European Commission

Structural indicators for monitoring education and training systems in Europe 2022

Overview of major reforms since 2015

Eurydice background report

5. Digital competence at school

European Education and Culture Executive Agency

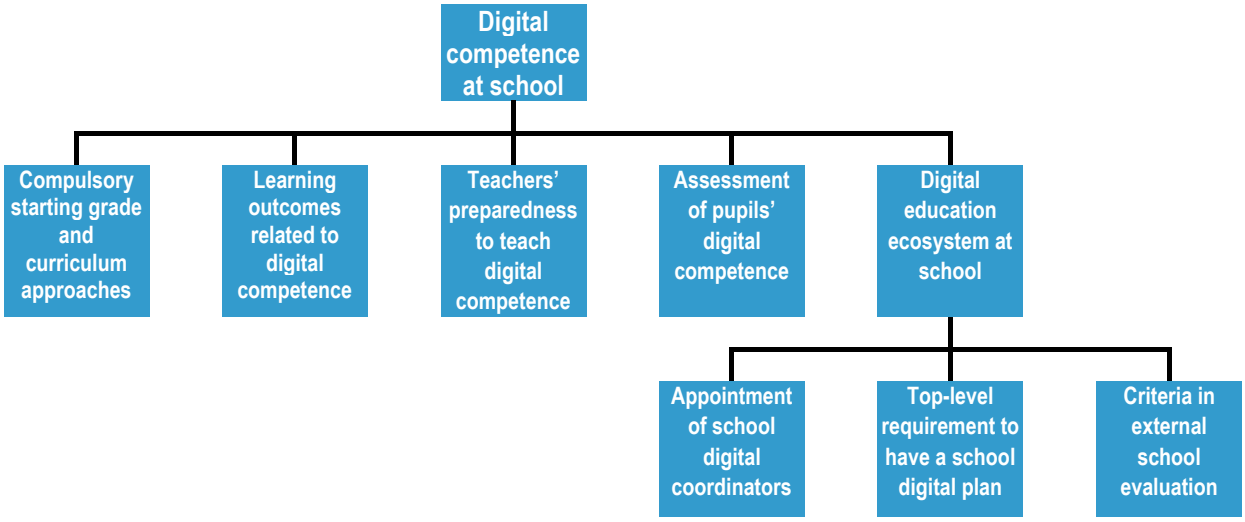
5. DIGITAL COMPETENCE AT SCHOOL

The structural indicators in this chapter provide an overview of key policies that support the development of digital competence at school in Europe. The selection of indicators is based on the strategic priorities outlined in the European Commission's 2021–2027 Digital Education Action Plan, which is a renewed EU policy initiative to support the sustainable and effective adaptation of education and training systems to the digital age ([22]). In particular, the Digital Education Action Plan sets two strategic priorities: promoting the development of a European digital education ecosystem and enhancing digital competence (knowledge, skills and attitudes) of all learners for the digital transformation and a world mediated by digital technologies ([23]). Achieving these priorities requires the implementation of a number of initiatives such as promoting:

- basic digital skills and competences from an early age;
- digital literacy, including tackling disinformation;
- computing education;
- high-quality learning content, user-friendly tools and secure platforms which respect e-privacy rules and ethical standards;
- digitally competent and confident teachers and education and training staff;
- effective digital capacity planning and development, including up-to-date organisational capabilities.

In addition, as a direct follow-up to Action 11 of the Digital Education Action Plan, in February 2021 the Council of the European Union introduced a new target on digital skills. It called for the share of low-achieving eight-graders in computer and information literacy to be less than 15 % by 2030 ([24]).

In line with these EU-level policy priorities and upon the request of the Directorate-General for Education and Culture, the Eurydice network undertook the 2022 trial data collection on structural indicators for digital competence. The diagram below depicts the selection of indicators.



([22]) COM/2020/624 final.
([23]) SWD (2020) 209 final. COM (2020) 624 final.
([24]) OJ C 66, 26.2.2021.

The majority of these indicators are based on the analysis in the 2019 Eurydice report *Digital Education at School in Europe* (European Commission/EACEA/Eurydice, 2019a) and the Eurydice brief *Digital Education at School in Europe* (European Commission/EACEA/Eurydice, 2019b). In order to align with the EU-level digital skills target, the selected indicators cover International Standard Classification of Education (ISCED) levels 1 and 24.

5.1. Compulsory starting grade for teaching digital competence and curriculum approaches

In order to foster the development of digital competence in students, national school curricula need to explicitly include it as from primary education. In this analysis, the term 'national curriculum' is used in a wide sense, referring to any official steering document issued by top-level authorities which contains study programmes, learning content, learning objectives, attainment targets, assessment guidelines or syllabi.

The curriculum approaches to digital competence may include teaching and learning through a cross-curricular topic, a separate subject or several other subjects (integrated approach). National curricula often combine several of these approaches, which are defined as follows.

- **Cross-curricular**. Digital competences are understood to be transversal and are therefore taught across all subjects in the curriculum. All teachers share the responsibility for developing digital competences.
- **Separate subject.** Digital competences are taught as a discrete subject area similar to other traditional subject-based competences.
- **Integrated into other subjects.** Digital competences are incorporated into the curriculum of other subjects or learning areas.

In line with the European target to reduce the share of low achievement in digital skills for all pupils, the focus of this indicator is on the **compulsory curriculum for all pupils**, therefore excluding optional subjects related to digital competences.

5.1.1. Compulsory starting grade for teaching digital competence

One way of understanding the importance given to digital competences by top-level education authorities is to examine the earliest grade from which digital competences are taught at school and whether this is done as a separate subject or as a transversal competence.

Figure 1 shows that in most European education systems the compulsory teaching of digital competences for all pupils starts in primary education (ISCED level 1). In 18 systems this is done as early as the first grade of primary education, and in another seven systems this happens several grades later. The latest compulsory starting grade that has been reported is seventh grade in lower secondary education (ISCED level 24), which concerns the current situation in Cyprus and Malta.

Finally, in several systems (the three Communities of Belgium, Germany, Ireland, the Netherlands, Slovenia, Iceland and Norway) top-level education authorities have not established a compulsory starting grade for the teaching of digital competences for all students. That said, general objectives unrelated to specific grades may exist, such as in Slovenia, and some German *Länder* have introduced compulsory starting grades. In some of these systems, the decision on the starting grade is subject to school and/or local autonomy.

For instance, in **the French and German-speaking Communities of Belgium**, some schools offer projects in informatics in primary education. In lower secondary education, informatics is an optional subject in some schools, but the contents vary across all schools.

In **Ireland**, there is no compulsory starting grade for teaching digital competences to all or most students. Instead, a top-level recommendation aims to assist schools in effectively embedding digital technologies into teaching, learning and assessment. Schools can then use their own local autonomy and come up with their own, bespoke approach to embedding digital technologies in teaching and learning on a school-wide level.

In the **Netherlands**, digital competences are not yet part of the formal curriculum. Schools have autonomy to decide how they integrate digital competences in the curriculum. However, a recent report on monitoring digital competences in primary education has found that 39 % of teachers work on digital skills through other subjects (integrated in other compulsory subjects) ([25]).

5.1.2. Curriculum approaches to teaching digital competence

Across Europe digital competence is being taught using a number of curricular approaches. In certain cases, these approaches could be employed in parallel or they could change depending on the education level. Overall, in primary education, the most common approach is to teach digital competence as a cross-curricular subject, while in lower secondary education this is most often done as a compulsory separate subject. This trend was already observed in the 2019 Eurydice report *Digital Education at School in Europe*.

In terms of the combination of curriculum approaches, a variety of situations can be observed at national level. It is common for two out of the three approaches discussed above to coexist (Denmark, Estonia, Greece, France, Latvia, Luxembourg (only in primary education), Hungary, Austria, Poland, Portugal, Sweden and Montenegro). Some systems (Czech Republic, Liechtenstein and Serbia) even use all three curriculum approaches.

On the other hand, some systems favour only one curriculum approach during both primary and lower secondary education. For instance, in Bulgaria, Slovakia, Bosnia and Herzegovina, North Macedonia and Türkiye, digital competence is taught only as a compulsory separate subject, while in Italy and Finland digital competence is taught only as cross-curricular competence.

Finally, it is also worth noting that digital competence is taught as a compulsory separate subject from first grade in nine countries (Greece, Latvia, Poland, Portugal, Bosnia and Herzegovina, Liechtenstein, Montenegro, Serbia and Türkiye).

([25]) https://ecp.nl/wp-content/uploads/2021/11/Rapportage-ECP-Monitor-Digitale-Geletterdheid-PO-2-november-2021.pdf

Figure 1: Compulsory starting grade and curriculum approaches to teaching digital competence, 2021/2022

		ISCED 1			ISCED 24		
	Compulsory starting grade	Compulsory separate subject	Integrated in other compulsory subjects	Cross-curricular	Compulsory separate subject	Integrated in other compulsory subjects	Cross-curricular
Belgium BE fr	■	■	■	■	■	■	■
Belgium BE de	■	■	■	■	■	■	■
Belgium BE nl	■			×		×	×
Bulgaria	3	×			×		
Czechia	4	×	×	×	×	×	×
Denmark	1		×	×		×	×
Germany							
Estonia	1		×	×		×	×
Ireland			×	×		×	×
Greece	1	×	×		×	×	
Spain	1	■	■	×	■	×	×
France	1		×	×		×	×
Croatia	5				×		
Italy	1			×			×
Cyprus	7		×	×	×		×
Latvia	1	×	×		×		
Lithuania	1		×		×		
Luxembourg	1		×	×	×		
Hungary	3	×		×	×		×
Malta	7			×	×		
Netherlands							
Austria	6		×	×	×	×	
Poland	1	×		×	×		
Portugal	1	×		×	×		
Romania	5			×	×		
Slovenia			×			×	
Slovakia	3	×			×		
Finland	1			×			×
Sweden	1		×	×		×	×
Albania	5		×		×	×	
Bosnia and Herzegovina	1	×			×		
Iceland							
Liechtenstein	1	×	×	×	×	×	×
Montenegro	1	×		×	×		×
North Macedonia	3	×			×		
Norway	■	■	■	■	■	■	■
Serbia	1	×	×	×	×	×	×
Türkiye	1	×			×		

Symbols:

× Exist ■ School/local autonomy

5.2. Learning outcomes related to digital competence

This indicator focuses on how European education systems address digital competences in terms of curriculum content. The European digital competence framework ([26]), DigComp, is used as a reference in terms of defining competences and related learning outcomes.

In this analysis, we do not differentiate between the terms 'learning objectives' and 'learning outcomes'. They can be seen as two sides of the same coin: while learning objectives refer to the content of the development of digital competences from the perspective of the education authorities, school or the teacher, learning outcomes refer to the same content but from the perspective of the learner. In the present context, learning outcomes are defined as statements of what a learner knows, understands and is able to do on completion of a level or learning module. Learning outcomes are concerned with the achievements of the learner rather than the intentions of the teacher (expressed in the aims of a module or course) (Harvey, 2022). Learning outcomes indicate actual attainment levels while learning objectives define the competences to be developed in general terms.

The indicator examines whether national curricula explicitly mention learning outcomes related to key digital competence areas as defined in the DigComp framework. Therefore, we identify the existence of learning outcomes related to **one competence from each of the five competence areas**.

The existence of learning outcomes is only considered if they are associated with compulsory subjects or cross-curricular areas for all pupils.

This analysis focuses on the following five competences.

- In the competence area 'Information and data literacy': learning outcomes related to:
  - Evaluating data, information and digital content
- In the competence area 'Communication and collaboration: learning outcomes related to:
  - Managing digital identity
- In the competence area 'Digital content creation': learning outcomes related to:
  - Programming/coding
- In the competence area 'Safety': learning outcomes related to:
  - Protecting personal data and privacy
- In the competence area 'Problem solving': learning outcomes related to:
  - Creatively using digital technologies

Figure 2 shows that, in line with earlier findings from the 2019 Eurydice report *Digital Education at School in Europe*, the great majority of European systems have included explicit learning outcomes in all five areas of digital competence. Overall, across the five competence areas, learning outcomes are most frequently cited for 'Evaluating data, information and digital content', while relatively less outcomes exist for 'Creatively using digital technologies'.

The French and German-speaking Communities of Belgium ([27]), Ireland, the Netherlands ([28]) and Slovenia reported no or almost no learning outcomes in any of the domains for both education levels. This is often linked to the fact that in these systems digital competences are not taught as part of the

([26]) The digital competence framework 2.0 | EU Science Hub (europa.eu).

([27]) The French Community of Belgium is preparing the adoption of a new curriculum which aims, among other things, to frame the different learning outcomes related to digital competences at the primary and lower secondary levels.

([28]) In the Netherlands, there are currently no legally established learning outcomes/objectives for digital literacy. It is likely that an update of the core objectives for all learning areas will start in 2022. Digital literacy is included in this process.

compulsory curriculum for all students. As a result, specific learning outcomes may exist only in optional subjects, which are not presented in Figure 2 ([29]). Another significant point is that Germany, Croatia and Romania reported learning outcomes related to lower secondary education only.

Figure 2: Learning outcomes related to selected digital competences defined in the DigComp framework, 2021/2022

	Information and data literacy	Communication and collaboration	Digital content creation	Safety	Problem solving
	Evaluating data, information and digital content	Managing digital identity	Programming/ coding	Protecting personal data and privacy	Creatively using digital technologies
Belgium BE fr	24	24			
Belgium BE de					
Belgium BE nl	1 | 24	24	24	1 | 24	24
Bulgaria	1 | 24	1 | 24	1 | 24	1 | 24	
Czechia	1 | 24	24	1 | 24	1 | 24	1 | 24
Denmark	1 | 24	1 | 24	24	1 | 24	1 | 24
Germany	24	24	24	24	24
Estonia	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Ireland	24				
Greece	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Spain	1 | 24	1 | 24	24	1 | 24	24
France	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Croatia	24	24	24	24	24
Italy	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Cyprus	1 | 24	24	1 | 24	1 | 24	1 | 24
Latvia	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Lithuania	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Luxembourg	1 | 24	1 | 24	1	1 | 24	1 | 24
Hungary	1 | 24	24	1 | 24	1 | 24	1 | 24
Malta	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Netherlands					
Austria	24	1 | 24	1 | 24	1 | 24	24
Poland	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Portugal	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Romania	24		24	24	24
Slovenia	1 | 24				
Slovakia	1 | 24		1 | 24	1 | 24	
Finland	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Sweden	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Albania	24	24	1 | 24	1 | 24	
Bosnia and Herzegovina	1 | 24		24		
Iceland	1 | 24		24	1 | 24	1 | 24
Liechtenstein	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Montenegro	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
North Macedonia	1 | 24	1	1 | 24	1	24
Norway	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Serbia	1 | 24	1 | 24	1 | 24	1 | 24	1 | 24
Türkiye	1 | 24	1 | 24	1	1 | 24	1 | 24

1=ISCED 1, 24= ISCED 24

([29]) In Ireland, learning outcomes in lower secondary education exist for the optional junior cycle course in digital media literacy. The specification can be accessed at: https://curriculumonline.ie/Junior-cycle/Short-Courses/Digital-Media-Literacy/.

5.3. Teachers' preparedness to teach digital competence

The strategic framework for European cooperation in education and training towards the European Education Area and beyond (2021–2030) highlights the importance of enhancing competences and motivation in the teaching profession. The Digital Education Action Plan mentions 'digitally competent and confident teachers and education and training staff' among the key elements of a high-performing digital education ecosystem.

Like all citizens, teachers need to acquire the necessary digital skills for their personal and professional lives and to be able to participate in digital society. Being digitally competent and able to use digital technologies in a confident, critical and responsible way is essential for teachers acting as role models for the future generation. However, teachers also need a set of specific competences that will allow them to realise the potential of digital technologies to transform their teaching and learning (Redecker, 2017, p. 15).

Teacher-specific digital competences are the competences needed to support and improve teaching and learning by using digital technologies, along with the ability to use digital technologies for communication, collaboration and professional development. They extend into all areas of a teacher's work, including teaching and learning, assessment, communicating and collaborating with colleagues and parents, and creating and sharing content and resources.

If teachers are to become digitally competent, then the basic knowledge and skills to do so, need to be integrated into initial teacher education (ITE) programmes. This indicator examines whether teacher-specific digital competences are included in ITE curriculum as mandatory competences to be developed. It covers initial teacher education for all teachers except specialist/semi-specialist teachers of information and communication technology subjects / informatics.

Figure 3: Teacher-specific digital competences to be included in ITE curriculum as mandatory element, 2021/2022

	BE fr	BE de	BE nl	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU
ISCED 1	●			●	●	●		●	●		●	●		●	●	○	●		●
ISCED 24	●			●	●	●		●	●		●	●		●	●	○	●	○	●
	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	AL	BA	IS	LI[30]	ME	MK	NO	RS	TR
ISCED 1				●		●				●					●	●		●	●
ISCED 24	○			●		●				●					●	●			●

● For all teachers' profiles ○ For some teachers' profiles

In 19 systems, top-level authorities require that teacher-specific digital competences be included in ITE curricula as a mandatory element, and this concerns all teachers' profiles. In another three systems – Latvia, Luxembourg and Malta – such competences are only compulsory for some teacher profiles (e.g. informatics, mathematics, languages) and in the latter two countries only in lower secondary education.

In the rest of the European education systems, there are no such top-level requirements. In many of these cases, the providers of initial teacher education have institutional autonomy regarding the content of the courses they offer. The data from the 2019 Eurydice report *Digital Education at School in Europe* points to the fact that at least some ITE institutions provide prospective teachers with the option to develop digital competences, despite the absence of top-level requirements.

([30]) Teachers are trained abroad.

The top-level requirements on the inclusion of teacher-specific digital competences can incorporate a different level of detail. For instance, in the Czech Republic, the methodology for assessing higher education programmes for teaching staff, which is used when approving new programmes or accrediting institutions, states that ICT must be part of the education of prospective teachers. However, it does not describe specific competences or learning outcomes.

In Denmark, the teachers' initial education programme consists of 'Teachers' foundational competences' and 'Teachers' competences in main subjects'. Digital competences are a priority in both. For instance, in the part on 'Teachers' foundational competences', digital competences are addressed directly on five occasions.

1) 'The student has knowledge about teaching methods and analogue and digital learning resources.'
2) 'The student can plan, develop and perform teaching with and about it and media in order to support the pupils' ability to act as a critical examiner, an analysing receiver, a focused and creative producer and a responsible participant'.
3) 'The student has knowledge about it and media competence.'
4) 'The student has knowledge about preventive, expected and intervention efforts and use of these efforts and other pedagogical tools in the daily teaching.'
5) 'The practical use of analogue and digital pedagogical tools and other resources in relation to a pupil's preconditions, ethics of teaching, purpose, goals and substance' ([31]).

In Ireland, the development of digital skills, including digital literacy, is a core element of 'CEIM – Standards for Teacher Education in Ireland' ([32]). In Italy, over time, different laws have defined and updated the requisites to enter the teaching profession, with specific references to digital competences ([33]). In Lithuania, the top-level teacher competence framework includes digital competences for specialist/semi-specialist teachers (i.e. ICT teachers) and for all other teachers separately ([34]). In North Macedonia, ICT technologies in education is an obligatory subject in the fourth semester for future primary school teachers. All higher-education faculties that train secondary-school teachers include informatics as an obligatory subject ([35]).

5.4. Assessment of pupils' digital competence

Brečko et al. (2014, p. 17) highlight that there is a 'consensus among educational stakeholders that what is assessed and examined determine[s] what is valued and what is taught in real settings'. Nevertheless, the assessment of some of the key competences is not straightforward and represents an important challenge for European education systems (European Commission, 2012). As underlined by different stakeholders, key competences and 21st-century skills cannot be assessed through conventional assessment methods – they need innovative approaches (Brečko et al., 2014). The assessment of literacy, science, mathematics and language skills is based on a strong tradition.

([31]) https://www.retsinformation.dk/eli/lta/2015/1068

([32]) https://www.teachingcouncil.ie/en/news-events/latest-news/ceim-standards-for-initial-teacher-education.pdf

([33]) https://www.gazzettaufficiale.it/eli/gu/2017/05/16/112/so/23/sg/pdf; https://www.miur.gov.it/documents/20182/611956/DM+del+10.8.2017+n.+616.pdf/f1f3c9e5-c4f5-453b-8695-bd854c1f8b6d?version=1.0; https://www.normattiva.it/uri-res/N2Ls?urn:nir:stato:legge:2021-12-29;233

([34]) https://e-seimas.lrs.lt/portal/legalActPrint/lt?jfwid=-1c2dtdz08t&documentId=599d489078af11e89188e16a6495e98c&category=TAD

([35]) https://www.pfsko.ukim.edu.mk/?page_id=102

Modern and meaningful assessment methods can be built on this strong base as we also consider new developments in the understanding of the role of assessment and the mechanisms involved. Meanwhile, efforts to assess other key competences, such as cultural awareness, citizenship, or personal and social skills, are still lagging behind (O'Leary et al., 2018).

Digital technologies potentially offer a range of assessment formats that provide many opportunities to capture skills, attitudes and the less 'tangible themes underlying all key competences, such as critical thinking or creativity' (Redecker, 2013, p. 2). Moreover, there is of course a direct link between the use of digital technologies and the assessment of specific digital competences, at least in terms of the more cognitive and practical skills. The assessment of digital competence without the use of digital technologies would seem strange, if not useless. As Beller (2013) noticed, in large-scale standardised assessment contexts, digital technologies are usually used to assess general competences, such as skills related to ICT and the management and communication of information. Also, as highlighted by Redecker (2013, p. 64), many of the most commonly used 'assessment tools for digital competence employ a knowledge-based, traditional multiple choice format', especially when it comes to summative computer-based tests used for certification.

This indicator focuses on the assessment of pupils' digital competence in national tests. Specifically, it looks at the context in which they are tested, for example as a specific national test or through the assessment of other competences, and the level of education at which this takes place.

National tests are defined as standardised tests/examinations authorised by top-level public authorities and carried out under their responsibility. They include any form of test/exam that (a) requires all test takers to answer the same questions (or questions selected from a common bank of questions) and (b) is scored in a standard or consistent way. Tests designed at school level on the basis of a centrally designed framework of reference are not considered national tests. International tests are excluded from the data collection. Similarly, tests based on samples of students aiming to monitor the quality of the education system rather than measuring the attainment levels of individual students are not the focus of this indicator.

This indicator distinguishes between four criteria.

- Digital competences are assessed through **specific national tests**. These specific national tests are dedicated to digital competences, which may be included in subjects such as ICT or informatics. They seek to determine an individual student's level of attainment, usually in relation to a graded scale.
- Digital competences are assessed through **non-specific national tests**. These non-specific national tests evaluate other subjects, such as mathematics, while also testing digital competences. They seek to determine an individual student's level of attainment, usually in relation to a graded scale.
- National tests do not include digital competences.
- No national testing.

In line with earlier findings in the 2019 Eurydice report *Digital Education at School in Europe*, data in Figure 4 demonstrates that the assessment of digital competences through national tests remains uncommon in primary and lower secondary education. Only three education systems (France, Malta and Austria) report that they assess students' digital competences through specific national tests related to individual student achievement. These tests invariably take place in lower secondary education.

For instance, in **Austria**, the acquisition of competencies in the subject of digital literacy (*Digitale Grundbildung*) in lower secondary education is assessed with an online test called 'Digi.check'. It includes reflection and knowledge questions, and its main purpose is to identify learning gaps ([36]).

In Denmark and France digital competences in lower secondary education are assessed through non-specific national tests. In addition, in the Flemish Community of Belgium (lower secondary education), the Czech Republic, Estonia ([37]), France (primary education), Luxembourg and Finland digital competences are assessed through sample tests that aim at monitoring the quality of the education system rather than measuring the attainment levels of individual students. This type of test is not shown in Figure 4.

In the majority of education systems, although national tests are organised, they do not include digital competences ([38]).

Finally, in the German-speaking Community of Belgium, Flemish Community of Belgium (primary education), Greece, Cyprus, Austria (primary education), Poland (primary education), Bosnia and Herzegovina (primary education) and Liechtenstein, no national tests in any competence are organised.

Figure 4: Assessment of pupils' digital competence through national tests, 2021/2022

	BE fr	BE de	BE nl	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV	LT	LU	HU
ISCED 1	×	◊	◊	×		×	×		×	◊	×		◊	×	◊	×	×		×
ISCED 24	×	◊		×		○	×		×	◊	×	●○	◊	×	◊	×	×		×
	MT	**NL**	**AT**	**PL**	**PT**	**RO**	**SI**	**SK**	**FI**	**SE**	**AL**	**BA**	**IS**	**LI**	**ME**	**MK**	**NO**	**RS**	**TR**
ISCED 1	×	×	◊	◊	×	×	×	×		×	×	◊	×	◊	×	×	×	×	×
ISCED 24	●	×	●	×	×	×	×	×		×	×	×	×	◊	×	×	×	×	×

● Digital competences are assessed through specific national tests

○ Digital competences are assessed through non-specific national tests

× National tests do not include digital competences

◊ No national tests

5.5. Digital education ecosystem at school

Strategic priority 1 in the Digital Education Action Plan aims at fostering the development of high-performing digital education ecosystems. At school level, this involves effective digital capacity planning and development. Under this heading, the proposed indicator looks at three different structural aspects that can contribute to better planning and development.

- **Appointment of digital coordinators.** Delivering digital competence and ensuring that technology is used across the curriculum goes beyond the individual teacher's responsibility. A whole school approach ([39]) is necessary to encourage and sustain change and innovation in teaching and learning (Cachia et al., 2010). Moreover, leadership at school level is an important lever for change. Leaders can motivate staff, set objectives, develop school digital plans,

([36]) https://digicheck.at/

([37]) This test is used to both monitor the quality of the education system and assess the level of digital competence of individual students that participate (in 2021, 49.7 % of all eighth graders).

([38]) In Spain, national tests have been paused until 2023/2024. Nevertheless, some autonomous communities have continued to organise standardised assessments during 2021/2022.

([39]) Such an approach means that the entire school community (school leaders, teaching and non-teaching staff, learners, parents and families) engages in cohesive, collective and collaborative action, with strong cooperation with external stakeholders and the community at large.

coordinate efforts and more generally create a favourable climate for innovation. However, teachers and school leaders may face new challenges when rolling out new digital learning environments or using digital technology for pedagogical purposes. These challenges may affect their motivation and self-confidence in employing digital technologies in the education process. Indeed, the *2nd Survey on Schools on ICT* (European Commission, 2019, p. 48) shows that a lack of pedagogical and technical support is one of the most important obstacles that teachers face in the use of digital technologies. Support for teachers and the wider school in the use of technologies in the education process is usually provided by digital coordinators, also known as ICT coordinators. Digital coordinators generally have responsibilities that cover both technical and pedagogical aspects (Devolder et al., 2010), although an explicit focus on either of these two aspects can also exist.

- **Requirement to have a school digital plan.** A requirement by top-level education authorities for schools to have a development plan which includes digital education, or a specific school digital plan means that the development of both digital competences and innovative teaching and learning methods becomes central to school development as part of a whole school approach. The International Computer and Information Literacy Study showed 'that teachers who were working in schools they saw as supporting ICT use through a planned and collaborative approach were more likely to use ICT in their teaching and emphasize the development of students' computer and information literacy' (European Commission, 2014, p. 6). More recently, the *2nd Survey of Schools on ICT in Education* found that 31 % of students in primary education, 34 % of students in lower secondary education and 30 % of students in upper secondary education attended schools that had written statements specifically on the use of ICT for pedagogical purposes (European Commission, 2019, pp. 98–99).
- **Criteria relating to digital education in external school evaluation frameworks.** At European level, external school evaluation is seen as an approach to quality assurance; it is a widespread practice that aims to monitor the performance of individual schools with a focus on improving their quality, and consequently students' learning outcomes (European Commission/EACEA/Eurydice, 2015). External evaluators usually follow evaluation frameworks or have lists of topics and/or indicators to consider when evaluating the quality of a school (Ibid.). These documents might include criteria specifically relating to digital education, and therefore require evaluators to assess aspects in this area. Most external evaluators are asked to evaluate the quality of teaching and learning in each curriculum subject, as well as to assess compliance with requirements relating to instruction time or learning outcomes. However, this sub-indicator goes beyond a simple requirement for a subject-based evaluation of ICT. Instead, it focuses on whether there are wider evaluation criteria relating to the integration of digital technologies across the whole school. The criteria include the use of digital technologies across the curriculum and in school management processes, as well as the quality of digital infrastructure and the level of investment.

5.5.1. Appointment of school digital coordinators

Figure 5 shows that only 11 education systems have established a top-level requirement to appoint a digital coordinator at school (only in lower secondary education in Cyprus). This position is often held by a teacher who receives a reduction of teaching hours to provide technical and other support to the school community.

For instance, in the **Flemish Community of Belgium**, the government funds a specific ICT-coordination time by earmarking hours within the total amount of human-resource provisions for schools. The amount of resources for ICT-coordination largely depends on

school size (the number of pupils). The ICT coordinator supports the team and the school management in taking appropriate measures with regard to ICT integration ([40]).

In **Austria**, there is an educational IT coordinator (*IT-Kustodiat*) at each school. They are responsible for the pedagogical support of the use of IT. The federal government pays for this work (reduction of teaching hours). In addition, there are coordinators for the technical support of IT. This task is the responsibility of the school owners. The federal government has developed a three-pillar model for IT support for its schools and has been implementing this model in all federal schools since 2015.

In another 16 systems, this matter is subject to school/local autonomy. In some cases, countries report that while there is no top-level requirement, in practice a digital coordinator is appointed in most schools.

For instance, in the **French Community of Belgium** the nomination of an ICT coordinator (*délégué(e) référent(e) numérique*) is a decision taken by the school head. The government decree gives autonomy to the school heads to assign this task to a teacher whose teaching time is consequently reduced.

In **Estonia**, most schools have an IT manager (in case of small schools, the IT manager can be employed by the local government authorities and be in charge of several schools) and/or an educational technologist. While the IT manager is responsible for the IT infrastructure, the educational technologist coordinates digital learning, supports the introduction of innovative solutions and advises teachers and learners in the use of digital tools and opportunities in the learning process.

In **Ireland**, most larger schools tend to appoint a digital coordinator. However, this may not typically be the case in the smaller schools at primary ISCED level 1. Often at ISCED level 1, the appointment of a digital coordinator may be on a voluntary basis or part of the additional responsibilities of a member of the middle-management team who happens to have a particular interest and expertise in digital technology.

In the remaining 11 systems no top-level requirement to appoint a digital coordinator at school exists, and the education authorities do not provide further information.

5.5.2. Top-level requirement to have a school digital plan

Concerning the establishment of a school digital plan, this is a top-level requirement in only nine systems (with four of them opting for a specific digital plan and five noting that it can be part of the general school-development plan).

In **Ireland**, each school must have a Digital Learning Plan, based on a whole school approach and taking into account its context and circumstances. The plan outlines the vision of the school for the embedding of digital technologies in teaching, learning and assessment and incorporate targets and priorities for improvement and development. Schools are advised to review and update the digital learning plan at least annually. This plan guides the use of grant funding to embed digital technologies in a phased and coherent approach to improve learning outcomes for students ([41]).

In **Portugal**, all schools are invited to develop action plans for digital development, which integrate actions in three areas: organisation, pedagogy, and technology and digital. These action plans are conceived, developed and monitored by digital development teams in each school and are supported by digital ambassadors at the teacher training centre at national level ([42]).

In a further 12 systems the creating of such a plan is subject to school/local autonomy. In many cases, although a digital school plan is not compulsory, schools are encouraged to develop such plans and receive support in this endeavour.

In the **French Community of Belgium**, schools are encouraged to create a management plan (steering plan) with a focus on three to five specific goals for improvement, which could include digital aspects of learning. Digital aspects can also be inserted as transversal points in various specific goals. More specifically, a school is encouraged to insert digital tools both in learning and in

([40]) https://data-onderwijs.vlaanderen.be/edulex/document/13401

([41]) The Grant Scheme for ICT Infrastructure for the 2021/2022 school year is outlined in the Department of Education Circular available at https://www.gov.ie/en/circular/e1f8e-grant-scheme-for-ict-infrastructure-20212022-school-year/#:~:text=The%20new%20Digital%20Strategy%20for,National%20Development%20Plan%202021%2D2030.

([42]) https://digital.dge.mec.pt/desenvolvimento-digital-das-escolas

school governance and to acquire digital equipment. The development of a specific digital strategy is therefore not mandatory, and actions can be developed in a transversal way through the management plan (steering plan).

Similarly in the **Flemish Community of Belgium**, although not mandatory, schools are encouraged and supported to develop such a plan. The Knowledge Centre for Digital Education, for example, supports schools by providing training and policy-planning tools.

In **Estonia**, schools are required to have a development plan that is drawn up for at least three years and sets the goals and main directions of the school's development. Some schools include their digital development goals in the general development plan; the others have a separate digital development plan (coordinated by the educational technologist).

Finally, the remaining 17 systems do not require the establishment of a school digital plan and do not have further information on school practices in this regard.

However, although there is no top-level requirement in **Germany**, when school authorities apply for funding from the DigitalPakt Schule of the Federation and the Länder, they need to submit a technical and pedagogical concept, which includes media education concepts, a technical concept and a further training concept. These concepts ensure the pedagogical use of digital technologies and the qualification of teachers. Most schools have developed or are in the process of developing school digital plans (*Medienentwicklungspläne*) ([43]).

5.5.3. Criteria relating to digital education included in external school evaluation

Finally, it is not very common for criteria related to digital education to be included in external school evaluations. Nevertheless, 16 education systems (only lower secondary education in Ireland) report that such criteria exist, either specifically for digital competences or as a part of wider areas. Some examples that can serve as an illustration of different approaches are given below.

In **Estonia**, one of the 13 performance indicators that are considered in external school evaluations is the frequency of the use of digital solutions in teaching and educational activities, which is monitored in eighth grade.

In **Ireland**, for ISCED level 24, during whole school evaluations inspectors use specific criteria relating to digital education as outlined in the Digital Learning Framework for Post-Primary schools (DLFPP) ([44]).

In **Serbia**, external school evaluations do not explicitly include indicators relating to digital education. On the other hand, in some areas of quality assurance such as 'Organization of school work, management of human and material resources', certain indicators implicitly define criteria that are relevant for digital education, such as 'The school head creates conditions for continuous monitoring and evaluation of digital maturity of school' ([45]).

In 17 education systems no criteria related to digital education are used in external school evaluation (only primary education in Ireland and lower secondary education in Cyprus). In seven systems, no external school evaluation exists (in Cyprus, this only applies to primary education).

When looking across the three sub-dimensions of this indicator, it becomes clear that top-level requirements for appointing digital school coordinators and establishing school digital plan are not common. Actions in these areas are often left to the discretion of school leaders, which implies that practices vary and not every school benefits from these activities. Similarly, specific criteria related to digital education in external school evaluation are not widespread either.

Overall, it appears that there is scope for more active top-level guidance and support on establishing a viable digital ecosystem at school.

([43]) https://www.digitalpaktschule.de/files/VV_DigitalPaktSchule_Web.pdf

([44]) https://www.pdsttechnologyineducation.ie/en/Planning/Digital-Learning-Framework-and-Planning-Resources-Post-Primary/Digital-Learning-Framework-for-Post-Primary-Schools.pdf

([45]) Bylaw on the quality evaluation of institutions: https://www.paragraf.rs/propisi/pravilnik-standardima-kvaliteta-rada-ustanove.html

Figure 5: Digital education ecosystem at school, 2021/2022

	Top-level requirement to appoint a digital coordinator at school	Top-level requirement to have a school digital plan	Criteria relating to digital education in external school evaluation	
			ISCED 1	ISCED 24
Belgium BE fr	■	■	○	○
Belgium BE de	■	■	○	○
Belgium BE nl	●	■	●	●
Bulgaria	■		◊	◊
Czechia	■		●	●
Denmark	■	■	○	○
Germany			●	●
Estonia	■	■	●	●
Ireland	■	●	○	●
Greece			○	○
Spain	●	○	●	●
France	●	●	●	●
Croatia			○	○
Italy	●	●	○	○
Cyprus	●	■	◊	○
Latvia	■	○	○	○
Lithuania	■	○	●	●
Luxembourg	●	○	◊	◊
Hungary		■	●	●
Malta	●	■	●	●
Netherlands	■		○	○
Austria	●	○	◊	◊
Poland	■		●	●
Portugal	■	●	○	○
Romania	■	■	●	●
Slovenia	●		○	○
Slovakia			○	○
Finland	■	■	◊	◊
Sweden	■	■	●	●
Albania			○	○
Bosnia and Herzegovina			○	○
Iceland			○	○
Liechtenstein			●	●
Montenegro	●		○	○
North Macedonia			●	●
Norway	■	■	◊	◊
Serbia			●	●
Türkiye	●		◊	◊

Top-level requirement to appoint a digital coordinator at school	Top-level requirement to have a school digital plan	Criteria relating to digital education in external school evaluation
● Yes	● Specific digital plan	● Criteria relating to digital education exist
	○ As part of the school development plan	○ No criteria exist
■ School/local autonomy **and/or** No top-level requirement (1)	■ School/local autonomy	◊ There is no external school evaluation

(1) but in practice a digital coordinator is appointed in most schools

5.6. Main findings

This analysis reviews the situation of the 2021–2022 school year regarding key structures and policies that support the teaching of digital competence at school in Europe, based on information from 38 European education systems. Several main findings can be underlined.

- In the majority of European education systems, the compulsory teaching of digital competence for all pupils starts in primary education (ISCED level 1). In 18 systems this is done as early as the first grade of primary education, and in another seven systems this happens several grades later. The latest compulsory starting grade that has been reported is seventh grade in lower secondary education (ISCED level 24) – this concerns the current situation in Cyprus and Malta. On the other hand, the top-level education authorities in the three Communities of Belgium, Germany, Ireland, the Netherlands, Slovenia, Iceland and Norway have not established a compulsory starting grade for the teaching of digital competences for all students.
- Across Europe, digital competences are taught using several curricular approaches that may be applied in parallel or alternated depending on the education level. Overall, in primary education, the most common approach is to teach digital competences as a cross-curricular subject, while in lower secondary education teaching is most often done as a compulsory separate subject.
- The great majority of European systems have included explicit learning outcomes in all areas of digital competence. Overall, across the five competence areas, learning outcomes are most frequently cited for 'Evaluating data, information and digital content', while relatively less outcomes exist for 'Creatively using digital technologies'. No or almost no learning outcomes in any of the domains for both primary and lower secondary education were reported in the French and German-speaking Communities of Belgium, Ireland, the Netherlands and Slovenia. This is often linked to the fact that in these systems digital competences are not taught as part of the compulsory curriculum for all students. As a result, specific learning outcomes may exist only in optional subjects. Another significant point is that Germany, Croatia and Romania reported learning outcomes relating only to lower secondary education.
- In about half of all education systems, top-level authorities require that teacher-specific digital competences be included in ITE curricula. In the rest of the European education systems, there are no such top-level requirements. In many of these cases, the providers of initial teacher education have institutional autonomy regarding the content of the courses they offer. However, the absence of top-level requirement does not necessarily mean that ITE institutions do not offer teachers the opportunity to develop digital competences.
- The assessment of students' digital competences through national tests remains rare. Most often such national tests take place in lower secondary education. In more than half of all education systems full cohort national tests do not include digital competences or no national tests in any competence are organised.
- Specific measures for the establishment of a digital ecosystem in every school are not widely available. The appointment of school digital coordinators and the development of school digital plan are often left to the discretion of school heads, which means that in practice not all schools and students can benefit from better planning and the development of new digital learning. Similarly, specific criteria relating to digital education in external school evaluations exist in only 16 European systems.
- Most of these findings are in line with the conclusions of the 2019 Eurydice report *Digital Education at School in Europe*, and no major policy shifts have been observed in the past few years. Overall, it appears that there is ample scope for more active top-level guidance and support to improve teachers' preparedness, develop student assessment through national tests and establish viable digital ecosystems at school.