substantial variation between institutions (Nordic Council of Ministers, 2024).



Empirical research indicates that while ITE programmes address sustainability conceptually, they do not consistently equip student teachers with pedagogical tools for implementing Education for Sustainable Development (ESD), particularly in subjects where sustainability is referenced implicitly rather than explicitly (Teskamicael & Enge, 2024). As a result, sustainability education in ITE remains optional and highly dependent on institutional and disciplinary priorities.

### Digital Pedagogy in ITE

Digital pedagogy is the most consistently integrated component of Norwegian ITE. This is driven by the PfDK, the LK20 curriculum requirement that digital competence be addressed across all subjects, and national strategies for digitalisation in higher education (Kelentrić et al., 2017; Ministry of Education and Research, 2020; Government of Norway, 2021).

Nevertheless, research highlights considerable variation in implementation, reflecting differing interpretations of PfDK and local institutional priorities. While digital pedagogy is mandatory in principle, its pedagogical depth and coherence differ markedly across institutions (Norhagen et al., 2024; Utdanningsforskning, 2022).

### AI in Education within ITE

Norway currently has no explicit national requirement for AI literacy or AI pedagogy in ITE. The National Strategy for Artificial Intelligence underscores ethical and responsible AI use at system level but does not define teacher-specific competence expectations (Government of Norway, 2020).

As a result, AI appears in teacher education only through isolated initiatives, elective modules (primarily in ICT-related specialisations), or research-driven projects. AI-related competences are therefore not a standard or compulsory element of initial teacher education (European Commission, 2024).

### OER and Open Educational Practices in ITE

There is no evidence of systematic training in Open Educational Resources (OER) within Norwegian ITE. Programmes do not include mandatory instruction in open licensing, open pedagogy, or collaborative resource development. While Norway has a strong culture of publicly funded digital resources and open access, OER competences are not formalised within teacher education frameworks (Nordic Council of Ministers, 2024). Consequently, OER creation and reuse remain outside the scope of standard ITE provision.

Aspect	Adoption Level	Notes
Education for Sustainable Development	Optionally	Present in curriculum discourse (LK20), but weakly embedded in ITE; inconsistent across institutions
Digital Pedagogy	Mandatory (in principle)	PfDK strongly influences ITE; digital competence is a required basic skill, though implementation varies locally.
AI in education	Not available	No national requirements; appears only through isolated initiatives or elective modules; no teacher-specific AI competence standard.
OER creation	Not available	No national OER policy; OER practices exist but are not integrated into teacher education curricula.

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

## 3.2 Continuous Professional Development (CPD) opportunities

Continuous Professional Development (CPD) for teachers in Norway is organised through a decentralised competence development model, in which municipalities and schools are responsible for identifying priorities and organising professional learning. National authorities define overall policy direction, while CPD provision is delivered through a combination of universities, national agencies, and selected digital platforms. This results in a well-resourced but uneven CPD landscape, particularly across DigiSET-relevant areas.

### Governance and Main Providers

The organisation of CPD is shaped by the national competence development model analysed by the OECD, which emphasises local autonomy, school-based development, and collaboration between school owners and higher-education institutions (OECD, 2021). In practice, CPD for teachers is provided primarily by:

- Municipal and school-based initiatives, aligned with local development needs;
- Universities and university colleges, offering postgraduate courses and further education, particularly in digital pedagogy;
- National digital initiatives, providing broadly accessible competence development aligned with national digitalisation priorities.

This structure enables flexibility and responsiveness, but also leads to variation in content, depth, and availability across competence areas.

### CPD in Sustainability Education

Opportunities for CPD in sustainability education exist, but they are not systematically embedded in the national CPD system. OECD and Nordic policy analyses consistently show that sustainability pedagogy remains optional and fragmented, often dependent on local initiatives or externally funded projects rather than national requirements (OECD, 2021; Nordic Council of Ministers, 2024).

As a result, while some teachers access professional learning related to Education for Sustainable Development, sustainability does not function as a coherent or mandatory CPD domain across the system.

### CPD in Digital Pedagogy

Digital pedagogy represents the strongest and most established CPD area in Norway. National digitalisation strategies prioritise continuous strengthening of teachers' digital competence, and universities play a central role in delivering further education in digital pedagogy and learning technologies (Government of Norway, 2021; 2023).

However, participation in digital-pedagogy CPD is not mandatory and varies according to municipal priorities and institutional capacity. While availability is high, coverage and pedagogical depth remain uneven.

### CPD in AI in Education

CPD opportunities related to AI have expanded in recent years, driven by Norway's national AI strategy and investments in research and innovation. Teachers increasingly encounter CPD focused on general AI literacy, ethical principles, and responsible use, reflecting system-level priorities (Government of Norway, 2020; European Commission, 2024).

Nevertheless, these opportunities are emerging and optional, and they are not anchored in a national teacher-specific AI competence framework. CPD in this area rarely addresses curriculum-specific or pedagogical integration of AI, limiting its relevance for classroom practice.

### CPD in OER and Open Educational Practices

There is no structured CPD provision in Norway dedicated to Open Educational Resources or open pedagogical practices. National strategies do not define OER-related teacher competences, and CPD offerings do not include systematic training in open licensing, resource adaptation, or collaborative content development (Nordic Council of Ministers, 2024).

As a result, OER-related competence development remains largely absent from CPD, aside from isolated and project-based initiatives.

Aspect	Adoption Level	Notes
Education for Sustainable Development	Optionally	Available mainly through NGOs, project-based initiatives, and municipal programmes; not system-wide or mandatory
Digital Pedagogy	Optionally	Widely available and prioritised, but participation depends on local decisions
AI in education	Optionally	Emerging CPD offers focused on general AI literacy and ethics; no teacher-specific framework
OER creation	Not available	No national CPD structures for OER or open pedagogy

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

## 3.3 Certification and recognition

Recognition of teacher competences in Norway is characterised by high institutional autonomy and decentralised governance, rather than by formal, nationally standardised certification systems. While teachers must fulfil statutory qualification requirements to enter the profession, there is no unified national certification scheme for competences related to digital education, sustainability, artificial intelligence, or open educational practices. Instead, competence recognition is embedded within initial qualifications, postgraduate studies, and non-formal CPD provision.

### Certification of Digital Competence

Digital competence is primarily recognised indirectly, through formal teacher education qualifications and further education. Initial Teacher Education programmes are required to address professional digital competence in line with the Professional Digital Competence Framework (PfdK), but completion of ITE does not result in a separate or explicit certification of digital competence (Kelentrić et al., 2017).

In CPD contexts, digital competence is often documented through course completion certificates or institutional attestations, which may be used locally by school owners in competence development dialogues. However, these mechanisms do not constitute a nationally regulated certification system and vary considerably across municipalities (OECD, 2021).

### Certification of Sustainability Competence

There is no formal certification mechanism for teacher competences related to sustainability or Education for Sustainable Development. Although LK20 requires teachers to address sustainable development as an interdisciplinary topic, sustainability competences are not defined or assessed as part of national teacher qualification frameworks. Nordic policy analyses consistently identify sustainability as weakly institutionalised in teacher education and CPD, with limited recognition beyond project-based participation (Nordic Council of Ministers, 2024).

### **Certification of AI-Related Competences**

Norway does not offer teacher-specific certification pathways for AI literacy or AI pedagogy. The National Strategy for Artificial Intelligence articulates ethical and governance principles at system level, but does not define competence requirements or certification structures for educators (Government of Norway, 2020). Any recognition of AI-related competence currently occurs through elective higher-education courses or non-formal CPD and does not carry formal status within the teacher qualification system (European Commission, 2024).

### **Certification of OER-Related Competences**

Similarly, no certification or formal recognition framework exists for OER-related competences, including open licensing, resource adaptation, or open pedagogical practice. National teacher competence frameworks do not reference OER, and neither ITE nor CPD programmes award recognised credentials in this area. As a result, OER-related skills remain largely invisible within formal professional development structures (Nordic Council of Ministers, 2024).

### **Potential for Microcredentials**

Despite the absence of formal certification schemes, Norway's education policy increasingly emphasises flexible, modular learning pathways and lifelong learning. The higher-education sector has expanded provision of short courses and further education aligned with digitalisation priorities, suggesting strong potential for microcredentials as future recognition mechanisms (OECD, 2021).

While microcredentials are not yet integrated into national teacher qualification regulations, this policy direction indicates an opportunity to formally recognise competences in areas such as digital pedagogy, AI literacy, sustainability education, and OER practices—particularly through voluntary, stackable credentials aligned with competence frameworks rather than statutory licensing.

### **National Qualification Framework**

Teacher qualifications in Norway are governed by the National Qualifications Framework for Lifelong Learning (NKR), national regulations for teacher education, and institutional accreditation standards. However, the NKR defines qualification levels, not content-specific professional competences. Consequently, digital, sustainability-related, AI-related, and OER-related competences are recognised implicitly through degrees and coursework, rather than through dedicated certification or professional standards.

## **3.4 Gaps in current ITE/CPD**

This section synthesises key gaps in Norwegian Initial Teacher Education (ITE) and Continuous Professional Development (CPD) in relation to the competence profile of the *Digitally Sustainable European Teacher*. While Norway has strong structures for digital competence development, significant gaps remain in the integration of sustainability, AI pedagogy, open educational practices, and environmental responsibility.

### **Most Supported Competence Development**

The most consistently supported competence area across both ITE and CPD is digital pedagogical competence. Digital competence is embedded in the LK20 curriculum as a basic skill and operationalised in teacher education through the Professional Digital Competence Framework (PfdK), which shapes expectations for pedagogical integration, ethical use, and responsible digital practice (Kelentrić et al., 2017; Ministry of Education and Research, 2020).

At CPD level, national policy prioritises digital upskilling through the decentralised competence development model, with universities and school owners jointly responsible for

further education. As a result, digital pedagogy is well established as a core component of teacher professionalism, even though the depth and consistency of implementation vary across institutions (Norhagen et al., 2024; OECD, 2021).

Inclusive pedagogy in digital contexts is moderately supported. Inclusion is a foundational principle of the Norwegian education system, and PFDK refers to differentiation and accessibility. However, research shows uneven integration of inclusive digital pedagogy across teacher education programmes, reflecting institutional autonomy and differing implementation priorities (Norhagen et al., 2024; Utdanningsforskning, 2022).

### **Least Supported Competence Development**

Several competence areas central to sustainable digital literacy remain weakly developed or absent from both ITE and CPD.

Sustainability pedagogy and systems thinking represent the most prominent gap. Although sustainable development is a mandatory interdisciplinary topic in LK20, sustainability competences are not embedded in teacher competence standards, and ITE programmes provide limited preparation in systems thinking, futures literacy, or interdisciplinary sustainability pedagogy. Nordic comparative analyses describe sustainability as structurally under-integrated in teacher education and professional development (Tesfamicael & Enge, 2024; Nordic Council of Ministers, 2024).

Similarly, AI pedagogy and critical AI literacy are weakly addressed. There is no teacher-specific AI competence framework in Norway, and AI appears in ITE only through elective or isolated initiatives. CPD related to AI focuses largely on general literacy and ethical awareness rather than pedagogical integration or curriculum-specific use. National AI policy remains system-oriented and does not articulate expectations for classroom practice (Government of Norway, 2020; European Commission, 2024).

Open Educational Resources (OER) and open pedagogical practices are largely absent from both ITE and CPD. National frameworks do not define OER-related teacher competences, and neither initial training nor CPD includes systematic preparation in open licensing, resource adaptation, or collaborative knowledge sharing. As a result, open practices remain peripheral and project-based rather than structurally supported (Nordic Council of Ministers, 2024).

Finally, environmentally responsible digital practice is not addressed in teacher education or professional development. National digitalisation and AI strategies prioritise ethics and privacy but do not address the environmental impact of digital technologies or AI systems, leaving teachers without guidance on sustainable digital decision-making (Government of Norway, 2020; European Commission, 2024).

### **Synthesis in Relation to the DigiSET Profile**

Overall, Norway's ITE and CPD systems provide strong support for digital pedagogy and general digital professionalism. However, competences central to the *Digitally Sustainable European Teacher*—notably sustainability-oriented pedagogy, systems thinking, AI pedagogy, OER practices, and environmentally responsible digital use—remain weakly developed or missing.

This imbalance highlights the need for an integrated competence framework, such as DigiSET, that bridges digital competence with sustainability, ethics, openness, and inclusion into a coherent model of teacher professionalism aligned with Norway's evolving educational priorities.



## 4. Analysis of the Four DigiSET Thematic Areas

### 4.1 Gender-unbiased AI in teaching

In the Norwegian context, there is growing attention to AI ethics and responsible technology use, but gender bias in AI is not addressed as a specific educational or pedagogical domain. Existing policies and frameworks recognise bias as a general risk in AI systems, yet do not articulate teacher competences for identifying, teaching, or mitigating gender bias in digital and AI-mediated learning environments.

#### **Policy Context and Teacher Guidance**

Norway's National Strategy for Artificial Intelligence establishes overarching principles related to fairness, transparency, non-discrimination, and human rights in public-sector AI use. However, the strategy treats bias as a general ethical concern, without addressing gender bias as a distinct pedagogical issue or defining expectations for teachers in educational settings (Government of Norway, 2020).

Similarly, the European Commission's AI Watch analysis notes Norway's strong focus on trustworthy and ethical AI, but does not identify any gender-specific guidance, curriculum expectations, or teacher-facing frameworks for addressing algorithmic gender bias in schools (European Commission, 2024). As a result, national policy recognises bias as a system-level issue but does not translate this into teaching competences or classroom practice.

#### **Resources and Training for Teachers**

Norway does not offer national teaching resources or CPD programmes specifically focused on gender bias in AI. Existing initiatives related to AI and digital competence primarily address general AI literacy, ethical awareness, and responsible use, rather than gender-critical perspectives. Research-oriented AI initiatives and general digital-competence CPD contribute to awareness of AI ethics but do not provide pedagogical tools for teaching about gender bias, representation, or algorithmic stereotyping.

Teacher education and professional development therefore lack structured opportunities for developing competences such as:

- explaining how training data can reproduce gender stereotypes,
- supporting learners in critically analysing AI-generated representations, or
- evaluating digital tools for gender bias and discriminatory effects.

#### **Implications for DigiSET**

The absence of pedagogical guidance, competence frameworks, and CPD related to gender bias in AI reveals a clear application-level gap in Norway's teacher-competence landscape. Teachers are expected to promote equality, inclusion, and ethical digital citizenship, yet are not prepared to address how AI systems can reinforce gender inequality.

This makes *gender-unbiased AI in teaching* a highly relevant DigiSET application domain. DigiSET can add concrete value by:

- defining teacher competences for recognising and explaining gender bias in AI systems,
- supporting the creation of OER that model gender-fair AI use, and
- embedding algorithmic fairness and gender awareness into sustainable digital teaching practice.



## 4.2 Systems thinking for sustainability in education

In Norway, systems thinking for sustainability is implicitly encouraged through the national curriculum, but remains weakly articulated as a teaching competence and insufficiently supported through teacher education and professional development. This creates a gap between curricular expectations and teachers' pedagogical capacity to address sustainability through complexity-oriented and future-focused approaches.

### Systems Thinking in the Curriculum

The LK20 national curriculum defines sustainable development as an interdisciplinary topic spanning environmental, social, and economic dimensions (Ministry of Education and Research, 2020). This creates curricular space for systems thinking concepts such as interdependence, long-term consequences, and trade-offs. However, systems thinking is not specified as a pedagogical approach or professional competence for teachers, and its implementation is left largely to local interpretation.

Empirical curriculum analyses indicate that while sustainability is structurally present, systems thinking is only implicitly supported. Opportunities for systems-based learning exist in subjects such as mathematics and science, but are not consistently operationalised in teaching practice due to lack of explicit guidance (Tesfamicael & Enge, 2024).

### Teacher Preparation and Professional Learning

Evidence from Nordic comparative research shows that systems thinking is not systematically embedded in teacher education. Sustainability pedagogy in general—and systems thinking in particular—has a weak and uneven status in both ITE and CPD, with no national framework defining expected teacher competences in this area (Nordic Council of Ministers, 2024).

As a result, teachers receive limited preparation in:

- complexity reasoning and interdependence modelling,
- futures-oriented sustainability perspectives, and
- interdisciplinary sustainability pedagogy.

Where systems-oriented approaches appear in practice, they tend to rely on individual teacher initiative or project-based activity, rather than structured competence development.

### Connection to Education for Sustainable Development (ESD)

Norwegian ESD policy is strongly aligned with LK20's interdisciplinary structure, but focuses primarily on **curricular intentions and values** rather than on operational pedagogical competences. Research indicates that this leads to an implementation gap: teachers are expected to teach sustainability, yet lack clear guidance on *how* to do so through systems-based, action-oriented pedagogies (Tesfamicael & Enge, 2024; Nordic Council of Ministers, 2024).

### Implications for DigiSET

The absence of explicit teacher competences for systems thinking represents a clear application-level gap in the Norwegian context. Systems thinking for sustainability is required by curriculum logic but not supported by teacher competence frameworks or structured training.

This makes systems thinking a highly relevant DigiSET application domain. DigiSET can add value by:

- operationalising systems thinking as a concrete teaching competence,
- embedding sustainability reasoning into digital and OER-based learning designs, and
- supporting teachers in integrating sustainability across subjects using structured pedagogical tools.

## 4.3 AI for adaptive learning

AI-supported adaptive learning is an emerging but not yet established practice in Norwegian education. While national policy and research investments signal high interest in personalised and data-informed learning, teacher preparedness for pedagogical implementation of adaptive AI systems remains weak. This results in a gap between technological potential and classroom-level practice.

### State of Adaptive Learning in Education

Norway has made significant investments in artificial intelligence research with relevance for education, including national research initiatives focused on human–AI interaction, hybrid intelligence, and trustworthy AI systems (Government of Norway, 2020). These initiatives contribute to knowledge development in areas such as adaptive assessment, personalised feedback, and learning analytics.

At policy level, education is identified as a priority domain for AI innovation, and national reforms promote digital skills, computational thinking, and responsible AI use across the education system (Government of Norway, 2020; European Commission, 2024). However, there are no national pedagogical standards or guidelines governing the use of adaptive AI systems in schools, and classroom-level adoption remains limited.

### Teacher Preparation for AI-Supported Personalisation

Teacher exposure to AI in adaptive learning contexts is fragmented and optional. Existing professional learning related to AI focuses primarily on general AI literacy and ethical awareness, rather than on pedagogical design for personalised learning. Neither Initial

Teacher Education nor CPD provides systematic training in:

- designing AI-supported personalised learning activities,
- interpreting data generated by adaptive systems, or
- integrating AI-based feedback into assessment practices.

As a result, adaptive learning remains largely research-driven or experimental, without consistent translation into mainstream classroom pedagogy.

### Ethical and Pedagogical Considerations

Ethical use of AI is strongly emphasised in national policy, particularly with regard to privacy, transparency, data protection, and trustworthy systems (Government of Norway, 2020). These principles are reinforced by European analyses highlighting the importance of responsible AI governance (European Commission, 2024).

However, these ethical considerations are not operationalised as teacher competences. Teachers receive limited guidance on how to evaluate adaptive learning tools, interpret algorithmic recommendations, or safeguard learner autonomy in AI-mediated environments. Ethical AI therefore remains framed as a system-level responsibility, rather than as a pedagogical practice embedded in everyday teaching.

### Implications for DigiSET

The limited pedagogical integration of adaptive AI systems highlights a clear application-level gap in teacher competence development. While Norway has strong AI policy foundations and research capacity, teachers are not systematically prepared to use adaptive AI tools for personalised learning in ethically and pedagogically informed ways.

This positions *AI for adaptive learning* as a key DigiSET application domain. DigiSET can add value by:

- defining teacher competences for pedagogically sound AI-supported personalisation,
- embedding ethical evaluation and learner-centred design into adaptive learning practices,

- supporting the creation of OER that model responsible use of adaptive AI, and
- integrating sustainability and learner autonomy into AI-mediated teaching.

## 4.4 Inclusive teaching practices and learning difficulties

Inclusive education is a core principle of the Norwegian education system, supported by strong equity policies and decentralised competence development structures. However, when examined as an application domain for *digitally supported teaching*, inclusion reveals significant pedagogical gaps, particularly in relation to digital and AI-mediated learning, which are directly relevant to DigiSET.

### Policy Context and Teacher Guidance

Norwegian education policy places strong emphasis on inclusion and equity, requiring schools to address diverse learner needs through flexible pedagogical approaches and professional collaboration (OECD, 2021). While this provides a solid structural foundation, national frameworks do not define teacher competences for digital inclusion, nor do they address the use of emerging technologies, including AI, to support learners with disabilities or learning difficulties.

At system level, inclusion is framed primarily as an organisational and welfare responsibility, rather than as a digital-pedagogical competence domain for teachers.

### Teacher Preparation and Professional Learning

Inclusive education is addressed in Initial Teacher Education through thematic and cross-curricular components, such as differentiation, special educational needs, multilingual education, and classroom diversity. However, research shows substantial variation in how these themes are implemented, and no shared framework connects inclusion to digital pedagogy or technology-enhanced learning (Nordic Council of Ministers, 2024; Norhagen et al., 2024).

In Continuous Professional Development, inclusion is typically prioritised locally, particularly in contexts with high diversity or adult and migrant education. These CPD opportunities focus mainly on literacy, language acquisition, and general differentiation, and are not systematically designed around digital or AI-supported inclusion (OECD, 2021). As a result, access to relevant competence development varies across municipalities.

### Use of Digital Tools for Inclusive Teaching

Digital tools are widely used in practice to support inclusive education—especially for multilingual learners, adults with limited prior schooling, and students requiring flexible learning arrangements. However, these uses remain practice-driven rather than strategy-driven. National teacher competence frameworks, including PfdK, do not specify how digital technologies or assistive tools should be pedagogically applied to support inclusion.

Importantly, there are no national guidelines for using AI-supported tools—such as adaptive literacy systems, text simplification, or automated feedback—for inclusive teaching. Research indicates that teachers' understanding of digital instructional design for diverse learners is uneven, and largely dependent on individual initiative rather than structured training (Norhagen et al., 2024).

### Support for Learners with Learning Difficulties

Norway provides strong general support structures for learners with difficulties, emphasising early identification, flexible adaptation, and team-based collaboration. However, teacher competences for addressing learning difficulties in digital and AI-mediated environments are not standardised. There are no national requirements for training in digital accessibility,

assistive technologies, or inclusive digital learning design, resulting in limited pedagogical guidance for teachers working in technology-rich classrooms.

### Implications for DigiSET

This thematic area highlights a clear application-level competence gap. While inclusion is a fundamental principle of Norwegian education, it is not translated into a coherent set of digital inclusion competences for teachers.

DigiSET can add concrete value by:

- defining teacher competences that bridge inclusion and digital pedagogy,
- supporting the pedagogical use of digital and AI-based tools for diverse learners,
- providing OER that model inclusive digital learning design, and
- reducing inequity caused by fragmented local CPD provision.

Inclusive teaching practices in digitally mediated contexts therefore represent a high-impact application domain for the DigiSET framework.

## 5. Innovative practices and case studies

This section presents selected examples of innovative professional development practices in Norway that demonstrate how teachers develop competences related to digital pedagogy, sustainability, and collaborative knowledge creation. The focus is on competence development processes, rather than student outcomes.

### 5.1 Case Study 1: Den naturlige skolesekken (The Sustainable Backpack)

<b>Organisation/Project</b>	Den naturlige skolesekken (DNS), coordinated by the Norwegian Centre for Science Education (Naturfagsenteret) in collaboration with universities and national education authorities
<b>Main Dimensions Addressed</b>	Education for Sustainable Development; interdisciplinary teaching; systems thinking; inquiry-based pedagogy; sharing of digital learning resources
<b>Teacher Competences Developed</b>	Sustainability pedagogy; interdisciplinary curriculum design; systems thinking; inquiry-based teaching; collaborative professional learning
<b>Learning Approach</b>	Long-term, school-based professional development through local projects, mentoring, teacher networks, and reflective practice
<b>Transferability to DigiSET</b>	Strong relevance as a model for practice-based competence development, collaborative resource creation, and systems-oriented sustainability teaching

Den naturlige skolesekken (DNS) was a national professional development programme operating between 2009 and 2022, supporting more than 750 schools in developing practice-oriented Education for Sustainable Development. The programme was explicitly designed as teacher-focused professional development, rather than as a short-term instructional intervention for students (Naturfagsenteret, 2023).

DNS supported teachers in working with local sustainability challenges—such as biodiversity, climate, and resource use—through interdisciplinary projects embedded in everyday school practice. Central to the programme was the expectation that teachers would design, test, document, and revise their own teaching approaches collaboratively, thereby developing sustainable professional competence over time.

Evaluations and research on DNS show that competence development was driven by:

- interdisciplinary curriculum design across subjects,
- systems-oriented approaches linking local phenomena to global sustainability challenges,
- inquiry-based pedagogies that shift teachers' roles from knowledge transmission to facilitation, and
- participation in professional learning communities at school and national level (Scheie & Stromholt, 2019).

Teachers produced and shared a large number of teaching resources via national platforms such as natursekken.no. Although these materials were not formally framed as Open Educational Resources, they functioned in practice as reusable and adaptable digital teaching resources, supporting peer learning and dissemination beyond individual schools (Udir, 2023).

An independent evaluation by NIFU confirmed that DNS contributed to lasting changes in teachers' pedagogical practices, particularly in interdisciplinary teaching and sustainability-oriented didactics. The evaluation also noted that the digital dimension of competence development varied by local implementation, reflecting the absence of a national framework explicitly linking sustainability and digital pedagogy (NIFU, 2014).

### Relevance for DigiSET

From a DigiSET perspective, Den naturlige skolesekken offers a highly transferable professional development model that aligns closely with gaps identified in Chapters 1–4:

- It demonstrates long-term, practice-based competence development, rather than fragmented CPD provision.
- It operationalises systems thinking for sustainability, an area identified as weakly supported in formal teacher competence frameworks.
- It shows how collaborative creation and sharing of digital teaching resources can function as an informal OER practice, even in the absence of national OER policy.
- It provides a concrete example of how teachers can develop integrated sustainability and digital competences through reflective, project-based work.

While DNS did not address AI or advanced digital technologies, its professional learning architecture offers a strong blueprint for DigiSET training design—particularly for integrating sustainability, collaborative pedagogy, and resource production into demonstrable teacher competences.

## 5.2 Case Study 2: Digital Norway – National Platform for Digital and AI Competence Development

<b>Organisation/Project</b>	Digital Norway (Digital Norway AS) – a public–private competence initiative supported by the Norwegian government, national industry actors, and public-sector stakeholders
<b>Main Dimensions Addressed</b>	Professional digital competence; AI literacy; ethical and critical digital judgement; data literacy; responsible technology use
<b>Teacher Competences Developed</b>	Critical digital literacy; ethical AI awareness; responsible use of generative AI; digital judgement; reflective professional use of emerging technologies
<b>Learning Approach</b>	Modular, online CPD using micro-courses, self-paced learning, and practice-oriented reflection

### Transferability to DigiSET

Demonstrates scalable, modular CPD, competence-based progression, and certificate-driven learning adaptable to DigiSET's OER-based model

Digital Norway is a national competence platform established to support digital skills development across the public sector. While not designed specifically for teachers, it has become a widely used CPD resource for in-service educators, particularly in areas related to digital judgement, AI awareness, data ethics, and responsible technology use (Digital Norway, 2026).

The platform's relevance lies in its focus on professional reflection rather than technical training. Its courses address questions of why and how digital and AI tools should be used, emphasising ethical considerations, societal consequences, and professional responsibility. This orientation aligns closely with key findings from Chapters 1–3, which identify ethical digital competence as a strength in the Norwegian teacher landscape, but note uneven implementation across institutions (Norhagen et al., 2024).

Digital Norway applies a modular learning model. Courses are short, self-paced, and designed to be combined flexibly, enabling teachers to integrate CPD into ongoing professional practice. Completion certificates and digital badges provide informal recognition of competence development, even though these credentials are not embedded in national qualification frameworks.

### Competence Development Processes

From a teacher-competence perspective, Digital Norway supports development through:

- structured reflection on digital and AI-related dilemmas,
- scenario-based engagement with ethical and legal considerations, and
- incremental competence building through modular learning.

Empirical research on professional digital competence in Norway highlights the importance of such reflective approaches, particularly given the variation in teachers' digital backgrounds and institutional CPD provision (Norhagen et al., 2024; Utdanningsforskning, 2022).

### Relevance for DigiSET

Digital Norway provides a complementary counterpoint to *Den naturlige skolesekken*:

- DNS demonstrates long-term, school-based, sustainability-oriented competence development.
- Digital Norway demonstrates scalable, modular, cross-sector CPD for digital and AI literacy.

For DigiSET, Digital Norway offers a strong delivery model, but also highlights clear limitations:

- sustainability is not explicitly addressed,
- gender bias and inclusion in AI are absent, and
- OER creation and open pedagogy are not part of the competence model.

DigiSET can therefore build on Digital Norway's modular and scalable CPD architecture, while extending it towards:

- sustainable digital pedagogy,
- inclusive and gender-aware AI use, and
- demonstrable competence development through OER-based outputs.



## 6. Conclusions and Implications

### 6.1 Competence Implications for the Digitally Sustainable Teacher

The Norwegian desk research indicates that teachers operate within a system with strong digital foundations but fragmented integration of sustainability, AI pedagogy, inclusion, and openness. Rather than lacking competences, teachers face challenges in connecting these domains into coherent professional practice. These findings identify a set of emerging competence areas that directly inform the development of the DigiSET framework.

#### 6.1.1 Emerging Competence Areas

##### **Critical and Ethical Use of AI in Teaching**

An essential emerging competence is teachers' ability to engage with AI critically, ethically, and pedagogically. While Norway has well-established national principles for trustworthy and responsible AI, these remain weakly translated into classroom-level competences. Teachers increasingly encounter AI through generative tools, data-driven systems, and adaptive platforms, yet receive limited preparation for evaluating pedagogical value, ethical risks, or bias. The evidence suggests that AI competence should be framed not as technical proficiency, but as pedagogical agency: the capacity to make informed, reflective decisions about when and how AI should be used in teaching.

##### **Designing Inclusive Digital Learning Environments**

A second key competence area concerns inclusive digital learning design. Inclusion is a foundational value in Norwegian education, but digital and AI-mediated learning introduces new accessibility risks and design challenges. Research shows that inclusive digital pedagogy is unevenly addressed in teacher education and CPD, leaving much to local initiative. Teachers therefore need competences that integrate digital pedagogy with accessibility, differentiation, and learner diversity, ensuring that technology-enhanced learning supports heterogeneous learners rather than reinforcing inequality.

##### **Integrating Sustainability through Systems Thinking**

A third emerging competence area is the ability to integrate sustainability into teaching through systems-oriented and future-focused pedagogy. Although sustainability is embedded in the curriculum as an interdisciplinary topic, teachers receive limited support in translating this mandate into practice. Evidence from both research and professional development initiatives indicates that sustainability competence requires more than content knowledge; it requires pedagogical capacity to address complexity, interdependencies, and learner agency. DigiSET can strengthen this area by explicitly linking systems thinking, digital tools, and inquiry-based learning for sustainability.

##### **Creating, Adapting, and Sharing Open Educational Resources (OER)**

A further competence area concerns open educational practice. Norwegian teachers frequently create and adapt digital resources, yet openness is not recognised as a professional competence within national frameworks. There is no systematic preparation for open licensing, collaborative resource development, or reuse beyond local contexts. Practice-based initiatives demonstrate, however, that sharing and adapting resources strengthens professional learning and sustainability. DigiSET should therefore articulate OER competence as a core element of sustainable digital professionalism.

##### **Reflective Professional Judgement and Digital Responsibility**

Finally, the Norwegian context underscores the importance of reflective professional judgement as a transversal competence. The decentralised education system places substantial responsibility on teachers to navigate rapid technological change. While reflection is emphasised in existing digital competence frameworks, teachers need stronger

support to apply reflective judgement to AI-related dilemmas, sustainability trade-offs, and ethical decision-making. Reflective competence should therefore be positioned as a unifying element enabling teachers to integrate digital, ethical, inclusive, and sustainable considerations across their practice.

All of these emerging competence areas indicate that DigiSET's primary added value in the Norwegian context lies in integration rather than replacement. Teachers already possess foundational strengths in digital pedagogy and inclusion, but lack a framework that systematically connects these with sustainability, ethical AI use, and openness. The Digitally Sustainable European Teacher framework can serve as a coherent professional model that aligns existing capacities with future-oriented requirements for responsible and sustainable digital education.

### **6.1.2 Underdeveloped Competences**

The desk research identifies several competences that remain weakly developed or structurally absent in the Norwegian context, despite strong foundations in digitalisation and inclusion. These gaps are not primarily due to lack of policy intent, but to missing integration between policy priorities and teacher competence frameworks. Addressing these underdeveloped competences is central to DigiSET's added value.

#### **Ethical and Pedagogical Use of AI**

A major competence gap concerns teachers' ability to use AI ethically and pedagogically. Although national AI policy strongly emphasises trust, transparency, and human rights, these principles are framed at system level and not translated into teacher-specific competences. Teachers receive little structured preparation for evaluating AI tools, identifying bias, or making informed pedagogical choices about generative and adaptive systems. As a result, AI use in education depends largely on individual initiative rather than professional standards, leaving a clear gap between national AI ambitions and classroom practice.

#### **Interdisciplinary Sustainability Teaching and Systems Thinking**

Another underdeveloped area is sustainability pedagogy grounded in systems thinking. While sustainable development is a mandated interdisciplinary topic in the curriculum, teacher education provides limited support for the competences required to enact this in practice. Teachers are expected to address complexity, long-term impacts, and interdependencies across disciplines, yet lack systematic training in futures literacy, systems thinking, and interdisciplinary planning. This gap risks reducing sustainability education to fragmented content rather than transformative learning.

#### **Teacher Autonomy in Creating and Sharing Learning Resources**

Teacher autonomy in creating, adapting, and sharing learning resources—particularly in open digital formats—remains weakly recognised. Norwegian teachers frequently develop their own materials, but open educational practice is not articulated as a professional competence within national frameworks. There is no systematic preparation in open licensing, collaborative resource development, or reuse beyond local contexts. This limits teachers' capacity to contribute to sustainable knowledge-sharing practices and to demonstrate professional competence through reusable outputs.

#### **Environmental Awareness of Digital and AI Technologies**

A further gap concerns the environmental dimension of digitalisation and AI. While sustainability is a core educational priority and AI ethics is well established, the environmental impacts of digital technologies—such as energy use, infrastructure, and AI-related carbon footprints—are not addressed in teacher education or CPD. Teachers are therefore not supported in making environmentally informed digital choices or in integrating

these considerations into teaching, representing a missing dimension of sustainable digital literacy.

### **Integration Across Competence Domains**

Finally, a transversal gap lies in the lack of integration across competence areas. Digital competence, sustainability, inclusion, AI, and openness are addressed through separate frameworks and policy streams, leaving teachers to connect them independently. The absence of an integrative competence model makes it difficult for teachers to develop a coherent professional identity aligned with sustainable digital transformation.

Taken together, these underdeveloped competences indicate that DigiSET's contribution in the Norwegian context should focus on making implicit expectations explicit and professionally actionable. Teachers are already operating at the intersection of digitalisation, sustainability, and inclusion, but lack a framework that defines, supports, and validates these combined competences. DigiSET can fill this gap by articulating integrated competences for ethical AI use, systems-oriented sustainability teaching, open educational practice, and environmentally responsible digital decision-making—areas that are currently weakly addressed but increasingly essential.

## **6.2 Recommendations and Implications for DigiSET Framework Development**

The Norwegian desk research shows that DigiSET will be most relevant and transferable if it integrates and operationalises competences that already exist in fragmented or implicit form across national policy, curriculum, and professional development. Rather than introducing new priority areas, the DigiSET Framework of Learning Outcomes (D2.2) should function as a connecting architecture, translating Norway's strong foundations in digitalisation, inclusion, and sustainability into a coherent and practice-oriented competence model for teachers.

In the Norwegian context—characterised by decentralised governance and high institutional autonomy—relevance depends less on alignment with formal statutory standards and more on DigiSET's ability to provide clarity, pedagogical concreteness, and demonstrable learning outcomes. The framework should articulate what teachers are expected to know, be able to do, and value when working at the intersection of digitalisation, sustainability, AI, inclusion, and openness.

### **6.2.1 Implications for the Competence Framework**

Based on national evidence, DigiSET's competence framework should explicitly include a small number of integrative competence areas, articulated through clearly defined knowledge, skills, and attitudes.

#### **Key Competence Areas to Be Included**

First, DigiSET should include critical and ethical digital competence, with explicit emphasis on AI-related pedagogical decision-making. While Norway has strong national AI ethics principles, these are not translated into classroom-level competences. DigiSET should define teachers' ability to evaluate AI tools, recognise bias and limitations, exercise pedagogical judgement, and safeguard learner agency in AI-mediated contexts.

Second, inclusive digital learning design should be positioned as a core competence area. Inclusion is a foundational Norwegian value, but digital and AI-mediated teaching introduces new accessibility challenges. DigiSET should integrate accessibility, differentiation, and inclusive design directly into digital competence, rather than treating inclusion as a separate or parallel domain.

Third, DigiSET should include sustainability competence grounded in systems thinking. Teachers are required to teach sustainable development, yet lack pedagogical support for addressing complexity, interdependencies, and long-term consequences. The framework should conceptualise sustainability as an applied teaching competence supported by digital tools, inquiry-based learning, and interdisciplinary perspectives.

Fourth, open educational practice and OER competence should be articulated as a distinct area. Although Norwegian teachers regularly create and adapt digital materials, openness is not recognised as a professional competence. DigiSET should define competences related to open licensing, collaborative resource development, reuse, and sharing across professional communities.

Finally, reflective professional judgement should be retained as a transversal competence across all areas. In a decentralised system, teachers must continually make informed choices in evolving digital environments. Reflection, ethical reasoning, and professional agency should therefore underpin all DigiSET competences.

### **Competence Components: Knowledge, Skills, and Attitudes**

To be transferable to the Norwegian context, DigiSET competences should be framed through a balanced combination of knowledge, skills, and attitudes.

At the level of knowledge, teachers require conceptual understanding of digital systems and AI, sustainability principles, open licensing, and ethical frameworks.

At the level of skills, teachers should be able to design and evaluate digital learning activities, adapt teaching for diverse learners, assess AI-generated outputs critically, create and share OER, and facilitate systems-oriented sustainability learning.

At the level of attitudes, particular emphasis should be placed on ethical responsibility, critical curiosity, openness to collaboration, and reflective professional practice—qualities closely aligned with Norwegian educational culture.

### **Aspects Requiring Special Emphasis in Norway**

Three aspects should receive particular emphasis to ensure national relevance.

First, DigiSET should prioritise integration across competence domains, explicitly connecting digital competence, sustainability, inclusion, AI, and openness into a single professional profile.

Second, learning outcomes should emphasise practice-based competence demonstration, especially through the creation of artefacts such as OER, reflecting Norway's strong tradition of experiential professional learning.

Third, DigiSET should foreground ethical and environmental responsibility in digital decision-making, including AI bias, data ethics, and the environmental impact of digital technologies—areas currently absent from national teacher competence frameworks. Flexibility and modularity should underpin the entire framework, allowing DigiSET to be used across diverse institutional contexts, CPD formats, and career stages in line with Norway's decentralised system and emerging interest in micro-credentials.

For DigiSET to be relevant in the Norwegian context, the D2.2 Framework of Learning Outcomes should function as an integrative and enabling model, not a prescriptive standard. Its added value lies in making underdeveloped competences explicit, connecting currently separate policy priorities, and supporting teachers in navigating sustainable digital transformation with professional confidence, ethical awareness, and pedagogical agency.

## 6.2.2 Implications for Learning Outcomes

The Norwegian desk research indicates that DigiSET learning outcomes should be demonstrable, practice-oriented, and integrative, reflecting the professional realities of teachers operating in a decentralised and digitally mature education system. Rather than emphasising abstract knowledge acquisition, learning outcomes should describe what teachers can design, justify, implement, and share after completing DigiSET training.

To ensure national relevance, learning outcomes must connect digital competence, sustainability, inclusion, AI, and openness in ways that align with everyday teaching practice and professional autonomy.

### **Responsible and Pedagogically Grounded Use of AI**

After DigiSET training, teachers should be able to design and justify learning activities that use AI responsibly. This includes selecting AI tools based on pedagogical relevance rather than technical novelty, explaining limitations and risks to learners, and critically interpreting AI-generated outputs before using them in teaching or assessment.

Teachers should also be able to demonstrate ethical judgement by recognising bias, ensuring transparency, and safeguarding learner data. This outcome directly addresses the gap between Norway's strong AI ethics principles and the limited translation of those principles into classroom-level practice.

### **Integration of Sustainability Across Subjects**

Another core learning outcome is the ability to integrate sustainability meaningfully across subjects using systems-oriented approaches. After training, teachers should be able to design interdisciplinary learning sequences that connect environmental, social, and economic dimensions of sustainability and use digital tools to support inquiry, modelling, and critical reflection.

The emphasis is on pedagogical strategies that help learners understand complexity, interdependencies, and long-term consequences, rather than treating sustainability as isolated content.

### **Inclusive Use of Digital Tools for Diverse Learners**

DigiSET learning outcomes should ensure that teachers can adapt digital learning designs to diverse learner needs. After training, teachers should be able to modify materials, tasks, or assessment formats to support linguistic diversity, different learning speeds, and accessibility requirements.

Demonstration of this outcome may include redesigned learning activities, use of accessibility features, or explicit pedagogical justification of inclusive digital choices. This strengthens Norway's inclusion tradition while addressing current gaps in digital and AI-supported differentiation.

### **Creation and Collaborative Sharing of OER**

A central DigiSET-specific learning outcome is the ability to create, adapt, and share Open Educational Resources. Teachers should be able to produce at least one openly licensed resource, apply appropriate open licences, and document conditions for reuse or adaptation by others.

This outcome is particularly relevant in Norway, where teachers already develop digital materials but lack formal recognition and guidance for open pedagogical practice. OER creation enables teachers to demonstrate competence simultaneously in digital pedagogy, sustainability, collaboration, and professional reflection.



### **Reflective Professional Judgement**

Finally, DigiSET learning outcomes should require teachers to demonstrate reflective professional judgement. Teachers should be able to critically reflect on their digital and pedagogical choices, articulate ethical and sustainability considerations, and justify how their practice aligns with inclusive and responsible educational values.

Reflection should be embedded across all demonstrated outputs, including AI-supported learning, sustainability-oriented teaching, inclusive design, and OER production.

These learning outcomes position DigiSET as a programme that emphasises capability over compliance. Teachers should complete the training able to demonstrate integrated competence in action: responsible use of AI, meaningful sustainability integration, inclusive digital teaching, and open knowledge sharing.

Framed in this way, DigiSET aligns with Norway's professional culture while strengthening underdeveloped competences at the intersections of digitalisation, sustainability, ethics, and openness.

### **6.2.3 Implications for Training Design**

The analysis indicates that DigiSET training will be most effective if it is designed as practice-based, collaborative, reflective, and flexible, rather than as a content-heavy or purely theoretical programme. This reflects both the structure of the Norwegian education system—characterised by decentralisation and professional autonomy—and the documented success of national initiatives such as *Den naturlige skolesekken* and Digital Norway, which emphasise learning through practice and reflection.

#### **Practice-Based and Application-Oriented Learning**

A central design implication is the need for practice-based learning, where teachers develop competences by designing, testing, and revising pedagogical solutions in authentic or near-authentic contexts. DigiSET training should therefore be structured around concrete production tasks, such as designing digitally supported sustainability lessons, developing inclusive digital learning activities, or creating OER that demonstrate responsible AI use.

This approach reflects Norway's strong tradition of linking professional development closely to everyday teaching practice and supports competence development that is durable and transferable beyond the training context.

#### **Collaborative Design and Professional Learning Communities**

Collaborative learning should be a core design principle of DigiSET training. Evidence from Norwegian professional development highlights that teachers develop deeper and more sustained competences when working in professional learning communities that support peer feedback, shared problem-solving, and collective reflection.

DigiSET training should therefore include structured opportunities for collaborative design, particularly in the development and peer review of learning materials and OER. Collaborative tasks reinforce openness, professional dialogue, and shared responsibility, while also supporting teachers' professional identity formation.

#### **Interdisciplinary and Systems-Oriented Workshops**

Given the weak institutionalisation of systems thinking and interdisciplinary sustainability pedagogy, DigiSET training should incorporate interdisciplinary workshop formats. These should explicitly connect subject perspectives with digital competence, sustainability, AI, and inclusion, rather than addressing these domains in isolation.



Digital tools and AI should be positioned as supports for interdisciplinary inquiry and systems-oriented learning, not as ends in themselves. This design principle directly addresses the gap between curricular expectations and pedagogical preparedness identified in earlier chapters.

### **Reflective Learning and Ethical Deliberation**

Reflection should be embedded as a core component of DigiSET training, not treated as a supplementary activity. In a system that values professional autonomy, teachers require structured opportunities to reflect on ethical trade-offs, sustainability implications, and inclusion challenges associated with digital and AI-mediated teaching.

Reflective learning can be supported through design rationales, peer dialogue, and documentation of pedagogical decisions linked to produced artefacts. Embedding reflection within assessment strengthens teachers' capacity to articulate professional judgement and ethical responsibility.

### **Modularity, Flexibility, and Microcredential Logic**

Finally, DigiSET training should be designed with modularity and flexibility. The Norwegian CPD landscape is diverse and decentralised, and teachers engage with professional learning at different career stages and institutional contexts. Modular training units—potentially linked to micro-credential recognition—would allow DigiSET to integrate smoothly into existing CPD structures while retaining coherence within a shared European competence framework.

### **Overall Implication**

In summary, the Norwegian evidence suggests that DigiSET training should be designed as a competence-development process grounded in professional practice, rather than as a traditional course. By combining practice-based learning, collaborative design, interdisciplinary approaches, reflective activities, and flexible modular structures, DigiSET can align with Norway's professional culture and support teachers in demonstrating sustainable digital competence in action.

## **6.3 Potential for National Integration**

The Norwegian education system offers good conditions for integrating DigiSET, particularly through Continuous Professional Development (CPD). Integration into Initial Teacher Education (ITE) is also possible, but is more likely to occur incrementally and through institution-specific pathways. Overall integration potential is shaped by a balance of enabling systemic features and identifiable structural barriers.

### **Integration into Continuous Professional Development (CPD)**

In the short term, CPD is the most viable entry point for DigiSET in Norway. The decentralised competence development model gives municipalities and school owners broad autonomy to select professional learning initiatives, enabling adoption of externally developed, competence-based programmes where they align with recognised priorities such as digital competence, inclusion, and sustainability.

DigiSET's modular, practice-oriented design aligns well with existing CPD patterns, including short courses, flexible learning trajectories, and non-formal recognition mechanisms. DigiSET could therefore be integrated either as a recognised CPD pathway or embedded within existing municipal or institutional competence development plans. Its emphasis on demonstrable outputs, such as pedagogical designs and OER, also resonates with Norway's strong tradition of practice-based professional learning, increasing acceptability among teachers and school leaders.

### **Integration into Initial Teacher Education (ITE)**

Integration into ITE is feasible but will require incremental and locally driven approaches. Norwegian higher-education institutions enjoy substantial academic autonomy, making rapid nationwide integration unlikely. However, DigiSET could contribute in several complementary ways: as elective or cross-cutting modules, as a reference framework for curriculum development, or as a basis for practicum tasks, master's projects, or portfolio assessment.

In this context, DigiSET is best positioned as a guiding framework that enhances coherence across existing curriculum areas, rather than as a mandatory standard imposed from outside.

### **Key Enablers for National Integration**

Several factors support DigiSET integration. Norway has high digital maturity in schools and teacher education, reducing entry barriers for advanced topics such as AI, inclusive digital design, and sustainability-oriented pedagogy. DigiSET's thematic focus areas also enjoy strong policy legitimacy, as digital competence, sustainability, inclusion, and ethical technology use are already recognised national priorities.

A further enabler is Norway's culture of professional trust and autonomy, which favours competence-based and reflective approaches over prescriptive regulation. DigiSET's emphasis on teacher judgement, reflection, and practice-based demonstration aligns well with this professional culture. The growing acceptance of modular learning and micro-credential logic in CPD strengthens this alignment.

Recent policy signals concerning cautious use of screen-based teaching in the early years indicate an evolving national debate on digital pedagogy. DigiSET's focus on responsible and pedagogically grounded digital use positions it well within this evolving context.

### **Barriers and Constraints**

The primary barrier to national integration is fragmented governance. Responsibility for teacher competence development is distributed across national authorities, municipalities, and higher-education institutions. In the absence of a national mandate, DigiSET uptake may therefore vary by region and institution.

A second barrier is the lack of formal teacher competence standards covering sustainable digital literacy, AI pedagogy, and open educational practice. This makes DigiSET more likely to be perceived as an enhancement rather than a necessity unless its added value is clearly communicated.

Finally, DigiSET's integrative ambition may challenge existing structures in which digital competence, sustainability, inclusion, and AI are treated through separate policy streams. Successful integration will therefore depend on clear positioning, emphasising DigiSET's role in connecting—not replacing—existing frameworks.

### **Overall Integration Potential**

Overall, the Norwegian context offers strong potential for DigiSET integration, particularly within CPD and as a reference framework for teacher education innovation. DigiSET is best positioned not as a replacement for existing structures, but as an integrative competence framework and training pathway that helps teachers connect existing priorities into a coherent professional practice. If positioned as flexible, practice-oriented, and supportive of professional autonomy, DigiSET can be successfully embedded in Norway's evolving teacher development ecosystem.

## 6.4 Key Findings Summary

The desk research reveals a teacher competence landscape shaped by strong digitalisation policies, a deeply embedded inclusion ethos, and a curriculum level commitment to sustainability, combined with a decentralised governance model that grants schools and teachers substantial professional autonomy. These drivers have enabled rapid uptake of digital pedagogies and fostered a high level of trust in teachers' professional judgement. At the same time, they have produced a system in which key competence areas develop unevenly and largely in parallel rather than as part of a unified professional profile.

The strongest driver shaping teacher competence development in Norway is the long standing prioritisation of digital competence. Digital literacy is embedded as a basic skill in the national curriculum and operationalised through the Professional Digital Competence Framework for Teachers, supported by extensive CPD provision and strong national digital infrastructure. This has resulted in comparatively high teacher capacity in using digital tools, engaging in reflective digital practice, and supporting basic digital citizenship.

A second important driver is Norway's commitment to inclusive education and equity, reflected in national legislation, welfare-based educational structures, and decentralised competence development. Teachers are accustomed to working in diverse classrooms and adapting teaching to learner needs, although this adaptability is not yet fully translated into structured digital or AI supported inclusion competences.

A third, more recent driver is the national focus on artificial intelligence and responsible innovation. Norway has invested heavily in AI research and ethical governance at a systemic level, but these developments have not yet been translated into teacher specific competence requirements or pedagogical guidance.

Against this background, the main competence needs identified by the desk research are integrative rather than foundational. Norwegian teachers do not lack digital skills or sustainability awareness per se; rather, they need support in connecting digital competence, sustainability, inclusion, AI, and openness into coherent pedagogical practice. Emerging competence needs include the critical and ethical use of AI in teaching, inclusive digital learning design, sustainability teaching grounded in systems thinking, open educational practices, and reflective professional judgement across rapidly evolving digital contexts.

The analysis also identifies clear gaps in current policy and training systems. Sustainability is strongly embedded in the curriculum but weakly supported in teacher education and CPD, particularly in relation to systems thinking and interdisciplinary pedagogy. Ethical and pedagogical AI competences remain underdeveloped, with national strategies stopping short of defining classroom level teacher roles. Open Educational Resources and open pedagogy are present in practice but absent from formal competence frameworks, limiting teacher autonomy and recognition in resource creation. Finally, the environmental implications of digital and AI technologies are almost entirely missing from teacher training, despite Norway's broader sustainability commitments.

Taken together, these findings suggest that Norway offers high readiness for DigiSET uptake, not because the system already addresses sustainable digital literacy comprehensively, but because its strong foundations create favourable conditions for integration. DigiSET's added value in the Norwegian context lies in its ability to connect existing strengths and address underdeveloped intersections, rather than introducing entirely new priorities. The framework of the Digitally Sustainable European Teacher provides a coherent professional profile that aligns well with Norway's decentralised, trust based education system by clarifying expectations, supporting reflective practice, and emphasising competence demonstration through real pedagogical artefacts such as OER.

In conclusion, DigiSET is well positioned to support Norwegian teachers by transforming a fragmented landscape of relevant initiatives, policies, and practices into an integrated, practice-oriented competence model. Its strongest contribution will lie in helping teachers navigate sustainable digital transformation with confidence, ethical awareness, and professional agency—attributes increasingly essential in the Norwegian educational context and beyond.

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