

DigiSET – The Academy of Digitally Sustainable European Teacher

Project Number: 101249272

ERASMUS-EDU-2025-PEX-TEACH-ACA

WP2 – COUNTRY REPORT

Bulgaria

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

Authors:

Anastasia Savova, Syndicate Education Podkrepa, Sofia

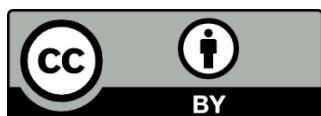
Deyana Peykova, Osnovno uchilishte Hristo Smirnenski, Rakovski

Date: 27.04.2026

Version: 0.2



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



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



**Co-funded by
the European Union**

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or EACEA. Neither the European Union nor the granting authority can be held responsible for them

Project contribution to Agenda 2030



Acknowledgment

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

To download

<https://creativecommons.org/licenses/by/4.0/>

Based on *Academic Integrity and Transparency in AI-assisted Research and Specification Framework* (Bozkurt, 2024), the authors of this paper acknowledge that the paper was reviewed, and refined with the assistance of OpenAI ChatGPT (Versions as of April 2026), complementing the human editorial process. The human authors critically assessed and validated the content to maintain academic rigour. **The authors also assessed and addressed potential biases inherent in the AI-generated content. The final version of the paper is the sole responsibility of the human authors.**

Content

1. National Policy Framework for Digital and Sustainable Education	4
1.1 Digital Education Strategy and Teacher Competences	4
1.2 Sustainability in Education Policy	5
1.3 AI in Education Policy	6
1.4. Open Educational Resources (OER) in Education Policy	7
1.5 Gap Analysis: Sustainable Digital Literacy	8
2. Teacher competence frameworks in use	9
2.1 National teacher competence standards	9
2.2 Adoption of European frameworks	9
2.3 Gaps in current competence frameworks	11
3. Initial Teacher Education (ITE) and Continuous Professional Development (CPD) and its Certification	12
3.1 Initial Teacher Education (ITE) provision	12
3.2 Continuous Professional Development (CPD) opportunities	13
3.3 Certification and recognition	14
3.4 Gaps in current ITE/CDP	14
4. Analysis of the Four DigiSET Thematic Areas	17
4.1 Gender-unbiased AI in teaching	17
4.2 Systems thinking for sustainability in education	17
4.3 AI for adaptive learning	17
4.4 Inclusive teaching practices and learning difficulties	18
5. Innovative practices and case studies	20
5.1 Case Study 1: National Teacher Training on Artificial Intelligence in Education (Bankya Training Programme)	20
5.2 Case Study 2: STEM Skills for the 21st Century Classroom – Erasmus+ Teacher Mobility Project	21
6. Conclusions and Implications	22
6.1 Competence Implications for the Digitally Sustainable Teacher	22
6.1.1 Emerging Competence Areas	22
6.1.2 Underdeveloped Competences	22
6.2 Recommendations and Implications for DigiSET Framework Development	23
6.2.1 Implications for the Competence Framework	24
6.2.2 Implications for Learning Outcomes	25
6.2.3 Implications for Training Design	25
6.3 Potential for National Integration	25
6.4 Key Findings Summary	26
7. References	28

1. National Policy Framework for Digital and Sustainable Education

1.1 Digital Education Strategy and Teacher Competences

Digital transformation is a central priority in Bulgarian education policy, with a strong focus on developing teachers' digital competences and integrating digital technologies into teaching and learning. This priority is explicitly defined in the Strategic Framework for the Development of Education, Training and Learning in the Republic of Bulgaria (2021–2030), which identifies digitalisation and competence development as key drivers for modernising the education system (Ministry of Education and Science, 2021).

At the European level, Bulgarian policy is aligned with the Digital Education Action Plan (2021–2027), which promotes high-performing digital education ecosystems and the development of digital skills for educators and learners (European Commission, 2020). In addition, the European Framework for the Digital Competence of Educators (DigCompEdu) provides a structured model for defining teachers' digital competences, including digital pedagogy, assessment practices and learner engagement (Redecker, 2017).

At the national level, the strategic vision is implemented through concrete policy instruments. The Action Plan 2025–2027 to the Strategic Framework translates national priorities into specific implementation measures and activities (Ministry of Education and Science, 2023). Furthermore, national programmes such as “Information and Communication Technologies in the System of Pre-school and School Education” and “Qualification of Pedagogical Specialists” support both digital infrastructure and teachers' professional development (Ministry of Education and Science, 2022a; Ministry of Education and Science, 2022b).

An important component of the national digital ecosystem is the Digital Backpack platform, which provides integrated access to digital learning resources, communication tools and classroom management functionalities within a unified national environment (Ministry of Education and Science, n.d.). This platform reflects a systemic approach to digital transformation, combining infrastructure, content and pedagogical support.

These policy instruments demonstrate that digital transformation in Bulgaria is not limited to technological provision but is increasingly understood as a comprehensive process of capacity-building for teachers, students and educational institutions. The policy framework emphasises the use of innovative pedagogical approaches, the integration of digital tools into everyday teaching practice and the continuous upgrading of teachers' competences.

According to national and European policy documents, teachers are expected to develop a broad set of digital competences that extend beyond basic technological skills. These include designing digital learning environments, using digital tools for assessment and feedback, supporting students' digital literacy and ensuring the safe and responsible use of technologies (Ministry of Education and Science, 2021; European Commission, 2022). Particular emphasis is placed on fostering critical thinking, digital citizenship and media literacy among students.

Several key factors drive the digital transformation of teaching in Bulgaria. These include the rapid development of digital technologies, the increasing availability of digital learning platforms and the need to prepare students for participation in a digital and knowledge-based economy. In addition, the COVID-19 pandemic accelerated the adoption of online and hybrid learning models, highlighting the importance of teachers' digital readiness and adaptability (European Commission, 2020).

Bulgarian education policy positions teachers as key agents of digital transformation. Teachers are expected to act as facilitators of innovative and digitally enriched learning environments and are encouraged to continuously develop their competences through professional development programmes, national initiatives and participation in European projects.

1.2 Sustainability in Education Policy

Sustainability is an increasingly recognised priority in Bulgarian education policy, although it is mainly addressed as a cross-curricular theme rather than as a standalone policy field. This is explicitly reflected in the Strategic Framework for the Development of Education, Training and Learning in the Republic of Bulgaria (2021–2030), which promotes sustainable development, civic responsibility and environmental awareness as key educational priorities (Ministry of Education and Science, 2021). In addition, the integration of sustainability is aligned with international frameworks such as the UNESCO Recommendation on Open Educational Resources, which highlights the role of education in supporting sustainable development (UNESCO, 2019).

Environmental sustainability is most visible within the school curriculum, particularly in subjects such as geography, biology and civic education, where students explore topics related to climate change, biodiversity, environmental protection and sustainable consumption. These priorities are supported at policy level through the Strategic Framework (2021–2030), which emphasises environmental education and responsible attitudes towards natural resources (Ministry of Education and Science, 2021). In addition, schools are encouraged to implement extracurricular activities, eco-projects and community initiatives that promote environmental awareness and active citizenship.

Social sustainability is addressed through policies related to inclusive education, equal access to learning opportunities and the development of social and civic competences. The Pre-school and School Education Act provides the legal framework for inclusive education in Bulgaria and defines mechanisms for supporting students with diverse needs (Pre-school and School Education Act, 2015). This approach is further aligned with the Council Recommendation on Key Competences for Lifelong Learning, which emphasises social and civic competences as essential for participation in society (Council of the European Union, 2018). In the Bulgarian context, this dimension is closely linked to efforts to reduce educational inequalities and support participation through inclusive school environments and targeted support measures.

Economic sustainability is connected to the development of key competences such as entrepreneurship, financial literacy and responsible decision-making. These competences are embedded in the European competence framework and are increasingly integrated into interdisciplinary and project-based learning approaches (Council of the European Union, 2018).

A growing connection between sustainability and digital education can also be observed. Digital technologies enable teachers and students to explore sustainability topics through data visualisation, simulations and collaborative projects. This aligns with international policy frameworks such as the UNESCO Recommendation on OER, which highlights the role of digital resources in supporting access to knowledge and sustainable development (UNESCO, 2019).

Teacher training initiatives are gradually incorporating sustainability-related topics. A key institutional driver in the Bulgarian context is the National Programme “Building a School STEM Environment”, which explicitly includes “Green technologies and sustainable development” as one of its thematic directions (Ministry of Education and Science, 2022). This programme links sustainability to innovation in teaching, STEM environments and resource development.

Although sustainability is not always presented as a separate policy field, it is increasingly recognised as a cross-cutting priority within the Bulgarian education system. Current policy developments suggest a gradual shift towards more integrated approaches that combine sustainability, digital technologies and interdisciplinary learning in order to address complex societal challenges (Ministry of Education and Science, 2021).

1.3 AI in Education Policy

Artificial Intelligence (AI) is an emerging priority in the Bulgarian education system, with increasing policy attention at both national and European levels. At the national level, Bulgaria adopted the *Concept for the Development of Artificial Intelligence in Bulgaria until 2030*, which defines strategic priorities for the development and responsible use of AI across sectors, including education, research and innovation (Council of Ministers of the Republic of Bulgaria, 2020).

More recently, the Ministry of Education and Science has taken steps towards sector-specific policy development. In January 2026, the Ministry published a *Draft Vision for the Introduction and Use of Artificial Intelligence in Bulgarian School Education* for public consultation, outlining strategic directions for the responsible, pedagogically meaningful and ethically grounded integration of AI into teaching and learning (Ministry of Education and Science, 2026). This document marks an important shift from general national AI strategy towards more concrete guidance for the education sector, addressing not only technological aspects but also pedagogy, assessment, school governance, teacher support and student protection.

At the current stage, national policy discussions emphasise the integration of AI across different subject areas rather than treating it as a separate discipline. The focus is on supporting teachers in using AI tools to enhance learning in subjects such as mathematics, science, languages and social sciences. This approach aligns with broader European policy directions promoting the use of digital technologies to support inquiry-based learning, creativity and critical thinking (European Commission, 2022).

Teacher competences related to AI are currently framed within broader digital competence frameworks and the emerging concept of AI literacy. According to European policy guidelines, educators are expected to understand the functioning of AI systems, critically evaluate AI-generated content and guide students in the responsible use of AI technologies (European Commission, 2022; UNESCO, 2024). In the Bulgarian context, however, this area is still in an early stage of development, as policy guidance is evolving more rapidly than formalised requirements for teacher training, assessment and certification.

Professional development initiatives increasingly introduce teachers to AI-supported tools and encourage experimentation with innovative teaching practices. However, these initiatives remain uneven in scope and are not yet systematically embedded within national teacher education frameworks. This suggests that Bulgaria is currently transitioning from exploratory initiatives to more structured policy development in AI education.

Ethical considerations play a central role in current policy discussions. Teachers are encouraged to address issues such as algorithmic bias, misinformation, data protection and transparency of automated systems. These priorities are consistent with European guidelines on the ethical use of AI in education, which emphasise the importance of developing critical digital literacy and responsible use of technologies among students (European Commission, 2022).

These national developments are strongly influenced by broader European regulatory and policy frameworks, including the *Artificial Intelligence Act*, which establishes rules for trustworthy and human-centred AI within the European Union (European Commission, 2023). Although environmental aspects of AI are not yet explicitly addressed in Bulgarian education policy, the increasing focus on sustainable digital transformation may lead to greater awareness of the environmental impact of digital technologies in the future.

Bulgaria is moving from an exploratory phase towards a more policy-guided approach to AI in education. While national-level strategies and draft guidance documents are already in place, the systematic integration of AI into teacher education, professional development and competence frameworks remains at an early stage and requires further development.

1.4. Open Educational Resources (OER) in Education Policy

Open Educational Resources (OER) are an increasingly important component of digital education policy, as they support equitable access to learning materials, enable the reuse and adaptation of content, and foster collaboration among educators. At the international level, their importance is clearly established in the *UNESCO Recommendation on Open Educational Resources (2019)*, which encourages Member States to promote open licensing, capacity building and supportive policy environments for OER (UNESCO, 2019).

In Bulgaria, the development of OER is closely linked to the broader digital transformation of the education system, as defined in the *Strategic Framework for the Development of Education, Training and Learning in the Republic of Bulgaria (2021–2030)* (Ministry of Education and Science, 2021). The Ministry of Education and Science has established several national digital platforms that provide access to educational resources for teachers and students.

One of the central components of this ecosystem is the *Digital Backpack* platform (<https://edu.mon.bg>), which serves as a national environment for digital learning resources, communication and classroom organisation (Ministry of Education and Science, n.d.-a). Within this ecosystem, the *Catalogue of Open Educational Resources* (<https://oer.mon.bg>) provides access to educational materials that are explicitly licensed for reuse, adaptation and redistribution (Ministry of Education and Science, n.d.-b).

The existence of this catalogue is particularly important because it distinguishes openly licensed resources from the broader category of freely accessible digital materials. This distinction is essential for teachers' professional practice, as the pedagogical value of OER lies not only in access but also in the legal possibility to adapt, remix and redistribute resources in accordance with classroom needs (UNESCO, 2019). The OER catalogue supports the discovery, sharing and reuse of resources aligned with the national curriculum and contributes to the gradual development of an OER culture in Bulgarian school education.

In addition, Bulgaria has developed the *National Electronic Library for Teachers* (<https://e-learn.mon.bg>), which serves as a repository of teaching materials, lesson plans and methodological resources (Ministry of Education and Science, n.d.-c). Together, these platforms demonstrate that Bulgaria has already established a solid digital infrastructure for resource sharing and professional collaboration among teachers.

At the European level, Bulgarian teachers also participate in resource sharing through platforms such as the *European School Education Platform (ESEP)*, which supports collaboration, exchange of teaching materials and participation in Erasmus+ projects (European Commission, n.d.).

Despite these developments, an important policy challenge remains. While digital infrastructure for resource access and sharing is well developed, the systematic integration of OER into teacher training and professional development is still limited. In particular, competences related to open licensing, resource adaptation, and collaborative content creation are not yet consistently embedded in national training frameworks.

It is therefore important to distinguish between freely accessible digital resources and OER in the strict sense. While many digital materials available through national platforms are free to use, only those with open licences allow legal reuse, modification and redistribution (UNESCO, 2019).

Bulgaria has made significant progress in building digital ecosystems that support access to educational resources. However, further development of teacher competences related to OER creation, adaptation and sharing is needed in order to fully realise the potential of open education and support more sustainable and collaborative teaching practices.

1.5 Gap Analysis: Sustainable Digital Literacy

The analysis of current policies in Bulgaria shows that both digital competence and sustainability education are recognised as important priorities within the education system. Digital transformation is strongly promoted through national strategies such as the *Strategic Framework for the Development of Education, Training and Learning in the Republic of Bulgaria (2021–2030)*, which emphasises digitalisation, innovation and the development of teachers' digital competences (Ministry of Education and Science, 2021). At the same time, sustainability is addressed through environmental education, civic education and initiatives related to responsible consumption, climate awareness and social inclusion, in line with European and international policy frameworks (Council of the European Union, 2018; UNESCO, 2019).

However, these two policy areas are primarily developed in parallel rather than as an integrated concept. In practice, this means that schools and teachers often encounter digitalisation and sustainability as two separate policy agendas: one focused on digital technologies, platforms and competences, and the other on environmental awareness and social responsibility. The absence of an explicitly integrated national teacher competence model linking these areas remains a key policy gap. While digital competence frameworks such as DigCompEdu focus on digital pedagogy, tools and media literacy (Redecker, 2017), sustainability-related frameworks such as GreenComp emphasise environmental awareness, systems thinking and responsible action (European Commission, 2022). Explicit integration of these two dimensions within national policy remains limited.

This gap is also visible in teacher training and professional development in Bulgaria. While training programmes increasingly address digital skills and the use of educational technologies, they rarely include structured guidance on how digital tools can be used to support sustainability education or how the environmental and social impact of digital technologies should be addressed in the classroom (Ministry of Education and Science, 2022b). Similarly, sustainability initiatives in schools often focus on environmental projects and activities without strong integration of digital tools or data-driven learning approaches.

Another emerging gap relates to the rapid development of artificial intelligence and digital technologies. Although national policy has begun to address AI through documents such as the *Concept for the Development of Artificial Intelligence in Bulgaria until 2030* and the *Draft Vision for AI in School Education* (Council of Ministers of the Republic of Bulgaria, 2020; Ministry of Education and Science, 2026), the environmental and sustainability-related implications of AI are not yet systematically included in teacher training or educational policy.

Current policies in Bulgaria provide a strong foundation for both digital transformation and sustainability education. However, there is a clear need for more integrated approaches that connect digital competence, sustainability principles and innovative pedagogy. Strengthening the concept of sustainable digital literacy for teachers would enable educators to design learning activities that use digital technologies responsibly while addressing environmental, social and economic challenges.

The Bulgarian policy context already provides important building blocks for such integration, including digital competence frameworks, sustainability initiatives, OER platforms and emerging AI policies. However, these elements remain only partially connected within a coherent teacher competence framework. A logical next step for policy development would therefore be to integrate existing strands more explicitly—such as digital pedagogy, AI literacy, OER use, media literacy, sustainability competences and inclusive teaching—into a unified model of teacher competence. This would support a clearer national understanding of what a digitally and sustainably competent teacher should know and be able to do.

2. Teacher competence frameworks in use

2.1 National teacher competence standards

In Bulgaria, teacher competence standards are defined within a well-established national regulatory framework that outlines the professional profile, responsibilities and development requirements for teachers. This framework is primarily based on the *Pre-school and School Education Act* and further detailed in *Ordinance No. 15 on the Status and Professional Development of Teachers, Principals and Other Pedagogical Specialists* (Pre-school and School Education Act, 2015; Ministry of Education and Science, 2019).

These regulatory documents define key competence areas for teachers, including pedagogical competence, subject-specific expertise, communication and collaboration skills, and the ability to support students' personal and social development. They also establish the expectation that teachers continuously improve their professional practice through lifelong learning and participation in structured professional development programmes (Ministry of Education and Science, 2019).

Digital competences are increasingly recognised as an important component of teacher professionalism. This is reflected in national policy documents such as the *Strategic Framework for the Development of Education, Training and Learning in the Republic of Bulgaria (2021–2030)*, which emphasises the importance of integrating digital technologies into teaching and developing students' digital literacy (Ministry of Education and Science, 2021). Teachers are expected to use digital tools for lesson planning, delivering interactive learning activities, assessing student progress and communicating with students and parents through digital platforms.

The development of teachers' digital competences is further supported through national programmes and initiatives aimed at digitalising the education system. These include the *National Programme "Information and Communication Technologies in the System of Pre-school and School Education"*, the *National Programme "Qualification of Pedagogical Specialists"*, and the national digital environment *Digital Backpack* (Ministry of Education and Science, 2022a, 2022b; Ministry of Education and Science, n.d.-a). These instruments support both infrastructure development and teacher capacity building in the use of digital technologies.

In addition, the national regulatory framework is complemented by the *Ordinance on the State Requirements for Acquiring the Professional Qualification "Teacher"*, which links initial teacher education with the broader professional profile and continuing development of teachers (Ministry of Education and Science, 2016). This creates continuity between initial training and ongoing professional development.

Although digital competence is clearly recognised as an important professional requirement, it is typically embedded within broader pedagogical competences rather than defined as a fully separate competence framework. As a result, teachers are encouraged to integrate digital tools and resources into their teaching practice in ways that support student engagement, collaboration and the development of key competences for the 21st century, rather than following a standalone national digital competence standard.

2.2 Adoption of European frameworks

European competence frameworks play an increasingly important role in shaping teacher development policies and educational practices in Bulgaria. Although these frameworks are not formally adopted as mandatory national standards, they are widely used as reference models in national strategies, teacher training programmes and European-funded projects (Ministry of Education and Science, 2021; European Commission, 2023).

The framework with the strongest influence is the European Framework for the Digital Competence of Educators (DigCompEdu), which provides a comprehensive model for the development of teachers' digital competences, including digital pedagogy, assessment and

learner engagement (Redecker, 2017). In Bulgaria, DigCompEdu is frequently used as a reference in teacher training initiatives, Erasmus+ projects and professional development programmes focused on digital education. Its influence is also reflected in national policy priorities related to digital transformation and competence-based education (Ministry of Education and Science, 2021).

Other European competence frameworks are also gaining visibility in the Bulgarian context. The GreenComp framework supports the development of sustainability competences, including systems thinking, critical thinking and responsible action (European Commission, 2022). The LifeComp framework focuses on personal, social and learning-to-learn competences (European Commission, 2020), while the EntreComp framework promotes entrepreneurship competences such as creativity, initiative and value creation (European Commission, 2016).

In Bulgaria, these frameworks are not systematically embedded in national standards but are increasingly used in European projects, innovative school practices and teacher training programmes. Their implementation is therefore more project-based and practice-oriented rather than policy-driven. In this context, European frameworks mainly influence practice through projects, training initiatives and international cooperation rather than through formal regulation.

The UNESCO AI Competency Framework for Teachers represents a more recent development in this area, providing guidance on AI literacy, ethical use of AI and pedagogical integration of AI technologies (UNESCO, 2024). In the Bulgarian context, this framework is not yet formally integrated into national policy. However, recent developments indicate a shift towards greater policy attention to AI competences. These include the Concept for the Development of Artificial Intelligence in Bulgaria until 2030 and the Draft Vision for the Introduction and Use of Artificial Intelligence in Bulgarian School Education, which signal the emergence of AI as a policy priority in the education sector (Council of Ministers of the Republic of Bulgaria, 2020; Ministry of Education and Science, 2026).

European competence frameworks play a supportive and guiding role in the Bulgarian education system. They are primarily used as recommended reference models that inform teacher training, project-based learning and innovation in educational practice. While their formal integration into national regulatory frameworks remains limited, their influence is growing, particularly in areas related to digital competence, sustainability, and artificial intelligence.

Framework	Adoption Level	Notes
DigCompEdu (2017)	Recommended	Widely used as a reference framework in teacher training programmes, Erasmus+ projects and digital education initiatives in Bulgaria (Redecker, 2017; Ministry of Education and Science, 2021).
GreenComp (2022)	Recommended	Increasingly referenced in sustainability education and environmental initiatives, mainly through European projects and innovative school practices (European Commission, 2022).
LifeComp (2020)	Recommended	Supports social-emotional learning and the development of personal, social and civic competences; mainly applied through projects and training initiatives (European Commission, 2020).
EntreComp (2016)	Recommended	Used as a reference framework for entrepreneurship education and project-based learning, particularly in EU-funded initiatives (European Commission, 2016).
AI Competence Framework for Teachers (UNESCO, 2024)	Not used	Not formally integrated into national teacher standards; however, it is increasingly relevant in policy discussions, as reflected in the Concept for the Development of Artificial Intelligence in Bulgaria until 2030 and the Draft Vision for AI in School Education (Council of Ministers of the Republic of Bulgaria, 2020; Ministry of Education and Science, 2026; UNESCO, 2024).

Table: Overview of Adoption Level in Bulgaria

2.3 Gaps in current competence frameworks

In the Bulgarian educational context, current teacher competence frameworks place a strong emphasis on pedagogical competence, subject expertise and digital skills. This reflects national policy priorities outlined in the Strategic Framework for the Development of Education, Training and Learning in the Republic of Bulgaria (2021–2030), which highlights digital transformation and competence-based education as key drivers of system development (Ministry of Education and Science, 2021). As a result, digital competence has become one of the most strongly developed areas, supported by national programmes for digitalisation and the implementation of digital learning environments in schools (Ministry of Education and Science, 2022a).

Teachers are increasingly expected to use digital tools for lesson preparation, communication, assessment and interactive learning activities. Professional development programmes therefore frequently focus on digital pedagogy, the use of educational platforms and the integration of digital resources into classroom practice, in line with national priorities for technology-enhanced learning (Ministry of Education and Science, 2022b).

Another competence area receiving growing attention is inclusive education and social-emotional support. The Pre-school and School Education Act and related regulations establish a strong framework for inclusive education, encouraging teachers to develop competences that support diverse learners and promote positive classroom environments (Pre-school and School Education Act, 2015).

However, several competence areas remain less developed within current frameworks. One of the most significant gaps is the limited integration of sustainability competences with digital competences. While sustainability is present in the curriculum—particularly through civic, environmental and intercultural education—it is not systematically connected with digital pedagogy or digital competence development (Ministry of Education and Science, 2021). This results in a fragmented approach where sustainability and digitalisation are addressed as separate educational priorities.

This distinction is important in the Bulgarian context. Sustainability-related learning is already embedded in educational practice, but the key gap lies in the insufficient integration of environmental and sustainability-oriented learning with digital tools, digital resource design and teachers' professional digital competences. This lack of integration limits the development of what can be described as sustainable digital literacy among teachers.

A similar gap is evident in relation to artificial intelligence (AI). While national policy has begun to address AI through documents such as the Concept for the Development of Artificial Intelligence in Bulgaria until 2030 and the Draft Vision for the Introduction and Use of Artificial Intelligence in School Education, structured competence frameworks for AI literacy in teaching are still emerging (Council of Ministers of the Republic of Bulgaria, 2020; Ministry of Education and Science, 2026). Although some initiatives—particularly in vocational education and training—combine digital and green skills with AI, virtual reality and blended learning, these developments are not yet fully integrated into a coherent national teacher competence framework.

Another important gap relates to the concept of digitally sustainable teaching, which combines digital competence with awareness of the environmental, ethical and social implications of digital technologies. Current frameworks tend to address digital competence and sustainability separately rather than promoting an integrated and interdisciplinary approach. This indicates a need for more comprehensive competence models that reflect the complexity of contemporary educational challenges.

The most emphasised competences in the Bulgarian context are digital skills and pedagogical competence, while sustainability-oriented digital competences, AI literacy and awareness of the environmental impact of digital technologies remain less developed. Addressing these gaps would support the development of teachers who are better prepared to act as digitally sustainable educators and to respond to the evolving demands of the European education landscape.

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

3.1 Initial Teacher Education (ITE) provision

In Bulgaria, Initial Teacher Education (ITE) is provided mainly by universities and higher education institutions that offer accredited pedagogical programmes. These programmes prepare future teachers through bachelor's or master's degrees in pedagogy, subject teaching methodology and education sciences. Major providers include pedagogical faculties and universities such as Sofia University „St. Kliment Ohridski“, Plovdiv University „Paisii Hilendarski“, Veliko Tarnovo University „St. Cyril and St. Methodius“ and other higher education institutions offering teacher qualification programmes.

Within these programmes, digital pedagogy is increasingly integrated as part of teacher preparation. Teacher education in Bulgaria is framed by the state requirements for acquiring the professional qualification „teacher“, while programme delivery is ensured by accredited higher education institutions. In practice, digital competences are increasingly embedded across pedagogical training, although their scope and depth vary between institutions and study programmes. Courses related to educational technologies, digital learning environments, and the use of digital tools in teaching are typically included in pedagogical training modules. These courses aim to prepare future teachers to integrate digital resources and platforms into classroom practice and to support students' digital literacy.

Education for sustainable development is usually addressed through interdisciplinary subjects such as environmental education, civic education and social sciences. While sustainability is included in certain courses and educational activities, it is often integrated indirectly rather than structured as a dedicated mandatory module focused specifically on sustainability competences for teachers.

Artificial intelligence in education is still an emerging topic in Initial Teacher Education. Some universities and innovative programmes have begun to introduce discussions about AI tools and their potential role in education but this area is generally not yet systematically included in teacher preparation programmes. This assessment should, however, be read in light of recent policy developments: in January 2026, the Ministry of Education and Science published for public consultation a national vision for the introduction and use of artificial intelligence in Bulgarian school education, signalling a shift from exploratory discussion towards a more structured policy approach.

Similarly, the creation and sharing of Open Educational Resources (OER) are not widely addressed as a separate competence area within ITE. Future teachers may learn to use digital resources and educational platforms, but explicit training on designing, licensing and sharing OER is still relatively limited. At the same time, the Bulgarian context already includes enabling infrastructures relevant to OER use and dissemination, such as the National Electronic Library for Teachers and the national OER catalogue, which can support stronger future integration of OER-related competences in teacher education.

Initial Teacher Education in Bulgaria is gradually adapting to the digital transformation of education. Digital pedagogy is increasingly integrated into teacher training programmes, while topics such as sustainability education, AI in education, and OER creation are developing areas that may receive greater attention in future curriculum updates.

Aspect	Adoption Level	Notes
Education for Sustainable Development	optionally	Sustainability topics are integrated mainly through environmental, civic and interdisciplinary subjects, in line with the <i>Strategic Framework for Education (2021–2030)</i> , but are rarely structured as dedicated modules in ITE (Ministry of Education and Science, 2021; UNESCO, 2019).
Digital Pedagogy	mandatory	Digital pedagogy is included in most ITE programmes through courses on educational technologies, digital learning environments and technology-enhanced teaching, aligned with national digitalisation priorities (Ministry of Education and Science, 2021).
AI in education	not available	AI-related topics are occasionally introduced in innovative programmes, but are not yet formally embedded in ITE curricula; however, recent policy developments indicate a shift towards structured integration (Ministry of Education and Science, 2026; Council of Ministers of the Republic of Bulgaria, 2020).
OER creation	optionally	Future teachers are trained to use digital resources, but explicit competences related to OER creation, licensing and sharing remain underdeveloped despite the existence of national OER infrastructure (Ministry of Education and Science, n.d.; UNESCO, 2019).

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

3.2 Continuous Professional Development (CPD) opportunities

Continuing Professional Development (CPD) for teachers in Bulgaria is regulated by a national framework that defines professional learning as a mandatory and ongoing process. This framework is established through *Ordinance No. 15 on the Status and Professional Development of Teachers, Principals and Other Pedagogical Specialists*, which requires teachers to participate regularly in training activities in order to maintain and upgrade their competences (Ministry of Education and Science, 2019). Participation in CPD contributes to the accumulation of professional qualification credits, which are linked to career development and professional advancement.

CPD activities are delivered through accredited training programmes offered by a range of providers, including higher education institutions, teacher training centres, educational organisations and accredited private providers approved by the Ministry of Education and Science. In addition, Regional Education Authorities and individual schools may organise training initiatives at local level (Ministry of Education and Science, 2019).

Digital pedagogy is one of the most visible and widely represented areas within CPD. This reflects national policy priorities related to digital transformation, as outlined in the *Strategic Framework for the Development of Education, Training and Learning in the Republic of Bulgaria (2021–2030)* (Ministry of Education and Science, 2021). Many CPD programmes focus on the use of digital educational platforms, online tools, interactive teaching methods and technology-enhanced learning environments. These training activities aim to strengthen teachers' digital competences and support the integration of digital technologies into everyday classroom practice.

Education for sustainable development is also present within CPD, although it is typically offered as optional training rather than a mandatory component. These programmes often address environmental education, climate awareness and sustainable practices in schools, and are frequently linked to project-based learning, eco-school initiatives and international cooperation projects (UNESCO, 2019).

Training related to artificial intelligence in education is emerging but remains limited in scope. Some innovative training programmes and workshops introduce teachers to AI tools, their pedagogical applications, and issues such as ethics, critical evaluation of AI-generated content and responsible use of digital technologies. This development is supported by recent national policy initiatives, including the *Draft Vision for the Introduction and Use of Artificial Intelligence in Bulgarian School Education* and training opportunities under the *National Programme “Qualification of Pedagogical Specialists”* (Ministry of Education and Science, 2026; Ministry of Education and Science, 2022). However, AI-related training is not yet systematically embedded across the CPD system.

Open Educational Resources (OER) are sometimes included within broader digital education training, particularly in courses focused on digital content creation and the use of online platforms. However, dedicated training on OER design, licensing and sharing practices remains limited. At the same time, Bulgaria has established national support infrastructures—such as the OER catalogue and the National Electronic Library for Teachers—which provide a foundation for expanding OER-related competences within CPD (Ministry of Education and Science, n.d.-a; n.d.-b).

CPD in Bulgaria strongly supports the development of teachers’ digital competences and reflects national priorities for digital transformation. At the same time, areas such as sustainability education, AI literacy and OER competences are gradually emerging as new directions for professional development, but are not yet fully integrated or systematically addressed across the CPD landscape.

Aspect	Adoption Level	Notes
Education for Sustainable Development	optionally	Addressed in selected CPD programmes related to environmental education, eco-school initiatives and project-based learning, but not systematically embedded across the national CPD framework (UNESCO, 2019; Ministry of Education and Science, 2021).
Digital Pedagogy	mandatory	Widely included in CPD programmes, with strong focus on digital tools, online platforms and technology-enhanced learning, in line with national digitalisation priorities (Ministry of Education and Science, 2021; Ministry of Education and Science, 2022).
AI in education	not available	Emerging topic in CPD, with selected training initiatives introducing AI tools, ethical considerations and responsible use; not yet systematically integrated (Ministry of Education and Science, 2026).
OER creation	not available	Occasionally included in digital content creation trainings; however, dedicated training on OER design, licensing and sharing remains limited despite existing national infrastructure (Ministry of Education and Science, n.d.; UNESCO, 2019).

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

3.3 Certification and recognition

The certification and recognition of teacher competences in Bulgaria are regulated through the national framework for professional development established by Ordinance No. 15 on the Status and Professional Development of Teachers, Principals and Other Pedagogical Specialists (Ministry of Education and Science, 2019). This regulatory framework defines professional development as a mandatory and continuous process and links it directly to career progression within the teaching profession.

According to this framework, teachers are required to participate regularly in professional development activities in order to maintain and upgrade their competences. The successful completion of accredited training programmes is recognised through the award of qualification credits, which represent the main formal mechanism for validating professional learning (Ministry of Education and Science, 2019). These programmes are delivered by universities, accredited training organisations and other providers approved by the Ministry of Education and Science. Teachers accumulate credits over time, which contribute to their professional appraisal and advancement within the system of professional qualification degrees.

In the Bulgarian school education system, qualification credits remain the central and established mechanism for recognising teacher competences. In contrast, micro-credentials are not yet institutionalised as a distinct certification pathway for teachers. Instead, they are currently better understood as a potential future development, particularly in the context of European policy initiatives (European Commission, 2022).

Digital competences are increasingly represented within certified training programmes. Many accredited CPD courses focus on digital pedagogy, the use of digital platforms and technology-enhanced teaching approaches, reflecting national priorities for digital transformation outlined in the *Strategic Framework for the Development of Education, Training and Learning (2021–2030)* (Ministry of Education and Science, 2021).

Similarly, sustainability-related competences are included in professional development activities, particularly in training programmes related to environmental education, climate awareness and sustainable practices. However, these competences are usually integrated within broader training programmes rather than recognised as a separate certified competence area.

The certification system is also closely connected to the broader national qualification framework and the professional career structure for teachers. Teachers may progress through different qualification levels by combining professional experience, participation in training programmes and demonstrated competences in practice. This creates a structured pathway for career development based on continuous learning.

At the same time, the existing system provides favourable conditions for future alignment with the European approach to micro-credentials. The Council Recommendation on a European approach to micro-credentials for lifelong learning and employability outlines principles for recognising short, flexible learning experiences, which could complement the existing credit-based system (Council of the European Union, 2022).

In this context, the DigiSET project is aligned with current European policy directions, as it aims to develop a learning outcomes framework that is compatible with micro-credential approaches. This suggests that, while micro-credentials are not yet formally embedded in the Bulgarian system, there is a clear opportunity for future integration within the existing professional development and certification structures.

3.4 Gaps in current ITE/CDP

The Bulgarian education system demonstrates a relatively strong structural foundation for teacher professional development, particularly in the area of digital pedagogy. This is supported by a well-established regulatory framework and national policy priorities, including the *Strategic Framework for the Development of Education, Training and Learning in the Republic of Bulgaria (2021–2030)* and the national system for continuing professional development (Ministry of Education and Science, 2021; Ministry of Education and Science, 2019).

Both Initial Teacher Education (ITE) and Continuing Professional Development (CPD) have increasingly incorporated digital competences as a key component of teacher preparation. Digital pedagogy, the use of digital learning platforms and the integration of educational technologies into teaching represent some of the most strongly developed areas. Teachers regularly participate in training related to digital tools, online learning environments

and interactive teaching methods, reflecting the national priority of digital transformation in education (Ministry of Education and Science, 2022).

Recent policy developments also indicate a transition towards a more structured and forward-looking approach, particularly in relation to artificial intelligence and emerging technologies. The *Concept for the Development of Artificial Intelligence in Bulgaria until 2030* and the *Draft Vision for the Introduction and Use of Artificial Intelligence in Bulgarian School Education* demonstrate a shift from fragmented initiatives towards a more coordinated policy direction (Council of Ministers of the Republic of Bulgaria, 2020; Ministry of Education and Science, 2026).

Another well-supported area is the development of pedagogical competences related to inclusive education, student engagement and collaborative learning. The national regulatory framework, including the *Pre-school and School Education Act*, emphasises the importance of inclusive practices and the development of key competences for all learners (Pre-school and School Education Act, 2015).

Despite these strengths, several competence areas related to the concept of a digitally sustainable teacher remain underdeveloped. While sustainability, artificial intelligence and Open Educational Resources (OER) are increasingly present in policy discussions and pilot initiatives, they are not yet systematically embedded across ITE, CPD and certification frameworks.

One of the most significant gaps is the limited integration of sustainability education with digital pedagogy. Although sustainability is addressed through environmental and civic education, it is often treated as a separate domain rather than being connected with the use of digital technologies in teaching and learning (Ministry of Education and Science, 2021; UNESCO, 2019).

Artificial intelligence in education represents another emerging but still underdeveloped area. While awareness of AI tools and their potential use in education is increasing, structured training programmes addressing AI literacy, ethical use and critical evaluation of AI-generated content remain limited (European Commission, 2022; UNESCO, 2024).

Similarly, competences related to the creation and sharing of Open Educational Resources are not yet widely emphasised. Teachers are generally trained to use digital resources but receive limited guidance on designing, adapting and openly sharing educational materials, despite the existence of national platforms such as the OER catalogue and the National Electronic Library for Teachers (Ministry of Education and Science, n.d.).

A key strength of the Bulgarian system is its well-established CPD framework, which ensures regular teacher participation in professional development through a structured system of qualification credits linked to career progression (Ministry of Education and Science, 2019). At the same time, this system provides favourable conditions for the future integration of micro-credentials.

Although micro-credentials are not yet explicitly defined or widely implemented as a distinct recognition mechanism within the Bulgarian school education system, European policy developments—such as the *Council Recommendation on a European approach to micro-credentials*—indicate a clear direction for future development (Council of the European Union, 2022).

In this context, the DigiSET project is well aligned with both national and European priorities. It has the potential to support the Bulgarian system in bridging the gap between existing digital competence development and the emerging need for integrated, future-oriented competences that combine digital skills, sustainability principles, artificial intelligence literacy and open education practices.

Strengthening the concept of sustainable digital literacy and embedding it more systematically within teacher education, professional development and certification frameworks would support the development of teachers who are better prepared to respond to the complex challenges of the European education landscape.

4. Analysis of the Four DigiSET Thematic Areas

4.1 Gender-unbiased AI in teaching

In Bulgaria, gender equality in digital education and artificial intelligence is addressed mainly within broader policy areas such as digital literacy, media literacy and gender equality in STEM, rather than as a distinct policy field focused specifically on gender bias in AI. National policy documents, including the *Strategic Framework for the Development of Education, Training and Learning in the Republic of Bulgaria (2021–2030)*, promote inclusive education, equal access and the development of key competences, including digital literacy and critical thinking (Ministry of Education and Science, 2021). These priorities provide a general foundation for addressing issues related to bias and discrimination in digital environments.

At the European level, growing attention is given to the risks of bias in AI systems and the importance of ethical and inclusive use of digital technologies. The *Ethical Guidelines on the Use of Artificial Intelligence and Data in Teaching and Learning for Educators* emphasise the need for awareness of algorithmic bias, fairness and inclusivity in AI-supported education (European Commission, 2022). Similarly, the *UNESCO AI Competency Framework for Teachers* highlights the importance of understanding bias, equity and ethical considerations in AI use (UNESCO, 2024).

In the Bulgarian context, these principles are not yet systematically translated into specific national guidelines focused on gender bias in AI. However, the policy landscape is evolving. The *Concept for the Development of Artificial Intelligence in Bulgaria until 2030* establishes a national framework for responsible AI development, including ethical considerations (Council of Ministers of the Republic of Bulgaria, 2020). More recently, the *Draft Vision for the Introduction and Use of Artificial Intelligence in Bulgarian School Education* (2026) signals a shift towards more explicit institutional attention to AI in the education sector, although it does not yet provide detailed guidance on gender bias in AI (Ministry of Education and Science, 2026).

Teacher training in this area remains at an early stage of development. Existing professional development initiatives related to AI focus primarily on the pedagogical use of AI tools, digital competences and innovation in teaching. Structured training addressing ethical issues such as algorithmic bias, gender representation and fairness in AI systems is still limited. At the same time, research and survey data among Bulgarian teachers indicate growing interest in AI and a clear demand for training that includes methodological and ethical aspects of AI use in the classroom. This suggests a favourable foundation for the future development of bias-aware and gender-sensitive AI literacy.

Some initiatives addressing gender issues in technology education are implemented through European projects, university research and STEM promotion programmes aimed at increasing girls' participation in science and technology fields. These initiatives may include elements of gender-sensitive digital literacy and critical media education, although they are not yet systematically linked to AI education.

Gender-unbiased AI is not yet a clearly established teaching domain in the Bulgarian education system. While awareness of gender equality and ethical digital practices is gradually developing, systematic training, teaching resources and national programmes specifically targeting gender bias in AI remain limited. This represents a significant opportunity for projects such as DigiSET to support teachers in developing competences to critically analyse AI systems, recognise algorithmic bias and create inclusive and gender-sensitive digital learning environments.

4.2 Systems thinking for sustainability in education

In Bulgaria, systems thinking is not explicitly defined as a separate pedagogical concept within national education policy. However, elements of systems thinking are implicitly integrated through interdisciplinary learning, environmental education and initiatives related to

Education for Sustainable Development (ESD). This approach is aligned with the Strategic Framework for the Development of Education, Training and Learning in the Republic of Bulgaria (2021–2030), which promotes competence-based learning, interdisciplinarity and the connection between education and the green and digital transitions (Ministry of Education and Science, 2021).

Sustainability topics are mainly addressed within subjects such as geography, biology, environmental education and civic education. These subject areas explore the relationships between natural systems, economic development and social processes, encouraging students to understand the interconnections between environmental challenges, human activities and global sustainability issues. This interdisciplinary approach reflects key principles of systems thinking, even though the concept itself is not explicitly defined in the curriculum. In this sense, the Bulgarian context can be described as an implicit ESD-oriented approach rather than a formally articulated systems thinking methodology for teachers (UNESCO, 2017).

Education for Sustainable Development is further supported through national priorities and school-level initiatives that aim to strengthen environmental awareness, responsible behaviour and understanding of global challenges such as climate change and sustainable resource management. These efforts are consistent with international frameworks that emphasise the role of education in developing systems thinking and sustainability competences (UNESCO, 2017; European Commission, 2022). Schools frequently participate in projects, eco-initiatives and international programmes, including Erasmus+ activities, which promote project-based and inquiry-based learning approaches.

Teacher training related to sustainability education is primarily delivered through continuing professional development programmes, Erasmus+ projects and school-based initiatives. These training activities often focus on environmental education, climate literacy and interdisciplinary teaching methods. While they may implicitly include elements of systems thinking—such as analysing complex problems, understanding cause-and-effect relationships and exploring long-term impacts—formal training specifically focused on systems thinking as a structured pedagogical framework remains limited (Ministry of Education and Science, 2019).

Digital tools and project-based learning approaches are increasingly used to support sustainability education. Teachers may use simulations, data analysis tools and collaborative platforms to help students explore environmental and societal challenges from multiple perspectives. However, structured guidance on integrating systems thinking with digital pedagogy is still developing, and this integration is not yet systematically supported by national frameworks.

The Bulgarian education system provides multiple entry points for teaching sustainability through interdisciplinary and project-based approaches. However, explicit methodological guidance and structured training on systems thinking for sustainability remain limited. Strengthening teacher competences in this area would support educators in helping students better understand complex sustainability challenges and develop holistic problem-solving skills aligned with European sustainability competence frameworks.

4.3 AI for adaptive learning

The use of AI-supported and adaptive learning technologies is gradually emerging as part of the broader digital transformation of the education system. Adaptive learning refers to digital systems that personalise content, feedback and learning pathways according to the individual needs and progress of learners. While large-scale implementation in schools is still developing, elements of personalised learning are increasingly supported through digital tools and teacher-led differentiation, rather than through fully institutionalised adaptive learning systems (Ministry of Education and Science, 2021).

In practice, AI-based technologies are beginning to support personalised learning experiences by enabling students to learn at their own pace and receive tailored explanations and feedback. The growing use of digital platforms, learning management systems and AI-supported tools reflects national priorities related to digitalisation and competence-based

education (Ministry of Education and Science, 2022a). However, in the Bulgarian context, personalised learning is more commonly implemented through the use of individual digital tools and teacher-designed differentiation strategies than through integrated adaptive learning ecosystems at system level.

At the policy level, Bulgaria has established a strategic direction for AI development through the *Concept for the Development of Artificial Intelligence in Bulgaria until 2030*, which promotes the development of AI competences, digital skills and innovation across education and the labour market (Council of Ministers of the Republic of Bulgaria, 2020). This policy direction is further supported by recent initiatives of the Ministry of Education and Science, including the *Draft Vision for the Introduction and Use of Artificial Intelligence in Bulgarian School Education*, which aims to provide guidance for the pedagogical and responsible use of AI in schools (Ministry of Education and Science, 2026).

Teacher training related to personalised learning and AI-supported instruction is gradually expanding through continuing professional development programmes, STEM initiatives and innovation-focused projects. Some training activities introduce teachers to AI tools that can support the analysis of student progress, the creation of differentiated learning materials and the automation of feedback. However, structured training specifically focused on adaptive learning methodologies remains limited, and many teachers are still at an early stage of exploring these approaches (Ministry of Education and Science, 2022b).

Ethical considerations are increasingly integrated into discussions on AI use in education. European policy frameworks, such as the *Ethical Guidelines on the Use of Artificial Intelligence and Data in Teaching and Learning for Educators*, emphasise the importance of data protection, transparency, fairness and responsible use of AI technologies (European Commission, 2022). These principles are also relevant in the Bulgarian context, where teachers are encouraged to develop critical digital literacy and to support students in understanding both the opportunities and risks associated with AI.

Adaptive learning technologies in Bulgaria are in a developmental phase. AI-supported personalised learning is becoming more visible through digital tools and pilot initiatives, but large-scale implementation and systematic teacher training remain limited. Strengthening teacher competences in adaptive learning and AI-supported pedagogy would support more effective, inclusive and personalised learning environments in the future.

4.4 Inclusive teaching practices and learning difficulties

Inclusive education is a well-established priority within the Bulgarian education system and is strongly supported by national legislation and policy frameworks. The foundation is provided by the Pre-school and School Education Act, which guarantees equal access to education and promotes the inclusion of students with diverse learning needs in mainstream schools (Pre-school and School Education Act, 2015). This framework is further detailed through secondary legislation, including Ordinance No. 1 on Inclusive Education, which defines the mechanisms for identifying and supporting students with special educational needs (SEN) and learning difficulties (Ministry of Education and Science, 2017).

Within the Bulgarian system, support for learners is structured through two main levels: general support for personal development, which is available to all students when needed, and additional support, which is targeted at students with SEN, chronic illnesses, risk factors or exceptional abilities. This dual approach reflects a comprehensive model of inclusive education that combines universal and targeted interventions (Ministry of Education and Science, 2017).

Teachers are prepared for inclusive education both during Initial Teacher Education and through Continuing Professional Development. Training programmes include topics such as differentiated instruction, inclusive pedagogical strategies and methods for supporting diverse learning needs. In addition, inclusive education is supported by multidisciplinary teams, including psychologists, speech therapists and resource teachers, who collaborate with classroom teachers to design and implement individual support plans (Ministry of Education and Science, 2019).

At the institutional level, inclusive practices are coordinated through school-based support teams and regional support centres, which assess students' needs and provide methodological guidance. Teachers are encouraged to work collaboratively with specialists to adapt teaching strategies, learning materials and assessment approaches in response to individual learner profiles.

Digital technologies are increasingly used to support inclusive learning environments. Digital platforms, educational resources and assistive technologies enable teachers to differentiate instruction, provide alternative learning formats and support students with learning difficulties. Tools such as multimedia content, interactive applications and adaptive learning environments can facilitate personalised learning and improve accessibility (Ministry of Education and Science, 2021).

Teacher professional development programmes also include training related to inclusive teaching practices, classroom management in diverse settings and the use of digital technologies for inclusion. However, despite the strong regulatory framework, teachers often require additional practical training, methodological guidance and access to high-quality digital resources in order to effectively implement inclusive digital pedagogy in everyday classroom practice.

Recent policy analysis indicates that the long-term effectiveness of inclusive education depends not only on regulatory provisions but also on sustained implementation support, teacher training, school leadership and institutional capacity (European Agency for Special Needs and Inclusive Education, 2022).

Bulgaria has a well-developed legal and institutional framework for inclusive education. Teachers are expected to address diverse learning needs and increasingly use digital tools to support inclusive practices. Nevertheless, further development of specialised training and digital resources is needed to strengthen teachers' capacity to design inclusive, accessible and learner-centred educational environments.

5. Innovative practices and case studies

5.1 Case Study 1: National Teacher Training on Artificial Intelligence in Education (Bankya Training Programme)

Organisation/Project	Ministry of Education and Science of Bulgaria in cooperation with the National Centre for Qualification of Pedagogical Specialists (NCKPS), Bankya
Main Dimensions Addressed	Digital competences for teachers; AI literacy; responsible use of AI in education; digital pedagogy; critical use of AI tools
Teacher Competences Developed	Understanding AI tools and their educational applications; critical evaluation of AI-generated content; ethical and responsible use of AI; designing AI-supported learning activities; development of digital learning materials
Learning Approach	Face-to-face intensive training workshops combined with practical sessions, demonstrations of AI tools, collaborative tasks and reflection on classroom application
Transferability to DigiSET	Demonstrates how teachers can learn to integrate AI tools into teaching practice through hands-on experimentation and peer learning. Shows the importance of combining digital competence development with ethical awareness and pedagogical reflection, which aligns with the DigiSET goal of preparing teachers to create OER using AI responsibly.

An important example of innovative teacher professional development in Bulgaria is the national training programme on Artificial Intelligence in Education organised at the *National Centre for Qualification of Pedagogical Specialists – Bankya*. The initiative is coordinated by the Ministry of Education and Science and aims to prepare teachers and school leaders for the pedagogically meaningful and responsible integration of AI technologies into the educational process (Ministry of Education and Science, 2022; 2026).

This programme is consistent with recent national policy developments, including the *Concept for the Development of Artificial Intelligence in Bulgaria until 2030* and the *Draft Vision for the Introduction and Use of Artificial Intelligence in Bulgarian School Education*, which identify AI as a priority area for teacher qualification and educational innovation (Council of Ministers of the Republic of Bulgaria, 2020; Ministry of Education and Science, 2026).

The training is implemented as a structured professional development initiative that combines face-to-face sessions with practice-oriented activities. This blended format supports the gradual development of practical competences related to the use of AI tools in teaching, learning and assessment. Participants engage with a range of AI technologies and digital tools that support content creation, differentiated instruction and personalised learning approaches.

A strong emphasis is placed on critical digital literacy and ethical awareness. Teachers explore issues such as misinformation, algorithmic bias, data protection and the responsible use of AI tools in educational contexts. This aligns with European policy guidelines on ethical AI use, which stress the importance of combining technological innovation with critical thinking and responsible pedagogical practices (European Commission, 2022).

An important feature of the programme is its connection to national teacher qualification priorities and its scalability. The training involves a large number of teachers from different regions of Bulgaria, who act as multipliers by disseminating acquired knowledge and practices within their schools and professional networks. This cascading model contributes to the wider spread of AI-related competences and supports system-level capacity building.

The methodology of the programme is strongly practice-oriented. Teachers participate in hands-on activities, collaborative discussions and design tasks, allowing them to experiment with AI tools and develop concrete ideas for classroom application. This approach supports experiential learning and peer exchange, which are key elements of effective professional development.

This initiative is particularly relevant for the DigiSET project, as it demonstrates how structured and large-scale CPD programmes can effectively support the development of AI competences among teachers. It also illustrates the importance of integrating technological innovation with pedagogical reflection, ethical awareness and collaborative learning. These elements are closely aligned with the DigiSET objective of preparing teachers to design and implement AI-supported Open Educational Resources in a digitally sustainable and responsible way.

5.2 Case Study 2: STEM Skills for the 21st Century Classroom – Erasmus+ Teacher Mobility Project

Organisation/Project	Hristo Smirnenski Primary School – Erasmus+ KA122 project “STEM Skills in the 21st Century Classroom”
Main Dimensions Addressed	Digital competences for teachers; AI-supported teaching; STEM and interdisciplinary learning; sustainability education; digital resource creation
Teacher Competences Developed	Designing interdisciplinary STEM learning scenarios; integrating AI, AR/VR, robotics and 3D technologies into teaching; developing digital learning resources; applying project-based and inquiry-based learning approaches

Learning Approach	International teacher mobility and professional courses in Europe combined with school-level experimentation, peer learning, and knowledge sharing among teachers
Transferability to DigiSET	Demonstrates how international professional development and collaborative learning help teachers develop digital competences and apply them in classroom practice. The model highlights the importance of combining digital innovation, AI tools, and sustainability-oriented STEM learning, which directly supports the DigiSET focus on creating OER and digitally sustainable teaching practices.

A relevant example of innovative teacher professional development in Bulgaria is the Erasmus+ project “STEM Skills in the 21st Century Classroom” implemented by Hristo Smirnenki Primary School in Rakovski. The project focuses on strengthening teachers’ competences in STEM education, digital technologies and innovative pedagogical approaches, with the aim of transforming traditional classroom practices into interactive and interdisciplinary learning environments.

This initiative is embedded within the broader institutional profile of the school, which is characterised by sustained participation in Erasmus+ projects, a strong emphasis on STEM-based pedagogy and the development of dedicated STEM learning environments. These conditions enable teachers not only to acquire new competences but also to apply them systematically in everyday teaching practice.

Through the project, teachers participated in international training courses across several European countries. These courses addressed topics such as AI-supported content creation, integration of AR and VR technologies, coding and robotics (including Arduino-based activities), and the use of digital tools for STEM education. The training combined technological innovation with pedagogical approaches such as inquiry-based and project-based learning.

Following the mobility activities, teachers transferred the acquired knowledge into classroom practice. They collaboratively designed interdisciplinary STEM learning scenarios, project-based activities and technology-enhanced lessons that engage students in exploring real-world challenges, including environmental sustainability and technological innovation. This process contributed to the gradual transformation of the classroom into a more interactive, student-centred and digitally enriched learning environment.

A key strength of the initiative is the development of a professional learning community within the school. Teachers actively share knowledge gained during the Erasmus+ mobilities through internal workshops, peer training sessions and collaborative lesson design. This cascading model supports institutional capacity building and ensures that the impact of the project extends beyond individual participants.

The existence of dedicated STEM learning spaces further enhances this process by providing opportunities for experimentation, interdisciplinary collaboration and the sustainable integration of digital technologies into teaching. These environments support hands-on learning, innovation and the practical application of newly developed competences.

6. Conclusions and Implications

6.1 Competence Implications for the Digitally Sustainable Teacher

Translate the evidence into competence insights that can inform the DigiSET framework.

6.1.1 Emerging Competence Areas

Based on the analysis of policies, teacher education practices and innovative initiatives in Bulgaria, several key competence areas emerge that are important for the development of a Digitally Sustainable Teacher. In the Bulgarian context, these competence areas are

increasingly supported by recent policy and implementation developments. In addition to the national AI Concept until 2030, the Ministry of Education and Science published in January 2026 a draft vision for the introduction and use of artificial intelligence in school education, which signals growing institutional attention to AI-related teacher competences. At the same time, national platforms such as the National Electronic Library of Teachers and the Bulgarian OER catalogue provide a practical basis for resource sharing and collaborative content development.

- **Critical and Responsible Use of AI in Teaching**

Teachers need the ability to use AI tools critically and ethically in the learning process. This includes understanding how AI works, evaluating AI-generated content and guiding students in responsible use of AI technologies. Evidence comes from emerging AI training programmes and national discussions about AI integration in education.

- **Designing Inclusive Digital Learning Environments**

Teachers need competences to create digital learning environments that support diverse learners, including students with learning difficulties. Digital tools can help differentiate instruction and improve accessibility. This competence is supported by national policies on inclusive education and the use of digital platforms in schools.

- **Integrating Sustainability into Teaching Practice**

Teachers should be able to integrate sustainability topics into different subjects and learning activities. This includes addressing environmental challenges and promoting responsible attitudes toward sustainable development. Evidence comes from sustainability initiatives and interdisciplinary learning approaches used in schools.

- **Creating and Sharing Open Educational Resources (OER)**

Teachers need skills to design, adapt and share digital learning materials as open educational resources. OER support collaboration among teachers and improve access to flexible learning materials. Evidence includes national digital platforms and collaborative practices developed through educational projects.

- **Interdisciplinary and Systems-Oriented Teaching**

Teachers need the ability to address complex topics through interdisciplinary learning and systems thinking. This helps students understand connections between environmental, technological, and social issues. Evidence comes from STEM initiatives and project-based learning practices in schools.

6.1.2 Underdeveloped Competences

The analysis of the national policy context, teacher education programmes and professional development opportunities in Bulgaria reveals several competence areas that remain weakly addressed or insufficiently developed. These gaps are particularly relevant for the DigiSET project as they highlight areas where teacher training can provide added value.

- **Ethical and Critical Use of AI in Education**

Although interest in AI tools for teaching is increasing, structured training on AI ethics, algorithmic bias and responsible AI use is still limited. Teachers often experiment with AI tools independently without systematic guidance on ethical implications or critical evaluation of AI-generated content. This competence gap remains particularly relevant because current national guidance on AI in school education is still emerging and has not yet been fully embedded in mandatory teacher training structures.

- **Interdisciplinary Sustainability Teaching**

Sustainability topics are present in the curriculum but teachers are rarely trained to address them through interdisciplinary and systems-based approaches. Sustainability education is often taught within individual subjects rather than through integrated learning scenarios that connect environmental, social and technological perspectives.

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

Teachers frequently use digital learning materials, but competences related to creating, adapting and openly sharing educational resources (OER) are still underdeveloped. Many teachers rely on ready-made materials rather than designing their own digital learning

resources that can be adapted and shared within professional communities. In Bulgaria, this gap should be understood not as a complete absence of infrastructure, but rather as limited systematic support for teachers to develop, adapt, license and share their own resources in an open and pedagogically informed way. Although national repositories and sharing platforms already exist, participation in OER creation is still uneven and often depends on individual initiative rather than structured professional development.

- **Use of AI for Personalised and Adaptive Learning**

While digital tools are increasingly used in classrooms, teachers often lack training on how to apply AI-supported personalised learning approaches or adaptive learning technologies. As a result, the potential of AI to support differentiated instruction and personalised learning remains largely unexplored.

- **Integration of Digital Technologies for Inclusive Education**

Although inclusive education is a national priority, teachers often need additional competences in using digital technologies and assistive tools to support students with learning difficulties. Training opportunities that combine inclusive pedagogy with digital innovation remain relatively limited.

Addressing these competence gaps is essential for developing teachers who are able to combine digital innovation, sustainability principles and inclusive pedagogical approaches, which represents a key objective of the DigiSET framework.

6.2 Recommendations and Implications for DigiSET Framework Development

6.2.1 Implications for the Competence Framework

Based on the analysis of the Bulgarian educational context, the DigiSET competence framework should include several key competence areas that reflect current policy priorities and identified gaps in teacher preparation

One important competence area is the critical and ethical use of artificial intelligence in teaching. Teachers need knowledge of how AI systems function, as well as skills to evaluate AI-generated content and integrate AI tools into teaching and learning processes. In addition, teachers should develop attitudes that promote responsible, ethical and reflective use of technology in educational contexts.

Another key competence area is the integration of sustainability into teaching practice. Teachers should understand the principles of sustainable development and be able to design interdisciplinary learning activities that address environmental and societal challenges. This competence is particularly important in the Bulgarian context, where sustainability is present in education but not always systematically connected with digital pedagogy.

A further competence area concerns the design of inclusive digital learning environments. Teachers need competences to use digital tools that support differentiated instruction and accessibility for students with diverse learning needs. Particular emphasis should be placed on assistive technologies, accessibility and the pedagogically appropriate use of digital tools for students with special educational needs, in line with the national framework for inclusive education.

The framework should also include competences related to creating and sharing Open Educational Resources (OER). Teachers need practical skills for designing digital learning materials, adapting existing resources and sharing them within professional communities. These competences are supported by existing national digital platforms but are not yet systematically developed in teacher training.

Special emphasis should be placed on the interconnection between digital competence, sustainability education and inclusive pedagogy, as these elements are often addressed separately in current teacher training but need to be integrated within a digitally sustainable teaching approach.

For effective transferability to the Bulgarian context, the framework should also be compatible with the existing national system for teacher qualification, including accredited

CPD provision, qualification credits and school-based professional learning. This would support its practical implementation within recognised professional development pathways, rather than limiting its use to a project-based reference tool.

6.2.2 Implications for Learning Outcomes

Based on the findings, the DigiSET training programme should enable teachers to demonstrate clearly defined and assessable learning outcomes after completing the training. These outcomes should be expressed in observable terms so that they can be aligned with accredited professional development programmes in Bulgaria. In this context, teachers should not only demonstrate conceptual understanding of AI, sustainability or OER, but also provide evidence of practical application, such as lesson scenarios, adapted digital materials and documented classroom implementation through reflective or portfolio-based approaches.

Teachers should be able to design and implement learning activities that use AI tools in a responsible and pedagogically meaningful way. This includes the ability to critically evaluate AI-generated content and to guide students in the responsible and ethical use of digital technologies in learning contexts.

Another expected outcome is the ability to integrate sustainability concepts into teaching across different subjects. Teachers should be able to design interdisciplinary and project-based learning activities that address environmental and societal challenges and connect them with real-world contexts.

Teachers should also be able to adapt their teaching using digital tools to support diverse learners, including students with learning difficulties. This involves applying differentiated instruction strategies and using inclusive digital approaches that improve accessibility and participation for all students.

Finally, teachers should be able to create, adapt and share Open Educational Resources collaboratively. This includes designing digital learning materials, modifying existing resources and contributing to shared repositories and professional communities, thereby supporting collaborative and sustainable teaching practices.

6.2.3 Implications for Training Design

The analysis suggests that the DigiSET training programme should adopt practice-oriented and collaborative learning approaches. Training activities should include hands-on experimentation with digital and AI tools, allowing teachers to explore technologies, test their application in educational contexts and develop their own learning materials. Practical tasks such as designing lesson scenarios, creating Open Educational Resources (OER) and testing digital tools in simulated or real classroom situations are particularly important.

Collaborative learning approaches should also be emphasised. Teachers should work in groups to co-design learning materials, exchange experiences and reflect on their teaching practices. In the Bulgarian context, this type of training design would be especially effective if delivered through a blended model that combines accredited external training with school-based internal qualification activities, professional learning communities and peer exchange. Such an approach aligns well with the existing national framework for teacher qualification, which combines formal training requirements with ongoing professional development.

Interdisciplinary workshops should be included as part of the training design. These can support teachers in exploring how sustainability, digital technologies and artificial intelligence can be integrated across different subjects through project-based and inquiry-based approaches.

Finally, the training should incorporate structured reflective learning activities. Teachers should be encouraged to analyse the pedagogical and ethical implications of using digital technologies, including issues related to AI, inclusion and sustainability. Reflection can be supported through discussions, portfolios and classroom-based evidence of practice.

Modular and practice-based training formats are also recommended, as they provide flexibility and make it easier for teachers to participate despite varying workloads and different

levels of digital competence. Such formats support gradual competence development and allow teachers to apply learning in their own professional context.

6.3 Potential for National Integration

The DigiSET training programme has strong potential to be integrated into the existing system of Initial Teacher Education (ITE) and Continuous Professional Development (CPD) in Bulgaria. The national framework for teacher professional development requires teachers to participate regularly in training and to accumulate qualification credits through accredited programmes. This creates a favourable institutional environment for introducing new training initiatives focused on digital innovation and sustainability.

More specifically, integration would be supported by several existing mechanisms, including the official register of approved qualification programmes, national programmes for teacher qualification and the expanding digital ecosystem in education, such as the Digital Backpack and related national resource platforms. These structures provide established channels through which DigiSET modules could be recognised, delivered and scaled within the system.

Within CPD, DigiSET could be implemented as an accredited training course delivered by recognised providers such as universities, teacher training centres and national institutions responsible for teacher qualification. It could also be offered through organisations providing large-scale professional development, as well as through regional education authorities and school-based professional learning communities.

In Initial Teacher Education, elements of the DigiSET framework could be integrated into existing courses related to digital pedagogy, educational technologies, sustainability education and innovative teaching methods. Universities preparing future teachers could incorporate DigiSET learning outcomes into current modules or offer specialised courses focused on AI-supported teaching, OER creation and digitally sustainable pedagogy.

Several factors support the integration of the DigiSET programme. These include the strong national emphasis on digital transformation in education, the increasing availability of digital infrastructure and learning platforms in schools and the growing interest among teachers in developing digital competences and using AI tools in teaching. Participation in European programmes and international projects also creates a supportive environment for adopting innovative training approaches.

At the same time, several challenges need to be considered. Policy guidance on AI in school education is still evolving, and although institutional attention to the topic is increasing, it has not yet been fully translated into stable and mandatory training requirements. Teachers often face limited time for professional development due to workload and administrative demands. In addition, differences in teachers' levels of digital competence require flexible and differentiated training approaches. Topics such as AI ethics, sustainability integration and OER creation are still relatively new and may require additional methodological support and structured guidance.

The DigiSET programme could be successfully integrated into the Bulgarian teacher development system if it is aligned with existing CPD structures, recognised within the national qualification framework and delivered through flexible, practice-oriented training formats. Such an approach would support teachers in applying newly developed competences directly in their classroom practice and would increase the sustainability and impact of the programme.

6.4 Key Findings Summary

The analysis of the Bulgarian national context shows that several key drivers are shaping the development of teacher competences. The most significant of these include the digital transformation of education, national policies promoting digital learning environments, the increasing use of digital platforms and AI tools, and the growing importance of sustainability and inclusive education within both European and national educational agendas. In Bulgaria, these drivers are explicitly reflected in the Strategic Framework for the

Development of Education, Training and Learning (2021–2030), where educational innovation, digital transformation and sustainable development are identified as priority areas for system development.

As a result of these developments, teachers increasingly require competences related to digital pedagogy, the critical use of artificial intelligence, inclusive digital learning design and the integration of sustainability into teaching practice. The ability to create and share Open Educational Resources (OER), as well as to collaborate with other educators in developing digital learning materials, is also becoming increasingly important.

At the same time, the analysis highlights several gaps in current policies and training systems. Although digital competences are widely promoted, areas such as the ethical and critical use of AI, interdisciplinary sustainability education, systems thinking and OER creation are not yet systematically embedded in many teacher education programmes. Training opportunities in these areas are emerging but remain limited or fragmented. The Bulgarian context also demonstrates that the key challenge is no longer access to digital tools and platforms, but rather their effective pedagogical integration, including the use of AI, inclusive digital methods, sustainability-oriented interdisciplinary teaching and meaningful OER development.

These findings suggest that the concept of the Digitally Sustainable European Teacher should integrate digital innovation, sustainability awareness, inclusive pedagogy and ethical understanding of emerging technologies. Teachers need competences that enable them to critically use digital tools, design inclusive and interdisciplinary learning environments and develop digital learning resources that address complex societal challenges.

The DigiSET framework therefore has strong potential to contribute to teacher professional development by providing structured guidance and training that combine AI literacy, sustainability education, inclusive teaching practices and collaborative creation of OER. In this way, it can support teachers in responding effectively to the evolving demands of contemporary education systems.

7. References

Council of Ministers of the Republic of Bulgaria. (2020). *Concept for the development of artificial intelligence in Bulgaria until 2030*.

https://www.mig.government.bg/files/Concept_AI_Bulgaria_2030_EN.pdf

Council of the European Union. (2022). *Council recommendation on a European approach to micro-credentials for lifelong learning and employability*.

[https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627\(01\)](https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32022H0627(01))

European Agency for Special Needs and Inclusive Education. (2022). *Supporting inclusive school leadership and teacher professional learning*. <https://www.european-agency.org>

European Commission. (2020). *LifeComp: The European framework for personal, social and learning to learn key competence*. https://joint-research-centre.ec.europa.eu/lifecomp_en

European Commission. (2022a). *Ethical guidelines on the use of artificial intelligence and data in teaching and learning for educators*.

<https://education.ec.europa.eu/document/ethical-guidelines-on-the-use-of-artificial-intelligence-and-data-in-teaching-and-learning-for-educators>

European Commission. (2022b). *GreenComp: The European sustainability competence framework*. https://joint-research-centre.ec.europa.eu/greencomp_en

European Commission. (2023). *Artificial Intelligence Act*. <https://eur-lex.europa.eu/>

Hristo Smirnenski Primary School. (n.d.). *STEM skills in the 21st century classroom (Erasmus+ project)*.

<https://smirnenski.com/bg/stem-%D1%83%D0%BC%D0%B5%D0%BD%D0%B8%D1%8F-%D0%B2-%D0%BA%D0%BB%D0%B0%D1%81%D0%BD%D0%B0%D1%82%D0%B0-%D1%81%D1%82%D0%B0%D1%8F-%D0%BD%D0%B0-21-%D0%B2%D0%B8-%D0%B2%D0%B5%D0%BA/>

Ministry of Education and Science. (2016). *Ordinance on the state requirements for acquiring the professional qualification "Teacher"*.

https://www.mon.bg/upload/1340/naredba_visshe_uchitel.pdf

Ministry of Education and Science. (2017). *Ordinance No. 1 on inclusive education*.

https://www.mon.bg/upload/1351/naredba_priobshtavashto_obrazovanie.pdf

Ministry of Education and Science. (2019). *Ordinance No. 15 on the status and professional development of teachers, principals and other pedagogical specialists*.

https://www.mon.bg/upload/21340/naredba15_2019.pdf

Ministry of Education and Science. (2021). *Strategic framework for the development of education, training and learning in the Republic of Bulgaria (2021–2030)*.

https://www.mon.bg/upload/26840/strategic_framework_2021-2030.pdf

Ministry of Education and Science. (2022a). *National programme "Information and Communication Technologies in the system of pre-school and school education"*.

<https://www.mon.bg/bg/100843>

Ministry of Education and Science. (2022b). *National programme "Qualification of pedagogical specialists"*. <https://www.mon.bg/bg/100844>

Ministry of Education and Science. (2026). *Draft vision for the introduction and use of artificial intelligence in Bulgarian school education*.
<https://nova.bg/news/view/2026/01/28/525394/>

Ministry of Education and Science. (n.d.-a). *Digital Backpack platform*.
<https://edu.mon.bg>

Ministry of Education and Science. (n.d.-b). *Catalogue of open educational resources*.
<https://oer.mon.bg>

Ministry of Education and Science. (n.d.-c). *National electronic library for teachers*.
<https://e-learn.mon.bg>

Pre-school and School Education Act. (2015). <https://lex.bg/laws/ldoc/2136641509>

Redecker, C. (2017). *European framework for the digital competence of educators: DigCompEdu*. https://joint-research-centre.ec.europa.eu/digcomedu_en

UNESCO. (2017). *Education for sustainable development goals: Learning objectives*.
<https://unesdoc.unesco.org/ark:/48223/pf0000247444>

UNESCO. (2019). *Recommendation on open educational resources (OER)*.
<https://unesdoc.unesco.org/ark:/48223/pf0000370936>

UNESCO. (2024). *AI competency framework for teachers*.
<https://unesdoc.unesco.org/ark:/48223/pf0000389375>