Digital Education

at School in Europe

Eurydice Report

Digital Education

at School

in Europe

Eurydice Report

CONTENTS

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CODES, ABBREVIATIONS AND ACRONYMS

Country codes

EU/EU-28	European Union	**CY**	Cyprus	**UK**	United Kingdom
BE	Belgium	**LV**	Latvia	**UK-ENG**	England
BE fr	Belgium – French Community	**LT**	Lithuania	**UK-WLS**	Wales
BE de	Belgium – German-speaking Community	**LU**	Luxembourg	**UK-NIR**	Northern Ireland
BE nl	Belgium – Flemish Community	**HU**	Hungary	**UK-SCT**	Scotland
BG	Bulgaria	**MT**	Malta		**EEA and candidate countries**
CZ	Czechia	**NL**	Netherlands	**AL**	Albania
DK	Denmark	**AT**	Austria	**BA**	Bosnia and Herzegovina
DE	Germany	**PL**	Poland	**CH**	Switzerland
EE	Estonia	**PT**	Portugal	**IS**	Iceland
IE	Ireland	**RO**	Romania	**LI**	Liechtenstein
EL	Greece	**SI**	Slovenia	**ME**	Montenegro
ES	Spain	**SK**	Slovakia	**MK**	North Macedonia
FR	France	**FI**	Finland	**NO**	Norway
HR	Croatia	**SE**	Sweden	**RS**	Serbia
IT	Italy			**TR**	Turkey

Statistics

(:)	Data not available	(–)	Not applicable or zero

Abbreviations and acronyms

CPD	Continuing Professional Development
ICILS	International Computer and Information Literacy Study
ICT	Information and Communication Technologies
ISCED	International Standard Classification of Education
IT	Information Technologies
ITE	Initial Teacher Education
PIRLS	Progress in International Reading Literacy Study
PISA	Programme for International Student Assessment
TIMSS	Trends in International Mathematics and Science Study

MAIN FINDINGS

The main findings highlight conclusions of particular interest to policy-makers. These findings are the product of an analysis of national level data using a comparative approach. They also serve as an overview of the key areas covered including the development of digital competence through school curricula, teacher-specific digital competences, the assessment of students' digital competences and the use of technology in assessment and testing, and finally, the strategic approaches to digital education across Europe with specific reference to policies supporting schools. Readers are referred to the specific indicators where more detailed information can be found.

This report addresses digital education in Europe at primary and general (lower and upper) secondary levels for the school year 2018/19 in all 28 EU Member States, as well as Albania, Bosnia and Herzegovina, Switzerland, Iceland, Liechtenstein, Montenegro, North Macedonia, Norway, Serbia, and Turkey, covering 43 education systems in total.

Digital competence in school curricula

- There is a consistent approach to defining digital competence as a key competence across Europe. Nearly half of the European education systems refer to the European key competence definitions for digital competence: 11 education systems use exclusively their own national definition of digital competence ([1]); eight other countries (Estonia, France, Cyprus, Lithuania, Malta, Austria, Albania and Serbia) use both the European definition and a national one (see Figure 1.1). In general, these definitions originate in curriculum or top-level strategy documents related to digital competence.

- The development of digital competence is included in the vast majority of countries at all three education levels. However, unlike other traditional school subjects, it is not only addressed as a topic in its own right, but also as a transversal key competence. In primary education, in eight education systems (French and German-speaking Communities of Belgium, Croatia, Latvia, Luxembourg, Albania, Bosnia and Herzegovina, and Turkey), digital competence is not explicitly addressed in the national curriculum in the reference year (2018/19), while in secondary education, this is only the case in two systems – the French and German-speaking Communities of Belgium. However, the French Community of Belgium, Croatia and Latvia are currently reforming the curriculum to introduce digital competences or are in the process of implementing ongoing curriculum changes as from primary education (see Figure 1.2).

- In primary education, more than half of the European education systems include digital competence as a cross-curricular theme. It is addressed as a compulsory separate subject in 11 countries ([2]), and integrated into other compulsory subjects in ten countries ([3]). A quarter of the education systems combine two approaches ([4]), while in Czechia and Liechtenstein all three exist at the same time.

- In lower secondary education the number of countries teaching digital competences as a compulsory separate subject increases to over half of the education systems. In upper secondary, the number of countries teaching digital competences as a cross-curricular topic decreases slightly in relation to lower secondary and fewer countries offer compulsory separate subjects for

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([1]) Germany, Croatia, Netherlands, Portugal, Slovakia, Sweden, United Kingdom (WLS and SCT), Iceland, Norway and Turkey

([2]) Bulgaria, Czechia, Greece, Poland, Portugal, United Kingdom (ENG and WLS), Iceland, Liechtenstein, Montenegro and North Macedonia

([3]) Czechia, Ireland, Spain, France, Italy, Cyprus, Lithuania, Slovenia, Sweden and Liechtenstein

([4]) Ireland, Greece, Spain, France, Italy, Poland, Portugal, Slovenia, Sweden, United Kingdom (WLS) and Iceland

all students in this area. It must be borne in mind though that in upper secondary education, students can usually choose more optional subjects and these can include subjects related to digital competence.

- Iceland, Greece and North Macedonia have the highest number of recommended hours for information and communication technologies (ICT) as a compulsory separate subject in primary education (around 150 hours). Lithuania and Cyprus allocate the highest number of hours during lower secondary education, although they do not have any recommended instruction time for primary education. Within the scope of compulsory education, Romania has the highest number of hours related to digital competence as a compulsory separate subject in upper secondary education (see Figure 1.3).

- Half of the European education systems are currently reforming the curriculum related to digital competence (see Figure 1.4). The revisions aim either at introducing digital competence into the curriculum where it had not previously been addressed, or making the subject area more prominent. Some reforms are also about changing the curriculum approach, updating content or strengthening particular areas such as coding, computational thinking or safety.

Competence areas and related learning outcomes

- The majority of European education systems have explicitly included learning outcomes related to all five digital competence areas. In descending order of prevalence these are: information and data literacy, digital content creation, communication and collaboration, safety, and problem solving (see Figure 1.5).

- Most of the learning outcomes related to digital competences are associated with lower secondary education. For primary education, the number of countries with related learning outcomes is the lowest, but still around 30 education systems cover the first four areas, and 24 education systems ([5]) also cover problem-solving (see Annex 1b).

- In some countries, depending on the prevalent curriculum approach, these learning outcomes can be distributed across a range of subjects and rather broad. Alternatively, they can be concentrated within a specific separate subject with detailed learning outcomes itemised in subject curricula, often accompanied by a specific amount of instruction time. In several other countries, where the main approach to digital competence is cross-curricular, there is nevertheless a high level of detail in the related learning outcomes (e.g. Estonia, Greece, Malta, Finland and the United Kingdom – Northern Ireland) (see Section 1.3.1).

Eight essential competences

For the purpose of this focused analysis, eight ([6]) of the 21 digital competences in DigComp have been selected, taking at least one from each of the five areas.

- Evaluating data, information and digital content (information and data literacy area): this competence is explicitly stated as a learning outcome in the curricula of nearly three quarters of the countries studied, mostly at lower secondary level. It is the second most frequently referred to in terms of learning outcomes of the eight selected competences (see Figure 1.7).

([5]) Bulgaria, Czechia, Germany, Estonia, Greece, Spain, France, Italy, Cyprus, Malta, Poland, Portugal, Slovakia, Finland, Sweden, United Kingdom (all four jurisdictions), Switzerland, Iceland, Montenegro, North Macedonia and Serbia

([6]) Evaluating data, information and digital content; collaborating through digital technologies; managing digital identity; developing digital content; programming/coding; protecting personal data and privacy; protecting health and well-being; identifying digital competence gaps

- Collaborating through digital technologies (communication and collaboration area): while these learning outcomes are less frequently mentioned in European curricula than the previous competence, they are still covered by 27 education systems ([7]) at lower secondary level, and by more than 20 systems at primary and upper secondary levels (see Figure 1.7).

- Managing digital identity (communication and collaboration area): only one third of European curricula have related learning outcomes in lower secondary education and less than a dozen in primary and upper secondary education (see Figure 1.7).

- Developing digital content (digital content creation area): virtually all European education systems have learning outcomes for this competence at lower secondary level, and around 30 countries at primary and upper secondary levels. It is the most frequently cited of the eight competences analysed (see Figure 1.7).

- Programming/coding (digital content creation area): while less than half of the European education systems explicitly include this competence in terms of learning outcomes in primary education, around 30 countries do so in lower and upper secondary education. It is the third most frequently referred to competence coming after 'digital content creation' and 'evaluating data, information and digital content' (see Figure 1.7).

- Protecting personal data and privacy (safety area): the increasing relevance of this competence is reflected in European curricula, as nearly 30 education systems have explicit related learning outcomes in secondary education, and nearly 20 in primary education (see Figure 1.7).

- Protecting health and well-being (safety area): this competence has explicit learning outcomes in more than half of the European education systems in lower secondary education, in more than 20 education systems in primary education, and in slightly less in general upper secondary education (see Figure 1.7). Some common topics are: the prevention of risks linked to the length/overuse of digital technologies, including addiction and physical health and ergonomics.

- Identifying digital competence gaps (problem solving area): this is the competence least referred to in national curricula of the eight selected (fewer than ten countries). In four education systems it features at all three education levels (Estonia, Greece, the United Kingdom – Wales and Northern Ireland), in two at primary and lower secondary level (Germany and Malta), in one only at primary level (Lithuania) and in one other at upper secondary level (Bulgaria) (see Figure 1.7).

Development of teacher-specific digital competences before entry to the profession

- In about two thirds of European education systems, teacher-specific digital competences are recognised in competence frameworks as some of the essential competences teachers are expected to have. The definition of what constitutes digital competence for a teacher varies. In some competence frameworks, it is a very broad definition, in others there is a detailed description of areas and skills. All of them, however, emphasise that teachers have to know how to integrate digital technologies into their teaching and learning and be able to use them effectively.

- Estonia, Spain, Croatia, Lithuania, Austria, Norway and Serbia have even developed a distinct digital competence framework for teachers which provide a complete mapping of the essential competences, including those related to the pedagogical use of technologies (see Figure 2.1). In Ireland, the Digital Learning Frameworks refer to the standards described in terms of 'effective'

([7]) Belgium (BE nl), Bulgaria, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Lithuania, Malta, Austria, Poland, Portugal, Romania, Slovakia, Finland, United Kingdom (WLS, NIR and SCT), Bosnia and Herzegovina, Switzerland, Iceland and Norway

and 'highly effective' school practices. The Spanish, Croatian, Austrian and Serbian frameworks propose a progression model to help teachers evaluate their skills and move forward. Moreover, in Spain and Austria self-assessment tools have been developed alongside teacher digital competence frameworks and together represent a comprehensive system for teacher self-evaluation.

- In about half of the European education systems, top-level regulations or recommendations promote the inclusion of teacher-specific digital competences in initial teacher education (ITE) (see Figure 2.2). Education providers, however, are usually free to decide on the subject content and how this should be delivered. It is also worth noting that in almost all education systems where ITE is subject to top-level regulations or recommendations, they are published in the same official documents as the teacher competence frameworks (see Annexes 2 and 3).

- Top-level regulations or recommendations on the assessment of prospective teachers' digital competences exist in less than a quarter of education systems. In most, they are assessed during ITE (see Figure 2.3).

Figure 1: Inclusion of teacher-specific digital competences in top-level regulations/recommendations on ITE or teacher competence frameworks, primary and general secondary education (ISCED 1-3), 2018/19

Teacher-specific digital competences are:

■ included and mandatory for development of ITE programmes

■ included but not mandatory for development of ITE programmes

▨ No top level regulation or recommendation/no teacher competence framework or digital competence is not included in teacher competence framework/autonomy of HEIs

Source: Eurydice.
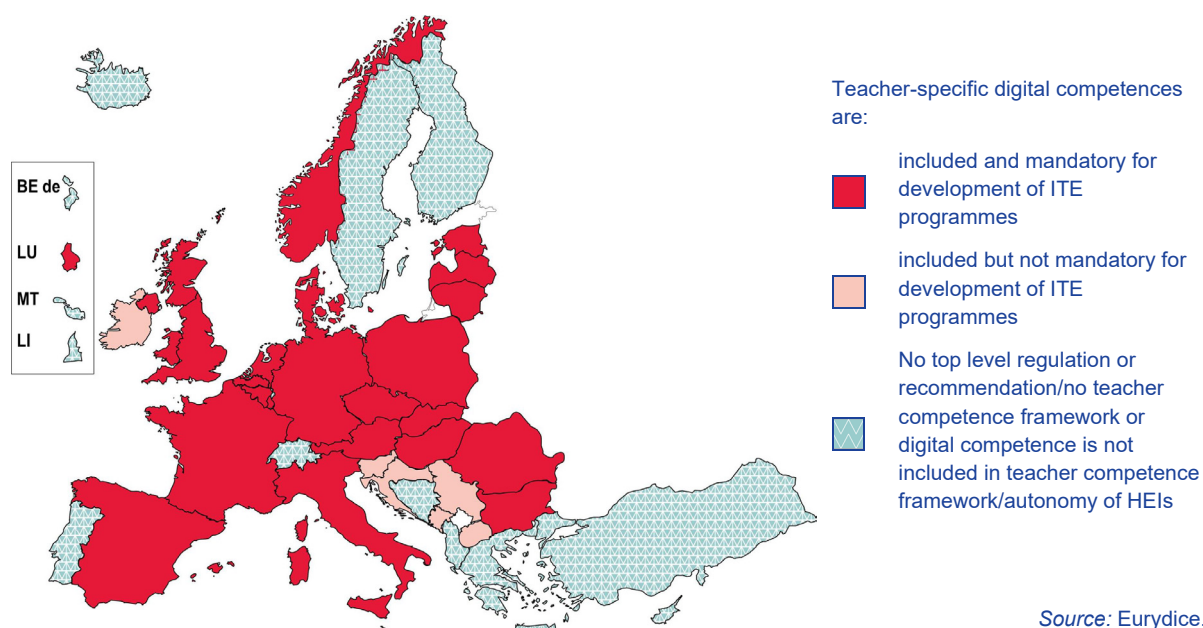
Explanatory note

This Figure is based on Figures 2.1 and 2.2 located in Chapter 2 'Digital competences for teachers: professionalisation and support'.

Support measures for the continued development of teacher-specific digital competences

- In almost all education systems, top-level authorities are involved in the provision of continuing professional development (CPD) in the area of digital education (see Figure 2.4). In Bulgaria, Croatia, Italy, Hungary, Poland, the United Kingdom (England) and Montenegro, CPD is a part of national initiatives focusing on different aspects of digitalisation in society. To define CPD needs, 21 education systems ([8]) may use teacher competence frameworks. In nine (France, Lithuania,

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([8]) Belgium (BE fr and BE nl), Estonia, Ireland, Spain, France, Croatia, Lithuania, Hungary, Netherlands, Austria, Romania, Slovenia, United Kingdom (all four jurisdictions), Montenegro, North Macedonia, Norway and Serbia

Austria, Romania, Slovenia, the United Kingdom – Wales and Scotland, Montenegro and North Macedonia), their use is mandatory (see the table below the Figure 2.1).

- To help teachers evaluate their level of digital competence and thereby define their development needs, 15 education systems (⁹) promote the use of self-assessment tools. Six countries (Czechia, Estonia, Spain, Cyprus, Portugal and Slovenia) have adopted the European self-assessment tool (TET-SAT), the others have developed their own models.

- In almost two-thirds of education systems, top-level education authorities have helped establish teacher networks. In France, Croatia, Austria, Slovenia and the United Kingdom (England and Wales), they have set up networks specifically dedicated to digital education. Digital communities of teachers usually operate on-line, often through digital resource platforms or portals that provide access to various types of support such as digital learning resources, including open education resources (OER), and informal on-line professional development opportunities.

Assessment of digital competences in national tests

- In half of the education systems, digital competences are never assessed at school through national testing. Only two countries (Austria and Norway) have tests in digital competences at all school education levels. Latvia tests digital competences only at lower secondary level, while 11 (¹⁰) other education systems have national tests on digital competences at both lower and general upper secondary level. In nine (¹¹) education systems, digital competences are tested only at general upper secondary level.

Figure 2: National tests to assess students' digital competences by education level, primary and general secondary education (ISCED 1-3), 2018/19

� red	Upper secondary education
▰	Lower secondary education
▰	Primary education
▨	National tests do not include digital competences/ no national testing

Source: Eurydice.
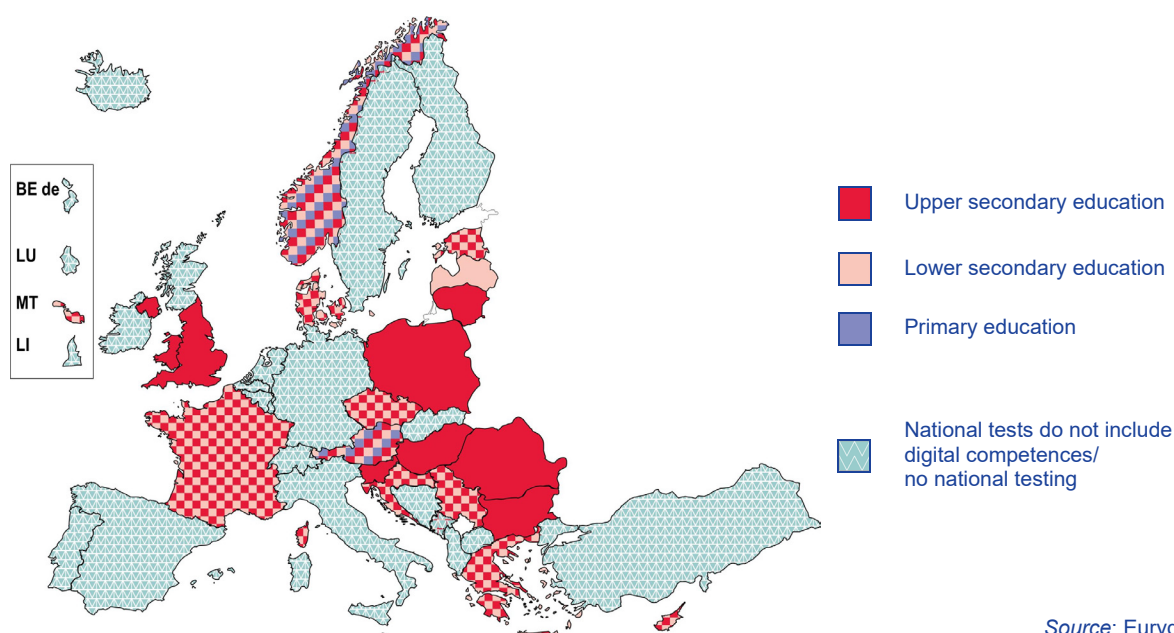
Explanatory note

This Figure is based on Figure 3.1 located in Chapter 3 'Assessing digital competences and using digital technologies in assessment'.

(⁹) Bulgaria, Czechia, Estonia, Spain, France, Cyprus, Austria, Portugal, Slovenia, Finland, United Kingdom (ENG, WLS and NIR), Switzerland and Serbia

(¹⁰) Czechia, Denmark, Estonia, Greece, France, Croatia, Cyprus, Malta, Austria, Norway and Serbia

(¹¹) Bulgaria, Lithuania, Hungary, Poland, Romania, Slovenia and United Kingdom (ENG, WLS and NIR)

- National tests are carried out for two main reasons: to evaluate and certify the competences of individual students; or to collect data that can be used to support students and teachers, and to evaluate schools and/or the education system as a whole. In most cases, the assessment of individual students' digital competences is the main focus of national tests, while only four countries test pupils for quality assurance purposes (Croatia in lower secondary education and Czechia, Estonia and Serbia in lower and upper secondary education). The testing of digital competences for quality assurance purposes is never carried out at primary level (see Figure 3.1).

- Although many more countries have national tests at upper secondary level compared to other education levels, t he cohort of students tested is limited. In 12 education systems ([12]), digital competence tests carried out for assessment/certification purposes only involve students on a particular educational pathway (e.g. STEM), or those who decide to take the specific test (e.g. for reasons linked to higher education admission requirements). Only in Bulgaria, Denmark, Malta and Romania are all upper secondary education students required to take a national test to assess their digital competences. In the four countries where digital competences are assessed for quality assurance purposes, the cohort of students is also limited as these tests are usually carried out on a sample basis (see Figure 3.1).

- The national tests carried out for assessment/certification purposes can either be a specific test in digital competences or related subject area (e.g. ICT), or a test in another competence area (e.g. mathematics), which also includes an assessment of digital competences. The latter approach exists only in a few countries. In France and Norway, this approach is used for lower secondary students, and in Denmark for lower and general upper secondary students (see Figure 3.1).

Guidance on the assessment of digital competences in the classroom

- Teachers across Europe receive very little guidance from top-level authorities on the assessment of digital competences in the classroom. In 13 education systems ([13]), the only guidance available at any school level is through the learning outcomes stated in national curricula (see Figure 3.2).

- Overall, 11 education systems ([14]) have developed criteria and/or standards that can be used by teachers as guidance for assessing proficiency in digital competences in the classroom. However, only five ([15]) apply the criteria/standards at all school levels. It is also to be noted that these criteria and/or standards are not necessarily prescriptive and teachers have a good deal of autonomy in how and when to use them (see Figure 3.2).

- National test specifications that can be used by teachers to assess students in the classroom are available in 15 education systems. At primary level, these are found only in Austria and Norway, and at lower secondary level in France, Greece, Austria and Norway. Conversely, in general upper secondary education, they are available in all 15 education systems ([16]) (see Figure 3.2). National test specifications vary in the types of information they provide in terms of the competences tested, tasks students undertake, and marking methods used.

- The tendency to rely on the specifications for national tests at upper secondary level is consistent with the fact that these tests mostly take place within the framework of the official examinations to

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([12]) Greece, France, Croatia, Cyprus, Lithuania, Hungary Poland, Slovenia, United Kingdom (ENG, WLS and NIR) and Norway

([13]) Belgium (BE nl), Czechia, Denmark, Germany, Spain, Italy, Portugal, Slovakia, Sweden, Finland, Switzerland, Liechtenstein and North Macedonia

([14]) Estonia, Ireland, Croatia, Latvia, Malta, United Kingdom (WLS, NIR and SCT), Iceland, Montenegro and Serbia

([15]) Estonia, Ireland, Latvia, United Kingdom (NIR) and Montenegro

([16]) Bulgaria, Greece, France, Cyprus, Lithuania, Hungary, Malta, Austria, Poland, Romania, Slovenia, United Kingdom (ENG, WLS and NIR) and Norway

certify students' digital competences at the end of this education level. While this approach has a number of benefits such as transparency for students, an approach exclusively based on exam expectations carries the risk of distorting teachers' perceptions of what is important for students to know and be able to do, and so classroom learning activities might be limited to the requirements of the standardised test (see Figures 3.1 and 3.2).

Recognition of digital competences on certificates awarded at the end of secondary education

- In the vast majority of education systems across Europe, students receive a certificate at the end of secondary education. However, only 23 education systems [17] include information on digital competences on such certificates, and only three (Bulgaria, Malta and Romania) apply this to all students. In the remaining 20 education systems, only students who have taken specific related subjects or learning pathways, or those who have chosen to take the digital competence related final exam have their digital competences acknowledged on their certificates (see Figure 3.3).

- The information included on certificates varies. In all but two countries (France and Serbia), the certificates include a reference to the exam result or more generally to the final grade. In France and Serbia, the certificates make only a general reference to digital competence without any further detail. In addition to the test results, in Malta and Romania, the certificates report achievement in specific competences, while in Norway there is reference to the instruction time received. In Lithuania, all three elements are provided on the certificates (see Figures 3.3).

Use of digital technologies in national testing

- There are some examples of countries in Europe moving towards integrating digital technologies into national testing. For example: in Finland, the 'Matriculation examination', the national test carried out at the end of upper secondary education, has been gradually digitalised since autumn 2016, and as of spring 2019 the test is fully digital nationwide and for all subjects. Similarly, in Sweden, schools have been using digital devices in some tests since June 2018, and digital national tests will continue to be trialled during the period 2018-2021 before full-scale adoption. Currently, three quarters of education systems make use of digital technologies in national testing in at least one school level. The number of countries performing technology-supported national tests increases with the education level. While 10 education systems [18] make use of technology in national testing at primary level, at upper secondary level the number rises to 20 [19] (see Figure 3).

- While the assessment of individual pupils is the main purpose of national tests at both primary and upper secondary levels, more countries use technology-supported testing for quality assurance purposes at lower secondary level. This is the case in fact for 11 education systems [20] compared to five in primary education (Czechia, Estonia, France, Switzerland and Liechtenstein), and four in general upper secondary education (Czechia, Estonia, Italy and Serbia) (see Figure 3.4).

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[17] Bulgaria, Denmark, Czechia, Estonia, Greece, France, Croatia, Cyprus, Malta, Latvia, Lithuania, Hungary, Austria, Poland, Romania, Slovenia, United Kingdom (ENG, WLS and NIR), Liechtenstein, Montenegro, Norway and Serbia

[18] Czechia, Denmark, Estonia, France, United Kingdom (WLS and SCT), Switzerland, Iceland, Liechtenstein and Norway

[19] Bulgaria, Czechia, Denmark, Estonia, France, Italy, Cyprus, Lithuania, Hungary, Austria, Poland, Romania, Slovakia, Sweden, Finland, United Kingdom (ENG, WLS and NIR), Norway and Serbia

[20] Czechia, Estonia, France, Croatia, Italy, Lithuania, Luxembourg, Slovakia, Switzerland, Liechtenstein and Serbia

- Digital technologies are, unsurprisingly, mostly used in national tests to assess individual students' digital competences. This is the case in 13 education systems ([21]), where national tests to assess digital competences at upper secondary level may use digital technologies in the testing procedures. However, it is to be noted that upper secondary students in Greece, Croatia, Malta, Slovenia, and partly Cyprus have their digital competences assessed through paper-based tests. In Malta, this is also the case for lower secondary students, and in Austria for primary pupils. In Greece, a pilot project is taking place at lower secondary level to certify students' digital competences through a technology-supported national test. In Cyprus, out of the three subjects that integrate digital competences at upper secondary level, only one is tested using digital technologies (computer applications) (see Figure 3.4).

Figure 3: Use of digital technologies in national tests, primary and general secondary education (ISCED 1-3), 2018/19
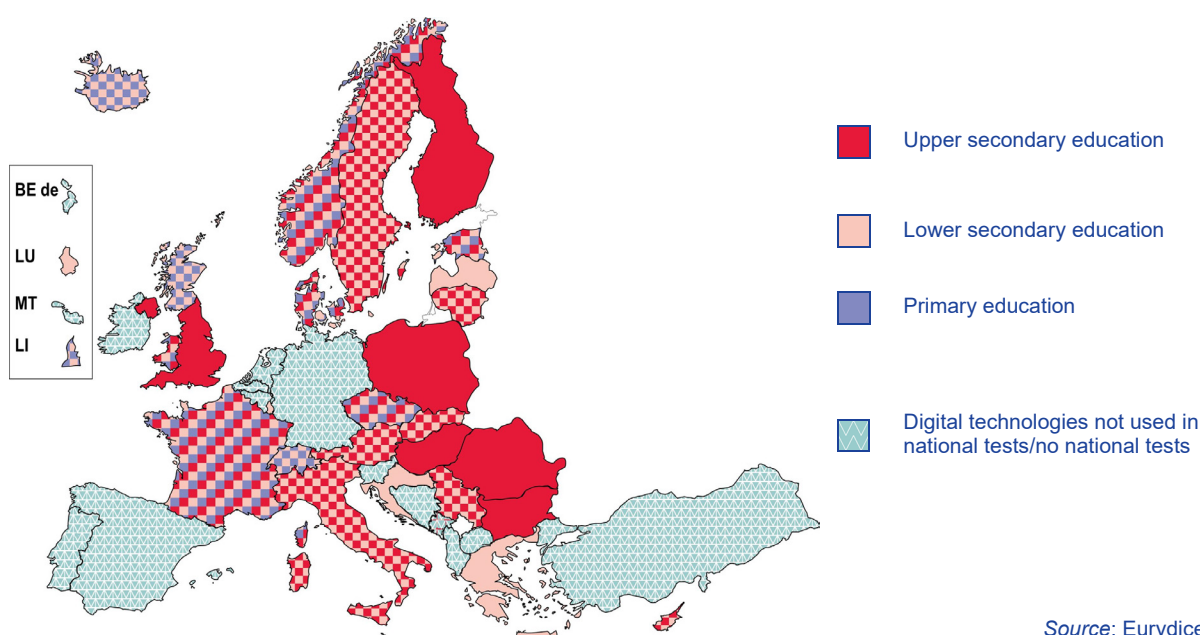
Source: Eurydice.

Explanatory note

This Figure is based on Figure 3.4 located in Chapter 3 'Assessing digital competences and using digital technologies in assessment'.

- In nine education systems ([22]), digital technologies are used in national tests related to individual student achievement to assess other competences, sometimes in addition to digital competences. Usually, these are literacy and numeracy.

- In some of the Nordic countries, digital technologies are used in the assessment of a wider range of subjects. This is the case in Norway at all education levels, in Denmark and Iceland at primary and lower secondary levels, and in Finland for the national test taken at the end of upper secondary education.

- In total, 14 education systems ([23]) do not use digital technologies in any of their national tests (see Figure 3.4).

([21]) Bulgaria, Denmark, France, Cyprus (partly), Lithuania, Hungary, Austria, Poland, Romania, United Kingdom (ENG, WLS and NIR) and Norway

([22]) Denmark, France, Slovakia, Finland, Sweden, United Kingdom (WLS and SCT), Iceland and Norway

([23]) Belgium, Germany, Ireland, Spain, Netherlands, Malta, Portugal, Slovenia, Albania, Bosnia and Herzegovina, Montenegro and North Macedonia

- The assessment of digital competences in technology-supported national tests in general upper secondary education most commonly combines on-screen testing with practical testing. This is the case in nine education systems (Bulgaria, Denmark, Lithuania, Austria, Poland, Romania, and the United Kingdom – England, Wales and Northern Ireland). In France, Cyprus and Hungary, testing is based only on practical demonstrations of the acquired competences, while in Norway only on-screen testing is used (see Figure 3.5).

Digital education strategies, monitoring and implementation

- The continuous and increasing digitalisation in society, as well as changes in technology itself, results in strategies and policies becoming rapidly out of date. European countries need to continually review and develop new strategic policies and measures to meet the new demands for high quality digital education. Therefore, virtually all education systems currently have strategies for digital education (see Figure 4.1).

- Almost half of the countries (mostly in eastern and south-eastern Europe) address digital education within a broader strategy. However, 18 education systems (mostly in western, central and northern Europe) ([24]) have a specific strategy in place (see Figure 4.1).

- While most countries across Europe have strategies in place for digital education at school level, procedures for the monitoring and evaluation of these strategies and related policies are not widespread, and where they do occur, they are rarely carried out on a regular basis. In the last five years, around half of the European education systems have undertaken some form of monitoring and/or evaluation of digital education policies, and only eight have done so at regular intervals (Flemish Community of Belgium, Bulgaria, Czechia, Estonia, Sweden, the United Kingdom – Scotland, Montenegro and Norway). In another 15 systems ([25]), monitoring and/or evaluation has taken place, but only on an ad hoc basis (see Figure 4.2).

- Almost two thirds of the top-level education authorities support one or more external agencies or bodies that have responsibilities in the area of digital education at school level. These agencies offer support to schools, school heads, teachers, students and policy-makers. They offer a range of different services such as continuing professional development, creation and dissemination of digital resources, raising awareness, providing assessment methods and tools, running digital platforms, and developing and maintaining a working digital infrastructure. Most top-level authorities support only one agency, while seven (Estonia, Greece, Lithuania, Austria, Poland, Slovenia and Sweden) support multiple agencies. In 20 education systems ([26]), they operate with a mandate that is wider than digital education at school level, and in eight (Greece, the Netherlands, Austria, Slovenia, the United Kingdom – England, Wales and Northern Ireland, and Switzerland), the mandate is focused exclusively on digital education (see Figure 4.3).

Support to schools

- A large majority of European countries currently have definite plans to invest in schools' digital infrastructure (see Figure 4.4). In many countries, investment in infrastructure is clearly indicated among the objectives of the digital education strategy. In some countries, investment in digital

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([24]) Bulgaria, Czechia, Denmark, Germany, Ireland, Spain, France, Italy, Luxembourg, Hungary, Austria, Slovenia, Slovakia, Sweden, United Kingdom (WLS and SCT), Switzerland and Norway

([25]) Denmark, Germany, Ireland, France, Croatia, Italy, Netherlands, Austria, Poland, Romania, Slovenia, Finland, United Kingdom (WLS and NIR) and Serbia

([26]) Belgium (BE nl), Denmark, Estonia, Ireland, Greece, France, Croatia, Cyprus, Lithuania, Hungary, Malta, Poland, Slovenia, Finland, Sweden, United Kingdom (SCT), Albania, Iceland, Montenegro and Norway

infrastructure is still an important need identified in relation to digital education and therefore a major focus of the strategy (e.g. in Bulgaria, Italy and Hungary).

• While the 2nd Survey of Schools on ICT in Education finds that around one third of students in primary and secondary education attend schools that have written statements on the use of ICT for pedagogical purposes (European Commission, 2019, p. 98-99), only a few European education systems refer to school development plans or digital development plans in their digital strategies or regulations (see Section 4.2.2).

• While the role of school heads is fundamental in promoting digital education at school, their training is less frequently and less explicitly stated in terms of objectives in current national strategies. Only one third of the education systems have, in fact, current measures in this area as part of their current strategy (see Figure 4.5).

• In about half of the European education systems, there are policies to support the appointment of digital coordinators in schools (see Figure 4.5). Digital coordinators, known also as ICT coordinators, may be assigned different tasks and responsibilities, but these usually cover both technical and pedagogical aspects. The digital coordinator role is usually assigned to ICT teachers or teachers specialising in digital education. In Ireland, Slovenia ([27]), Finland and the United Kingdom (Wales), a separate digital coordinator position may be created, while in Greece, Cyprus ([28]) (primary schools), Malta and Poland, the digital coordinators provide support to several schools.

• Parents' own attitudes and abilities are important in determining whether they can provide effective support for the development of their children's digital competences. However, only a minority of education systems currently report practical measures to involve and support parents in digital education. It is very rare for such measures to feature in the main objectives of digital education strategies (see Section 4.2.4).

• Digital learning resources are on the political agenda in many European education systems. Policies to improve the development and availability of digital learning resources (including Open Educational Resources) are evident in 32 education systems ([29]). Additionally, in 11 of these systems ([30]), top-level authorities have taken practical steps to ensure the quality of digital resources and Czechia is in this process. Moreover, in Czechia, Estonia, Croatia and Austria, top-level policies include the development of specific standards or qualitative requirements for digital learning resources (see Figure 4.6).

• Of the countries that carry out external school evaluation, only 14 ([31]) include specific criteria related to digital education in their external school evaluation frameworks. In these education systems, evaluators are required to consider different aspects of digital education including how well digital technologies are integrated into teaching and learning or school management processes, or whether the quality of IT infrastructure meets the required standards (see Figure 4.7).

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[27] In small-size schools there are no full-time digital coordinator posts. Digital coordinator's role may be performed by a teacher having appropriate qualification or assumed by school heads or their deputies.

[28] In secondary education, an ICT/computer science teacher is assigned the task of coordinating technical aspects/maintenance of digital technologies in each school.

[29] Belgium (BE fr and BE nl), Czechia, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Croatia, Italy, Cyprus, Latvia, Luxembourg, Hungary, Malta, Austria, Poland, Portugal, Romania, Slovenia, Slovakia, United Kingdom (all four jurisdictions), Albania, Switzerland, Liechtenstein, Norway and Turkey

[30] Estonia, Ireland, Greece, France, Croatia, Malta, Austria, Slovenia, Slovakia, Switzerland and Norway

[31] Czechia, Estonia, Ireland, Spain, Latvia, Lithuania, Hungary, Malta, Poland, Romania, United Kingdom, Albania, Liechtenstein and North Macedonia

INTRODUCTION

Digital technologies have revolutionised our society, and children today grow up and live in a world where these are ubiquitous. The 4th industrial revolution, the term originally coined by Schwab (2016) to describe the spread of digital technologies, affects all aspects of life, from health to commerce, from social interactions to the way people work. Education systems are no less affected, not only because technology can impact the way education is delivered, but also because education has a role to play in preparing young people for a tech-driven world. Moreover, as research has long shown, growing up in the digital age does not make 'digital natives' (Prensky, 2001), inherently competent and confident with digital technologies (European Commission, 2014). Surveys indicate, in fact, that the use of technology is to a great extent restricted to non-school, leisure time activities, while engagement with technology for educational purposes in school lags behind (OECD, 2015b).

The challenges posed by and the potential benefits of digital education in school are manifold. From a labour-market perspective, there is a skills gap to fill, as an increasing number of jobs require a high level of proficiency in the use of technologies and many new jobs are based on specialised digital skills (Cedefop, 2016). From a social point of view, the challenge is one of inclusiveness: a digital divide between those with no or only basic digital skills, and others with higher level skills could widen existing gaps in society and further exclude some parts of the population (European Commission, 2017b). From an educational point of view, the challenge is not only to ensure that young people develop the digital competences needed, but also to reap the benefits from the pedagogical use of technology (Cachia et al., 2010).

Empirical evidence on the effects of using digital technologies for educational purposes and for improving learning outcomes is still scarce and the findings are mixed (Bulman and Fairlie, 2016; Escueta 2017). However, several potential benefits are already apparent. The use of technology could provide innovative and stimulating learning environments, facilitate individualised learning and increase student motivation (Blossfeld et al., 2018; Süss, Lampert and Wijnen, 2013).

The educational perspective also means preparing young people to use digital technologies effectively and safely. Some of the risks posed to students' personal well-being such as through cyber-bullying and internet addiction, as well as the loss of privacy, have long alerted policy makers to the need to make safety an essential part of digital education (European Commission, 2017a). International scandals related to the misuse of personal data, web-tracking, and the spreading of fake news have put the spotlight on the crucial role that education can play in preparing young people to be digitally mature.

European and national policies have long acknowledged as a priority, the need for all citizens to understand that, as a key competence, digital competence must continue to be developed throughout life. It has featured among the key competences for lifelong learning since the first European Recommendation on this issue was published in 2006 ([32]). In the latest revision published in May 2018, digital competence is defined as the confident, critical and responsible use of and engagement with digital technologies for learning, work, and participation in society ([33]).

Similarly, the Communication from the Commission on the Digital Education Action Plan (European Commission, 2018) from January 2018 also defines digital competence in terms of the confident and critical use of digital technology. It focuses on the need to encourage, support and scale up purposeful use of digital and innovative education practices. Its two first priorities are: 1) making better use of

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[32] Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning, OJ L 394, 30.12.2006, p. 10-18.

[33] Council Recommendation of 22 May 2018 on key competences for lifelong learning, OJ C 189, 4.6.2018, p. 1-13.

digital technology for teaching and learning; 2) developing relevant digital competences and skills for the digital transformation.

This report uses the expression 'digital education' to highlight these two different but complementary perspectives: the development of learners' and teachers' digital competences on the one hand, and the pedagogical use of digital technologies to support, enhance and transform learning and teaching on the other.

The European framework for digital competence, also known as DigComp, was first published in 2013 (Ferrari, 2013) and has since been revised several times. This framework has been used as a reference throughout this report. It describes digital competence in detail and divides the knowledge, skills and attitudes that all citizens need in a rapidly evolving digital society into five areas:

1. Information and data literacy;

2. Communication and collaboration;

3. Digital content creation;

4. Safety;

5. Problem solving.

Regarding the pedagogical use of digital technologies, the prime factor is teachers' digital competence, with particular emphasis on whether they see the use of digital technology as an added value to their teaching and to their students' learning experience. At European level, this has been captured in a specific competence framework for educators, the European Framework for the Digital Competence of Educators (Redecker, 2017). Teachers' digital competences and related teaching and learning practices are also addressed in the European Framework for Digitally Competent Educational Organisations (DigCompOrg). SELFIE (Self-reflection on Effective Learning by Fostering the use of Innovative Educational Technologies) ([34]), is an online and free self-reflection tool for schools, based on DigCompOrg, that helps schools to identify strengths and weaknesses in their use of digital technologies for teaching and learning.

Those three European frameworks (DigComp, DigCompEdu, DigCompOrg/SELFIE) aim to provide a common language and common ground for discussions and developments at national, regional and local levels. Moreover, they offer a consistent set of self-reflection tools at European level addressing citizens and learners (DigComp), educators (DigCompEdu) as well as schools (DigCompOrg/SELFIE).

Besides teachers' own ability to use digital technologies, it is important to underline that pedagogy is central: a teacher does not necessarily need to be fully conversant with technologies in order to use them in a way that improves the teaching and learning experience. Rather, they have to be open to innovative pedagogies and to understand the benefit these technologies can bring to their work.

Attitudes among teachers (as well as parents and society as a whole) can typically range from pessimism to euphoria. The former is rooted in the threats posed by the (excessive) use of technology and the requirement for a high degree of self-regulatory skill among users, whilst the latter is based on highly optimistic views of the potential uses of digital media in education, which consequently demands that schools are well-equipped in terms of digital infrastructure (Blossfeld et al., 2018). The hypothesis that seems to be closest to empirical findings is that the outcomes of the use of digital technologies in education depend on a variety of conditions, such as the type of learner, the intensity of use and the motivation for engagement, as well as the quality of digital resources and pedagogy.

([34])   https://ec.europa.eu/education/schools-go-digital_en

The current focus in digital education, namely capacity building among teachers, follows the first policy wave that gave priority to infrastructure development (Conrads et al., 2017). Obviously, countries are at different stages in the development of digital education, which means that for some digital infrastructure might still be the priority. At the same time, empirical evidence has shown that improvements in infrastructure do not systematically lead to the integration and pedagogical use of digital technology in schools across Europe. Still, the quality of pedagogy is the single in-school factor that has the greatest impact on students' learning outcomes. Thus, the development of teachers' digital competence is a critical component if investment in digital technologies is to be maximised, and if education systems are to keep pace with 21st century needs.

Content and structure of the report

This report analyses many different aspects of digital education but it has a particular focus on the areas in which top-level education authorities have a role to play. It is intended to add to the existing body of evidence, to encourage the exchange of best practice, and to support policy makers in developing new policies and planning reforms.

The report is divided in four chapters covering:

1. school curricula and learning outcomes related to digital competence;
2. the development of teachers' digital competence;
3. the assessment of students' digital competences and the use of digital technologies to assess students;
4. top-level strategies and policies on digital education in school.

Both dimensions of digital education are analysed: the teaching and learning of digital competences, and the pedagogical use of digital technologies. The first dimension is explored through an analysis of the curriculum and assessment procedures for digital competences, while the second dimension focuses on teachers' competences and the use of technologies for assessment in general.

The first chapter gives an overview of how European education systems address the development of students' digital competence through primary and general secondary school curricula. Firstly, the chapter looks at how countries define digital competence. Secondly, it looks at the main approaches to teaching digital competences, namely, as a cross-curricular topic, a separate subject, or integrated into other subjects. It also examines the recommended instruction time for ICT as a compulsory separate subject. Current curricular reforms related to teaching digital competences are then explored. Thirdly, the areas of digital competence as expressed in the explicit learning outcomes for the curriculum are analysed using the DigComp framework as a reference. Finally, the analysis takes a closer look at how eight of the framework's digital competences are integrated into primary and secondary education curricula in terms of learning outcomes, namely: evaluating data, information and digital content, collaborating through digital technologies, managing digital identity, developing digital content, programming/coding, protecting personal data and privacy, protecting health and well-being and identifying digital competence gaps.

The second chapter deals with the development of teacher-specific digital competences during their initial training and whilst in service. The information provided draws on teacher competence frameworks and regulations/recommendations on initial teacher education (ITE) issued by top-level authorities. It shows whether these documents refer to the development of digital competences, and if so, at what level of detail. This chapter also looks at whether any assessment of teacher-specific digital competences is mandatory prior to their entry into the profession. Finally, to provide an overview of the development of teacher-specific digital competences during their career, the chapter

maps the different types of support promoted by top-level education authorities, namely continuous professional development, self-assessment tools and teacher networks.

The third chapter analyses the relationship between digital technologies and assessment. Firstly, it addresses the assessment of students' digital competences by focusing on national tests in related subjects and on the guidance provided to teachers for classroom assessment. It also examines whether students' digital competences are shown on school certificates. The second part of the chapter explores the use of digital technologies for administering national tests in any subject area, looking at the purposes, kinds of testing, and the technological environment in which the tests are carried out.

The fourth and last chapter analyses national policies related to digital education. First, it looks at whether European countries currently have strategies in place that either specifically tackle digital education in schools or include it in a broader strategy related to digitalisation. The chapter also looks at whether top-level authorities undertake any monitoring and/or evaluation of progress made in the implementation of digital education and whether they assess the impact of their policies. In many European countries, top-level authorities have created a specific body and/or agency, or mandated an existing one, to take responsibility for supporting and developing digital education in schools. The types of services offered to schools, teachers and students by these agencies are also analysed. The second part of the chapter delves into the specific policies that are part of the many initiatives taken across Europe that can be critical in moving forward digital education in schools. These include any support provided to schools through investment in infrastructure, school digital plans, the training of school heads or the appointment of school digital coordinators. The involvement of parents is also examined as is the development of digital learning resources, particularly with respect to their quality. In this context, the chapter also addresses the existence of criteria related to digital education in external school evaluation frameworks.

In addition, the report includes five annexes that provide further national information on the different aspects discussed in the main chapters. Annex 1 first provides details on the curricular approaches to digital education in schools, with further information on the subjects and the education levels covered. This is followed by an overview of the digital competence areas covered by curricula in terms of learning outcomes. Annexes 2 and 3 list the teacher competence frameworks providing links for further analysis. Annex 4 contains the references to all the strategies currently in operation on digital education in schools, providing a short description, timeframe, education levels covered and web links where further information can be found. Finally, Annex 5 lists all the current bodies and/or agencies that support digital education at school level on behalf of the top-level authorities.

Scope of the report and sources of information

This report addresses digital education in Europe at primary and general (lower and upper) secondary levels ([35]) (ISCED levels 1, 2 and 3).

Publicly funded schools are the focus in all countries. Private schools are not included, except for grant-aided private schools in the small number of countries where such schools enrol a large proportion of pupils, namely Belgium, Ireland, the Netherlands, and the United Kingdom (England). Grant-aided private schools are schools that receive more than half of their basic funding from public sources.

([35]) For precise information on full-time compulsory primary and secondary general education in each country, see: European Commission/EACEA/Eurydice, 2018, *The Structure of the European Education Systems 2018/19: Schematic Diagrams. Eurydice Facts and Figures*. Luxembourg: Publications Office of the European Union.

The reference year is 2018/19. The report covers 43 education systems, including the 28 EU Member States, as well as Albania, Bosnia and Herzegovina, Switzerland, Iceland, Liechtenstein, Montenegro, North Macedonia, Norway, Serbia, and Turkey.

The information has been collected through a questionnaire completed by national experts and/or the national representative of the Eurydice Network. The prime sources of information and the analysis contained in the report always refer to regulations/legislation and official guidance issued by top-level education authorities, unless otherwise stated.

The preparation and drafting of the report was coordinated by Unit A7, Erasmus+, the Education and Youth Policy Analysis unit of the Education, Audiovisual and Culture Executive Agency (EACEA).

An 'Acknowledgements' section at the end of the report lists all those who have contributed to it.

CHAPTER 1: CURRICULUM

This chapter gives an overview of how European education systems address the development of students' digital competences in primary and general secondary education curricula (ISCED 1-3). This period of compulsory, formal education is an important formative time for young people's learning as it lays the foundation for their future studies and working lives. Looking at the aims and objectives set for the development of this key competence in national curricula is a way of understanding the importance placed on digital competences by top-level education authorities. Becoming digitally competent is essential if young people are to be able participate effectively in a digitalised society and economy; not addressing these skills risks exacerbating the digital divide and perpetuating existing inequalities (OECD, 2019a, p. 38).

For 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.

A first short section looks at how 'digital competence' is defined, either in national curricula or other policy documents such as top-level strategies related to digital education. This may be a purely national definition or it may make reference to the European key competences.

As this definition is often laid down in national curricula, it leads to the second section on curricular approaches to teaching digital competences. These approaches may include teaching and learning through a cross-curricular topic, a separate subject, or several other subjects (integrated approach). Often national curricula combine several of these approaches. In this context, a closer look is taken at the recommended instruction time for compulsory separate subjects related to information and communication technology (ICT) in compulsory education. Finally, this section maps which education systems are currently revising their curricula related to digital competences.

The third section analyses how European education systems address digital competence in terms of curriculum content. The European framework DigComp is used as a reference. The section looks first at the coverage of the five broad areas of competence defined in the framework before examining eight of the 21 specific competences in closer detail in terms of learning outcomes.

1.1. European and national definitions of digital competence

At European level, digital competence has long been acknowledged and defined as one of the key competences for lifelong learning, initially appearing in the 2006 Recommendation ([36]). In the latest edition of May 2018, digital competence is defined as 'the confident, critical and responsible use of, and engagement with, digital technologies for learning, work, and for participation in society' ([37]). A comprehensive framework describing the competence in more detail was first published in 2013 and later updated. It has become a common reference tool both at European and national level. It divides digital competence into five areas, namely, information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. The latest version, DigComp 2.1 (Carretero, Vuorikari & Punie, 2017), has added proficiency levels and examples of use.

The national definitions of digital competence analysed below are drawn from curriculum documents or strategies produced by top-level authorities.

([36]) Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning, OJ L 394, 30.12.2006, p. 10-18.

([37]) Council recommendation of 22 May 2018 on key competences for lifelong learning, OJ C 189, 4.6.2018, p. 1-13.

Figure 1.1 shows that nearly half of the European education systems refer to the European key competence definition of digital competence, while 11 education systems use only their own national definition ([38]). Although the use of the European key competence definition is widespread, it seems more common in southern and eastern Europe. The use of purely national definitions is found slightly more often in northern Europe, but also in Croatia, Portugal, Slovakia and Turkey.

The 11 education systems that use only a national definition, nevertheless refer to similar areas of competence as those specified in the DigComp framework (information and data literacy, communication and collaboration, digital content creation, safety, and problem solving). The exact formulation may, however, differ slightly, or other areas may be added.

Also, in several other countries, the national definitions not only differ in their formulation and the terms used but also, in some cases, they have a different, sometimes narrower focus than the DigComp framework.

> The **Dutch** definition stated in the curriculum refers to four areas: basic information and communication technology skills, information skills, media awareness and computational thinking. In comparison with the European key competence definition, there is therefore more focus on media awareness and computational thinking.
>
> In **Portugal**, the InCoDe 2030 ([39]) definition of digital competence includes the notion of digital literacy as well as the production of new knowledge through research. It is narrower than the European key competence definition and the concepts of safety, digital well-being and intellectual property rights are absent. However, in essentials skills and in citizenship education, these are included in compulsory school curricula.
>
> In **Serbia**, the definition from the national digital competence framework puts the accent on the pedagogical use of technology. Digital competence refers to a set of knowledge, skills, attitudes, abilities and strategies necessary for effective use of information and communication technologies and digital media. It seeks to ensure deliberate, flexible and safe use of the technologies, as well as improving the teaching and learning process and activities in both on- and off-line environments.

In eight countries (Estonia, France, Cyprus, Lithuania, Malta, Austria, Albania and Serbia), both the European key competence definitions and a national definition have been or are currently in use. In France and Austria, national definitions refer to, or have been based on the European key competence definition and/or the DigComp framework.

> In **France**, the reference used to be the 2006 European recommendation on key competences. However, since 2015 a new definition of key competences has been adopted (*socle commun de connaissances, de compétences et de culture* – common basis of knowledge, competences and culture). Digital competence is defined along two lines. The first refers to it as a language: programming languages and algorithms. The second refers to it as a tool, namely to use digital technologies to search and access information and to produce digital content. Through these two lines, and in the context of the national project 'For a school of trust', special attention is given to the development of digital citizenship.
>
> The **Austrian** definition is based on the European key competence definition and the DigComp framework and is reflected in the new curriculum subject, *digitale Grundbildung* (basic digital education). Basic digital education encompasses digital literacy, media literacy and political literacy. Teaching digital competences enables pupils to select, reflect upon and apply suitable tools and methods for specific scenarios in an academic, professional and private context on the basis of a broad overview of current digital tools. The acquisition of competences in the field of digital technologies is always done in a reflective way and also bears in mind the prerequisites and consequences, advantages and disadvantages and social effects of the use of technology.

([38]) Germany, Croatia, Netherlands, Portugal, Slovakia, Sweden, United Kingdom (WLS and SCT), Iceland, Norway and Turkey

([39]) http://www.incode2030.gov.pt/sites/default/files/incode2030_en.pdf

Figure 1.1: Use of national and/or European definitions of digital competence for school education as stated in curricula or related strategies, 2018/19

National definition of digital competence

European key competence definition

No common definition of digital competence
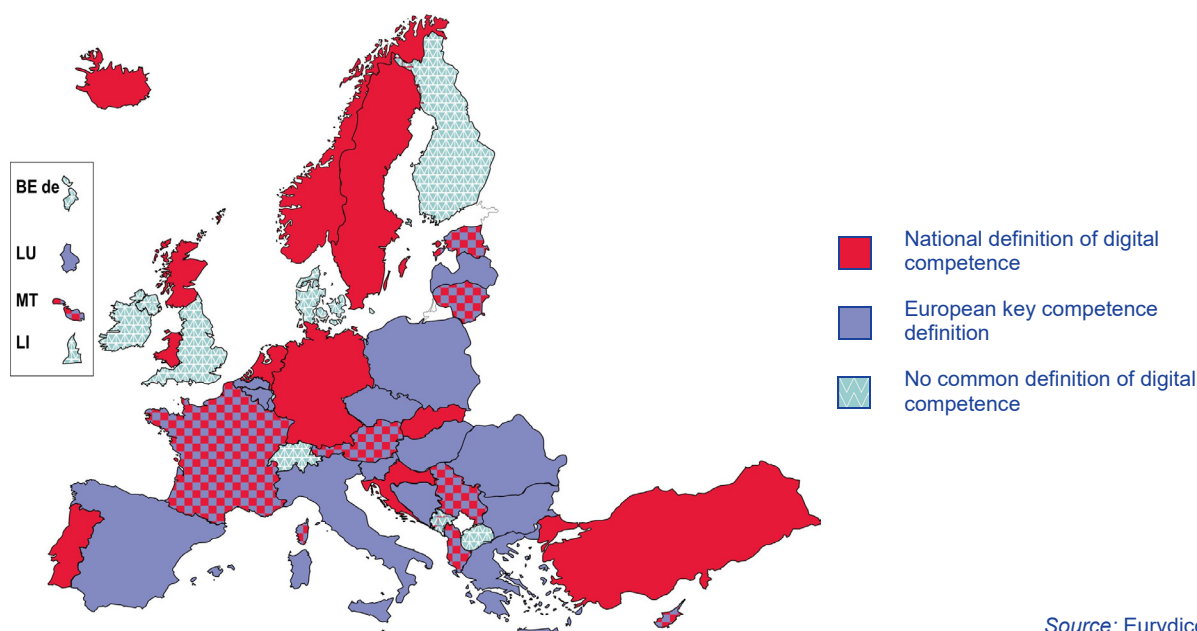
Source: Eurydice.

Explanatory note

The category 'European definition' refers both to the 2006 definition of digital competence as a key competence in the Council Recommendation, and to the latest 2018 edition.

Country-specific notes

Belgium (BE de): Only a general definition of media competence is used.
Denmark: While no official national or European definition is used, national descriptions of digital competences have been incorporated into curricula for the related educational areas and subjects.
Switzerland: Digital competence is defined in each of the language regions for ISCED 1 and 2. For general upper secondary education, a national definition exists.

In nearly a dozen education systems, the top-level authority does not define digital competence.

For some countries, this means that there is no single common definition but there may be a range of expected competences, such as in Ireland, where the Digital Learning Framework for Schools identifies standards with due regard to both the UNESCO Competency Framework and the European DigComp framework; or in the United Kingdom (Northern Ireland), where the curriculum must ensure that learners become digital citizens, digital workers and digital makers.

In two countries, Denmark and Hungary, the national definition is currently being developed or updated in the framework of ongoing reforms or programmes in the area of digital competence (see Section 1.2.3 and Figure 1.4 on current reforms linked to digital competence).

> **Denmark** is currently (between 2018 and 2021) testing how 'technological comprehension' can be taught as a separate subject and how it can be integrated into other subjects.

> In **Hungary**, the definition used in the curriculum is based on the 2006 European recommendation on key competences, which is by now outdated. Therefore, the Hungarian Digital Education strategy requires a reconceptualisation of the definition, without actually providing one. The official formulation of a new definition is currently underway and is being developed during the process of renewing the national core curriculum.

1.2. Curriculum approaches to digital competence and current developments

1.2.1. Main approaches in primary and secondary education curricula

The development of learners' digital competences is referred to in almost all of the primary and secondary curricula of European education systems. However, unlike other traditional school subjects, this curriculum area is not only delivered as a topic in its own right, but also as a transversal key competence. It can be integrated within school curricula in three main ways:

- As a **cross-curricular theme**: 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.

- As a **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.

While digital competences are part of the curriculum in the vast majority of countries at all three education levels, eight education systems (French and German-speaking Communities of Belgium, Croatia, Latvia, Luxembourg, Albania, Bosnia Herzegovina and Turkey) do not explicitly include them in their national curriculum for primary education during the reference year (2018/19). However, three among them, namely the French Community of Belgium, Croatia and Latvia are currently reforming the curriculum to introduce digital competences or are in the process of implementing ongoing curriculum changes as from primary education. Furthermore, two education systems (the French and German-speaking Communities of Belgium) also do not explicitly include them in their national curriculum for secondary education.

In a few countries the education system is more decentralised, leaving schools considerable autonomy. Consequently, the notion of a top-level/national curriculum applies differently. This is the case in the Netherlands, where schools have full autonomy to organise their teaching, as well as in the United Kingdom (Scotland), where the curriculum is not statutory, which means that digital competences are delivered by means of an entitlement rather than an obligation.

In primary education, more than half of the European education systems include digital competences as a cross-curricular theme. In 11 education systems ([40]), digital competence is addressed as a compulsory separate subject and in ten ([41]) it is integrated in other compulsory subjects. A quarter of the education systems combine two approaches ([42]), while in Czechia and Liechtenstein all three exist at the same time. In Romania, there is only an optional separate subject as this education level. Teaching digital skills as a transversal key competence is still dominant at this education level, although many education systems also already have separate, more specialised subjects.

In lower secondary education, the situation is quite similar regarding the cross-curricular and integrated approach. However, the number of countries teaching digital competences as a compulsory separate subject increases to over half of the education systems. At this education level, teaching digital competences as a separate, specialised subject, like informatics or computer science, becomes more widespread.

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[40] Bulgaria, Czechia, Greece, Poland, Portugal, United Kingdom (ENG and WLS), Iceland, Liechtenstein, Montenegro and North Macedonia

[41] Czechia, Ireland, Spain, France, Italy, Cyprus, Lithuania, Slovenia, Sweden and Liechtenstein

[42] Ireland, Greece, Spain, France, Italy, Poland, Portugal, Slovenia, Sweden, United Kingdom (WLS) and Iceland

Figure 1.2: Curriculum approaches to teaching digital competences according to national curricula for primary and general secondary education, (ISCED 1-3), 2018/19

Primary (ISCED 1)
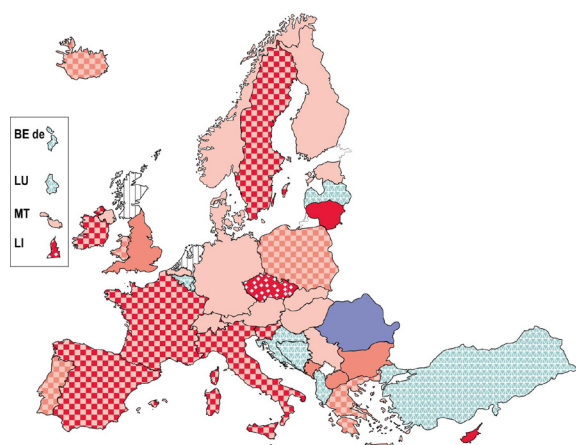
Lower secondary (ISCED 2)
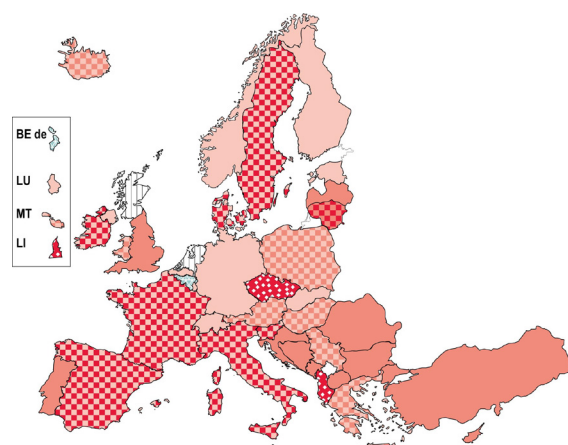
Upper secondary (ISCED 3)
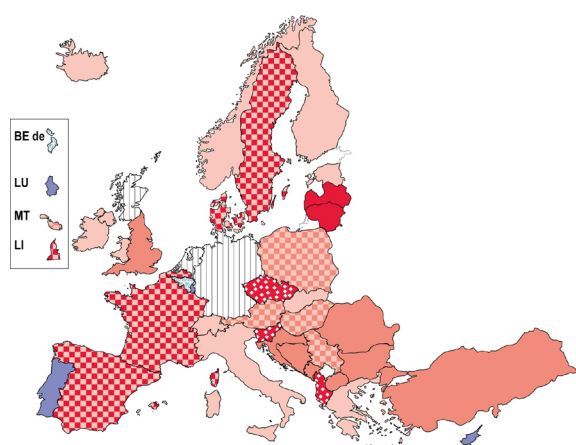
Cross-curricular

Compulsory separate subject

Integrated into other compulsory subjects

All three approaches

Only as an optional separate subject

School/regional autonomy

Not included in the curriculum

Source: Eurydice.

Compulsory and optional separate subjects

	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	CY	LV	LT	LU	HU	MT	AT
ISCED 1	●	●			○		●				○		○				
ISCED 2	●	●			○	○	●			●	●	●	●		●	●	●
ISCED 3	●	●	○		○		○	○	○	●	○	○	○	○	●	●	●
	PL	PT	RO	SI	UK-ENG	UK-WLS	UK-NIR	AL	BA	IS	LI	ME	MK	NO	RS	TR	
ISCED 1	●	●	○	○	●	●				●	●	●	●		○		
ISCED 2	●	●	●	○	●	●		●	●	●	●	●	●	○	●	●	
ISCED 3	●	○	●	●	●	○	○	●	●		○	●	●	○	●	●	

● = Compulsory   ○ = Optional

Explanatory note

Most countries have several approaches to incorporating digital competences in their curricula and these may change between grades or education level. By compulsory, this Figure refers to subjects that are compulsory for all students. Subjects that are compulsory, but only for some students, offered in certain educational pathways or school types, are shown here as optional.
As the map only shows where digital education is delivered through optional subjects when this is the only curriculum approach, the table below the map provides additional information on all countries with separate subjects related to digital competence showing whether these are compulsory or optional. See Annex 1a for more country-specific information.

Country-specific notes

Belgium (BE fr): Digital skills are not included in the curriculum in force in 2018/19, but a reform is in progress, and it will include an adaptation of the DigComp framework (see Section 1.2.3).

Belgium (BE de): A recently developed framework guide for the development of information and media competences has given impetus to the development of digital competences and serves as a basis for the development of school curricula in this area. However, it is not binding.

Germany: The strategy 'Education in the digital World' covering primary and lower secondary education has been taken as a national curriculum, although curricula are normally decided at *Länder* level.

Croatia: The regulation on the curriculum for the subject 'informatics' applies to secondary education from the 2018/19 school year and for primary education as from 2020/21. However, under the experimental *Škola za život* (School for Life) programme, which is part of the recent curriculum reform, informatics has already been introduced in the 48 participating primary schools as a subject for students in the 1st grade of primary education.

Cyprus: The separate subject in ISCED 3 is compulsory in year one and optional in years two and three.

Latvia: In 2015 a project for the subject *Datorika* (computing) was introduced as of the first year of primary education. It is not a requirement, but many schools provide it as a compulsory subject.

Austria: The new subject called *digitale Grundbildung* (digital basic education) may be integrated into other subjects with a dedicated number of hours and/or being offered as a separate subject.

Portugal: As a consequence of the current curriculum reform, the approach to digital competences is cross-curricular in lower primary education (grades 1-4) while in upper primary (grades 5 and 6) and lower secondary education students have a compulsory separate subject. For 2018/19, this reform is only implemented in the first years of each cycle. It will be gradually extended to the other grades.

Slovakia: Schools have the autonomy to decide how the cross-curricular topic will be integrated into the school education programme, whether as a separate subject or integrated into other compulsory subjects.

Finland: Moreover, in primary and lower secondary education, a part of lesson hours are allocated to optional subjects or instruction with a certain emphasis, which may contain elements of transversal competences such as digital competences. In general upper secondary education, schools can provide optional local specialisation or applied courses concentrating on digital competences. The contents are decided by the education provider in accordance with the national core curricula.

United Kingdom (ENG): Academies (publicly funded independent schools) do not have to follow the statutory national curriculum requirements but may choose to do so.

Switzerland: *Cantons* are free to decide how to organise the teaching and learning of ICT. Some have it as a separate subject for some grades, some integrate it into other subjects and all of them also incorporate it as a cross-curricular element.

Serbia: The development of cross-curricular competences is rather new. But there is a long tradition of integrating digital competences into other subjects, and this approach is now also supported by national strategies, but is not mandatory for teachers.

At upper secondary level, the number of countries teaching digital competences as a cross-curricular topic decreases slightly. Compared to lower secondary education, fewer countries offer compulsory separate subjects for all students in this area. Indeed, at this education level it is usual for students to choose optional subjects. Therefore, in 14 countries ([43]), digital competences are also taught as a separate subject that is either optional or only compulsory for some students (see table below Figure 1.2). In Luxembourg and Portugal, digital competences are only delivered in this way at this level. Furthermore, the separate subjects at this level are often more specialised, even more so than in lower secondary education. However, as they are often optional they are not studied by all students. In this context, it is important to highlight that there is a difference between teaching broad digital competences as a transversal key competence, as is the focus of this report, and the teaching of a specialised, scientific discipline like informatics or computer science (CECE, 2017).

At different education levels, several countries deliver digital competences through optional separate subjects instead of compulsory ones, generally besides other curriculum approaches (cross-curricular, integrated). In Estonia, this is the case at all three education levels; in Romania and Serbia in only primary education; in Slovenia in both primary and lower secondary education; in Ireland in only lower secondary education; in Norway in both lower and upper secondary education; in Lithuania in both primary and upper secondary education, and in Denmark, Greece, Spain, France, Latvia, Luxembourg, Portugal, the United Kingdom (Wales and Northern Ireland) and Liechtenstein in only upper secondary education (see the table below Figure 1.2).

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[43] Denmark, Estonia, Greece, Spain, France, Cyprus, Latvia, Lithuania, Luxembourg, Portugal, United Kingdom (WLS and NIR), Liechtenstein and Norway

1.2.2. Instruction time for digital competences taught as a compulsory separate subject

As seen previously (see Figure 1.2), digital competences are often taught as a compulsory separate subject. This is the case in nearly a dozen countries at primary level, and more than half of the countries in lower and upper secondary education.

It is therefore worth taking a look at the available data on the recommended minimum annual instruction time for the compulsory separate subjects relating to developing digital competences for all students in primary and compulsory general secondary education. The Eurydice publication on instruction time refers to information and communication technologies (ICT) subjects, as follows: 'Includes subjects such as informatics, information and communication technologies or computer science. These subjects include a wide range of topics concerned with the new technologies used for the processing and transmission of digital information, including computers, computerised networks (including the internet), microelectronics, multimedia, software and programming, etc.' (European Commission/EACEA/Eurydice, 2019, p. 148) see Annex 1a for subjects related to digital competence).

Figure 1.3 shows the recommended minimum instruction time specifically allocated to teaching digital competences as a compulsory separate subject by education level up to the end of compulsory education in 21 education systems ([44]). In some of these, the total time allocated to developing digital competences during compulsory education is, in practice, more than the data shows, given that they are also addressed through other subjects, as cross-curricular topics or as optional subjects, particularly at secondary level.

Many other countries do not appear in Figure 1.3 as digital competence is taught other than as a compulsory separate subject (see Section 1.2.1), or because upper secondary level is beyond the period of compulsory education. For the Netherlands and the United Kingdom (England, Wales and Scotland), it is not possible to indicate instruction time, as this is not specified for any curriculum area. It is left to schools to decide how to distribute curriculum time to specific subjects within the framework of school autonomy.

At primary level, it is possible to indicate a recommended minimum instruction time for digital competences for 11 countries, namely Bulgaria, Czechia, Germany (individual *Länder*), Greece, Latvia, Poland, Slovakia, Albania, Iceland, Montenegro and North Macedonia. Among these, Iceland, Greece and North Macedonia have the highest number of recommended hours, with around 150 hours at this level of education.

With more than 152 and 135 hours respectively, Lithuania and Cyprus have allocated the highest number of hours during lower secondary education, although they do not have any recommended instruction time for primary education. Five other countries only indicate instruction time in lower secondary education, namely Croatia, Bosnia and Herzegovina, Liechtenstein, Serbia and Turkey. Other countries have recommended hours in primary and lower secondary compulsory education (Czechia, Greece, Latvia, Poland, Albania, Iceland and Montenegro), lower and upper secondary compulsory education (Hungary, Malta and Romania), or even at all three levels (Bulgaria, Germany – individual *Länder*, Slovakia and North Macedonia).

For the upper secondary level, only seven countries specify the recommended minimum instruction time allocated to teaching digital competences (Bulgaria, Germany – individual *Länder*, Hungary,

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[44] Bulgaria, Czechia, Germany (individual *Länder*), Greece, Croatia, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Romania, Slovakia, Albania, Bosnia and Herzegovina, Iceland, Liechtenstein, Montenegro, North Macedonia, Serbia and Turkey

Malta, Romania, Slovakia and North Macedonia). There are several reasons for this. Compared to the lower education levels, there are more countries which offer optional subjects related to digital competences (see table below Figure 1.2). Another reason is that the figure only shows the grades which form part of compulsory education. Therefore, the subjects delivered in non-compulsory upper secondary education are not captured.

The length of the period of upper secondary education that falls within compulsory education varies between countries (European Commission/EACEA/Eurydice, 2018b). However, Romania appears to have the highest amount of instruction time for ICT (digital competences) as a compulsory separate subject in compulsory upper secondary education (168 hours).

Figure 1.3: Recommended minimum instruction time for ICT as a compulsory separate subject for all students by education level in primary and compulsory general secondary education (ISCED 1-3), 2018/19
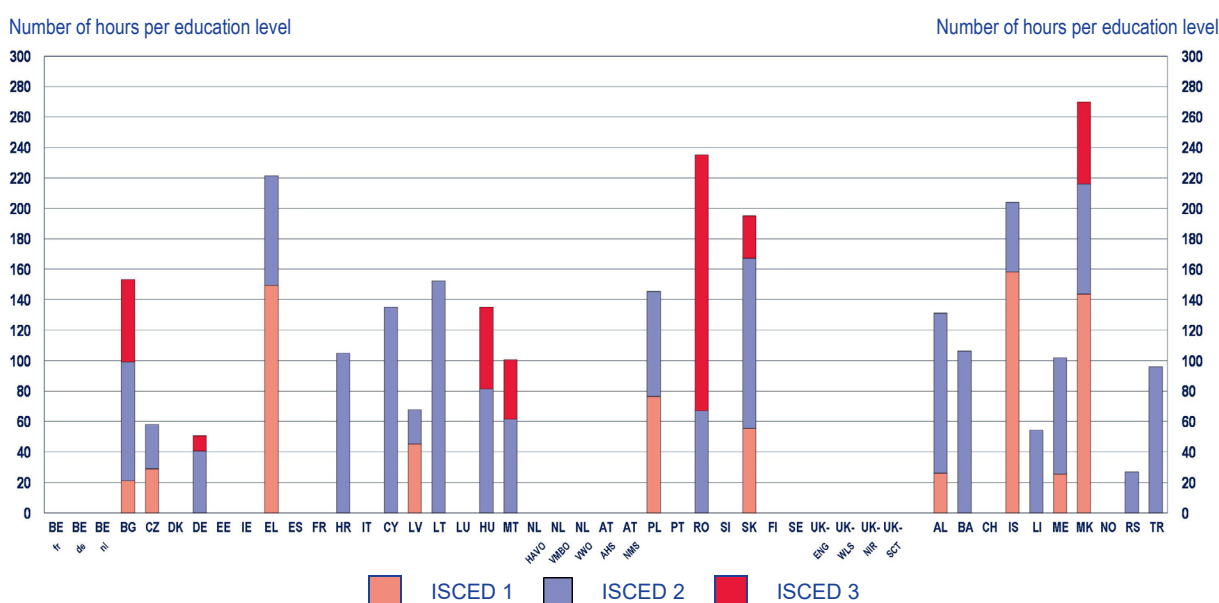
	BE fr	BE de	BE nl	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY	LV
ISCED 1				21.3	29.1		0.2			149.6						45.3
ISCED 2			78	29.1		40.6			72			105		135.2	22.7
ISCED 3				54	(-)	(-)	10.1			(-)			(-)		(-)	(-)

	LT	LU	HU	MT	NL HAVO	NL VMBO	NL VWO	AT AHS	AT NMS	PL	PT	RO	SI	SK	FI	SE
ISCED 1										76.6				55.8		
ISCED 2	152.6		81.5	61.6						69.1		67.2		111.6		
ISCED 3	(-)		54	39.1						(-)		168	(-)	27.9	(-)	(-)

	UK-ENG	UK-WLS	UK-NIR	UK-SCT	AL	BA	CH	IS	LI Gym/Reals	LI Obs	ME	MK	NO	RS	TR
ISCED 1					26.3			158.7			25.5	144			
ISCED 2					105	106.5		45.3	54.6	81.9	76.5	72		27	96
ISCED 3					(-)	(-)	(-)		(-)	(-)	(-)	54	(-)	(-)	

Source: Eurydice.

Explanatory note

The data for this Figure stems from the Eurydice data collection on recommended annual instruction time (European Commission/EACEA/Eurydice, 2019) and covers compulsory education only. It specifies the total amount of recommended minimum instruction time in hours and by education level within compulsory education. Education systems in which upper secondary education is not compulsory are indicated in the table below the figure as not applicable (-) in the respective line. In most countries, only some grades of upper secondary education are within compulsory education.

Country-specific note

Liechtenstein: Figure 1.3 shows the number of hours recommended in the *Gymnasium* and *Realschule* which are the most representative school types in the country. The table below the Figure also indicates the information for the *Oberschule*.

1.2.3. Ongoing curriculum reforms related to digital competences

Digital technologies change very rapidly. Consequently, more than for any other curriculum area, education authorities must find a way of keeping pace with new developments, and at the same time offer learning content that does not become outdated too quickly.

This need for change seems to be reflected in the fact that half of the European education systems are currently reforming the curricula related to digital competences. These reforms are largely aimed either at introducing digital competences into the curriculum where they had not previously been addressed, or at making the subject area more prominent. Some reforms are also intended to change the curriculum approach, update content or strengthen particular areas such as coding, computational thinking or safety.

Often they are directly linked to the implementation of a digital (education) strategy. Therefore they also relate to the more fundamental question of how digital technologies affect society.

> In **Sweden** for example, the basis of the revisions has been to understand how digitalisation affects society, to be able to use and understand digital tools and media, to have a critical and responsible approach and to be able to solve problems and convert ideas into action. These curriculum reforms are now completed but there is an ongoing reform of the national test system aiming at digitalisation.

Figure 1.4: Ongoing curriculum reforms related to digital competences in primary and general secondary education (ISCED 1-3), 2018/19

Ongoing curriculum reforms

No ongoing curriculum reforms

Source: Eurydice.
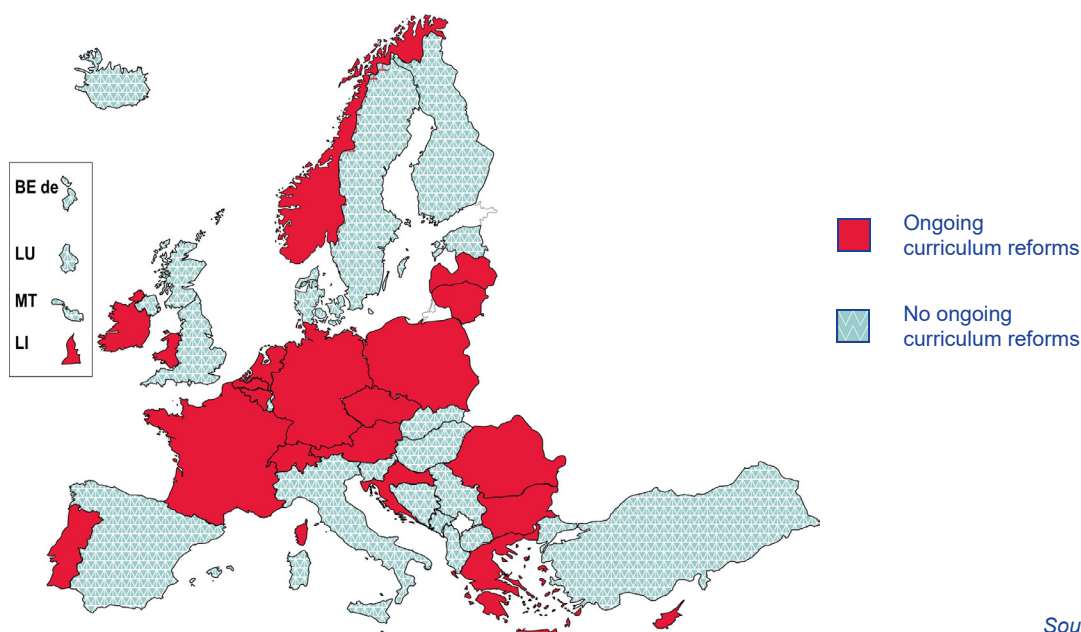
Country-specific notes

Denmark: During the 2017/18 school year, the Ministry of Education began a four-year pilot programme on teaching 'technological comprehension' in primary and lower secondary education, testing it both as an optional subject and as a component of other subjects.
Germany: As the reform is linked to the strategy 'Education in the digital World' covering primary and lower secondary education, it is only valid for those two educational levels.
Switzerland: The digital competence areas have already been introduced into the new curricula for compulsory education (ISCED 1 and 2), while in general upper secondary education a new, but not yet fully implemented framework curriculum for informatics/information technology is available (to be completed by 2022/23).

For countries not having explicitly mentioned digital competences previously in school curricula, these reforms are a major step forward.

> In the **French Community of Belgium**, where up to the 2018/19 school year, digital competences have not been included in the curriculum, curricula and teacher training programmes are being drafted based on an adaptation of the DigComp framework. The

specific curricula and teacher training programmes will be ready for September 2020, after validation by the Government. They will be introduced first for 3- to 7-year-old pupils and will then be progressively implemented for other students up to 15 years old.

In the **Netherlands**, the key objectives for primary and secondary education provide starting points for digital literacy, but are formulated in such a general way that they offer insufficient support for practical implementation into education practice. As part of a study on 21st century skills commissioned by the National Institute for Curriculum Development (SLO), the role of digital literacy was examined in 2014. The conclusion was that digital literacy had little or no place in primary education. In lower secondary education, relatively more attention was paid to basic IT knowledge and information skills, but the space given to media literacy and computational thinking is limited (Thijs, Fisser & van der Hoeven, 2014). Currently, the Netherlands is in the process of a major curriculum renewal in which digital literacy will form one of nine permanent parts of the curriculum.

In some countries, the reforms are aimed at strengthening digital education from primary education upwards.

In **Bulgaria**, in 2018/19, the introduction of the subject computer modeling, which includes coding in primary education, is part of a curriculum reform related to digital competences.

In **Cyprus**, in 2018/19, computational thinking will be introduced in primary education. Other competences will be introduced later as part of curriculum reforms.

In **Lithuania**, the curriculum framework for the subject 'informatics' in primary education is currently being piloted (since September 2018). It includes learning outcomes in the following areas: digital content, algorithms and programming, data and information, problem solving, virtual communication, security and legal aspects.

In **Poland**, the new core curriculum on digital education includes the introduction of programming from the first grade of primary school. The recommendations include the use of ICT skills in classes other than computer science and increasing the number of teaching hours for computer science (+70 hours – from 210 to 280 hours).

Other reforms are about introducing new curriculum approaches and/or subjects.

In **Ireland**, for example, the Digital Strategy for Schools (2015-2020) provides for a programme of curriculum reform, which sees digital technologies embedded in all emerging curricular specifications. Computer science has be introduced in general upper secondary education as from September 2018 in 40 schools (phase 1 rollout) and will be available as an option to all schools from September 2020. This new subject will help students develop an understanding of how computing technology presents new ways to address problems, and to use computational thinking to analyse problems as well as to design, develop and evaluate solutions. A review of the primary education curriculum is underway with specific consideration of including computational thinking and problem solving skills.

In **Portugal**, based on a pilot in 223 schools during the 2017/18 school year, a new framework for the national curriculum was published in July 2018 introducing ICT in all basic stages of education. A cross-curricular approach will be taken in primary education (grades 1-4) and it will be a specific subject for all students in upper primary (grades 5 and 6) and lower secondary education. In upper secondary education (grade 12), it is an optional separate subject. In 2018/19, this has already been put in place for all students at the beginning of each cycle and it will be progressively adopted in the remaining school years up to 2021. Specific guidelines, resources and training activities are being prepared to support teachers to work with this new curriculum framework.

In the **United Kingdom (Wales)**, the Digital Competence Framework introduces the teaching of digital competences as a cross-curricular responsibility for all teachers, alongside their cross-curricular responsibility for literacy and numeracy. It focuses on developing digital skills which can be applied to a wide range of subjects and scenarios.

Some countries take inspiration from the work done at European level on digital competence and especially the DigComp framework to revise their current curriculum.

In the **Flemish Community of Belgium**, a major reform of secondary education is taking place. This reform has important consequences for primary education as well and for the transition from primary to secondary education. The revision of primary and secondary education curricula is based on the DigComp framework. Starting from the 2019/20 school year, the new curriculum will be gradually integrated, starting with lower secondary education. The previous parliamentary debate was about what today's and tomorrow's education should look like and on how to deal with ICT, media literacy and coding.

In **Czechia**, an extensive revision of the national curriculum in the area of digital education/competences from pre-primary to upper secondary education (including IVET) is currently in preparation, as one of the objectives set in the Czech digital education

strategy ([45]). While the present national curriculum focuses primarily on knowledge and understanding of technology and the competences needed to use it, the ongoing revision should move the curricula to a broader conception of digital education, in accordance with the European key competence definition. The area of digital education in the new curriculum should be extended mainly towards competences developing critical thinking, problem solving, data literacy, safety, flexibility, communication and others.

1.3. Competence areas and learning outcomes related to digital competence

1.3.1. Coverage of the digital competence areas in national curricula

This section examines national curricula to identify whether they explicitly mention learning outcomes related to the digital competence areas as defined in the DigComp framework. The framework describes five areas of digital competence with 21 competences in total (see Figure 1.6). It has been used as a point of reference in this analysis to map the different areas and learning outcomes covered by national curricula. Some countries report that their digital competence curricula are directly inspired by the framework, such as in the Flemish Community of Belgium and Austria. Figure 1.5 shows the number of education systems which include learning outcomes related to the five competence areas of the DigComp framework in their national curriculum.

As seen previously, 18 education systems ([46]) have their own national definition of digital competence and therefore the digital competence areas also vary (see Section 1.1). For example:

In **Germany**, the first five are very similar to those in DigComp but there is a sixth 'analyse and reflect'.

The **Croatian** curriculum insists on creativity and innovation, personal and social responsibility, active citizenship as well as 'digital wisdom', which includes the ability to choose and apply the appropriate technology. Four areas are defined: information and digital technology, computational thinking and programming, digital literacy and communication, and the e-society.

The Education Ministry in **Malta** looks at both digital literacy and digital citizenship, considering the first as being about knowledge and the second about action.

In **Norway**, the last area is 'digital judgement', i.e. acquiring knowledge and good strategies for using the internet.

In this analysis, no difference is made between the terms learning objectives and learning outcomes, while the latter is the one commonly used throughout this text. Both 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 context of this report, learning outcomes have been 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, 2004-19). Learning outcomes indicate actual attainment levels while learning objectives define the competences to be developed in general terms.

Figure 1.5 shows that the majority of European education systems have explicitly included learning outcomes related to all five areas of digital competence. Those most frequently addressed in terms of learning outcomes across the education levels are, in descending order, information and data literacy, digital content creation, and communication and collaboration.

Most of the learning outcomes related to digital competences are directed at lower secondary level. Virtually all countries address at least information and data literacy, communication and collaboration and digital content creation. But the area of safety is also explicitly mentioned in 37 education systems

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([45]) http://www.msmt.cz/uploads/DigiStrategie.pdf

([46]) Germany, Estonia, France, Croatia, Lithuania, Malta, Netherlands, Austria, Portugal, Slovakia, Sweden, United Kingdom (WLS and SCT), Albania, Iceland, Norway, Serbia and Turkey

and the area of problem solving in 36. At upper secondary level, the picture is similar, even if the number of countries covering all five competence areas with explicitly stated learning outcomes decreases slightly compared with lower secondary education. At primary level, the number of countries with related learning outcomes is the lowest, but still around 30 education systems cover the first four areas and 24 education systems also include the area of problem-solving.

Only three education systems, the French and German-speaking Communities of Belgium and the Netherlands, do not currently have any explicit learning outcomes related to digital competence, either at primary or secondary level. In the French Community of Belgium, however, the new curriculum which includes digital competences based on DigComp, will start to be implemented in schools in 2020. Similarly, in the Netherlands, digital competence is also currently being addressed through curriculum reform (see Section 1.2.3 and Figure 1.4).

Figure 1.5: Digital competence areas addressed in terms of learning outcomes in national curricula for primary and general secondary education (ISCED 1-3), 2018/19
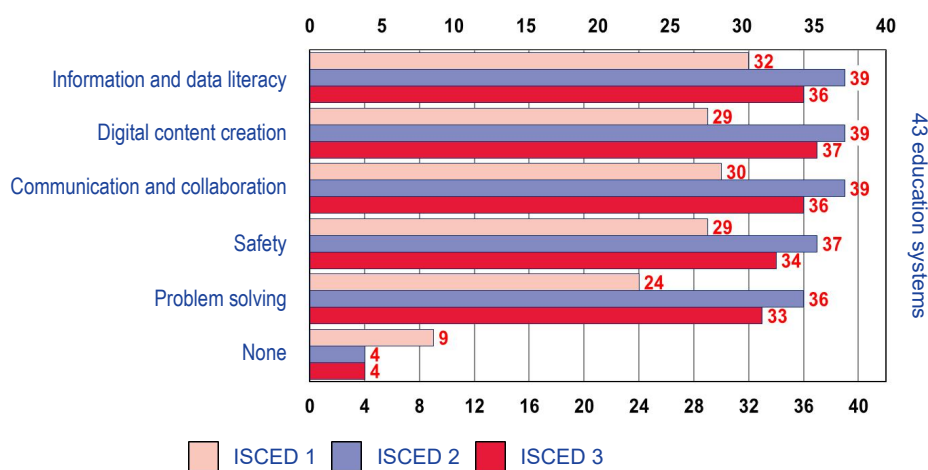
Source: Eurydice.

Explanatory note

This Figure shows the aggregated number of education systems with explicit learning outcomes in the five digital competence areas, as described in the DigComp framework. Information by country is presented in annex 1b.

Country-specific note

Croatia: The informatics curriculum will be implemented in all primary schools in 2020/21; it includes learning outcomes related to all five competence areas.

In addition, at primary level, there are no explicit learning outcomes in Luxembourg, Albania, Bosnia and Herzegovina and Turkey, as digital competence is not included in curricula at this level. In Croatia, learning outcomes related to all five competence areas are included at primary level in the new curriculum for informatics but will only be implemented in 2020/21. In Hungary, where digital competence is a cross-curricular objective at primary level, there are also no specific learning outcomes. On the other hand, in Iceland, learning outcomes are included in the curricula of primary and lower secondary education but not at upper secondary level, where digital competence is a cross-curricular theme but does not have any learning outcomes specified in the national curriculum. The situation in Hungary and Iceland contrasts with many other countries where cross-curricular learning outcomes for digital competence are in fact explicitly stated in curricula.

Most of the competence areas reported by countries are related to the DigComp framework. However, some countries mention others, such as having a positive attitude towards ICT (primary education in the Flemish Community of Belgium) or basic work with computers (primary education in Czechia).

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In France, digital competence, but especially digital literacy, is tackled within the wider field of information and media education, which has been a longstanding subject area in the curriculum.

In some countries, depending on the prevailing curriculum approach (see Figure 1.2), these learning outcomes can be distributed between a range of subjects and rather broad (e.g. in Belgium – Flemish Community, Portugal, Slovenia and Sweden). Alternatively, they can be concentrated within a specific separate subject, with detailed learning outcomes in the subject curricula and often a specific amount of instruction time (see Figure 1.3). This is the case in a number of countries with a separate subject: Bulgaria, Cyprus, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, the United Kingdom – England and Wales, Montenegro, North Macedonia and Turkey.

In Spain, Austria, the United Kingdom (Scotland) and Switzerland, although the curriculum approaches to digital competence vary since this decision is left to schools or the regional level, their curricula do in fact contain many explicit learning outcomes.

In several other countries, where the main approach to digital competence is cross-curricular, there is nevertheless, a high level of detail in the related learning outcomes. In Estonia, for example, although digital competences are taught in a cross-curricular way across all subjects, the learning outcomes are detailed and comprehensive. They are not found in a specific subject curriculum but in general provisions of the national curriculum for basic schools, promoting it as a general, key competence. Similarly, in Greece, updated teaching guidelines present a wide range of learning outcomes for digital competence to be acquired through a cross-curricular approach, in addition to teaching through separate subjects. Malta has a learning outcomes framework for digital literacy as a cross-curricular theme, stating many learning outcomes for all levels of compulsory education. Finally, Finland and the United Kingdom (Northern Ireland) have a cross-curricular approach only, but with comprehensive learning outcomes in their core curricula.

1.3.2. Focus on eight essential competences

For the purpose of this focussed analysis, eight of the 21 digital competences in DigComp have been selected, taking at least one from each of the five areas (see Figure 1.6, in bold). As seen before, most education systems cover all five digital competence areas (see Figure 1.5).

The rationale behind the choice of these eight competences is based on the current level of interest in the topic and its policy relevance (e.g. programming/coding, but also safety), how well it represents the core content of the competence area from which it is drawn, and how well it reflects the focus of this report, i.e., digital competence as a key competence that allows students to become confident, responsible, safe and critical users of digital technology.

This analysis of learning outcomes relating to the eight competences does not therefore pretend to be comprehensive and exhaustive, its intention is to give a glimpse into how they have been interpreted and to what extent they have been implemented in curricula across Europe.

Figure 1.6: The Digital Competence Framework for Citizens (DigComp)

DigComp 2.0

Competence areas	Competences		
Information & data literacy	1.1	Browsing, searching and filtering data, information and digital content	
	1.2	**Evaluating data, information and digital content**	
	1.3	Managing data, information and digital content	
Communication & collaboration	2.1	Interacting through digital technologies	
	2.2	Sharing through digital technologies	
	2.3	Engaging in citizenship through digital technologies	
	2.4	**Collaborating through digital technologies**	
	2.5	Netiquette	
	2.6	**Managing digital identity**	
Digital content creation	3.1	**Developing digital content**	
	3.2	Integrating and re-elaborating digital content	
	3.3	Copyright and licences	
	3.4	**Programming**	
Safety	4.1	Protecting devices	
	4.2	**Protecting personal data and privacy**	
	4.3	**Protecting health and well-being**	
	4.4	Protecting the environment	
Problem solving	5.1	Solving technical problems	
	5.2	Identifying needs and technological responses	
	5.3	Creatively using digital technologies	
	5.4	**Identifying digital competence gaps**	

Source: Adapted from Carretero, Vuorikari and Punie, 2017.

Figure 1.7 shows which of the eight competences are included at each education level in terms of explicit learning outcomes in the curricula of European education systems. It also shows which competences are the most or least frequently included.

Competence area 1 – Information and data literacy

Evaluating data, information and digital content

In the DigComp framework, this competence requires learners to analyse, compare and critically evaluate the credibility and reliability of sources of data, information and digital content.

The examples of learning outcomes in national curricula relating to these skills often include the following expressions: filter, cross-check, critically navigate, distinguish objective from non-objective, real from virtual (e.g. Slovenia), make simple/informed judgements about sources of information (e.g. the United Kingdom – Wales), validity, value, appropriateness, accuracy, authenticity, awareness of plagiarism (e.g. Malta and the United Kingdom – Scotland), etc.

This competence is explicitly stated as a learning outcome in the curricula of nearly three quarters of countries, mostly at lower secondary education. It is the second most frequently cited of the eight.

Competence area 2 – Communication and collaboration

Collaborating through digital technologies

In the DigComp framework, this competence refers to the use of digital tools and technologies for collaborative processes, and for the co-construction and co-creation of data, resources and knowledge.

Collaboration or teamwork is an educational objective that often appears in national curricula and in relation to many different activities. However, in this section it refers to the specific use of digital technologies for collaborative purposes.

The related learning outcomes in national curricula mention 'working together in an online environment' as well as 'using digital tools and collaborative/shared documents'. Other concepts include digital communities (e.g. Denmark), online learning communities (e.g. Estonia) or virtual communities and a collaborative online environment (e.g. Croatia), digitally mediated communities of practice (e.g. Malta), group problem solving with the use of technologies (e.g. Poland) and using collaborative applications for co-creating/co-developing digital materials (e.g. Romania).

Although collaborating through digital technologies is found less frequently in European curricula than 'evaluating data, information and digital content', it is still stated explicitly in 27 education systems at lower secondary level, and in more than 20 systems at primary and general upper secondary level.

Managing digital identity

This competence requires learners to: create and manage one or more digital identities, understand how to protect their personal reputation; and deal with the data produced through digital tools, environments and services.

Of the eight digital competences selected, 'managing one's digital identity' is one that is less frequently referred to in national curricula. Only one third of European curricula have explicit learning outcomes related to this in lower secondary education and less than a dozen in primary and upper secondary education.

Several curricula mention e-identity, e-/digital/online reputations, and control of a digital identity (e.g. the Flemish Community of Belgium); distinguishing between the digital and physical identity (e.g. Bulgaria); protecting a reputation online and distinguishing between multiple digital identities (e.g. Denmark); the use of and risks relating to a digital identity; the design, management and protection of a digital identity and digital footprint/traces; and understanding why another person's digital identity must not be used. Other references include using a digital identity in a safe and ethical way (e.g. Estonia); the dangers and rules of managing a digital identity and the dangers of mismanagement (e.g. Greece); ethical questions (e.g. Spain); recognising the dangers of manipulation through digital identities such as grooming and tracking, and protecting the reputation of a digital identity (e.g. Austria); creating a safe digital identity (e.g. Poland); using various tools for protecting against identity theft via the internet, selecting the elements of one's personal identity relevant for a digital identity and being aware of the difficulties in changing it (e.g. Romania); and realising that digital identities may not reflect the truth (e.g. Turkey).

Competence area 3 – Digital content creation

Developing digital content

This competence requires learners to create and edit digital content in different formats and to express themselves through digital means.

Being a very broad competence (references being made to a variety of formats for expressing oneself), national curricula of almost all countries include related learning outcomes. Virtually all European education systems have learning outcomes for this competence at lower secondary level, and around 30 countries do so at both primary and upper secondary level. It is the most frequently cited of all eight.

Some countries refer to specific software and applications (e.g. the Flemish Community of Belgium, Cyprus, Lithuania, and Hungary). Others insist on creativity, for example in Ireland, where the curriculum mentions that 'students are designers and creators of technology rather than mere users of technology'. In several other countries, there is a similar focus. Some examples are: 'working creatively across a range of digital media' (e.g. Malta), 'making creative and diverse use of digital technology' (e.g. Austria), 'creating and innovating' (e.g. Portugal), 'undertaking creative projects that involve selecting, using, and combining multiple applications' (e.g. the United Kingdom – England).

Programming/coding

In the DigComp framework, this competence requires learners to plan and develop a sequence of understandable instructions to enable a computing system to solve a given problem or perform a specific task.

Recent reports have highlighted the increasing importance of this competence (e.g. Balanskat & Engelhardt, 2015). Within the European Commission's current Digital Education Action Plan (European Commission, 2018), one action is specifically devoted to coding. However, for the 2017/18 school year, the 2nd Survey of Schools on ICT in Education shows that coding is rarely practised on a daily basis in secondary education, while between 76 % and 79 % of students in upper and lower secondary education, respectively, never or almost never undertake coding activities (European Commission, 2019, p. 66-68). There are also gender differences even as early as lower secondary education, where more male students than female engage in coding/programming activities, and this becomes even more apparent in upper secondary education (85 % of female students never or almost never engage in coding/programming while this is the case for only 66 % of male students (European Commission, 2019, p. 68-69).

The national curricula learning outcomes related to coding often mention the use of algorithms in general, and a few curricula refer to specific programming languages (e.g. Greece, Cyprus and Lithuania). Sometimes, computational thinking is mentioned in the same context (e.g. Flemish Community of Belgium, Ireland, Italy, Austria, Finland, the United Kingdom – England and Scotland, and North Macedonia). However, although there are some overlaps between both areas, according to Carnegie Mellon University ([47]), computational thinking is more than 'solving problems, designing systems, and understanding human behaviour'. Computational thinking is a thought process that is independent of technology, as well as being a specific type of problem solving that requires distinct abilities, e.g. being able to design solutions that can be executed by a computer, human, or a combination of both (Wing, 2011). Computational thinking is developed as part of studying computer science and can serve as a methodology for all students across all disciplines for solving problems; it

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([47]) http://www.digitalpromise.org/blog/entry/a-new-model-for-coding-in-schools

can also improve students' understanding of the role of computing in modern society (Syslo & Kwiatkowska, 2015).

Figure 1.7 shows that while this competence is still not explicitly mentioned in learning outcomes in primary education in around a half of European education systems, more than 30 countries do mention it at both lower and upper secondary levels. After 'digital content creation' and 'evaluating data, information and digital content', it is the next most frequently referred to of the eight.

Competence area 4 – Safety

This area is increasing in importance both for politicians and the general public. At European level for example, the EU data protection rules (GDPR) have been reformed recently ([48]). In addition, online safety and cyber security are clearly indicated among the specific objectives of the Digital Education Action Plan (European Commission, 2018). In 2017, a joint Communication to the European Parliament and the Council – Resilience, Deterrence and Defence: Building strong cybersecurity for the EU – was released, calling on EU Member States to include cyber security in academic and vocational training curricula ([49]). The Eurydice report on online safety in schools, supporting the European Commission's Safer Internet Programme ([50]), showed that even a decade ago a majority of European education systems had included education on online safety in their school curricula (European Commission/EACEA/Eurydice, 2010). Similarly, the 2nd Survey of Schools on ICT in Education shows that a large number of schools have implemented policies to enhance responsible internet behaviour (64 % of European students attend schools with such policies at primary level, 73 % at lower secondary and 66 % at upper secondary level). However, only slightly more than one third of European students across education levels attend schools that have a specific policy in place regarding the use of social networks in teaching and learning (European Commission, 2019, p. 100). Finally, the latest data from the Health Behaviour in School-Aged Children (HBSC) survey shows that on average, 9 % of 15-year-olds report having experienced cyberbullying at least once in their life. This might be an underestimate since children may not feel comfortable answering the survey questions in a school environment (OECD, 2019a, p. 72).

Protecting personal data and privacy

This competence requires learners to: protect personal data and privacy in digital environments; understand how to use and share personally identifiable information while being able to protect themselves and others from damage; and understand that digital services have a 'privacy policy' to inform users how personal data is used.

The increasing relevance of this competence is reflected in European curricula, as nearly 30 education systems have explicit learning outcomes related to it in secondary education and nearly 20 also in primary education.

Figure 1.7 shows which countries include learning outcomes that do more than make just a general mention of the need for e-safety or online security. Some refer specifically to protection/safety measures, the use of strong passwords, safeguards, encryption procedures (e.g. Poland, the United Kingdom – Scotland, and Switzerland) and data security. Others point to the ethical and legal issues in sharing information (e.g. Lithuania, Hungary, Malta, Poland, Finland, the United Kingdom – Wales and

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([48]) https://ec.europa.eu/commission/priorities/justice-and-fundamental-rights/data-protection/2018-reform-eu-data-protection-rules_en

([49]) Joint communication to the European Parliament and the Council. Resilience, Deterrence and Defense: Building strong cybersecurity for the EU, JOIN/2017/0450 final.

([50]) http://ec.europa.eu/information_society/activities/sip/index_en.htm

Scotland, and Liechtenstein), the misuse of data, as well as the protection of one's own and others' data (e.g. Denmark, Ireland, Greece, Spain, Austria and Poland).

This Figure shows whether national curricula include explicit learning outcomes related to eight competences selected from the 21 identified in the DigComp framework, with at least one chosen from each of the five main competence areas.

Country-specific notes

Belgium (BE nl): New learning outcomes are currently being validated. The old attainment targets considered in this Figure are still in place, but schools will have to incorporate the new ones which come into force from September 2019.
Croatia: The primary curriculum for informatics will be implemented in 2020/21 in all schools and includes learning outcomes related to all five competence areas.
Latvia: In 2015, a project for the subject *Datorika* (computing) was introduced as of the first year of primary education. It is not a requirement, but many schools provide it as a compulsory subject.
Luxembourg: No explicit learning outcomes have been defined as yet. However, the pilot phase for the introduction of a new qualifying pathway for ICT studies started in 2017 and is planned to be mainstreamed in all secondary schools in 2020.
United Kingdom (ENG): Academies (publicly funded independent schools) do not have to follow the statutory national curriculum requirements but may choose to do so.
Switzerland: *Lehrplan 21*, which is the framework curriculum for the German-speaking *Cantons*, is taken as a reference for ISCED 1 and 2; the national framework curriculum for information and communication technologies at Baccalaureate schools as a reference for ISCED 3.

Figure 1.7: Learning outcomes related to 8 digital competences from the 5 areas defined in DigComp in national curricula for primary and general secondary education (ISCED 1-3), 2018/19

Competence area	Information and data literacy	Communication and collaboration		Digital content creation		Safety		Problem solving
Competence	Evaluating data, information and digital content	Collaborating through digital technologies	Managing digital identity	Developing digital content	Programming/ coding	Protecting personal data and privacy	Protecting health and well-being	Identifying digital competence gaps
BE fr								
BE de								
BE nl								
BG								
CZ								
DK								
DE								
EE								
IE								
EL								
ES								
FR								
HR								
IT								
CY								
LV								
LT								
LU								
HU								
MT								
NL								
AT								
PL								
PT								
RO								
SI								
SK								
FI								
SE								
UK-ENG								
UK-WLS								
UK-NIR								
UK-SCT								
AL								
BA								
CH								
IS								
LI								
ME								
MK								
NO								
RS								
TR								
	Evaluating data, information and digital content	Collaborating through digital technologies	Managing digital identity	Developing digital content	Programming/ coding	Protecting personal data and privacy	Protecting health and well-being	Identifying digital competence gaps

Legend: ■ ISCED 1 ■ ISCED 2 ■ ISCED 3

Source: Eurydice.

Protecting health and well-being

This competence also belongs to the area of safety and requires learners to: be able to avoid health-risks and threats to physical and psychological well-being while using digital technologies; protect themselves and others from possible dangers in digital environments (e.g. cyber bullying); be aware of digital technologies for social well-being and social inclusion.

This competence is explicitly stated in more than half of the European education systems in lower secondary education, in more than 20 countries in primary education, and in slightly fewer in general upper secondary education.

The curricula including this competence generally mention mental and physical health or ethical norms and guidelines to protect health and safety. Other formulations include social issues – creating a healthy working environment, the impact on human relationships and personality, manipulative influences, digital abuse (e.g. Denmark), cyberbullying (e.g. Switzerland), e-violence/hate speech (e.g. Croatia), and finally the impact on the environment (e.g. Bulgaria and Germany).

Some common topics related to the protection of health and well-being stand out in European national curricula:

- The prevention of risks linked to the length/overuse of digital technologies, including addiction (e.g. Czechia, Germany, Estonia, Spain, Croatia, Malta, Austria, Romania, Finland and Switzerland).

- Physical health (eyes, posture etc.) and ergonomics (e.g. Estonia, Ireland, Cyprus, Finland), while Portugal and North Macedonia only refer to ergonomics.

- Social inclusion (e.g. Germany) and special needs (e.g. Croatia, Austria and Poland).

Competence area 5 – Problem solving

Identifying digital competence gaps

This competence requires learners to: understand where their own digital competences need to be improved or updated; be able to support others in developing digital competences; seek opportunities for self-development; keep up-to-date with digital evolution.

Of the eight digital competences under scrutiny, identifying gaps in competences is the least referred to in national curricula (in fewer than 10 countries). It features in only four education systems at all three education levels (Estonia, Greece and the United Kingdom – Wales and Northern Ireland), in two countries at primary and lower secondary level (Germany and Malta), in one at primary level only (Lithuania) and in one other country in upper secondary education (Bulgaria).

However, some countries provide accurate descriptions of this competence in their national curricula.

> In **Germany**, it is conceived as the capacity of pupils to 'determine one's own deficits and search for solutions: recognize one's own deficits in the use of digital tools and develop strategies for the remedy of the deficits; and share one's own strategies for problem solving with others'.

> In **Estonia**, at primary level, it is defined as 'students being able to describe what level of digital competences they have and which competences can be developed'.

> In the **United Kingdom (Wales)**, at Key Stage 2 (ages 7-11), the curriculum states for this competence that 'pupils should be given opportunities to evaluate their work and learning', and 'discuss new developments in ICT and the use of ICT in the wider world'.

CHAPTER 2: DIGITAL COMPETENCES FOR TEACHERS: PROFESSIONALISATION AND SUPPORT

Like all citizens, teachers need to acquire the necessary digital skills for their personal and professional lives and for participating in the 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). These specific digital competences are the focus of this chapter. 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. They will be referred to in this report as teacher-specific digital competences.

While using digital technologies generally to communicate, collaborate, create and learn is undoubtedly important in a teacher's professional life, the teaching and learning element, i.e. the specific pedagogical use of digital technologies, is essential for facilitating the learning process. This is also referred to in policy documents and the research literature as 'digital pedagogies' or 'digital-supported teaching methods' and is of central concern in this chapter. Technologies used in this context are a means to achieve defined learning outcomes.

It is widely acknowledged that integrating digital technologies into the education process provides new opportunities for creative learning, for strengthening innovative teaching and for improving students' learning outcomes. However, if digital technologies are to have such a positive impact certain conditions must be met. These include ensuring that teachers have both the appropriate competences and the positive attitudes to effect the necessary changes (Conrads et al., 2017, p. 15).

Similarly, the key role played by teachers and their ability to use technologies for pedagogical purposes have been underlined in the Computer and Information Literacy Study which states that 'the use of ICT teaching tools per se is not of primary importance for improving the outcome of educational efforts. The effectiveness of ICT-enabled pedagogies largely depends on how new technology is implemented in the classroom' (European Commission, 2014, p. 16).

Moreover, there is some evidence that inappropriate or unsafe employment of digital technologies may even have a negative impact on the educational process. The recent OECD publication on the opportunities created by the digital transformation and the risks it poses for people's well-being (OECD, 2019a, p. 43) points out that the use of digital resources by teachers lacking the appropriate digital skills may form a distraction for pupils and teachers themselves, and so have a negative impact on learning outcomes. Here again, teachers are recognised as having a key role in ensuring the appropriate employment of digital technologies.

Teachers' own perceptions of the usefulness of digital technologies in the educational process also confirm that the right skills and positive attitudes are crucial if these technologies are to be effective. According to the 2nd Survey of Schools (European Commission, 2019, p. 48) looking at the benchmark 'progress in ICT in education', alongside 'equipment-related factors', it is clear that teachers see the lack of appropriate skills and pedagogical models for using ICT in the learning process as important obstacles. The survey also reveals that teachers need to be motivated and convinced that there is a clear benefit to be had from using ICT for teaching. They must also receive pedagogical and technical support in order to be confident in employing digital technologies in their daily practice.

This chapter therefore provides an overview of the methods used by top-level education authorities to ensure that teachers are digitally prepared to enter the profession and can further develop and reinforce their specific digital competences throughout their career.

2.1. Building digital professionalism before entry to the teaching profession

In Europe, the teaching profession is a regulated profession which means that minimum qualifications are required to become a teacher – these may vary depending on the education level (European Commission/EACEA/Eurydice, 2015b). To become qualified, therefore, prospective teachers need to complete initial teacher education (ITE) – the first step towards professionalization ([51]). This is when prospective teachers acquire the core professional competences they will need for their future role and responsibilities. If teachers are to become digitally competent, then at least the basic knowledge and skills should be integrated into initial teacher education programmes.

The higher education institutions that deliver initial teacher education usually have a great deal of autonomy in developing programme content. Nevertheless, recognising that teachers need a wide range of knowledge and skills to carry out their role effectively, European education systems have been progressively mapping the necessary competences in terms of what a teacher should know and be able to do. This has led to the development of teacher competence frameworks. As discussed in the Eurydice report on teaching careers (European Commission/EACEA/Eurydice, 2018a, p. 81), teacher competence frameworks are commonly used to define learning outcomes in ITE programmes. They have therefore been used in this report to provide insight into the development of teacher-specific digital competences during ITE.

In this section, therefore, both teacher competence frameworks and top-level regulations or recommendations on ITE are examined to find out how higher education institutions approach the development of teacher-specific digital competences. To complete the picture, this section also looks at whether there is a mandatory assessment of teacher-specific digital competences during ITE or before entry to the profession.

The analysis only covers teacher competence frameworks and top-level regulations or recommendations that apply to all teachers. Any competence frameworks or ITE programmes developed exclusively for specialist/semi-specialist teachers of digital or information and communication technologies are not addressed in this section.

2.1.1. Teacher competence frameworks

A teacher competence framework, as defined in this report, is a collection of statements about what a teacher as a professional should know, understand, be able to do, and which values and attitudes they should have. They are issued by top-level education authorities in a variety of official documents (see Annexes 2 and 3). Competence frameworks are intended to be used by different stakeholders such as education policy makers, ITE institutions, teacher training providers, school leaders and evaluators, as well as by prospective and in-service teachers (European Commission/EACEA/Eurydice, 2018a, p. 78). In some education systems, teacher competence frameworks are presented in terms of standards (see Annexes 2 and 3). Therefore, when referring to the teacher competence frameworks, the existence of standards has also been considered.

([51]) Here the reference is made to the traditional way to become a teacher, i.e. by completing ITE. Alternative routes to the teaching profession are not addressed in this report.

Figure 2.1 shows that in about two thirds of the European education systems, teacher competence frameworks include digital competences among those considered essential for all teachers. Some countries have developed a specific framework referring to teacher-specific digital competences (Spain, Croatia, Lithuania, Austria, Norway and Serbia) or standards (Estonia and Ireland). In contrast, in Czechia, Portugal, Sweden, Albania, Bosnia and Herzegovina, Switzerland and Turkey, the existing teacher competence frameworks do not acknowledge digital competences, while a further seven education systems (52) have no teacher competence framework at all. This section examines the specific digital teacher competence frameworks first before exploring the general competence frameworks for evidence of digital skills.

Figure 2.1: Inclusion of digital competences in top-level teacher competence frameworks, primary and general secondary education (ISCED 1-3), 2018/19
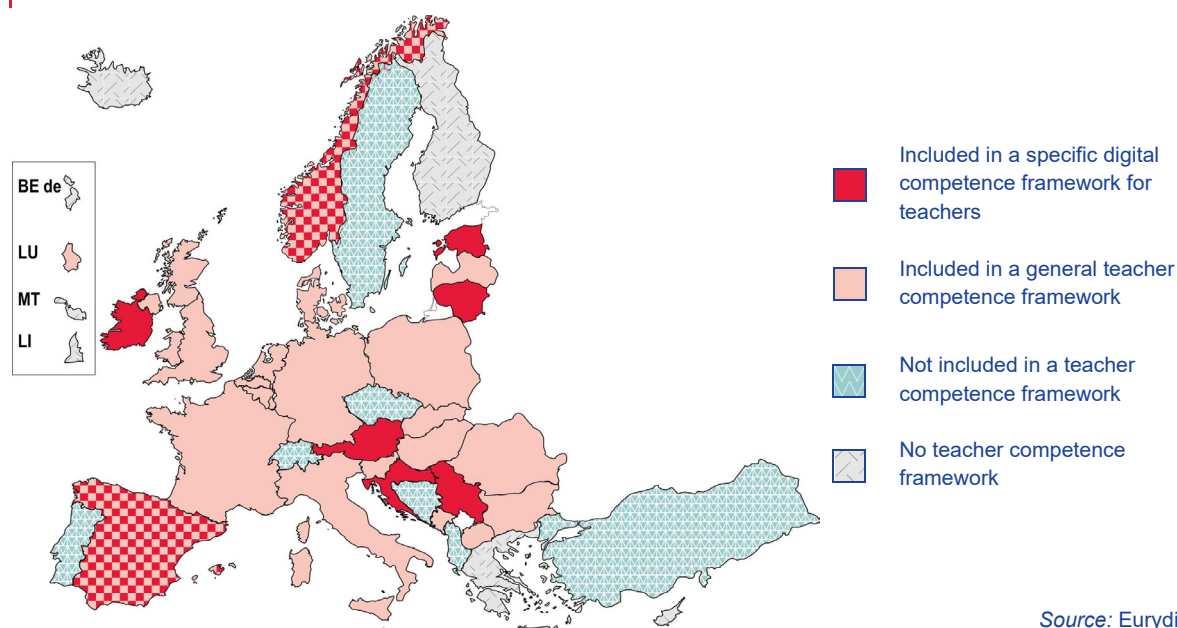
Source: Eurydice.

Use of teacher competence frameworks

	BE fr	BE nl	BG	DK	DE	EE	IE	ES	FR	HR	IT	LV	LT	LU	HU
ITE	●	●	●	●	●	◆	◇	●◇	●	◇	●	●	◆	○	●
CPD	○	○				◇	◇	○◇	●	◇			◆		○
	NL	AT	PL	RO	SI	SK	UK-ENG	UK-WLS	UK-NIR	UK-SCT		ME	MK	NO	RS
ITE	●	◆	●	●		●	●	●	●	●				●◇	◇
CPD	○	◆		●	●		○	●	○	●		●	●	○◇	◇

Use of **GENERAL** teacher competence framework:	○ Optional	● Mandatory
Use of **SPECIFIC** teacher competence framework:	◇ Optional	◆ Mandatory

Explanatory note

The map refers to the digital competences required of all teachers according to the teacher competence frameworks issued by top-level authorities. Competences required only of specialist/semi-specialist teachers of digital or information and communication technology related subjects are excluded. The table provides additional information as to whether the frameworks apply to initial teacher education (ITE) or continuing professional development (CPD) and whether they are mandatory or optional.

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(52) Belgium (BE de), Greece, Cyprus, Malta, Finland, Iceland and Liechtenstein

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Belgium (BE nl): From September 2019, under the Decision of the Flemish Government on the basic competences of teachers, a new teacher competence framework for teachers at all education levels will come into in force.

Czechia: A new Framework for the Digital Competence of Educators (drawn from the European Framework for the Digital Competence of Educators: DigCompEdu) (Redecker, 2017) has been approved on 30 April 2019 by the Ministry of Education, Youth and Sports management board. The Framework will be used for the definition of CPD needs and for the development of training programmes and teaching and learning methods for digital education. The development of teacher-specific digital competences will be also gradually integrated into ITE programmes.

Estonia: Is currently in the process of a transition to a new digital competence framework based on the European DigComp framework (Carretero, Vuorikari & Punie, 2017).

Croatia: The Digital Competence Framework was developed within the e-Schools pilot project (2015-2018), the objective of which was to improve teacher-specific digital competences. Teachers from 10 % of schools participated and were trained within the project. The pilot project is a part of the e-Schools programme (2015-2022) and, based on the results of the pilot project, the plan is to include all schools in the next stage of the programme.

Spain: There are two teacher competence frameworks: a specific one, the 'Common Digital Competence Framework for Teachers' (2017) and a general one, the 'Ministerial Order for accreditation of ITE programmes'. While both refer to teacher-specific digital competences, the use of the former is optional for ITE. The teacher competence frameworks set by two Autonomous Communities (Castilla y León and Galicia) also include digital competences; however they are not addressed here.

Italy and **Latvia**: In addition to the official documents regulating ITE, teacher-specific digital competences relating to the pedagogical use of technology are mentioned in separate regulations setting down provisions for induction and the probationary period (in Italy), and for the quality assessment of teachers' professional activities (in Latvia).

Slovenia: Teacher competences, including digital competences, are set out in Education Staff Traineeship Rules and are relevant to induction phase and the teacher certification examination.

Norway: Teacher-specific digital competences are covered by ITE regulations (see Annex 3). There is also an optional Professional Digital Competence Framework for Teachers.

Specific digital competence frameworks for teachers

Eight European education systems have developed specific frameworks referring to digital competences of teachers (Spain, Croatia, Lithuania, Austria, Norway and Serbia) or describing the standards (Estonia and Ireland) (see Annex 2). Most of these have been developed on the basis of European models, namely, DigComp: The Digital Competence Framework for Citizens (Carretero, Vuorikari and Punie, 2017) and DigCompEdu: The European Framework for the Digital Competence of Educators (Redecker, 2017). However, other frameworks have also been used. In Estonia, the Standards for Learning, Leading and Teaching in the Digital Age, were developed on the basis of the International Society for Technology in Education standards [53], while in Ireland the Digital Learning Frameworks were informed by the UNESCO ICT Competency Framework For Teachers (UNESCO, 2011) as well as by other relevant European and international digital competence frameworks.

Specific digital competence frameworks issued by top-level authorities provide a common reference point for different stakeholders as they offer model descriptors for teacher-specific digital competences/standards. In two countries, the digital competence frameworks are not restricted to teachers, as they also describe the digital standards for pupils and school heads (in Ireland) and the digital competences to which school heads should aspire (in Croatia). It is worth noting that in Spain, Croatia, Norway and Serbia, the use of digital competence frameworks for teachers is not mandatory. Only in Estonia, Lithuania and Austria must they be taken into consideration while developing ITE programmes (see the table below the Figure 2.1).

In all these countries, except for Ireland, the digital competence frameworks provide a complete mapping of teacher-specific digital competences.

In **Ireland**, the Digital Learning Frameworks refer to the standards providing Statements of Practice which describe 'effective' and 'highly effective' school practices for each standard. The statements will help teachers/schools to identify and prioritise the areas where improvement on the use of digital technologies is needed and to help them chart their school improvement plan and continuing professional development (CPD) needs.

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[53] https://www.iste.org/

The competences related to the pedagogical use of technologies are described in different ways. While they are usually included in a competence area focusing on 'teaching and learning' (see Annex 2), this is not always the case. In the Estonian framework, pedagogical digital competences are mainly described in the section on 'using teaching and evaluation methods in the digital area'; while in the Norwegian framework it is a part of the 'pedagogical and subject didactics' area. In the Spanish digital competence framework, there is no specific area dedicated to pedagogical competences in using digital technologies; these competences appear across five main areas (see Annex 2).

While describing pedagogical skills, digital competence frameworks usually refer to the teachers' ability to integrate digital technologies into teaching, as well as their use of digital tools and materials for educational purposes and the creation of a digital learning environment. In Estonia, the competence framework also refers to teachers being able to develop pupils' creative and innovative thinking and resourcefulness by using digital resources.

Teacher-specific digital competences, other than those purely related to pedagogical objectives, extend across all the five competence areas defined in DigComp (Carretero, Vuorikari and Punie, 2017), namely information and data literacy, communication and collaboration, digital content creation, safety, and problem solving.

In Estonia, Croatia, Ireland, Lithuania and Serbia, the framework also refers to the ability to use digital technologies for pupil assessment.

The Spanish, Croatian, Austrian and Serbian frameworks propose a progression model to help evaluate teacher-specific digital competences and therefore identify further development needs.

> In **Spain**, **Croatia** and **Serbia**, three proficiency levels (beginning, intermediate and advanced) apply. In Spain, each level is also divided into two sub-levels.

> In **Austria**, the digital competence progression model is designed as a process of digital professionalisation, starting from before entry to ITE (step 1), throughout ITE (step 2) and continued during the first five years in the profession (step 3).

General teacher competence frameworks

In 23 education systems ([54]), teacher-specific digital competences are included in the general teacher competence frameworks (see Figure 2.1).

The level of detail in which the competences are described varies between countries, ranging from a broad definition (in most frameworks) to detailed descriptions of competences according to skills, knowledge and attitudes. For example:

> In **Luxembourg**, the use of ICT is one of the nine competence areas set out in the teacher competence framework. Competences relating to the pedagogical use of technologies are expressed in terms of:
> - Knowledge: knowing the ethics and rules governing the use of technologies; and being familiar with ICT and online resources useful for professional practice.
> - Skills: being able to use ICT to search for new pedagogical resources to meet educational aims; adapting available online resources and making use of them; establishing a coherent link between educational objectives, the implementation of learning situations and the use of ICT; teaching students a functional use of digital tools; helping students to develop relevant, critical and civic approaches to the use of ICT; using ICT to foster networking, exchange experience and pool resources with colleagues.
> - Attitudes: being cautious and responsible in the use of information and communications when doing work for school; having a critical and constructive look at own use of ICT in education practice.

([54]) Belgium (BE fr and BE nl), Bulgaria, Denmark, Germany, Spain, France, Italy, Latvia, Luxembourg, Hungary, Netherlands, Poland, Romania, Slovenia, Slovakia, United Kingdom (all four jurisdictions), Montenegro, North Macedonia and Norway

All teacher competence frameworks include the competences related to the pedagogical use of technologies. This is generally defined as the ability to use digital information and communication technologies, multimedia, tools, materials and facilities in functional, critical and creative ways for teaching. In Hungary, the competence framework also underlines teachers' attitudes towards the use of digital technologies, such as being open to innovative pedagogies and new pedagogical applications of ICT.

Some competence frameworks also refer to teachers' use of digital technologies and resources to facilitate and encourage their pupils' acquisition of digital competences. In other words, teachers are expected to be able to create a learning environment that integrates digital technologies into their pedagogical practices. The learning dimension also implies the ability to teach pupils how to handle information from the media in a critical and useful way (Flemish Community of Belgium), empower pupils to use the internet responsibly (France), help pupils to develop a relevant critical approach toward the use of ICT (Luxembourg and Hungary) and ensure the safe use of ICT and digital resources (the United Kingdom – England, Wales and Northern Ireland, and North Macedonia).

> In the **United Kingdom (England)**, for example, the Teachers' Standards do not make explicit reference to competences relating to the pedagogical use of technologies. They do, however, specify teachers' responsibility to safeguard pupil well-being in line with statutory provisions and, as schools increasingly work online, this will include safeguarding pupils from potentially harmful and inappropriate online material. In this context, schools must ensure the provision of online filters and monitoring systems, and provide online safety training for staff.

Teacher competence frameworks also explicitly or implicitly refer to other aspects of teacher-specific digital competences such as the use of digital technologies for communication, collaboration and learning, as well as for operating digital equipment. In Belgium (French and Flemish Communities), Denmark, Luxembourg and the United Kingdom (Scotland), for instance, teachers have to know how to work with ICT and must develop a critical understanding of digital technologies. In Poland and Romania, basic knowledge and skills in the field of ICT (such as text processing, the use of spreadsheets, the use of databases, the use of presentation graphics, the use of services in information networks, obtaining and processing information) are referenced in the teacher competence framework. In France, the use of technologies for collaboration and continuing professional development (CPD) is mentioned; while in Montenegro, teachers' awareness of the importance of using ICT in education is emphasised. Similarly in Luxembourg, the teacher competence framework refers to the use of digital technologies for professional engagement such as collaboration and exchange of experience, networking and the pooling of resources among colleagues.

Usually the teacher-specific digital competences defined in the teacher competence frameworks apply to all teachers regardless of the education level at which they teach. In Belgium (French and Flemish Communities), Ireland ([55]) and Spain, the competences are expressed separately: for primary level teachers in the Flemish Community of Belgium ([56]), Ireland and Spain, and for upper secondary level teachers in the French Community of Belgium.

Use of teacher competence frameworks

The analysis of teacher competence frameworks shows that in almost all education systems their use is mandatory in defining the learning outcomes for ITE (see the table below Figure 2.1). Indeed, in eight education systems teacher competence frameworks have been developed for use in official ITE procedures such as the accreditation of initial teacher education programmes (Spain), or the

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([55]) The Digital Learning Frameworks are settled in terms of standards.

([56]) In Belgium (BE nl), there are two competence frameworks: teachers' basic competences and professional profiles. The former includes different sets of competences for pre-primary, primary and secondary education teachers, while the latter lists the competences for all teachers regardless of the level at which they teach.

establishment of ITE standards and requirements (the French Community of Belgium, Denmark, Germany, Italy, the Netherlands, Poland and Norway). In other education systems, teacher competence frameworks are used to describe teachers' professional competences or a set of professional standards (Belgium – Flemish Community, Estonia, France, Latvia, Lithuania, Hungary, Romania and the United Kingdom). In Bulgaria, the digital competences referred to in the requirements governing qualified teacher status must be developed during ITE.

In seven education systems, teacher competence frameworks either are not used for ITE (Slovenia, Montenegro and North Macedonia) or their use is optional (Ireland, Croatia, Luxembourg and Serbia). In Ireland, however, the ITE providers develop competencies to enable pre-service teachers to engage with the Digital Learning Framework when they qualify and work in schools. In about half of the education systems, teacher competence frameworks are used for defining continuing professional development (CPD) needs, in nine of these (France, Lithuania, Austria, Romania, Slovenia, the United Kingdom – Wales and Scotland, Montenegro and North Macedonia) their use is mandatory.

2.1.2. Regulations or recommendations on teacher-specific digital competences in initial teacher education

As Figure 2.2 shows, in about half of the European education systems, teacher-specific digital competences are subject to the regulations or recommendations for ITE issued by top-level authorities.

Figure 2.2: Top-level regulations or recommendations on the inclusion of teacher-specific digital competences in initial education for teachers in primary and general secondary education (ISCED1-3), 2018/19
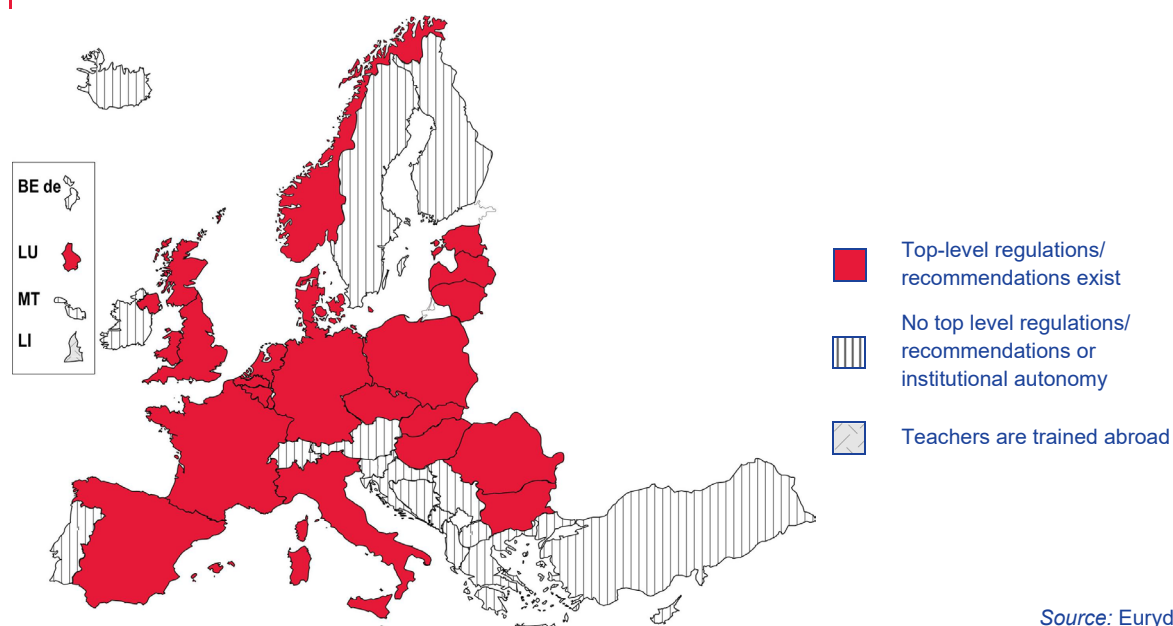
Top-level regulations/ recommendations exist

No top level regulations/ recommendations or institutional autonomy

Teachers are trained abroad

Source: Eurydice.

Explanatory notes

The Figure covers initial teacher education for all teachers except specialist/semi-specialist teachers of information and communication technology subjects.

Institutional autonomy in this report refers to the freedom of initial teacher education providers to define the structure and content of programmes.

Country specific note

Czechia: The Ministry of Education approved the methodology for assessing higher education programmes for teaching staff (on 5 October 2017). The resulting document is binding for the National Accreditation Bureau when approving new programmes or accrediting institutions. This document states that ICT must be part of the education of prospective teachers. However, it does not describe specific competences or learning outcomes.

Generally, these regulations and recommendations neither impose a common curriculum for digital education nor specify minimum instruction time. Therefore, ITE providers are free to determine subject content and how it should be delivered. Moreover, regulations or recommendations often refer to digital competence either as a transversal competence to be taught across the whole programme or as an element that should be integrated into the study of didactics.

It should be highlighted that in almost all education systems where ITE content is subject to top-level regulations or recommendations, these are set down in the same official documents as the teacher competence frameworks (see Section 2.1 and Annexes 2 and 3). Only in Latvia and Hungary, are separate documents issued.

In **Latvia**, the teacher competence framework is included in the Procedures for the Organisation of Quality Assessment, while the reference document for ITE is Professional Teacher Standards ([57]). In the professional standards document teacher-specific digital competences are defined as the ability to:

- purposefully and critically select and integrate different learning methods and technologies into the learning process;

- critically evaluate the risks related to the use of digital technologies;

- purposefully, rationally and effectively use ICT in the learning process and in professional development.

In **Hungary**, the teacher competence framework is an integral part of the ministerial decree on the system of promotion for teachers and their status as civil servants, while ITE curricula are regulated by the ministerial decree on the common requirements for initial teacher education and the learning outcomes of teacher training. Under the ministerial decree on ITE which defines the learning outcomes related to digital competence, teachers must be:

- familiar with printed and non-printed sources of information, digital textbooks, learning tools, learning organisation methods, teaching and learning strategies that can be used in teaching and learning the subject;

- able to critically analyse printed and digital textbooks, learning materials, and other learning resources that can be used to teach the subject, and to select them for specific purposes (especially for teaching information and communication technology);

- able to efficiently and professionally use traditional and digital technology-based tools and digital learning materials.

In about half of the European education systems (see Figure 2.2), there is no information available on digital competences in ITE. There are three possible reasons for this: top-level regulations or recommendations do not refer to these competences, ITE institutions have full autonomy regarding the content of their programmes, or there are no regulations or recommendations on this matter. However, the absence of guidance does not necessarily mean that ITE institutions do not offer student teachers the opportunity to develop digital competences. For instance, in Malta, Iceland, Montenegro, and Switzerland, all ITE programmes include ICT related subjects, while in Ireland, Greece and Portugal, most ITE programmes include training on digital education at least as an optional subject.

2.1.3. Assessment of teacher-specific digital competences

In most education systems, either there are no top-level regulations or recommendations on the assessment of teacher-specific digital competences prior to their entry to the profession or providers have full autonomy for determining assessment procedures.

Less than a quarter of education systems provide direction on the matter. In most of these, the competences are assessed during ITE, while in Italy (prospective secondary education teachers only) and Slovenia teacher-specific digital competences are assessed after completing ITE.

([57]) Professional Teacher Standards (*Profesijas standarts Skolotājs*):
https://visc.gov.lv/profizglitiba/dokumenti/standarti/2017/PS-048.pdf

In **Italy**, after completing ITE, prospective secondary education teachers have to pass a competitive examination to obtain the full qualification and access the profession. Teacher-specific digital competences are assessed during a competitive examination. Prospective primary education teachers are assessed during ITE.

In **Slovenia**, the use of ICT is one of the competences that a trainee teacher or a teacher beginner must develop during the induction period. At the end of this period, the teacher's mentor provides a written report on the trainee's competences for independent teaching. This written evaluation report is taken into consideration as one of the necessary supporting documents when applying for the state professional examination, which takes place after the induction period.

In Belgium (Flemish Community), Denmark (for primary and lower secondary teachers), France, Lithuania, the United Kingdom (Scotland) and Norway, the same top-level regulations or recommendations require ITE institutions to include digital education in curricula and to assess teacher-specific digital competences.

Figure 2.3: Top level regulations or recommendations on assessing teacher-specific digital competences prior to their entry into the profession, primary and general secondary education (ISCED1-3), 2018/19
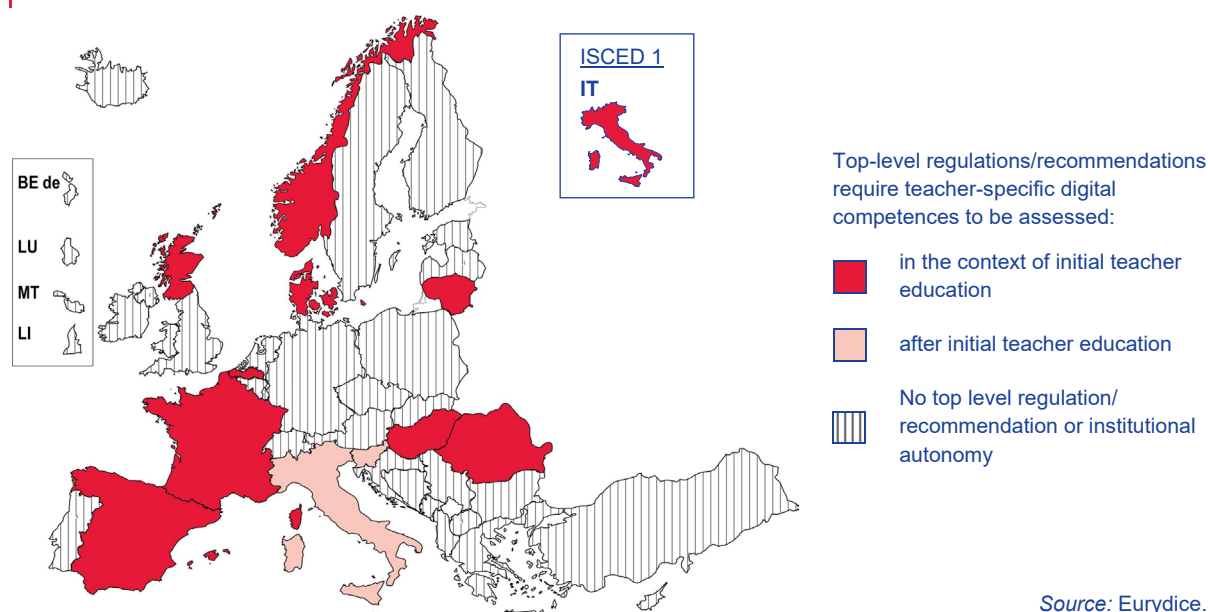
Source: Eurydice.

Explanatory notes

The Figure covers initial teacher education for all teachers except specialist/semi-specialist teachers of information and communication technology subjects.

Institutional autonomy in this report refers to the freedom of initial teacher education (ITE) providers to define the structure and content of programmes.

2.2. Support measures for the continued development of teacher-specific digital competences

After initial teacher education, the professionalisation process continues throughout a teacher's career. In today's society career-long professional development is a reality for all or almost all specialists. The European Commission Communication on school development and excellent teaching (European Commission, 2017c, p. 8) defines teaching as a 'profession of career-long learners working together'. Indeed, teacher competences, and particularly digital ones, need to be continually updated to respond to fast evolving technologies and to changes in society in general. According to the same Communication, teachers' learning can be updated through new forms of teacher collaboration and exchanges such as professional learning communities and networks. Moreover, in the Teaching and Learning International surveys (TALIS 2013 and 2018) (OECD, 2014 and OECD, 2019b), teachers reported ICT skills for teaching as one of the highest professional development needs.

Top-level education authorities may organise and/or promote in-service professional development through different means. This section looks first at the continuing professional development (CPD) activities intended to build teachers' digital capacities, before describing the self-assessment tools used to identify teachers' learning needs. Finally, it gives insight into professional networks, focusing on those dedicated to exchanges on digital education.

Figure 2.4 shows that in most education systems, top-level education authorities support teachers' professional development by combining different approaches. While in 14 education systems ([58]), they have a role in all the above-mentioned initiatives, in Belgium (German-speaking Community), Albania, Bosnia and Herzegovina and Turkey, none of them are supported by the top-level.

Figure 2.4: Methods of supporting the continued development of teacher-specific digital competences, primary and general secondary education (ISCED 1-3), 2018/19
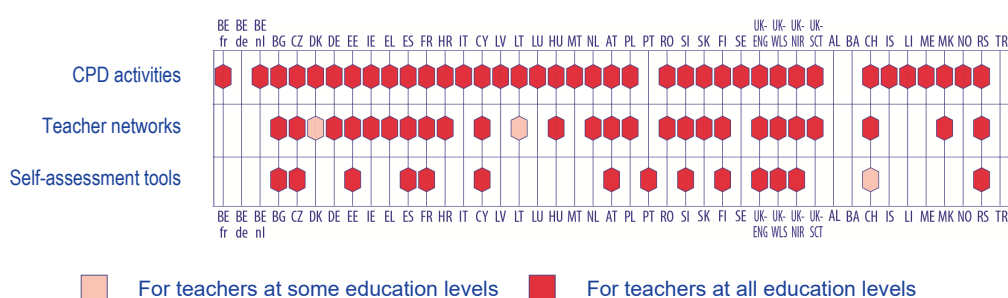
Source: Eurydice.

Explanatory note

Only the methods supported by top-level authorities are taken into account.

Country-specific notes

Denmark: Teacher networks exist for primary and lower secondary education teachers.
Lithuania: Teacher networks exist only for primary and lower secondary teachers. Members are proactive and support pilot projects relating the development of digital competences at these education levels at schools. The teachers of upper secondary education are supported by general professional development programmes and initiatives offering digital competence development including using ICT tools for educational purposes, but do not form part of any cooperative network.
Italy: Some regional educational authorities (e.g. the Region of Umbria, http://animatoridigitali.regione.umbria.it/) have created a teachers' network in line with the objectives of the Digital School Plan.
Switzerland: The self-assessment tool indicated is tailored to the curriculum for primary and lower secondary teachers. A self-assessment tool for upper secondary teachers is under development.

2.2.1. Continuing Professional Development (CPD)

Figure 2.4 shows that in almost all European education systems top-level authorities support the development of teacher-specific digital competences through continuing professional development activities. In most education systems, CPD is mandatory (i.e. there is a minimum amount of CPD that all teachers must complete) or it is considered to be one of the statutory duties (European Commission/EACEA/Eurydice, 2018a, p. 57). However, when it comes to deciding priorities and training needs, schools are usually involved in the decision-making process, and teachers' individual needs tend to be taken into consideration (European Commission/EACEA/Eurydice, 2015b, p. 62). This means that teachers can but are not obliged to engage in professional training to improve their digital competences unless it is defined as a priority (by top- or school-level authorities).

The continuing professional development of teachers may be supported by top-level authorities in different ways. One of the most common is the provision of training courses through national or

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[58] Bulgaria, Czechia, Estonia, Spain, France, Cyprus, Austria, Slovenia, Finland, United Kingdom (ENG, WLS and NIR), Switzerland and Serbia

regional training institutions. This is the case in 23 education systems ([59]), where CPD institutes, training agencies, educational centres or other training bodies offer a wide range of digital education related courses. For example:

In **Lithuania**, the Education Development Centre ([60]) provides CPD training for teachers at all educational levels. The Centre implements the current projects or initiatives on digital education initiated by the Ministry of Education, Science and Sport by including them in annual programme. The training includes the development of teacher-specific digital competences, including the pedagogical use of technology.

In **Malta**, the Institute for Education offers a whole range of CDP courses, including courses related to digital competence. Within the framework of the national project One-Tablet-Per-Child, all educators (teachers and learning support educators) in years 4, 5 and 6 have to take the mandatory course 'Award in the use of Tablets in Primary Classrooms'.

Allocating funding to different public or private CPD providers such as schools, universities, teacher associations or private institutions is another way in which top-level education authorities promote teacher training in the area of digital education. For example:

In **Belgium (Flemish Community)**, while schools have full autonomy to develop an in-service training plan and policy, top-level authorities allocate every school an earmarked budget for in-service training.

Similarly, in **Poland**, each school establishes its own CPD needs and priorities, while top-level authorities co-finance the provision of in-service training.

In **Finland**, education and CPD providers can apply for government subsidies to organise CPD in the area of digitalisation and communication technologies.

In the **United Kingdom (England)**, since autumn 2018, the Government has been financing a new National Centre for Computing Education. Its responsibilities include the provision of online and face-to-face continuing professional development.

In the **United Kingdom (Wales)**, the Hwb, a Welsh Government-funded open education resource platform, was developed as part of the Learning in Digital Wales programme to host a national collection of digital tools and resources. The Hwb also supports teachers' continuing professional development (CPD) through the organisation of 'HwbMeets' ([61]) events. These provide CPD opportunities and support around the adoption and use of digital tools and resources, and can be tailored to individual schools' needs.

In **Iceland**, various organisations are funded to support CPD, such as the Icelandic Centre for Research, the Icelandic Association of Local Authorities, the Icelandic Teachers' Union, among others.

In Bulgaria, Croatia, Italy, Hungary, the United Kingdom (England), Poland and Montenegro, supporting and strengthening the development of teacher-specific digital competences is among the objectives of national initiatives dealing with different aspects of digitalisation in society. In Hungary, Poland and the United Kingdom (England), the initiatives even contain quantitative objectives related to the number of teachers to be trained. In Belgium (Flemish Community), top-level education authorities have implemented specific training programmes to support and strengthen the development of teacher-specific digital competences.

In **Belgium (Flemish Community)**, the Knowledge Centre for Media Literacy has developed the MediaCoach ([62]), an intensive training programme funded by the Flemish government. This programme targets professionals working with young people. As part of a ten-day training programme, participants must set up a project in their own school. They are supported by a media coach who acts as an advocate and contact point for all aspects of digital media use and policies. The MediaCoach programme is run on an annual basis and in three different locations in Flanders.

In **Bulgaria**, within the framework of the 'Science and Education for Smart Growth' operational programme, the Ministry of Education undertook to lead a three-year project (2018-2020) aimed at improving teacher-specific digital competences in-service through relevant training. This mainly focuses on shaping the digital competences needed for teaching and learning and on the use of innovative technologies and interactive methods and tools in the educational process. The training covers a large number of topics

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([59]) Belgium (BE fr and BE nl), Czechia, Denmark, Estonia, Ireland, Greece, Spain, France, Cyprus, Latvia, Lithuania, Malta, Austria, Poland, Romania, Slovenia, Slovakia, Finland, Sweden, Switzerland, Liechtenstein and Montenegro

([60]) https://www.upc.smm.lt/veikla/about.php

([61]) https://hwb.gov.wales/hwbmeets

([62]) https://mediacoach.mediawijs.be/

such as the application of digital technologies in all subjects, using digital technologies and electronic resources, and the application of ICT in education.

In **Croatia**, different training courses and workshops related to teacher-specific digital competences have been developed in the framework of the 'e-Schools: Establishing a System for Developing Digitally Mature School' ([63]) pilot project (2015-2018), supported by the Ministry of Education and coordinated by the Croatian Academic and Research Network. This project is part of the wider e-schools programme 'e-Schools: a comprehensive informatisation of school operation processes and teaching processes aimed at the creation of digitally mature schools for the 21st century' (2015-2022). The experimental programme 'School for Life' (*Škola za život*) ([64]) also aims to strengthen teacher-specific digital competences through the setting up of 81 virtual classrooms involving 42 724 teachers.

In **Italy**, the National Teacher Training Plan (2016-2019) set digital education as one of its priorities. This plan is reinforced by the National Digital School Plan within which about 8 000 teachers have already been trained (one teacher per school), so as to become 'digital animators' (i.e. expert peer teachers) to support the whole school community.

In **Hungary**, the main purpose of the 'Development of Digital Competence' programme (2017-2020) is the targeted development of digital pedagogical knowledge and methods. The training of 40 000 teachers is envisaged under this programme ([65]).

In **Poland**, the Ministry of National Education has been implementing a number of CPD projects to enable teachers to participate in training and other forms of further education for the improvement of their digital competences. For example, the Digital Poland Project Centre (*Centrum Projektów Polska Cyfrowa)* together with the Ministry of National Education has planned the implementation of training projects under action 3.1 'Training activities for the development of digital competences' of the Operational Programme Digital Poland for the years 2014-2020. The aim of the project is to support the development of teacher competences in the use of ICT tools in the education process. The training courses, which will be run until June 2023, will be attended by at least 75 000 teachers in Poland ([66]).

In the **United Kingdom (England)**, the Industrial Strategy, published in November 2017, sets the target of up-skilling 8 000 computer science teachers – equivalent to one in every secondary school. This up-skilling is being facilitated through the funding of the new National Centre for Computing Education which offers online and face-to-face continuing professional development.

In **Montenegro**, teachers and administrative staff in educational institutions may apply for training in the framework of the European Computer Driving License (ECDL) for Digital Montenegro project ([67]).

CPD courses can take the form of traditional face-to-face training or on-line courses, including Massive Open Online Courses (MOOCs). In Spain, France, Slovenia, Sweden and the United Kingdom (Northern Ireland), the CPD courses on digital education tend to progressively develop into on-line training.

In **Spain**, within the framework of the *Aprende* initiative, the National Institute of Educational Technologies and Teacher Training offers teachers online training and learning experiences on digital education in different formats such as tutored courses, MOOC, NOOC (Nano MOOC) and EduPills ([68]).

In **France**, most of the CPD courses are provided on-line via the *M(@)gistère* platform ([69]) or some MOOC platforms such as FUN (*France Université Numérique*) ([70]). Since 2014, 362 000 teachers have been trained via *M(@)gistère*.

In **Slovenia**, top-level educational authorities have developed more than 50 digital competence related CPD courses for teachers, school heads and ICT coordinators, which have been implemented since 2009 as MOOCs, or at least half on-line.

In **Sweden**, the Swedish National Agency for Education developed an on-line training package called 'Digital Competence in Teaching' ([71]). This course includes different learning modules allowing teachers to gain in-depth knowledge of how digital tools support learning, and to test different tools in the classroom and share the experiences with colleagues.

([63])   https://www.e-skole.hr/en/

([64])   https://skolazazivot.hr/

([65])   http://kk.gov.hu/digitalis-kompetencia-fejlesztese

([66])   https://cppc.gov.pl/digital-poland-project-centre-cppc

([67])   http://www.ecdlfor.me/

([68])   EduPills is a micro-learning app for teachers which enables teachers to acquire and/or develop digital skills and competences in a simple and fast way: https://edupills.intef.es/

([69])   https://magistere.education.fr/

([70])   https://magistere.education.fr/; https://www.fun-mooc.fr/

([71])   https://www.skolverket.se/skolutveckling/kompetensutveckling/digital-kompetens-i-undervisning

In the **United Kingdom (Northern Ireland)**, the Council for the Curriculum, Examinations and Assessment's Digital Skills website offers online training for teachers.

CPD courses organised or supported by top-level authorities may cover a large range of topics, from basic skills in IT to targeted training on how to use digital technologies in teaching different subjects (e.g. history, geography). In most of the education systems that have teacher competence frameworks which include digital competences, top-level education authorities promote their use while also offering CPD activities (see the table under Figure 2.1).

2.2.2. Self-assessment tools

As already mentioned above, schools usually have a role in establishing teachers' professional development needs. Teachers' feedback and estimation of their training needs usually contributes to the definition of CPD priorities. Self-assessment tools may help teachers to evaluate the effectiveness of their performance, detect the areas for improvement and therefore establish their professional development needs. Within this report, the term 'self-assessment tools' refers to online or paper-based questionnaires which allow teachers to evaluate their digital competences with the help of a set of questions. Usually feedback in the form of a report is provided, identifying areas of strength and areas for development ([72]). Self-assessment tools are also considered as being useful for individual teacher assessment.

At the European level, a TET-SAT ([73]) self-assessment tool for teacher-specific digital competences has recently been developed. It has been designed as part of the MENTEP (Mentoring Technology-Enhanced Pedagogy) ([74]) policy experimentation project supported by the European Union through the Erasmus+ programme. Moreover, a new online self-assessment tool is being piloted by the European Commission Joint Research Centre based on DigCompEdu (Redecker, 2017) ([75]).

As Figure 2.4 shows, 15 education systems ([76]) promote self–assessment tools to evaluate teacher-specific digital competences. After being involved in the pilot MENTEP project, six of these (Czechia, Estonia, Spain, Cyprus, Portugal and Slovenia) have made the TET-SAT online self-assessment tool available to all schools.

In Spain and Austria, self-assessment tools were developed along with teacher digital competence frameworks. They are closely linked to the competences specified in the competence frameworks and together represent a comprehensive tool for teacher self-evaluation.

In **Spain**, the National Institute of Educational Technologies and Teacher Training (INTEF) has developed a 'Teacher Digital Competence Portfolio' ([77]) which is available to all teachers on a voluntary basis. It contains a self-assessment tool that allows teachers to determine their level in each of the five dimensions of digital competence specified in the digital competence framework for teachers, as well as an area where they can upload their most significant accomplishments and evidence related to digital literacy (courses, projects, awards, publications, didactic materials created, etc.). Some Autonomous Communities have also developed their own self-assessment tools, such as the one developed for Castilla y León's 'Training Programme for the Acquisition and Improvement of Digital Competence'.

In **Austria**, digi.check ([78]) is used by teachers to assess their digital skills, particularly those related to the use of digital media in the classroom. Some provinces have made this mandatory for all teachers. The self-evaluation tool consists of two parts: 1) self-

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([72])   The definition of 'self-assessment tool' is adapted from:
          http://publications.jrc.ec.europa.eu/repository/bitstream/JRC107466/pdf_digcomedu_a4_final.pdf (p. 92).

([73])   http://mentep.eun.org/tet-sat

([74])   http://mentep.eun.org/

([75])   https://ec.europa.eu/jrc/en/digcompedu/self-assessment

([76])   Bulgaria, Czechia, Estonia, Spain, France, Cyprus, Austria, Portugal, Slovenia, Finland, United Kingdom (ENG, WLS and NIR), Switzerland and Serbia

([77])   https://portfolio.intef.es/

([78])   https://digicheck.at/index.php?id=564&L=0

assessment of competences by level; 2) multiple choice questions on all the dimensions of digital competence specified in the digi.kompP teacher digital competence framework.

In the United Kingdom (Northern Ireland) and Serbia, the teacher competence frameworks (see Annexes 2 and 3) are set out in such way that they enable teachers to assess their own competences and therefore plan their development needs throughout their careers.

In the United Kingdom (Wales) and Switzerland, their self-assessment tools were mainly designed for the identification of CPD needs, while Bulgaria's is used for teacher appraisal.

In **Bulgaria**, teacher self-assessment is the first step of the appraisal process. The Teachers' Professional Portfolio contains a self-assessment tool that allows them to evaluate and reflect on their level of achievement in different competence areas, amongst which are information technologies. The Ministry of Education regulates the teacher self-assessment parameters specified in the professional portfolio ([79]).

In the **United Kingdom (Wales)** and **Switzerland** self-assessment enables teachers to evaluate their competences, identify areas for further development, and plan their ongoing professional development on that basis. In the **United Kingdom (Wales)**, the Digital Competence Framework self-assessment tool ([80]) was conceived as a specific online tool for digital competence. In **Switzerland**, the SE:MI ([81]) online self-assessment tool can also help education authorities and schools decide on their CPD priorities.

In Finland, teachers can measure and analyse their use of information and communication technologies in teaching through the online self-assessment tool Opeka ([82]). In France, teachers can assess their digital competences through an on-line tool and receive a *C2i* certificate (*Certificat informatique et internet*) ([83]) delivered by a certifying centre approved by the Ministry of Education.

2.2.3. Teacher networks

Alongside formal training courses, teachers may engage in digital-related professional development by participating in professional communities and networks. Teacher networks may reinforce collaboration and facilitate the exchange of teaching practices, experiences and methods. They are often used to share teaching materials and didactical resources. Usually teacher-specific digital communities operate on-line and are part of wider digital resource platforms or portals that provide other types of support such as digital learning resources, including open education resources (OER), and informal on-line professional development opportunities.

At the European level, e-Twinning ([84]) platforms offer school professionals and students a range of opportunities to communicate, collaborate, develop projects and share experiences using digital technologies.

At the national level, as shown in Figure 2.4, top-level education authorities support the establishment of teacher networks across schools in about two thirds of the education systems.

Top-level authorities may directly initiate and manage teacher networks and digital platforms or they may provide financial support to external institutions to do this for them (e.g. universities, teacher associations, etc.).

In some education systems, top-level authorities have initiated teacher networks dedicated to digital education. For example:

([79]) www.mon.bg

([80]) https://hwb.gov.wales/news/articles/96d6861f-62e1-46e8-9edb-73d6f7e96aa4

([81]) http://www.semifragebogen.ch

([82]) http://opeka.fi/en/presentation/index

([83]) https://c2i.enseignementsup-recherche.gouv.fr/etudiants/les-competences-du-c2i-niveau-2-enseignant-0

([84]) https://www.etwinning.net/en/pub/index.htm

In **France**, the on-line teacher network *Viaéduc* ([85]) was created in 2015 to meet development needs in the use of digital technologies in schools. It brings together 72 000 teachers, 8 200 working groups and thousands of resources. *Viaéduc* allows teachers to build their network(s), share their practices, work and produce resources together in complete freedom and in complete safety.

In **Croatia**, there is an online network for all ICT specialist teachers. It enables continuous communication between participants, continuous access to lectures and exercises, as well as online collaboration and team work opportunities. It has become a learning community in which all teachers share knowledge and materials. Teachers cooperate through virtual classrooms classified by subject and type of school (primary and upper secondary school). Work in every classroom is monitored by several mentors who cooperate in the virtual environment through a special tool (Teams) which allows the sharing of written communications between teams or smaller groups and offers the facility to use and share documents online and participate in online meetings.

In **Austria**, the eEducation Austria network deals with the following areas: school digital development, teacher digital training, developing pupils' digital skills and the pedagogical use of ICT.

In **Slovenia**, many teachers and head teachers are engaged in the 'ICT projects' ([86]) collaborative community.

In the **United Kingdom (Wales)**, a network of Digital Pioneer Schools ([87]) is supporting other schools in the implementation of the Digital Competence Framework. The Welsh Government also provides funding to the Regional Education Consortia across Wales to enable them to offer local, tailored events in line with school needs. These involve practitioners sharing good practice on topics including the implementation of the Digital Competence Framework, the use of digital technology to enhance school collaboration, online safety, and developments on the Hwb learning platform, a Welsh Government-funded open education resource platform for schools in Wales.

Despite the fact that participation in professional networks is not mandatory and therefore usually happens during teachers' spare time, this informal way of learning is popular with teachers across Europe. The 2nd Survey of Schools (European Commission, 2019, p. 77) shows that between 29 % of secondary level and 41 % of primary level students are taught by teachers that have participated in an online community for ICT related professional development.

([85]) https://www.reseau-canope.fr/actualites/actualite/viaeduc-le-nouveau-reseau-professionnel-des-enseignants.html

([86]) https://skupnost.sio.si/course/index.php?categoryid=867

([87]) http://learning.gov.wales/docs/learningwales/publications/180620-dcf-guidance-2018-en.pdf

CHAPTER 3: ASSESSING DIGITAL COMPETENCE AND USING DIGITAL TECHNOLOGIES IN ASSESSMENT

Assessment is a key element in any education system. It has many different forms and purposes. As part of the teaching and learning process it contributes to student motivation and learning strategies (Zeng et al., 2018), and is conceived of as a 'cycle involving elicitation of evidence, which, when interpreted appropriately, may lead to action, which in turn, can yield further evidence and so on' (Wiliam and Black, 1996, p. 537). It is also the main means by which decisions on student performance are made and this can influence young people's future academic careers. Moreover, the results obtained from assessment procedures not only provide evidence of individual student achievement, they can also be used as an indicator of school and teacher performance (OECD, 2015a). They are therefore seen as crucial in improving the education system as a whole. Assessment is, consequently, a key tool for policy makers, while also providing information to parents and society at large about educational performance, school improvement, school leadership and teaching practices (OECD, 2013, p. 13).

The value and uses of assessment are therefore manifold. It is generally referred to as being 'summative' or 'formative'. However, new paradigms, such as 'Learning-Oriented Assessment', where the boundaries between the two are less marked, are also emerging.

Summative assessment is traditionally linked to grading, certification and more generally to the evaluation of progress (Bloom et al., 1971). Also referred to as assessment *of* learning, conventionally summative assessment takes the form of tests or examinations, which can be invested with high stakes such as when it governs access to higher education. Summative assessment is an integral part of the education system. However, although it provides evidence on student learning, it is mainly assessment *after* learning (Miedijensky and Tal, 2016) and therefore offers little to the learning process itself.

Formative assessment is a more recent concept. First used by Scriven (1967), its value is closely linked with improving the learning and teaching processes (EACEA/Eurydice, 2011b), rather than with determining students' level of achievement. In this sense, formative assessment has a more positive role to play in the educational process because it takes place *during* learning and not after it (Zeng et al., 2018). As highlighted by Black and Wiliam (1998, p. 12) 'there is a body of firm evidence that formative assessment is an essential component of classroom work and that its development can raise standards of achievement'. According to some researchers, gains in learning outcomes associated with formative assessment 'are among the largest ever reported for educational interventions' (OECD, 2015a, p. 123).

Learning-oriented assessment is also emerging as an additional assessment method. It evolves from summative and formative assessment and integrates three dimensions: assessment *of* learning, assessment *for* learning, and assessment *as* learning, the latter emphasising more active participation by students in their own assessment and in exploring assessment as a learning process in itself (Zeng et al., 2018).

Similarly, self-assessment is an approach that receives full attention in the educational world and is nowadays considered an essential part of formative and classroom assessment (Brown and Harris, 2013; Brown et al., 2015). Student self-assessment is a judgement made by learners themselves on aspects of their own performance (Boud and Falchikov, 1989). There is a body of research associating self-assessment with positive returns in terms of learning (Brown et al., 2015), but there are also issues linked to the validity and accuracy of self-perceptions (Panadero et al., 2015; Brown et al., 2015; Harris and Brown, 2018), and the extent to which self-assessment results can be used in formal

assessment practices. Some countries have developed self-assessment tools for digital competences or have integrated this practice into a broader approach to assessment. This is the case, for example, in France with the PIX platform ([88]) and in Austria with the digi.check assessment model ([89]).

In the last few decades, standardised national and international assessments in different subjects have been on the rise. These are closely linked to the summative aspect of assessment, i.e. assessment that takes place after learning and focuses on measuring student learning outcomes. The United States' National Research Council (1999) connects the popularity of such assessments with the increased focus on the accountability of schools and individuals for achieving educational goals, and as a consequence, an increased interest in the measuring of deficiencies as the basis for change in practice and policy.

Standardised assessment has two main purposes: to assess the achievements of individual students and to gather data on the quality of the education system.

The first purpose of standardised assessment refers to the tests administered for certification purposes. The aim is to summarise the attainment levels of pupils and students at the end of a particular stage of education or school year. These test results can have a significant impact on an individual's progression in school or to the next level of education, for example, giving access to higher education. They may also affect students' transition to the workplace. The results of the tests are also generally used as the basis for the award of certificates to individual pupils/students (EACEA/Eurydice, 2009).

The second purpose refers to the standardised assessment intended to provide data for the evaluation of schools and/or the education system as a whole. This data allows school performance to be compared and institutions to be held accountable for their results. On the wider scale, it leads to an overall evaluation of the performance of the education system. The results of standardised tests 'may be used in conjunction with other parameters such as indicators of the quality of teaching and the performance of teachers. They also serve as pointers to the overall effectiveness of education policies and practices and provide evidence of whether or not improvements have occurred in a particular school or at system level' (EACEA/Eurydice, 2011b, p. 90). In some cases, these tests can also be used to pilot initiatives before rolling out policy reforms.

International standardised assessment results such as PISA, TIMSS and PIRLS contribute to the evidence base at education system level by providing cross-country comparative data on student achievement in a number of areas. This evidence is useful in shaping policies not only at national but also at European level.

Standardised tests at school level are criticised for a number of reasons. They are usually associated with high stakes for both students and schools – poor performance in examinations may prevent a student from, for example, winning a place at university, while schools may be negatively judged in external inspections. Some research has highlighted the negative impact that high stakes tests may have on the teaching and learning process. One of the problems is linked to the direct accountability of schools and teachers, which might push them into teaching what is being tested rather than what students need to learn (OECD, 2013). Other issues, reported by Britton and Schneider (2007), have to do, for example, with creating a hierarchy within the curriculum, which makes what is being tested more important than what is not tested. Furthermore, the types of standardised tests used at the moment are limited, often being based on multiple-choice questions, basic tasks, or short-answers

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that require knowledge to be reproduced. While these approaches have advantages in terms of making scoring easier, less costly, quicker, and the results more comparable, they usually assess a small range of skills. In addition, Britton and Schneider (2007) highlight that some studies show that the skills and knowledge tested tend to be at a lower level than curriculum requirements, thereby reinforcing friction between what is taught/learned and what is tested. This has a significant effect on the inferences drawn from the results of testing and the quality of education systems.

This chapter analyses the relationship between digital education and assessment in schools. As with other chapters, it explores two dimensions, i.e. student assessment in digital competences and the uses made of digital technologies in assessment procedures. Most of the chapter focuses on national tests. These are defined as standardised tests or examinations carried out under the responsibility of top-level public authorities, they (1) require all test takers to answer the same questions (or questions selected from a common bank of questions); and (2) are scored in a standard or consistent way (see the glossary for the full definition).

The first section of the chapter focuses on the assessment of digital competences in schools. It looks at three aspects:

- whether digital competences are assessed in national tests
- what guidance is provided to teachers to assess digital competences in the classroom
- whether information on digital competences is given on certificates awarded at the end of secondary education.

The second section focuses on the use of digital technologies in national tests. It investigates which education systems make use of technology in conducting these tests and for what purposes. The section also examines the competences tested, the types of tests used and the technological environment in which they are carried out.

3.1. Assessing digital competence

European countries have made considerable progress in ensuring that the key competences are present in national curricula (European Commission/EACEA/Eurydice, 2012), and that digital competence is among them ([90]). As seen in Chapter 1, digital competence is addressed in almost all national curricula at all school levels. This may be as a cross-curricular theme, as part of other subjects, or as a separate subject (see Figure 1.2). However, its mere presence in content and curricula is not sufficient.

Brečko et al. (2014, p. 17) highlight that there is a 'consensus among educational stakeholders that what is assessed and examined determine 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 but need innovative approaches (Brečko et al., 2014). The assessment of literacy, science, mathematics and language skills is based on a strong tradition. Modern and meaningful assessment methods can be built on this strong base whilst also taking into account new developments in the understanding of the role of assessment and the mechanisms

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([90]) Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning, OJ L 394, 30.12.2006, p. 10-18, and Council recommendation of 22 May 2018 on key competences for lifelong learning, OJ C 189, 4.6.2018, p. 1-13.

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 at the least, if not meaningless. As Beller (2013) notices, in large-scale standardised assessment contexts digital technologies are usually used to assess general competencies, such as skills related to ICT and the management and communication of information. As also 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.

The following analysis focuses on the use made of national tests for assessing digital competences. Specifically, it looks at the context in which they are tested, for example as a separate subject, the grade or level of education at which this takes place in schools, and whether all or only some students are assessed. The analysis then examines top-level authority guidance for teachers to assess digital competences in the classroom, exploring if, in addition to learning outcomes, there are any criteria or standards that teachers can consult, or whether teachers must rely on national test specifications. Finally, the last part examines whether the result of the digital competence test is shown on the certificates awarded at the end of secondary education.

3.1.1. Assessing digital competence through national tests

There are three ways of assessing digital competences in national tests: (1) through a specific, separate test (such as in ICT or informatics), (2) through the assessment of other competences/ subjects (such as the language of instruction, mathematics or science), or (3) through sample-based tests carried out for national/top-level quality assurance monitoring purposes. International surveys and tests, such as PISA ([91]) and ICILS ([92]), are excluded from this analysis.

The first two methods are used to evaluate the competences of individual students, while the third generally focuses on assessing how well the education system is performing. Usually, when national testing is carried out within the framework of quality assessment procedures, a representative sample of students is used and the results do not have an impact on the individual student's school career. In contrast, when national testing is carried out specifically to assess the competence of individual students, this often does have serious implications for them personally, for example, they may not be allowed to progress to the next class or school level, or allowed entry to the university or programme of their choice. In some education systems, however, this is not the case as the results of national tests may be only one source of information on which a student's performance is assessed. It must also be pointed out that in some cases, aggregated data from the national tests used for assessing individual student achievement is also used by top-level authorities to monitor the education system as a whole, even though this is not the primary reason for setting the tests.

The following analysis looks at all three types of testing regime in relation to digital competences.

([91]) http://www.oecd.org/pisa/aboutpisa/
([92]) https://www.iea.nl/icils

Figure 3.1 shows that the number of education systems holding national tests to assess digital competences increases with the education level. Overall, across Europe, only two countries (Austria and Norway) test pupils' digital competences in primary schools. In lower secondary education, these are tested in one quarter of the education systems, and the number increases to almost half at upper secondary education level.

Whilst Figure 3.1 indicates the level of education at which students are tested, in many countries the specific cohort of students tested is limited, usually for one of three reasons: only pupils following a specific subject or learning path are tested; testing is voluntary; or finally, testing is for quality assurance purposes, and is therefore sample-based (see table under Figure 3.1).

In half of the education systems, there is no national testing of digital competences at school level.

At primary level, only two countries – Austria and Norway – have national tests to evaluate students' digital competences.

> In **Austria** and **Norway**, specific digital competence tests are administered. However, these are not compulsory and schools decide whether their pupils participate. Moreover, the testing does not have implications for students' future schooling and is generally considered to serve only as an indication of students' digital competences and as a source of information for teachers, parents and the children themselves.

At lower secondary level, 12 ([93]) education systems have national testing on digital competences.

In seven of these countries, the aim is to evaluate the individual student's competences. Five of these (Greece, Cyprus, Latvia, Malta and Austria) have a dedicated test. Denmark and France test digital competences as part of the testing process for other competences, and Norwegian students are assessed both through a specific test and by integrating digital competences into the tests in mathematics and science. Overall, only Denmark, France and Malta assess the digital competences of all pupils at this education level.

It is worth highlighting some differences in approach between the countries that administer a specific test.

> In **Cyprus**, since the school year 2016/17, lower secondary students can take, on a voluntary basis, a test in digital competences on up to four modules of the European Computer Driving Licence (ECDL), which are aligned with the curriculum. These are Word Processing, Spreadsheets, Presentation and Using Databases. Testing is carried out on an ECDL-approved client-server platform ([94]), run by the national ECDL operator ([95]). Students receive an ECDL certificate for each module successfully passed.

> In **Latvia**, the test is administered to students who have taken an optional subject in informatics as part of their national exams at the end of compulsory education.

> In **Malta**, the national test is in information and communications technology, a separate subject compulsory for all pupils.

> In **Austria**, after the introduction of digital basic education as a new compulsory subject at lower secondary education, the online assessment of digital competences, previously available to schools as an optional test, is becoming compulsory. The first mandatory tests, however, will take place in grade eight for pupils currently enrolled in grade five, therefore in 2021.

> Finally, in **Greece**, during the 2018/19 school year, a pilot project is being conducted on the testing of digital competences among lower secondary students. The testing is supported by a digital platform ([96]) and is carried-out on a voluntary basis; it will lead to a national certificate in IT.

([93]) Czechia, Denmark, Estonia, Greece, France, Croatia, Cyprus, Latvia, Malta, Austria, Norway and Serbia

([94]) http://inates.ecdlexams.com.cy/32/

([95]) http://ecdl.com.cy

([96]) https://kpp.cti.gr/

Figure 3.1: Use of national tests for the assessment of digital competences, primary and general secondary education (ISCED 1-3), 2018/19

Primary (ISCED 1)

Lower secondary (ISCED 2)

Upper secondary (ISCED 3)

■ Specific national tests related to individual student achievement

■ Non-specific national tests related to individual student achievement

■ Quality assurance related national tests

■ National tests do not include digital competences

■ No national testing
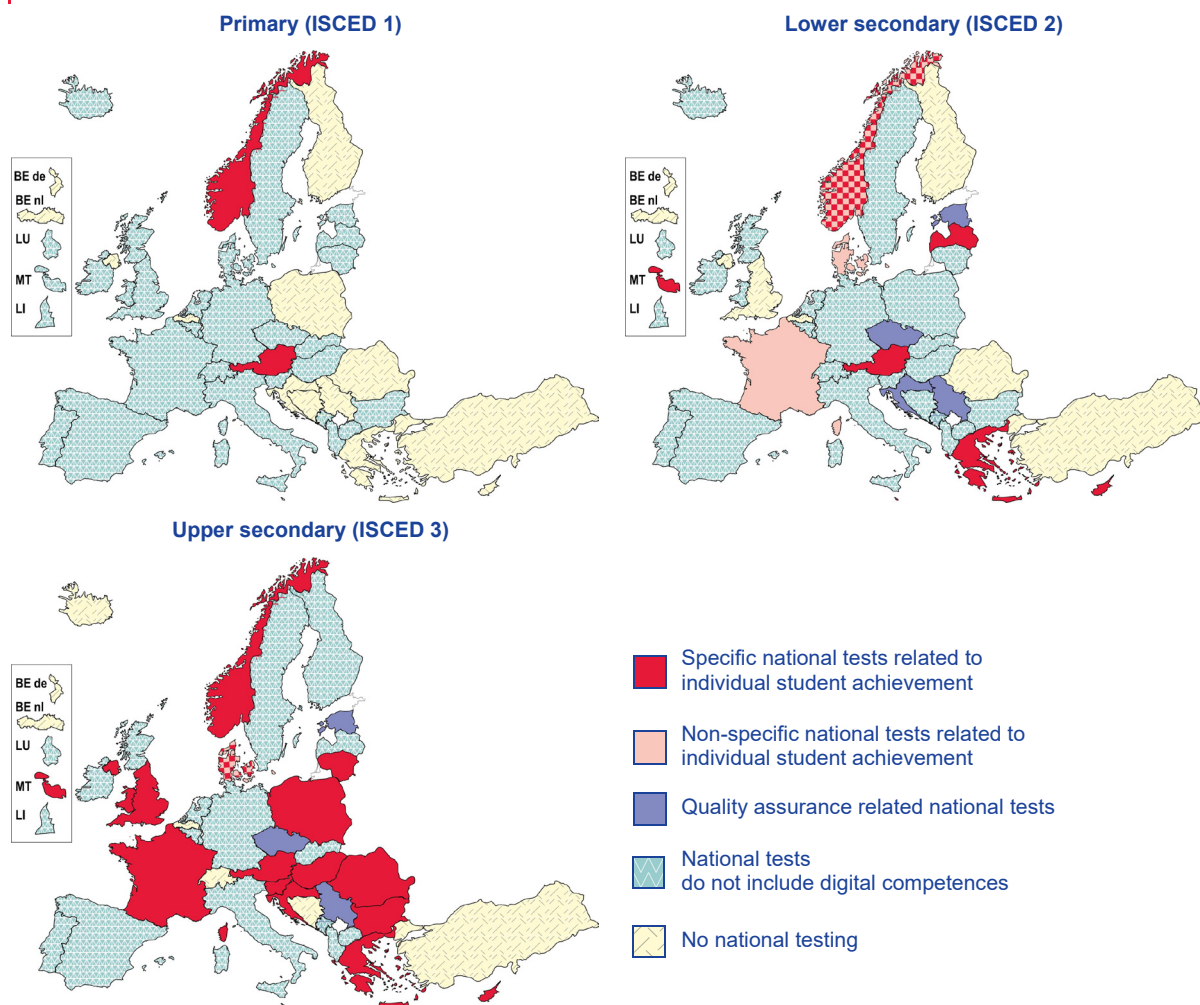
Student base

	BE fr	BE de	BE nl	BG	CZ	DK	DE	EE	IE	EL	ES	FR	HR	IT	CY
ISCED 1															
ISCED 2					⋏	●		⋏		◎		●	⋏		◎
ISCED 3				●	⋏	● - ○		⋏		○		○	○		○
	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE	
ISCED 1							◎								
ISCED 2	○				●		◎								
ISCED 3		○		○	● - ○		◎	○		●	○				
	UK-ENG	UK-WLS	UK-NIR	UK-SCT		AL	BA	CH	IS	LI	ME	MK	NO	RS	TR
ISCED 1													◎		
ISCED 2													◎	⋏	
ISCED 3	○	○	○										○	⋏	

● All pupils   ○ Some pupils   ◎ Volunteers   ⋏ Samples

Source: Eurydice.

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Explanatory note

Specific national tests are those dedicated to digital competences, which may be 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.

Non-specific national tests are those that are intended to test other subjects such as mathematics, but which also test digital competences. They seek to determine an individual student's level of attainment usually in relation to a graded scale.

Quality assurance related national tests in digital competences are conducted by the authority in charge of education to support teachers and students, and to monitor the quality of the education system rather than measuring the attainment levels of individual students. This type of testing is normally sample-based.

Country-specific notes

Greece and **Croatia**: National testing of digital competence at lower secondary education level (ISCED 2) is currently being piloted.

Spain: National tests are organised at Autonomous Community level.

Sweden: At all school levels, digital competence is integrated into the curriculum and syllabi of other subjects and/or competences. National tests may therefore cover digital competence, but there is no explicit requirement to do so.

Serbia: National testing of digital competence at secondary education level (ISCED 2 and 3) was piloted in 2017.

In the two countries (Denmark and France) where digital competences are tested through other competences/subjects, the test is mandatory for all pupils.

In **Denmark**, this is through the tests in mathematics and Danish taken by pupils at the end of compulsory education.

In **France**, it is part of the lower secondary education examination to obtain the *Diplôme National du Brevet*, at grade nine, the written test for mathematics, science and technology includes a practical exercise on coding.

In four countries (Czechia, Estonia, Croatia and Serbia), the digital competences of a sample of pupils are tested as part of the quality assurance processes. This is a recent development.

In **Estonia**, the testing of the digital competences of ninth graders to monitor the quality of the education system was launched in 2018.

Similarly, in **Czechia**, the testing of digital competences was introduced in 2016/17 as one of the six basic literacies to be regularly monitored by the school inspectorate through surveys and testing. The grade (or year group) of pupils being tested varies from one year to another.

In Croatia and Serbia, this approach is still in the pilot phase but it has an additional objective in that it will assess how well the education system is prepared to deliver technology-supported testing.

In **Croatia**, in 2018, a sample of pupils from the seventh grade was tested with a view to piloting test methods and monitoring pupils' knowledge in the area.

In **Serbia**, a similar exercise was conducted in 2017 as part of evidence gathering for future policy reform in the area of digital education.

In upper general secondary education, the scenario is very different. The number of education systems that perform some kind of national testing on digital competence increases to 20 ([97]).

In all but three (Czechia, Estonia and Serbia), the tests focus on assessing the achievement levels of individual students and in the vast majority through a dedicated test. In Denmark, digital competences are assessed through a specific test in informatics as well as through tests in Danish and English. In most countries, the dedicated test takes place within the framework of the final upper secondary graduation examination. The exceptions are Bulgaria (end of compulsory education at grade 10) and the United Kingdom (England, Wales and Northern Ireland), where it can take place both at the end of compulsory full-time education (age 16), and in the context of the A Level examinations at age 18.

Although many more countries test students' digital competences at upper secondary than other school education levels, in most of these countries the cohort of pupils being tested is limited. Students that take the tests are in fact those that have chosen to study a subject specifically linked to digital technologies or to another field of study that requires these competences, or to students that

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([97]) Bulgaria, Czechia, Denmark, Estonia, Greece, France, Croatia, Cyprus, Lithuania, Hungary, Malta, Austria, Poland, Romania, Slovenia, United Kingdom (ENG, WLS and NIR), Norway and Serbia

choose to take the test in digital competences. This is the case in Greece, France, Croatia, Cyprus, Lithuania, Hungary, Poland, Slovenia, the United Kingdom (England, Wales and Northern Ireland) and Norway. Only in Bulgaria, Denmark, Malta and Romania are all pupils tested.

> In **Bulgaria**, the national assessment of digital competences is taken by all grade 10 students at the end of compulsory education to determine their attainment levels in the area of informatics and information technologies.

> In **Romania**, digital competences are assessed in the context of the National Baccalaureate Examination, at the end of upper secondary education in grade 12.

In Denmark and Malta, both testing regimes are in place.

> In **Malta**, all pupils are tested for their knowledge in the subject of ICT and further specific testing is taken by pupils who have chosen the subjects computing or VET IT (VET IT is taken in the context of general upper secondary education).

Finally, in nine education systems (Bulgaria, Denmark, Estonia, France, Latvia, Malta and the United Kingdom – England, Wales and Northern Ireland), students' digital competence may be tested at the end of compulsory education, which either falls at the end of the lower secondary phase or during general upper secondary education.

In Czechia, Estonia and Serbia, digital competence is assessed within the framework of the quality assurance monitoring procedures following the same model used at lower secondary level. In Serbia, this form of testing has so far only been piloted.

Overall, only two countries (Austria and Norway) test pupils' digital competences at every level of education. In Latvia, digital competences are assessed only at lower secondary level, and in nine education systems (Bulgaria, Lithuania, Hungary, Poland, Romania, Slovenia, and the United Kingdom – England, Wales and Northern Ireland) only at upper secondary level.

3.1.2. Guidance on the assessment of digital competences in the classroom

National tests are not the only way of assessing students' competences. Regular, formative and/or summative assessment conducted in the classroom by individual teachers is more common.

As seen in Chapter 1, the teaching of digital competences can be cross-curricular, embedded in other subjects, or taught through one or more dedicated subjects. In principle, when digital competences are included in the curriculum, teachers are expected to regularly assess students to measure their achievement in relation to the learning outcomes outlined in the curricula.

An additional aspect to consider is that when digital competences are relatively new to the curriculum, top-level authorities often support their introduction by providing guidance and support to teachers, which may also include help for student assessment.

Research shows that innovations in education usually do not succeed if teachers are not provided with the skills and knowledge needed to implement them in practice. Training teachers is also a very expensive activity and often much neglected in relation to large-scale initiatives (Pelgrum, 2001). Moreover, as highlighted by Black and Wiliam (1998, p. 10) 'teachers will not take up ideas that sound attractive, no matter how extensive the research base, if the ideas are presented as general principles that leave the task of translating them into everyday practice entirely up to the teachers'.

Figure 3.2: Guidance on the assessment of digital competences in the classroom in primary and general secondary education (ISCED 1-3), 2018/19

Primary (ISCED 1)

Lower secondary (ISCED 2)

Upper secondary (ISCED 3)

■ Learning outcomes for digital competences only

■ Learning outcomes + criteria and/or standards for assessing digital competences

■ Learning outcomes + national test specifications for digital competences or related subjects

▨ None of the above
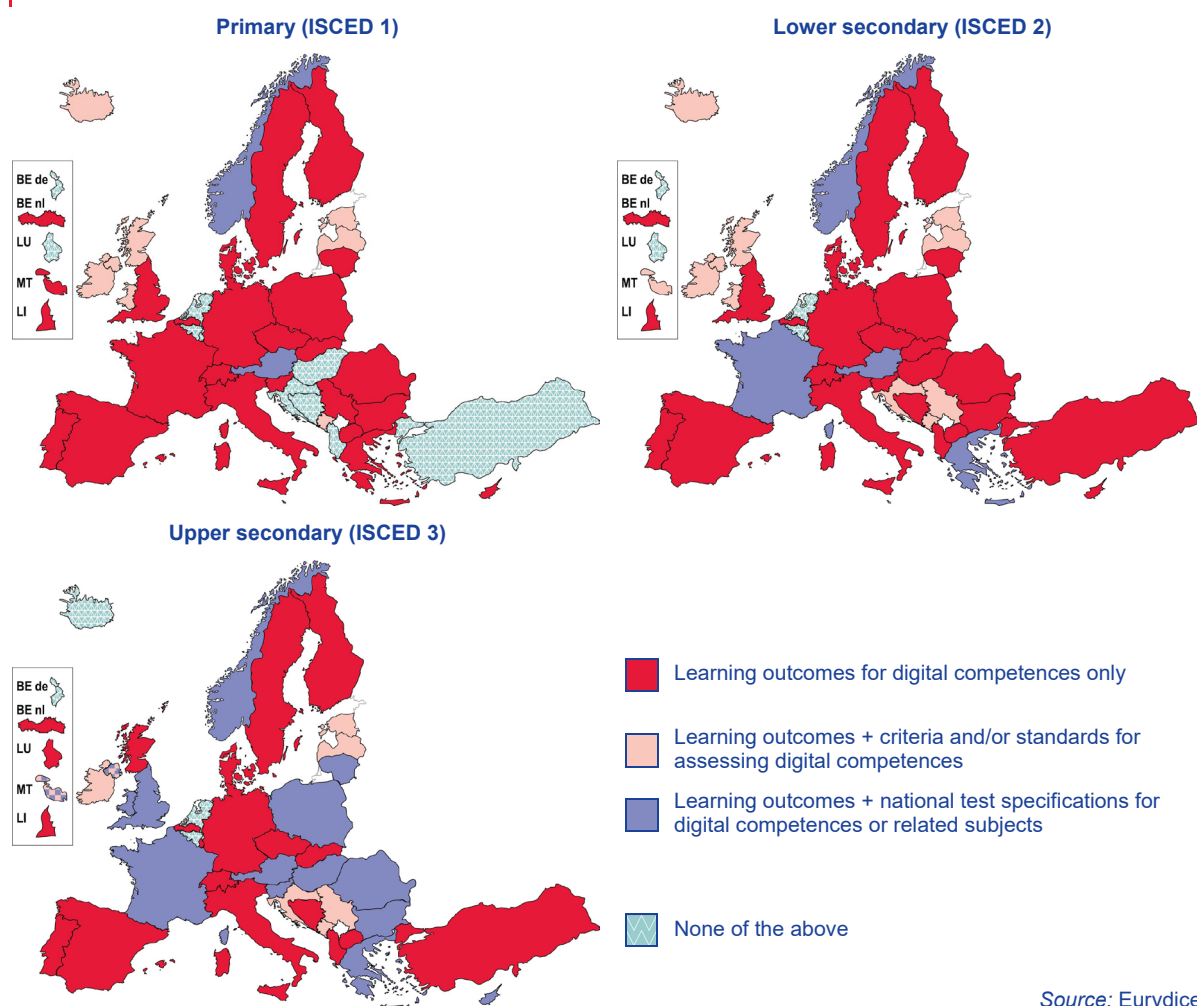
Source: Eurydice.

Explanatory note

The Figure refers to guidance provided by top-level authorities to support teachers in the assessment of digital competences in the classroom. Such assessment can be either formative or summative. Guidance refers to official documents providing learning outcomes and/or criteria/standards or publicly available national test specifications that teachers can use when assessing digital competences in the classroom.

Country-specific notes

Spain: Specific guidance has been developed by some Autonomous Communities (Andalucía, Aragón, Canarias, Cataluña, Galicia).
Croatia: Learning outcomes related to all five competence areas are included at primary level in the new curriculum for informatics but will be implemented only in 2020/21.
Latvia: Although digital competence is not yet included in the curriculum at primary level, a project running since 2015 introduced the subject *Datorika* (computing) as of the first year of basic education. It is not a requirement, but many schools provide it as a compulsory subject.
Netherlands: The curriculum only contains key objectives for digital literacy, formulated in a very general way.

While aspects of teacher professional development in the pedagogical use of digital technologies are discussed in Chapter 2, this part of the analysis explores the documents issued by top-level authorities (referred to here as 'guidance') that help teachers understand which competences to assess in the classroom and how to make judgements on students' proficiency levels. It looks at stated learning outcomes, standards and national test specifications. However, it does not consider the specific tools, forms of testing, or methods used, nor does it address any general assessment guidance that is not specifically related to digital competence.

Figure 3.2 identifies the countries that provide guidance on classroom assessment and the education levels to which it applies. It shows those which indicate: (1) learning outcomes only (linked to the curriculum) ([98]); (2) learning outcomes plus criteria and/or standards for the assessment of student proficiency; and (3) learning outcomes plus national test specifications that can be used by teachers in classroom assessment.

Overall, in most countries, the official guidance on the assessment of digital competences in the classroom is limited to learning outcomes. This is the case in over half of the education systems at primary and lower secondary education level, and in more than one third of the education systems at upper secondary education level. In 13 systems ([99]), the learning outcomes provided in the curriculum are the only guidance at any education level.

Eleven education systems ([100]) have developed criteria and/or standards describing proficiency levels in digital competence or use of digital technologies that can be used by teachers in assessing students in the classroom. However, only five (Estonia, Ireland, Latvia, the United Kingdom – Northern Ireland, and Montenegro) apply them to both primary and secondary education. In the United Kingdom (Wales and Scotland) and Iceland, criteria and standards are available at primary and lower secondary but not at upper secondary level. In Malta and Serbia, these have not been developed for primary education but are available throughout secondary education. In Croatia, they are available for all education levels, but will be implemented at primary level from 2020/21. These criteria and/or standards vary in their complexity and how prescriptive they are in terms of the amount of autonomy teachers have in using them, as shown in the examples below.

In **Ireland**, the Digital Learning Framework for Primary Schools ([101]) provides a common reference with statements or descriptors on digital competences for teachers and school leaders. The framework is intended mainly as a self-reflective tool to support teachers and schools in embedding digital technologies in learning, teaching and assessment practices. The standards linked to learners' outcomes contain statements for effective and highly effective practice. For example, under the standard 'Pupils have the necessary knowledge, skills and attitudes required to understand themselves and their relationships', teachers' and schools' practice are considered effective when pupils are able to 'understand the potential risks and threats in digital environments' and are considered highly effective when 'pupils can confidentially protect their digital identity and manage their digital footprint'. An equivalent framework exists for post primary school education ([102]). Both frameworks have been trialled in a sample of schools in 2017/18 and the current evaluation will be used to further improve the framework.

In the **United Kingdom (Scotland)**, teachers in primary and lower secondary education are provided with detailed benchmarks that guide them in assessing proficiency. The benchmarks are provided for each learning outcome identified in the curriculum at each study level. For example, under Digital Literacy level 4, and specifically the area of 'Cyber resilience and internet safety', the corresponding learning outcome has five benchmarks, such as 'identifies the main causes of security breaches in industry' and 'demonstrates understanding of how cyber security breaches in industry can impact on individuals'. However, there is great emphasis on the guiding nature of such benchmarks and their non-prescriptive nature. Moreover, teachers are recommended to 'avoid over focusing on and assessing based on individual benchmarks' ([103]).

In **Iceland**, competences for information and communication technology are divided into five different categories, such as 'information acquisition and processing' or 'ethics and security', and standards provided for three different grades (grades 4, 7 and 10). For example, under 'ethics and security', one criteria is the responsible use of the web. At grade 4, the standard is to follow simple rules for responsible internet use and be aware of their moral value. At grade 7, in addition to the previous ones, the standard emphasises

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([98]) The analysis of learning outcomes is provided in Chapter 1. In this context, learning outcomes are considered to be the minimum level of guidance on assessment of digital competences in the classroom.

([99]) Belgium (BE nl), Czechia, Denmark, Germany, Spain, Italy, Portugal, Slovakia, Sweden, Finland, Switzerland, Liechtenstein and North Macedonia

([100]) Estonia, Ireland, Croatia, Latvia, Malta, United Kingdom (WLS, NIR and SCT), Iceland, Montenegro and Serbia

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

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

([103]) https://education.gov.scot/improvement/documents/technologiesbenchmarkspdf.pdf

the responsibility of students for their communications and data on the internet and on social media. Finally, at grade 10, students need to show responsibility in use of electronic means of communication and social media, work in accordance with rules on responsible internet usage and be aware of their moral responsibilities. Assessment criteria are related to these standards with a four-scale marking (A to D). The assessment scale is obligatory only for pupils graduating at the end of grade 10 ([104]).

The national test specifications available for teachers to use when assessing students in the classroom are also a valuable source of guidance. If they indicate for the final examinations which competences will be tested, what is expected of pupils, what kind of tasks need to be performed and how the tests will be evaluated, teachers can use these as benchmarks for assessing students during the course.

At primary level, these are available only in Austria and Norway, which also provide them for secondary schools. At lower secondary education level, national test specifications are available in four education systems (France, Greece, Austria and Norway). Conversely, in general upper secondary education, they are available in 15 ([105]) education systems.

In **Bulgaria**, each year the Ministry of Education and Sciences publishes the requirements for carrying out the national online assessment of digital competences for students in grade 10. This document contains information on the competences that will be assessed, the cognitive levels to be achieved, and the weight carried by each task in the final mark.

In **Greece**, in the context of piloting the national certificate in IT for lower secondary pupils, the support platform also describes the competences to be achieved and provides supporting materials that teachers and pupils can use to prepare for the test.

In **France**, examples are given in the documents that describe how competences will be evaluated in the different national tests. For example, in the context of the written test for mathematics, science and technology at the end of lower secondary education (*Diplôme National du Brevet)*, in relation to coding, pupils could be required to perform, among other things, one of the following tasks: write or understand an algorithm or programme, transform it to achieve a different result, or test and validate it in a specific environment.

In **Romania**, within the framework of the National Baccalaureate at the end of upper general secondary education, the annual ministerial publication on the examination syllabi for the assessment of digital competences contains examples of tests administered in previous sessions together with assessment criteria.

In the **United Kingdom (England, Wales and Northern Ireland)**, the awarding organisations publish specifications for qualifications, such as, for example, the computer science A Level (taken by some students at age 18, the end of upper secondary education). Such specifications contain schemes of assessment and assessment objectives, and clarify expectations and examination requirements. Teachers may use these specifications to assess student progress in the classroom.

The fact that national test specifications are available mostly for general upper secondary education is consistent with the fact that these tests usually take place within the framework of official exams to certify students' digital competences at the end of schooling. While this can have advantages such as providing transparency for students, too much reliance on test specifications might distort teachers' perception of what is important for students to know and be able to do. This may result in a narrowing of classroom learning activities, including assessment, to the requirements of standardised tests (OECD, 2013).

In some education systems, there are no learning outcomes related to digital competences in the curriculum, which implies that there is no guidance from top-level authorities on assessment. This is the case for Belgium (French and German-speaking Communities) and the Netherlands for all education levels. In Luxembourg, there are no learning outcomes for primary and lower secondary school pupils, and guidance is limited to curriculum content statements or descriptors at upper secondary level. This is the same in Albania, Bosnia and Herzegovina and Turkey for all secondary school students. In Hungary, while there are no learning outcomes related to digital competences for

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children in primary schools, these exist for pupils in lower secondary schools, and teachers can use the national test specifications in general upper secondary education. In Croatia, teachers have specific criteria and/or standards for all secondary school students, while learning outcomes at primary level are developed but will be implemented from 2020/21. Finally, in Iceland, there are no learning outcomes at upper secondary level, but teachers have criteria and/or standards for primary and lower secondary education levels.

3.1.3. Recognition of digital competences on certificates awarded at the end of secondary education

Assessment is an important part of the teaching process. In its summative form it allows student attainment to be judged in relation to expected learning outcomes. However, if what has been attained in terms of learning outcomes is not officially recognised or clear both to students and to stakeholders outside the school (e.g. employers and higher education institutions), its value can potentially be diminished. This part of the chapter examines whether student achievement related to digital competences is shown on the certificates awarded at the end of secondary education. Certificates are defined here as official proof of a qualification awarded to students following the completion of a particular stage or a full course of education. The award of certificates may be based on various forms of assessment, and a national test or final examination is not necessarily a prerequisite (see Section 3.1.1). The analysis also explores the kind of information related to digital competences that is included on the certificates.

In the vast majority of education systems across Europe, students receive a certificate at the end of secondary education. The only exceptions are Belgium (German-speaking Community), North Macedonia and Turkey (European Commission/EACEA/Eurydice, 2017). These certificates provide official evidence of the level of education achieved and may allow access to higher education.

However, digital competence is not often shown on school certificates. As reported in Figure 3.3, only half of the education systems do so and in most of these, it applies only to a limited number of students.

Of the education systems that include information on digital competences on the certificates awarded at the end of secondary education (ISCED 3), only three (Bulgaria, Malta and Romania) register them on the certificates of all students. In the remaining 20 systems ([106]), only students who have taken a digital competence related subject or learning path or who have taken a related final examination have it acknowledged on their certificate. This is coherent with the data analysed in Chapter 1 on the curriculum approaches to digital competences and in section 3.1 of this chapter on national tests, showing that in many countries, in upper secondary education, digital competence related subjects are optional.

Certificates that include information on students' digital competences often refer to different aspects.

In almost all countries, certificates include a reference to the examination result or more generally to the final grade. In France and Serbia, certificates provide a general reference to the digital competence subject area without any further specification.

([106]) Denmark, Czechia, Estonia, Greece, France, Croatia, Cyprus, Latvia, Lithuania, Hungary, Austria, Poland, Slovenia, United Kingdom (ENG, WLS and NIR), Liechtenstein, Montenegro, Norway and Serbia

Figure 3.3: Information related to digital competences included on certificates awarded at the end of general upper secondary education (ISCED 3), 2018/19

The certificate makes reference to:

- specific digital competences
- general digital competence (no further detail)
- instruction time received
- assessment/exam results or final grading

No mention of digital competences/
No certificate at the end of general secondary education

Source: Eurydice.
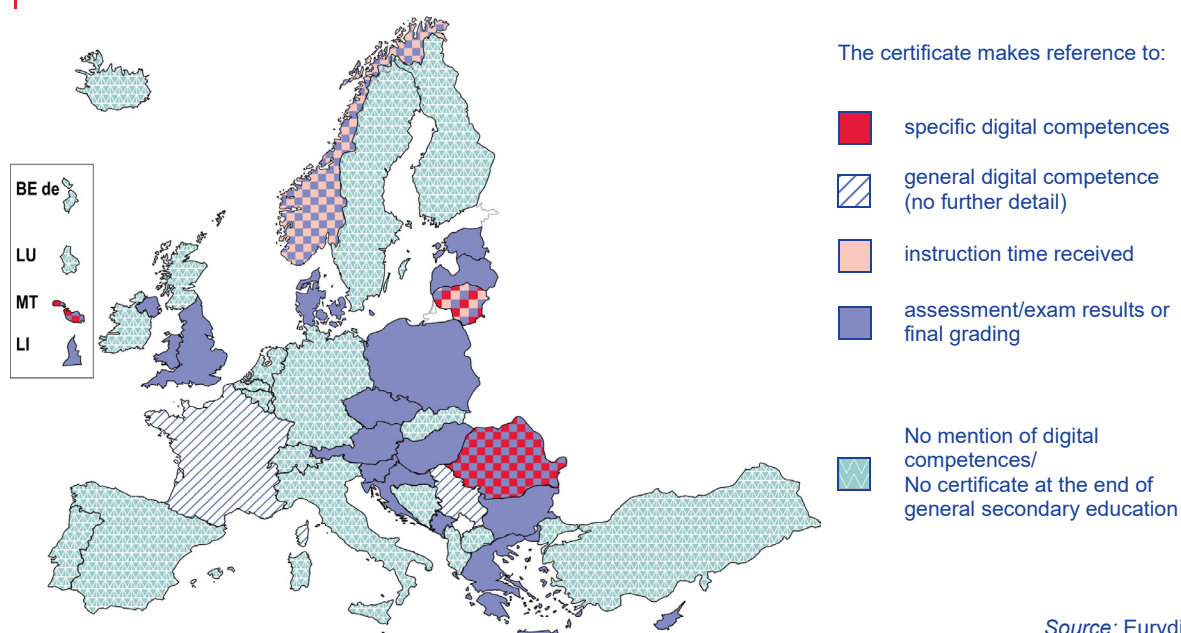
Explanatory note

The Figure refers to the certificates awarded to students on completion of general upper secondary education (ISCED 3). Digital competence or a related subject area such as ICT must be explicitly mentioned on the certificate (or in an attachment) but the final mark or grade is not necessarily shown. In most countries, digital competence is recorded on certificates only for those students who have taken a course in and/or sat an examination in a digital competence related subject.

Country-specific notes

Germany: In some *Länder,* certificates may contain a digital competence element.
Portugal: Students may request a certificate listing all subjects in their curriculum. Students who have taken the optional subject 'information applications B' would have this listed in their certificate without further detail.

Of the countries that provide reference to the examination result or the final grade, four add other elements. In Malta and Romania, certificates report achievement in specific competences, while in Norway there is reference to the instruction time received. In Lithuania, all three elements are reported.

At other education levels, some countries report that a digital competence element is included in official documents issued by schools. Such documents are not always certificates, as issued in general upper secondary education, but in many cases they are annual assessment reports with marks, grades, or achievements in individual subjects or competences.

Nine education systems (Greece, Italy, Poland, Slovenia, the United Kingdom – England, Wales and Northern Ireland, Montenegro and Serbia) report that digital competences are recorded in annual assessment reports at primary, and 18 ([107]) at lower secondary level.

3.2. Use of digital technologies in assessment and testing

As with many other areas of education, the use of digital technologies in assessment and testing has been explored in terms of both research and practice. Technology offers many advantages in comparison with more traditional pen-and-paper methods. It can, for example, provide important efficiency gains in terms of design, implementation and scoring. Potentially it also allows for a

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([107]) Greece, Croatia, Italy, Cyprus, Lithuania, Luxembourg, Hungary, Malta, Austria, Poland, Slovenia, United Kingdom (ENG, WLS and NIR), Iceland, Montenegro, Norway and Serbia

broadening of the range of skills and the breadth of constructs that can be assessed. Last but not least, it allows further integration of formative and summative assessment by, for example, simplifying and delivering feedback (O'Leary et al., 2018).

Bennett (2015) sees the integration of technology in assessment as a three-stage process. The first stage is delivering traditional assessment via digital technologies. This is followed by a re-articulation or adaptation of assessment procedures to make use of the new opportunities offered by technology, especially in terms of introducing innovation into what is tested and how learning outcomes are measured. The final stage is using technology in assessment following cognitive principles from what we know about learning, for example, by situating problems in realistic contexts. According to O'Leary et al. (2018), most of the technology-based assessments currently taking place, fall into the second stage of integration. Automated Essay Assessment for example, increases 'the efficiency of an existing practice, but it falls short of transforming assessment in terms of facilitating the measurement of complex competencies or re-conceptualising the principles that guide assessment design' (O'Leary et al., 2018, p. 170).

The following analysis looks at the use of digital technologies in national tests in any competency or subject area, specifically looking at the purpose for which they are used, the competences assessed, and, to some extent, the type of testing and the technological environment used.

3.2.1. Technology-supported national tests

Digital technologies can be useful in carrying out assessment and testing. The possibilities offered in optimising resources and time taken, for example in marking standardised tests, as well as the potential for deep and broad analysis of the results, are strong drivers for the adoption of digital technologies in assessment and testing. Digital tests are now being used in many different areas such as in on-line recruitment, in official international certification of foreign language skills as well as in large-scale international comparative education studies. Digital technologies also have the potential to transform or enrich the way assessment is carried out. One obvious example is the way adaptive tests can be adjusted to fit the competences of those being tested as the test is taking place. Further possibilities are offered by technologies in terms of both assessment experience and approach (O'Leary et al., 2018; Redecker, 2013; Redecker and Johannessen, 2013), such as the use of virtual reality, artificial intelligence, or the internet of things.

While the use of the more recent digital technologies for assessment is still in its very early stages, the move to more established ones is already taking place across Europe, although it is not yet widespread and countries are at different stages of development and using them for different purposes. For example:

> In **Finland**, the 'Matriculation examination', the national test carried out at the end of upper secondary education, has been gradually digitalised since autumn 2016, and as of spring 2019 the test is fully digital nationwide and for all subjects.
>
> Similarly, in **Sweden**, schools have been using digital devices in some tests since June 2018, and digital national tests will continue to be trialled during the period 2018-2021 before full-scale adoption.
>
> In the **United Kingdom (Wales)**, digital standardised tests are being introduced for primary and lower secondary education. The tests cover literacy (reading) and numeracy (procedural and reasoning) for children aged 6/7 to 13/14. The digital test in procedural numeracy is being implemented in the 2018/19 school year, and will be followed by reading in 2019/20, and numerical reasoning in 2020/21.

Section one of this chapter distinguishes between national tests for assessing the competences of individual students and those for quality assurance purposes in education. Technology-supported national tests are used in both instances. For example, some countries now use digital technologies in

tests at the end of compulsory education, or at the end of general upper secondary education. Other countries monitor and evaluate how well the system is delivering in a specific area by administering digitally supported standardised tests to a sample of students. In this second group of countries, the intention is not to mark or grade individual students, but to analyse the overall results of the cohort of students involved. The results are then used to evaluate how well the education system is delivering, and in some cases to try out digital technologies for the national testing of digital competences (e.g. Croatia and Serbia). Top-level authorities may also use aggregated data from the individual pupil testing regime as a source of information to monitor the quality of the education system, although this is not the primary reason for administering the test. The analysis therefore considers only the primary reason for administering the test. Excluded from the analysis are the uses made of digital technologies to prepare tests, or to mark students, or any other uses that do not involve students using the technology to perform any of the examination tasks.

Figure 3.4 shows that the assessment of individual students is the main purpose for using digital technologies in national tests in Europe. Overall, this is the case in 16 countries ([108]), while only 11 ([109]) use it for quality assurance related objectives. France, Lithuania and Slovakia use them for both goals. France, for example, uses digital technologies for quality assurance purposes in primary and lower secondary education and for the assessment of individual students in secondary education.

Moreover, the number of countries administering technology-supported national tests increases with the education level. While in primary education, 10 education systems ([110]) use technologies in national tests, at secondary education level the number doubles. Out of the 10 systems administering technology-supported national tests at primary education level, six (Czechia, Denmark, Estonia, France, the United Kingdom – Wales, and Norway) employ such technologies throughout the school system.

In almost half of the education systems (see Figure 3.4), lower secondary students take technology-supported national tests. Latvia and Luxembourg have technology-supported tests only at this level, as does Greece, which however is in the pilot phase.

At upper secondary level, the overall number of countries remains similar to lower secondary education, however some of the countries change. Bulgaria, Hungary, Poland, Romania, Finland and the United Kingdom (England and Northern Ireland) use technologies in national tests only at this level, although in most of them not all students are involved (see Section 3.1.1 and Figure 3.1). On the other hand, the United Kingdom (Scotland) and Liechtenstein do not use digital technologies in national tests in general upper secondary schools, while Switzerland and Iceland do not have any national tests at this education level.

The number of countries using digital technologies in national tests for the assessment of individual student competences increases with the education level. Only five education systems (Denmark, the United Kingdom – Wales and Scotland, Iceland and Norway) use the technologies at primary level for this purpose, 11 education systems do so at lower secondary level ([111]), and 16 do so in general upper secondary education ([112]). In three education systems (Denmark, the United Kingdom – Wales, and Norway), technology-supported national tests for the assessment of individual students are

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([108]) Bulgaria, Denmark, France, Cyprus, Latvia, Lithuania, Hungary, Austria, Poland, Romania, Slovakia, Finland, Sweden, United Kingdom, Iceland and Norway

([109]) Czechia, Estonia, France, Croatia, Italy, Lithuania, Luxembourg, Slovakia, Switzerland, Liechtenstein and Serbia

([110]) Czechia, Denmark, Estonia, France, United Kingdom (WLS and SCT), Switzerland, Iceland, Liechtenstein and Norway

([111]) Denmark, Greece, France, Cyprus, Latvia, Austria, Sweden, United Kingdom (WLS and SCT), Iceland and Norway

([112]) Bulgaria, Denmark, France, Cyprus, Lithuania, Hungary, Austria, Poland, Romania, Slovakia, Finland, Sweden, United Kingdom (ENG, WLS and NIR) and Norway

administered across the school system. In the context of individual student achievement national tests, in nine education systems ([113]), only upper secondary education students are tested using digital technologies, and in most cases these tests are linked to the assessment of digital competences. In the United Kingdom (Scotland) and Iceland, only primary and lower secondary education students undertake technology-supported national tests, while in France, Austria and Sweden this is the case for general secondary education students.

The competences assessed through technology-supported tests vary between countries. However, there are some clear patterns.

The competence most often assessed in this way is the digital one. This is the case in 13 education systems at upper secondary level ([114]), mirroring to some extent the information described in section one of this chapter on the use of national tests to assess digital competences (see Section 3.1.1 and Figure 3.1). Surprisingly, the digital competences of upper secondary students in Greece, Croatia, Malta, Slovenia, and partly also in Cyprus, are assessed through paper-based tests. In Malta, this is also the case for lower secondary students and in Austria for primary pupils ([115]). In Greece, a pilot programme is being conducted on the use of digital technologies to assess the digital competences of lower secondary students. In Cyprus, out of the three subjects that integrate digital competences at upper secondary level, two are tested on paper (informatics/computer science and computer networks) and one using technology (computer applications).

In nine education systems (Denmark, France, Slovakia, Finland, Sweden, the United Kingdom – Wales and Scotland, Iceland and Norway), digital technologies are used in national tests to assess other competences or subjects, sometimes in addition to testing digital competences. The most common practice is to assess literacy and numeracy. For example:

> In **France**, all sixth graders (1st year of lower secondary education) are assessed in literacy and numeracy in a technology-supported national test (online platform with adaptive testing). Furthermore, the test in mathematics also includes an exercise to assess student competence in coding. Moreover, as from September 2018, all students entering general upper secondary education (*Lycée*) are tested in French and mathematics through an online platform. All these tests are carried out by the Evaluation, Forward-planning and Performance Directorate (DEPP) of the Ministry of National Education and Youth.

However, in other countries digital technologies are used to assess a wider range of subjects. This is the case in Norway for all education levels, in Denmark and Iceland at primary and lower secondary level, and in Finland for the national test taken at the end of upper secondary education.

> In **Denmark**, for example, during the *Folkeskole*, students have to take a range of obligatory national tests, such as in the Danish language in grades 2, 4, 6 and 8, mathematics in grades 3 and 6, English language in grade 7 and geography and sciences in grade 8. In addition, students are tested at the end of the *Folkeskole* in a national school leaving examination. All these are largely supported by digital technologies.

While the assessment of individual students is the main purpose both in primary and upper secondary education, more countries seem to test lower secondary students for quality assurance purposes. This is the case in 11 education systems ([116]), three times as many as in primary (Czechia, Estonia, France, Switzerland and Liechtenstein) or general upper secondary education (Czechia, Estonia, Italy and Serbia).

([113]) Bulgaria, Lithuania, Hungary, Poland, Romania, Slovakia, Finland and United Kingdom (ENG and NIR)

([114]) Bulgaria, Denmark, France, Cyprus (partly), Lithuania, Hungary, Austria, Poland, Romania, United Kingdom (ENG, WLS and NIR) and Norway

([115]) At primary level, the voluntary digi.check test is based on a printed brochure (*Sammelpass*) where pupils place stickers in a document after having successfully performed specific tasks. https://digicheck.at/index.php?id=560&L=0

([116]) Czechia, Estonia, France, Croatia, Italy, Lithuania, Luxembourg, Slovakia, Switzerland, Liechtenstein and Serbia

Figure 3.4: Use of digital technologies in national tests, primary and general secondary education (ISCED 1-3), 2018/19

Primary (ISCED 1)

Lower secondary (ISCED 2)

Upper secondary (ISCED 3)

National tests related to individual student achievement

Quality assurance related tests

Pilot programmes

Digital technologies not used in national tests
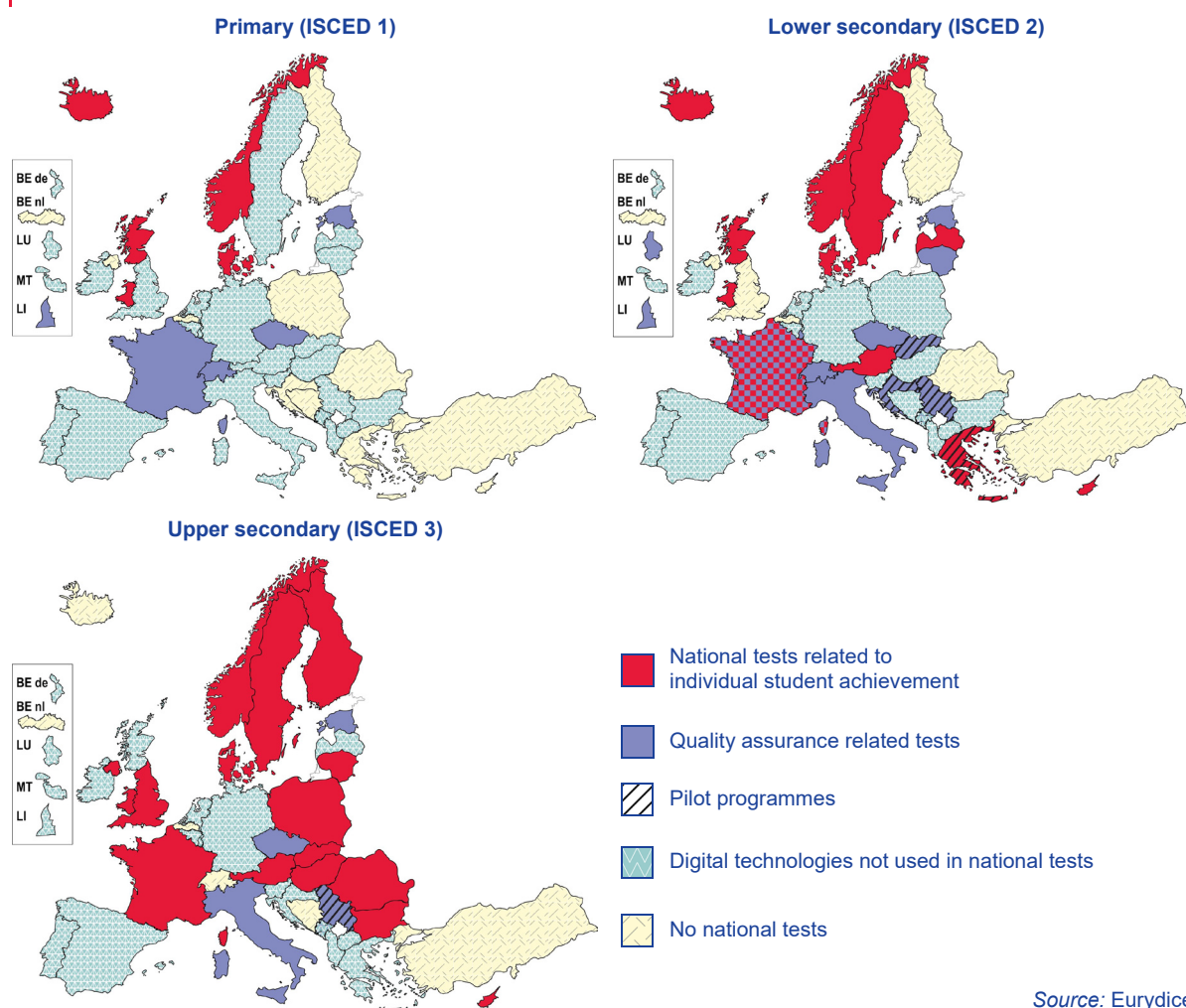
No national tests

Source: Eurydice.

Explanatory note

National tests related to individual student achievement seek to determine the individual student's level of attainment usually in relation to a graded scale.
Quality assurance related tests are conducted by the authority in charge of education primarily to support teachers and students, and to monitor the quality of the education system rather than measuring the attainment levels of individual students. This type of testing is normally sample-based.

Country-specific notes

Spain: National tests are organised at Autonomous Community level. In the Cities of Ceuta and Melilla they are organised by the Ministry of Education.
France: In the context of the *Journée de la Défense et Citoyenneté* (Defense and Citizenship Day), young citizens between the ages of 16 and 25 take a technology-supported reading test. The Evaluation, Forward-planning and Performance Directorate of the Ministry of National Education and Youth develops the test, and the data collected is used to identify and provide support to students at risk of dropping out of school and students with difficulties in reading and writing.
United Kingdom (ENG, WLS, NIR): GCSE and A Level (ISCED 3) examinations remain primarily paper-based, but technology may be used in some examinations, usually to assess digital competences.

Czechia is the only country that has technology-supported national tests for quality assurance purposes across the whole school system. All other countries carry out such tests only at some levels. Croatia, Lithuania, Luxembourg and Slovakia administer national tests with the support of digital technologies for quality assurance purposes only at lower secondary level. In France and Switzerland, quality assurance national tests are carried out with students in primary and lower secondary education, and in Estonia, Italy and Serbia, in lower and upper secondary education.

In Czechia, Estonia, France, Italy, Lithuania, Luxembourg and Liechtenstein, technology-supported testing for quality assurance is now becoming an established practice and is used in a variety of subjects. For example:

In **Czechia**, the testing is performed every year on three out of six randomly selected basic literacies.

In **France**, digital technologies are used to test literacy, numeracy, and sciences in different grades at primary and lower secondary level, and all core competences established in the curriculum at grade six and nine of lower secondary education.

In **Italy**, technology-supported national tests assess students' competences in Italian, maths and English as a foreign language, every year.

In **Lithuania**, during the 2018/19 school year, students were tested at grade 8 in science and mathematical literacy, and at grade 10 in foreign language proficiency (English, French, German and Russian).

Similarly, in **Luxembourg**, the assessment concerns German, French and maths.

In Croatia, Slovakia and Serbia, the implementation of digital technologies is still in the pilot phase. In these countries, the aim of the pilot phase is also to develop more mature testing systems that may be rolled-out in the future as technology-supported national tests for the assessment of individual students.

Finally, it is worth noting that overall, 14 education systems ([117]) do not use digital technologies in any of their national tests.

3.2.2. Test format and environment

The following analysis considers the format of tests used and the technological environment in which the test takes place. It is mainly limited to national tests for the assessment of individual students' digital competences in upper secondary education, although some references are also made to the assessment of other competences at other school levels.

The first part examines three different test formats: (1) on-screen testing, which includes activities such as multiple-choice and open questions, essays, and drills; (2) adaptive testing, where questions are automatically adapted to the capabilities of students depending on the results of preceding answers; and (3) practical testing, which refers to hands-on tasks such as programming and/or performing tasks using specific software. The second part discusses the technological environment used in national tests, distinguishing between open and closed environments.

As seen in section 3.1, at upper secondary level, digital competences are mostly assessed through a dedicated test, limited to students who have chosen a learning path requiring the acquisition of digital competences, or to those who have chosen to take a specific examination in a digitally related subject.

Figure 3.5 shows that digital competences are mainly assessed by combining on-screen testing with practical testing. This is the case in nine education systems (Bulgaria, Denmark, Lithuania, Austria, Poland, Romania, and the United Kingdom – England, Wales and Northern Ireland). For example:

In **Poland**, the examination in IT, taken by students within the framework of the upper secondary education school-leaving examination, is based on a theoretical and a practical test, each containing a requirement to carry out specific tasks. The theoretical part looks at aspects such as the ability to solve problems or to process and analyse information, usually by means of closed questions, such as multiple-choice, true/false statements, matching, or open ones. The practical part of the examination requires the examinees to perform different practical tasks such as making calculations on a spreadsheet, performing search queries, or demonstrating coding skills.

([117]) Belgium, Germany, Ireland, Spain, Netherlands, Malta, Portugal, Slovenia, Albania, Bosnia and Herzegovina, Montenegro and North Macedonia

Similarly, in the **United Kingdom (England, Wales and Northern Ireland)**, specifications for A Levels in subjects such as computer science may require students to show their theoretical knowledge through on-screen testing, as well as their competences in programming and computational thinking.

Figure 3.5: Main test formats used in technology-supported national tests to assess individual students' digital competences in general upper secondary education (ISCED 3), 2018/19

■ On-screen testing	
■ Practical testing	
▨ Not applicable	
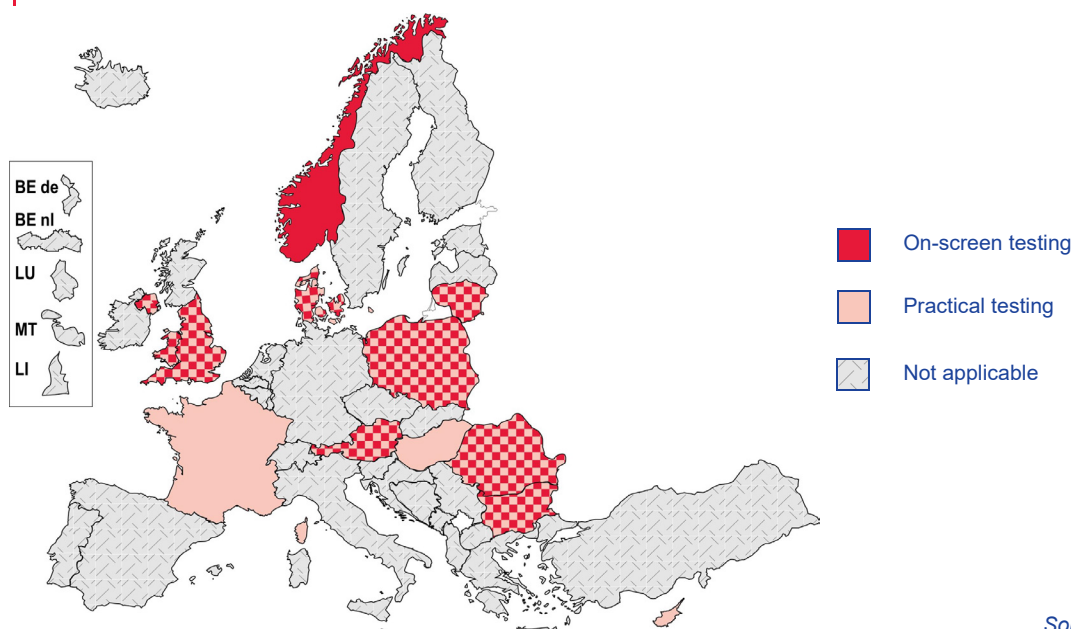
Source: Eurydice.

Explanatory note

On-screen testing includes tests based on multiple-choice, open questions, essays, drills, etc.
Practical testing refers to hands-on tasks such as programming and/or performing tasks using specific software.
Not applicable refers to the use of digital technologies in quality assurance related national tests or student assessment in other competences/subjects. Also included in this category are countries where there are no national tests or where digital technologies are not used in national tests.

The remaining countries have other approaches: in France, Cyprus and Hungary, testing is based only on practical demonstrations of the acquired competences, while in Norway only on-screen testing is used.

In **France**, national tests to evaluate the digital competences of general upper secondary students that have specialised in informatics and digital sciences are generally oral, on the basis of a personal file that students have prepared beforehand. During the examination, students are called to discuss, explain and defend their approach in developing a digital programme, presenting the problem they wished to solve, the algorithm they have used, the coding process, possible developments and providing practical demonstrations.

Adaptive tests are not used to assess digital competences at general upper secondary level.

It is also worth pointing out that in Latvia, the digital competences of individual students are assessed in technology-supported national tests at lower secondary education level and the approach is to mix on-screen and practical testing. In Austria, the testing approach used at lower secondary level also mixes on-screen and practical testing ([118]), while in Greece it is only on-screen testing.

As far as the use of technologies for testing other competences is concerned, the approach is generally on-screen testing. In some education systems, however, tests are adaptive. This is the case in Denmark, France, and the United Kingdom (Wales and Scotland).

([118]) The digi.check assessment model used in Austria in secondary schools starts with a self-assessment, followed by knowledge tests and an assessment of competences. The last two are based on on-screen and practical testing: https://www.digicheck.at/

In the **United Kingdom (Scotland)**, national tests for primary and lower secondary students are implemented through the Scottish National Standardised Assessment platform, which also provides support and training programmes for teachers and school staff. Assessments are just one element of a wider range of evidence used by teachers to understand how children are progressing. The assessments are adaptive so that if a child is struggling with the questions, they get easier, and if a child is doing well questions become more challenging. Moreover, contrary to many other practices in national tests, there is no set day or period of time during which the assessments must be taken. Individual teachers and schools, with guidance from their local authorities, decide the most appropriate time during the school year for children to take the standardised assessments. It is not necessary for all children in a year group to take the assessments at the same time. The assessments are designed to be as short as possible and are age and stage appropriate. There is no time limit. This is to ensure children do not feel unnecessary time pressure when undertaking the assessments. The system quickly and automatically generates information for teachers on where a child has done well and where further support may be required.

Finally, national tests can take place in open or closed environments. Closed environments do not allow the users to communicate with the external world (e.g. through the internet), and usually the computers on which the test is carried out are locked down, allowing students to use only test related applications. Open systems on the contrary, are connected to the external world and allow the use of diverse software, even those not specifically test related.

In most countries, digitally supported national tests rely on a closed environment. For example:

In **Finland**, candidates taking the Matriculation Examination boot into a Linux operating system from a USB memory stick delivered to schools. Once in the environment, candidates cannot access their local files and programmes but only those applications and materials that are pre-installed on the operating system.

There are of course reasons for this approach, one of them being the concern about cheating in high stakes examinations, given that students receive official certification of their competences and this may influence access to a higher level of education. However, although still in a minority of countries, open environments are also used, sometimes in combination with closed ones. For example:

In **Romania**, the section of the National Baccalaureate Examination testing digital competences requires an internet connection and includes tasks to test the ability of students to search for information on the web. In contrast, other parts of the test are carried out in a closed environment with both on-screen and practical testing.

CHAPTER 4: STRATEGIES AND POLICIES

The previous chapters dealt with the two fundamental dimensions of digital education: digital competences and the pedagogical use of technology. These were analysed through the lens of current guidance and legislation governing the curriculum (Chapter 1), teacher-specific digital competences (Chapter 2), and student assessment (Chapter 3). This last chapter takes a broader perspective by analysing the wider strategies and policies to promote the development of digital education in schools.

The first section looks at the strategies issued by top-level authorities. It distinguishes between the specific strategies that deal only with digital education and the broader strategies that include any objectives related to digital education (details of strategy titles, timeframes and education levels affected, arranged by country, are in annex 4). The monitoring and evaluation of these strategies and related policies is also addressed. The section concludes with an examination of the bodies and agencies that assist top-level education authorities in implementing policies in this field. In many cases, these organisations also provide professional support and other services to schools, school heads, teachers and pupils, and they are a key instrument for meeting policy targets and improving the provision of digital education in schools.

The second section of this chapter deals with some of the more specific policies and measures in the area of digital education. These mostly derive from or are part of the strategies discussed in the first section, but they can also be *ad hoc* measures or more long-standing actions which have continued on from earlier initiatives. As the digital education policies surrounding the curriculum, assessment and teacher education have already been specifically analysed in previous chapters, this section looks at the support given for digital education to schools in other areas. These include: investment in ICT infrastructure; school digital plans; specific training for school heads; appointment of digital coordinators; parental involvement; digital learning resources; and external evaluation of digital education.

4.1. Strategies, monitoring and implementation

A specific field of research – implementation science – tries to identify the reasons for successes and failures in translating policy into practice. It highlights the different stages in the implementation process, which usually begins with an exploratory stage (assessing needs, creating readiness, etc.), followed by initial installation (selecting and training partners/practitioners/participants and introducing the required changes into practice etc.), then full implementation (i.e. new practices effectively adopted by all stakeholders) and finally the evaluation of expected outcomes. This process can take several years (Spiel, Schober and Strohmeier, 2018).

While this analysis does not directly address the stage national strategies have reached or their progress towards achieving the strategic objectives, it is important to be aware of the implementation process since it provides an added layer of complexity to the comparative information provided. The differences between countries extend beyond the national digital environment and the content and scope of strategies. Furthermore, when considering the evaluation and monitoring procedures in place, it must be borne in mind that many national strategies in this field are very recent, so for some it may be too early to measure any progress or impact.

With these limitations in mind, this section examines which countries have introduced strategies relating to digital education and whether they are specific or broad strategies. It also looks at the monitoring and evaluation procedures put in place by top-level authorities to assess progress in relation to strategic objectives. Lastly, it examines the role and scope of the external agencies/bodies involved in supporting schools and authorities in implementing the top-level strategies, policies and actions.

4.1.1. Current strategies for digital education in schools

The last Eurydice report pertaining to digital education in Europe, Key Data on Learning and Innovation through ICT at School in Europe (EACEA/Eurydice, 2011a), showed that for the reference year (2009/10) all European countries had national strategies to encourage the use of ICT in education. Indeed, the European Commission had just adopted a new Digital Agenda for Europe in 2010 ([119]), which reaffirmed digital and media literacy as one of the central educational challenges. While the report found that all European countries had national strategies in place to encourage the use of digital technology in different areas, 28 countries had adopted a digital strategy devoted specifically to education. The strategies sought to provide students with the necessary digital skills, offer dedicated training for teachers, and provide schools with up-to-date technology and infrastructure.

The continuous and increasing digitalisation in all areas of life, as well as changes in the technology itself, means that government strategies and policies become out of date very rapidly. European countries need to continually revise and renew their approaches to meet the new demands for high quality digital education at school. Therefore, unsurprisingly, nearly a decade after the last Eurydice report, virtually all education systems still have strategies for digital education in place.

Figure 4.1 shows whether education systems have a specific strategy devoted to digital education or whether they have a broader strategy that incorporates elements of digital education. Broadly speaking, half of the countries address digital education within a broader strategy, and these are mostly located in eastern and south-eastern Europe. On the other hand, 18 education systems have a specific strategy, and most of these are in western, central and northern Europe ([120]).

The different types of broad strategies that include digital education are:

- Education and lifelong learning strategies (French and Flemish Communities of Belgium, Estonia, Croatia, Cyprus, Latvia, Finland, Albania and North Macedonia)

- Digital, information society and media literacy strategies (Greece, Malta, Portugal, Romania and Montenegro)

- Science, Technology, Engineering and Mathematics (STEM) strategies (Liechtenstein)

- Socio-economic development and industrial strategies (Poland and the United Kingdom – England)

- Innovation strategies (the United Kingdom – Northern Ireland)

Only six education systems currently have no strategy related to digital education: the German-speaking Community of Belgium, Lithuania, the Netherlands, Bosnia and Herzegovina, Iceland and Turkey. However, in Lithuania, the former strategy lasted until 2016 and a new one is currently being developed. In the Netherlands, a digitalisation strategy/agenda was presented in March 2019. In Turkey, in the absence of a top-level strategy, FATIH (Movement of Enhancing Opportunities and Improving Technology) is a large-scale project and educational movement supported by top-level education authorities that aims to increase digital competence and the pedagogical use of technology in schools.

([119]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of Regions – A Digital Agenda for Europe. COM/2010/245 final.

([120]) Bulgaria, Czechia, Denmark, Germany, Ireland, Spain, France, Italy, Luxembourg, Hungary, Austria, Slovenia, Slovakia, Sweden, United Kingdom (WLS and SCT), Switzerland and Norway

Figure 4.1: Types of top-level strategy encompassing digital education at school in primary and general secondary education (ISCED 1-3), 2018/19
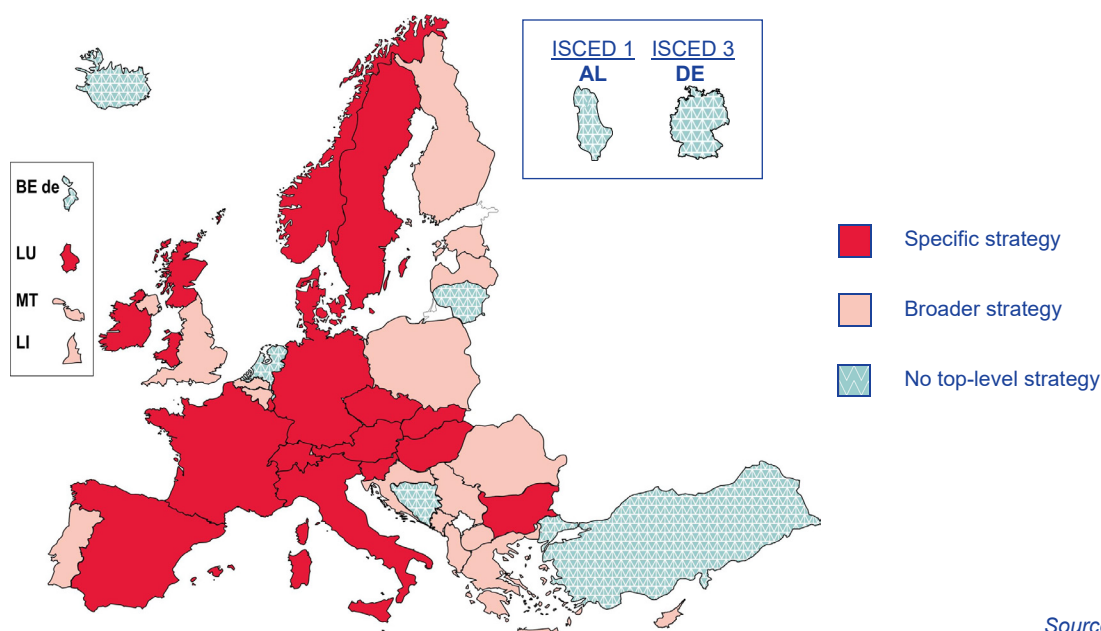
Source: Eurydice.

Explanatory note

Specific strategy refers to one that focuses exclusively on digital education, while **broader strategy** refers to strategies related to a wider policy area but which also include objectives for digital education.

Country-specific notes

Denmark: There is currently an action plan for technology in education and a new strategy focusing on digital education is under development.
Spain: Some Autonomous Communities have also implemented their own digital education strategies: Andalucía, Canarias, Extremadura, Galicia and Navarra.
Croatia: While a broader strategy is currently in place, a specific strategy on digital maturity of schools and of the education system has been developed and its adoption is planned for the near future. This followed the e-Schools pilot project which established a system for developing digitally mature schools and ended in 2018.
Iceland: The municipalities of Reykjavík and Kópavogur, for example, have issued several reports on the integration of digital technologies in their compulsory schools.
Serbia: In addition to the broader strategy, there is also a specific top-level policy paper on digital education. The guidelines present quantitative and qualitative data that reflect the current state of play, and 71 recommendations for further developments in this area.

4.1.2. Monitoring and evaluation of policies

Strategies and policies may be implemented in a variety of ways, and may involve different levels of authority or stakeholders. For example, local authorities may be involved when they are responsible for the provision of school education, or higher education institutions when they are responsible for initial teacher education. Moreover, in highly centralised countries, top-level authorities play a prominent role in implementing policies as they often have direct control of schools; in more decentralised systems, however, top-level authorities must rely on the local or school level to drive policies forward. Nevertheless, whatever the approach, the top-level authority has an important part to play in monitoring and evaluating how its policies are being put into practice. This section analyses what procedures are in place and when these are carried out.

Figure 4.1 shows that most European countries have strategies in place for digital education at school. Figure 4.2 on the other hand shows that monitoring and/or evaluation of these strategies and related policies is less common. Around half of the education systems have some form of monitoring or evaluation procedures in place, but only eight of these carry them out at regular intervals or set a definite time frame (Flemish Community of Belgium, Bulgaria, Czechia, Estonia, Sweden, the United Kingdom – Scotland, Montenegro and Norway). For example:

The **Flemish Community of Belgium** publishes a monitoring report on ICT in Flemish Education ([121]) every five years. The report is based on the analysis of the replies given by school heads, teachers and students to a survey focusing on four indicators: ICT infrastructure, ICT integration in the classroom, ICT competences and perceptions of ICT use at school.

In the **United Kingdom (Scotland)**, a 'Programme Board' meets quarterly to discuss progress on, and obstacles to the strategy actions. In addition, Education Scotland is responsible for tracking progress against actions and objectives. However, there are no reports available on this work.

In **Montenegro**, at the beginning of each year, the Ministry of Education prepares an action plan for the implementation of the measures proposed in the strategy and, at the end of the year, the Ministry reports back to the Government. This has allowed some specific targeted improvements in the area of digital education. For example, during 2017 specific efforts were made to improve the conditions for using ICT in teaching, such as for example, signing contracts with telecommunication operators to improve internet connectivity in schools, training teachers in IT security, and enhancing online collaboration between teachers.

Figure 4.2: Monitoring and/or evaluation of digital education strategies and policies carried out in the last five years by top-level authorities, 2018/19

Source: Eurydice.
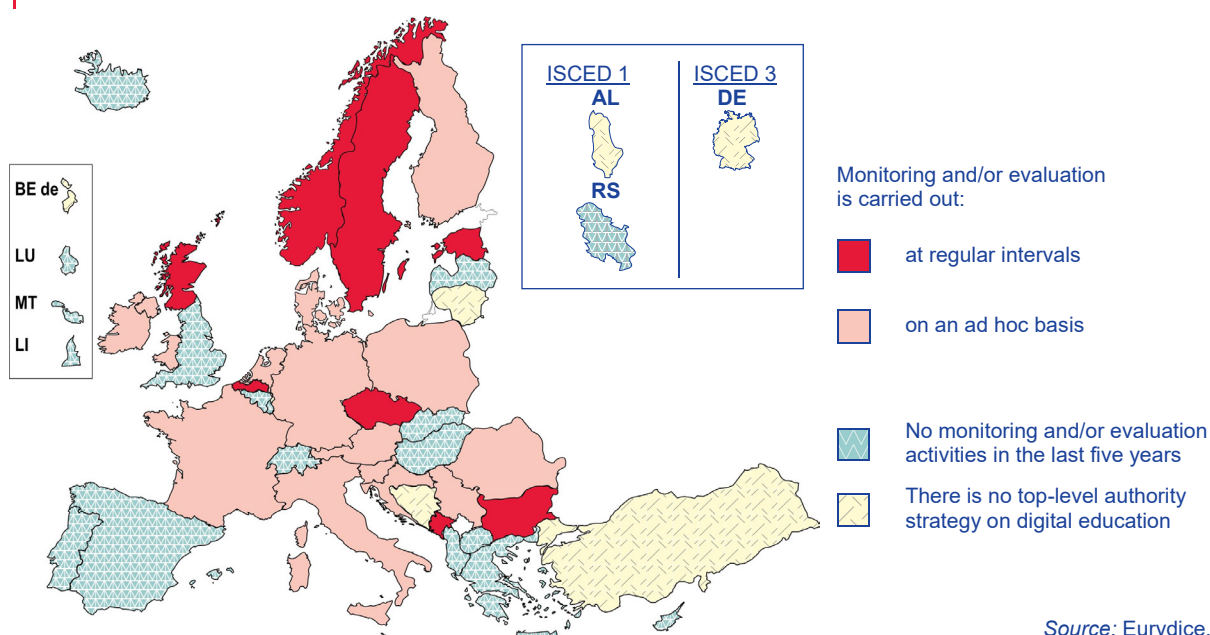
Explanatory note

The monitoring and/or evaluation must be directly related to the strategies or policies in the area of digital education. It may be conducted by the top-level authority itself or by other parties on its behalf (e.g. agencies, research bodies, experts, etc.).

Country-specific notes

Germany: Monitoring and/or evaluation has been conducted in some cases at *Länder* level.
Austria: The new strategy launched in 2017 incorporates actions and policies developed in previous years (e.g. 'digi.check' assessment platform, the network of innovative schools 'eEducation', etc.) which have previously been evaluated. There is, however, no ongoing evaluation planned under the current policy actions.
Poland: An evaluation report on the previous strategy 'Digital Schools' was published in 2013.
Romania: The strategy has a monitoring element which is the responsibility of the Ministry of Communication and Information Society. The methodology as well as quantitative and qualitative indicators have been specified ([122]) but data from monitoring activities have not been made public yet.
United Kingdom (ENG): Digital education is covered in the 2017 'Industrial Strategy', for which an independent Industrial Strategy Council was established in November 2018. The Council will review the impact of the industrial strategy and publish a regular public report assessing progress on implementation against success criteria.

In another 15 systems ([123]), monitoring and/or evaluation has taken place in the last five years, but on an ad hoc basis. For example:

([121]) www.mictivo.be

([122]) https://www.comunicatii.gov.ro//wp-content/uploads/2016/02/Manual_Monitorizare_Evaluare_v2.0-BM.pdf

([123]) Denmark, Germany, Ireland, France, Croatia, Italy, Netherlands, Austria, Poland, Romania, Slovenia, Finland, United Kingdom (WLS and NIR) and Serbia

In **Denmark**, the *It i folkeskolen* initiative, which ran between 2012 and 2017, was evaluated in 2018. The initiative aimed at reinforcing the use of digital technologies for teaching and learning in primary and lower secondary schools by providing support and easy access to digital learning materials. The evaluation was based on the responses from 9 512 students, 1 707 teachers, 180 educators and 306 managers across 351 schools. In addition, there were case studies in 24 schools with interviews with pupils, teachers, educators, managers and parents. Finally, telephone interviews were held with representatives of the municipalities and stakeholders in the field. The results of the evaluation were positive, showing that over 80 % of teachers make regular use of digital learning resources and integrate digital technologies into their teaching activities ([124]).

In **France**, in 2015 and 2017, the Ministry of Education requested two specific reports from the School Inspectorate. The first one analysed the state of digital education in pre-primary and primary education, while the second focused on secondary education. Both reports were used to develop the new strategy *Le numérique au service de l'École de la confiance* (Digital technologies serving a school of Trust) ([125]). Moreover, the current strategy also includes the creation of a permanent online observatory on the use and development of digital education in schools.

In **Croatia**, CARNet, the Croatian Academic and Research Network responsible for supporting and developing digital education in schools, assessed the digital maturity of schools on a sample of 151 schools. This evaluation was conducted within the framework of the pilot project 'e-Schools: Establishing a system for developing digitally mature schools' ([126]), implemented between 2015 and 2018 and co-financed by the European Union.

In **Italy**, the digital education strategy (Digital School Plan) includes the action 'Observatory for digital schools' which covers the monitoring of progress in this area. Under this action, a survey has been conducted over the last two school years to evaluate developments in schools on IT equipment, digital education and innovation.

In the **Netherlands**, the Ministry of Education, Culture and Science ran an evaluation in 2018 ([127]) of the *Mediawijzer.net* ([128]), a portal central to its media strategy. The evaluation assessed whether the portal helped young people (0-18 years) to live their lives in a 'media smart' way. The main conclusions recognised the importance of the portal and the need to continue it, but also acknowledged the challenges in measuring a clear impact. The evaluation committee also recommended developing specific tools for secondary education schools and for young people with special needs.

In the **United Kingdom (Wales)**, in July 2018, the inspectorate ([129]) published a report in response to a request for advice from the Welsh Government on how schools are preparing for the Digital Competence Framework (DCF). The report analysed, among other aspects, leadership in the introduction of the DCF, the role of the digital lead practitioner in schools, and the professional training of staff. It recommends that schools involve all stakeholders in developing a clear vision for the DCF; appoint a digital lead who has the full support of senior leaders; and monitor developments regularly. The report also recommends that local authorities support all schools in addressing these recommendations; monitor how well individual schools are progressing; and challenge limited progress. It further recommends that the Welsh Government should communicate clearly to schools the expectations for embedding the DCF, including timescales; ensure that initial teacher education courses provide new teachers with the necessary skills to successfully implement the DCF; and improve professional development.

In addition to the above examples, in four countries (Czechia, Estonia, Croatia and Serbia), students' digital competences are assessed in the context of quality assurance measures (see Chapter 3). The intention of top-level authorities is to gather evidence on how well the education system is delivering in this area or to pilot new methods. In Croatia and Serbia, this approach is still in the pilot phase. On the other hand, in Czechia, digital competence is now considered to be one of the six basic literacies that will be regularly monitored by the school inspectorate through surveys and testing. In Estonia, testing students' digital competences as part of quality assurance procedures is one of several monitoring instruments; the others include surveys sent to schools (see Section 4.2.6), schools' self-reporting on their digital technology infrastructure, and an annual report on the state of play carried out by specific agencies (see Section 4.1.3).

([124]) https://uvm.dk/aktuelt/nyheder/uvm/2018/juni/180619-it-er-en-aktiv-del-af-undervisningen-i-folkeskolen

([125]) http://cache.media.education.gouv.fr/file/08_-_Aout/36/1/DP-LUDOVIA_987361.pdf

([126]) https://www.e-skole.hr/wp-content/uploads/2017/09/Strate %C5 %A1ki_plan_primjene_IKT-a.docx

([127]) https://www.rijksoverheid.nl/documenten/rapporten/2018/07/17/evaluatie-expertisecentrum-mediawijzer.net-2015-2018

([128]) https://www.mediawijzer.net/about-mediawijzer-net/

([129]) https://www.estyn.gov.wales/about-us

In summary, Figure 4.2 shows that the monitoring and evaluation of the policies and strategies around digital education at school level is still not a widespread practice and, where it does take place, it is rarely done at regular intervals. As discussed in the introduction to this section, in some countries this absence of monitoring and evaluation might be due to the fact that many of the strategies have been introduced only recently (see Annex 4). There is necessarily a lapse of time between the introduction of a policy and the moment when it is appropriate to monitor or measure its effect. Nevertheless, top-level authorities could probably benefit from more systematic follow-up, particularly in view of the rapid changes in the area, which means that strategic objectives become outdated very quickly.

4.1.3. Agencies and bodies responsible for digital education at school level

To ensure that digital education policies are implemented on the ground, many countries have either set up a new body or agency outside the ministry of education, or an existing external agency has had its mandate extended for this purpose. These bodies or agencies usually have a dual role: on the one hand, they have a policy role – ensuring policies are implemented, feedback is provided to the top level authorities, and information provided to local policy-makers and stakeholders; on the other hand, they have a support role – providing assistance to schools, school heads, teachers and students. These roles are further explained below.

Almost two thirds of top-level education authorities support one or more external agencies or bodies that have responsibilities in the area of digital education at school level. A full list of these agencies and their websites is provided in annex 5.

In 20 of these education systems ([130]), the agencies have a wider mandate in terms of subject area, education level or population targeted.

Some agencies, for example, deal with digital technologies or media literacy in general but are not restricted to supporting educational institutions or organisations.

> In the **Flemish Community of Belgium**, for example, the Knowledge Centre for Media Literacy has a mandate to support media literacy in society in different ways. The agency works with schools, libraries, youth organisations, to mention a few, by providing training for professionals and citizens at large, raising awareness, developing the media literacy competence framework, and informing on media literacy initiatives and projects in Flanders.

> In **Hungary**, the Centre for Digital Pedagogy and Methodology is responsible for the digital transformation of public education, covering education at all levels, including vocational education and training and adult learning. The agency supports the development of the IT infrastructure, organisational transformation and content development. It supports education and training institutions in fulfilling their requirements for digital competence, implements and coordinates the development of digital pedagogical methodologies and supports their introduction. It also provides professional support for the Government in reforming the curriculum and participates in the development of the digital competence framework. A second agency (The Educational Authority) is also responsible for the digital transformation of public education at large.

Other agencies have a mandate to support schools in a particular area, for example, by offering teacher education and support, but this mandate includes the related aspects of digital education.

> In **Ireland**, the Professional Development Service for Teachers (PDST) is the national teacher support service funded by, and operating under, the remit of the Ministry for Education and Skills. Within the PDST, the Technology in Education team promotes and supports the integration of digital technologies in teaching and learning in primary and post-primary schools. It provides services covering all main aspects of digital education at school, from teacher training to IT technical support, including hardware purchasing through framework contracts. The agency manages *Scoilnet* ([131]), the official portal for Irish education in the field of digital education, participates in the Implementation Advisory Group for the Digital Strategy created by the Department of Education and Skills of the

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([130]) Belgium (BE nl), Denmark, Estonia, Ireland, Greece, France, Croatia, Cyprus, Lithuania, Hungary, Malta, Poland, Slovenia, Finland, Sweden, United Kingdom (SCT), Albania, Iceland, Montenegro and Norway

([131]) https://www.scoilnet.ie/

Republic of Ireland, and operates *Webwise* ([132]), an internet safety initiative co-funded by the European Union through the Connecting Europe Facility ([133]).

In **Cyprus**, the Pedagogical Institute has responsibility for the continuing professional development of teachers, including for digital education. The institute also manages a number of on-line platforms to support schools and teachers, some of them providing digital learning resources and tools to assess students' competences.

Figure 4.3: Extent of the mandate of external bodies/agencies operating in the field of digital education at school and supported by the top-level authority, 2018/19

Source: Eurydice.
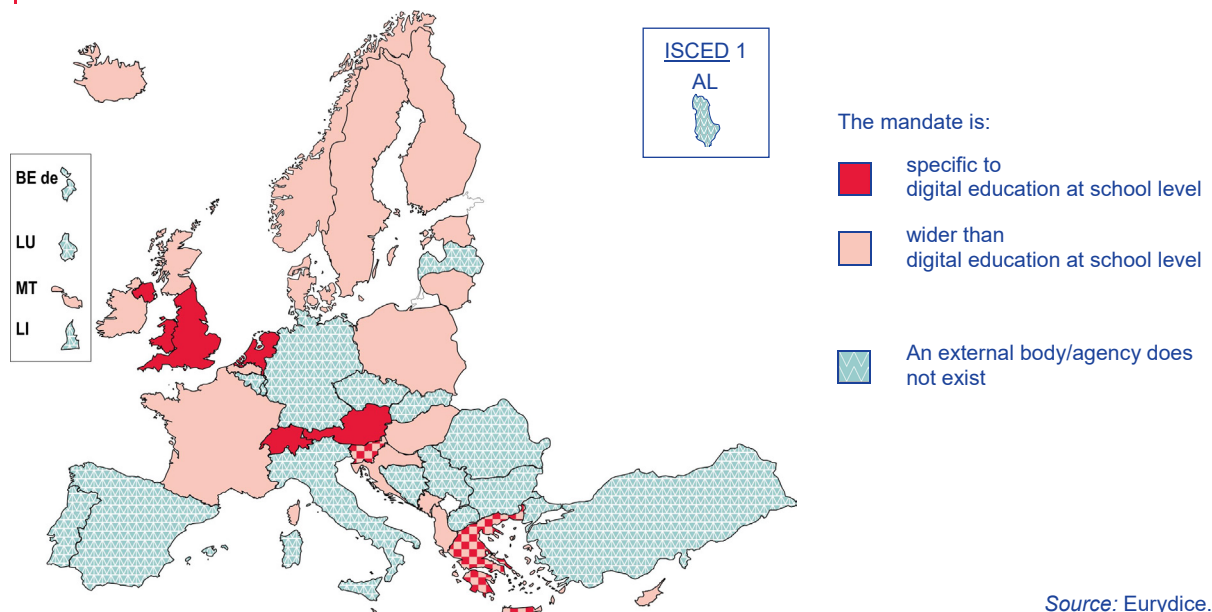
Explanatory note

The Figure refers to external bodies and agencies supported by the top-level education authority. Departments within the top-level authority specifically dedicated to digital education are excluded.

Country-specific note

Greece and **Slovenia**: They support more than one organisation with mandates that can be specific or wider than digital education at school.

Finally, some agencies have a much broader mandate covering many different aspects of educational provision and support, and again this may include responsibilities in the area of digital education.

In **Finland**, the National Agency for Education is responsible for early childhood education and care, pre-primary, basic, general and vocational upper secondary education as well as for adult education and training. Its mandate includes implementing national education policies, preparing the national core curricula and requirements for qualifications, developing education and teaching staff as well as providing services for the education sector, such as publishing education materials. In the area of digital education, the agency manages online platforms that support the adoption of digital technologies in the classroom, by providing, for example, digital learning resources as well as implementing dedicated professional development programmes.

In **Norway**, the Directorate for Education and Training has the overall responsibility for supervising early childhood education and care, primary and secondary general education and for the overall governance of the education sector. It is also tasked with ensuring that top-level authority regulations are implemented. The Directorate is responsible for managing the Norwegian Support System for Special Education, state-owned schools and the National Education Centres. It is also in charge of national statistics on education. In terms of digital education, the directorate cooperates with initial teacher education institutions to ensure the relevance of teachers' competences, and it manages online platforms, providing tests, exams, and digital learning resources, among other responsibilities in the field.

([132]) http://webwise.ie/

([133]) https://ec.europa.eu/inea/en/connecting-europe-facility

In eight education systems (Greece, the Netherlands, Austria, Slovenia, the United Kingdom - England, Wales and Northern Ireland, and Switzerland), the mandate is specific to digital education at school level. For example:

In the **Netherlands**, Kennisnet provides national IT infrastructure, advises school councils on implementing digital education, provides teacher training and manages online platforms to support schools and teachers. It also publishes a digital education monitoring report (*Vier in balans*) ([134]) every two years, which focuses on four building blocks: vision, expertise, content and application, and infrastructure. The report is designed for administrators, managers and policy-makers in primary and secondary education.

In seven countries (Estonia, Greece, Lithuania, Austria, Poland, Slovenia and Sweden), top-level authorities support more than one body or agency with responsibilities for digital education at school level. Usually, there is clear distinction between them in terms of portfolio.

In **Greece**, the Computer Technology Institute and Press 'Diophantus' is the main supporting body for digital education at school. It is responsible for the publishing of printed and electronic educational materials and the administration and management of the Greek School Network. Moreover, the Institute supports the organisation and operation of the electronic infrastructure of the Greek Ministry of Education, schools and other educational actors. It conducts research in ICT and provides continuing professional development for teachers on digital education. The Institute of Educational Policy, on the other hand, is responsible for providing scientific and technical support for policy planning and implementation. The Institute mainly provides research expertise to the Ministry of Education on primary and secondary education, and on the transition from secondary to higher education. The Institute has also an advisory role to the ministry on digital education.

In **Slovenia**, there are two main bodies operating in the field of digital education: the National Education Institute Slovenia and the Academic and Research Network of Slovenia (ARNES). While the former is active in the field of national curriculum development, research, professional development and support for teachers and schools, including aspects linked to digital education, the latter provides network services. Specifically, ARNES coordinates the Slovenian Educational Network ([135]), which is a major portal for general education and is the largest internet provider for schools. It also supports schools on infrastructure issues including connectivity, co-finances hardware for schools, and advises schools and students on the safe use of the internet.

The agencies with responsibilities for digital education usually cover all school levels. Albania is the only exception, as it has a specific agency that covers only secondary education.

The role played by agencies in supporting the implementation of digital education at school level is significant. The examples given above, demonstrate that they can be responsible for teacher training, assuring the quality of digital learning resources, and providing IT technical support to name but a few. Some agencies cover so many different areas that they become a hub for all matters related to digital education, as shown below.

In **France**, the agency CANOPÉ provides different services in support of digital education. In the area of teacher education for example, this agency provides specific modules on digital education that can be integrated into initial teacher education programmes. The agency also manages a number of platforms that support teachers in different ways ([136]). CANOPROF, for example, helps teachers create digital learning resources by providing software, cloud space for storage and access, and a catalogue of resources created by other teachers. Moreover, in terms of the development and quality assurance of digital learning resources, the agency filters and checks them before making them publicly accessible via the web ([137]). Schools can also receive support from CANOPÉ through a dedicated service that provides advice on commercial, functional and technical aspects.

Elsewhere, agencies offer expertise in embedding digital skills into teaching and learning. Less common is that agencies are involved in initial teacher education and in monitoring the digital education strategy.

([134]) For an example in English see: https://www.kennisnet.nl/fileadmin/kennisnet/corporate/algemeen/Four_in_balance_monitor_2015.pdf

([135]) https://sio.si/

([136]) https://www.viaeduc.fr/login; https://www.reseau-canope.fr/canoprof.html; http://www.reseau-canope.fr/savoirscdi/

([137]) http://www.educasources.education.fr/

In the area of initial teacher education in **Austria**, the Federal Ministry of Education supports the University College of Virtual Teacher Education. The main goal of this online campus is to support Teacher Education University Colleges in embedding their digitalisation strategies into their syllabus and teaching, and to develop teachers' digital competences during their initial teacher education.

In the **United Kingdom (Wales)**, the National Digital Learning Council acts as a source of guidance, information and support for the Welsh Government in respect of digital learning and guides the implementation of the Learning in Digital Wales Programme; its members support the wider strategic direction of the Programme. The Council also maintains an overview of the implementation of the Digital Competence Framework, ensuring it is embedded in schools as effectively as possible, and advises on the further development of the Learning in Digital Wales tools and resources to support the further transformation of digital classroom practice.

4.2. Specific measures to support schools in developing digital education

Top-level support for digital education extends far beyond the three main areas covered by this report (curriculum, teachers and assessment). This section, therefore, gives an overview of other policies and measures introduced to ensure that provision for digital education in schools is effective and up to date. It addresses investment in IT infrastructure; requirements for school digital plans; digital leadership in schools (school heads and digital coordinators); parental involvement; availability and quality of digital learning resources; and last but not least, the place of digital education in external school evaluation frameworks.

4.2.1. Investment in IT infrastructure

The following analysis looks at whether current digital education strategies or related policies commit to investments in digital technology infrastructure for schools. In this context, it is important to take into account that countries come from different starting points. Digital education and especially the availability of digital infrastructure in a country's schools cannot be seen in isolation from its economic background or its stage of digital development. It is therefore interesting to consider the Digital Economy and Society Index (DESI), a composite indicator that summarises relevant indicators on Europe's digital performance. It includes six dimensions: connectivity, human capital, use of internet services, integration of digital technology, digital public services, and research and development ICT [138].

According to this index (DESI 2019), Finland, Sweden, the Netherlands and Denmark, followed by the United Kingdom, Luxembourg, Ireland, Estonia and Belgium have the most advanced digital economies among the EU member states. Conversely, Bulgaria, Romania, Greece, and Poland score lowest. This could explain why some of the countries with already advanced digital economies do not currently have any top-level policies related to investment in school digital infrastructure (see Figure 4.4).

The 2nd Survey of Schools on ICT in Education (European Commission, 2019) also gives some empirical insight into the availability of IT infrastructure in schools. The survey shows that on average, across Europe, the higher the education level, the more schools are highly digitally equipped and connected: 35 % of schools in primary education, 52 % in lower secondary education and 72 % in upper secondary education. Furthermore, students in Nordic countries are more likely to attend schools which are highly digitally equipped and connected (European Commission, 2019, p. 39). However, the survey also shows that students' access to desktop computers in school is more likely to be in computer laboratories rather than in classrooms (European Commission, 2019, pp. 30-31).

Figure 4.4 shows that a large majority of European countries currently have definite commitments to invest in schools' digital infrastructure. In many countries, investment in infrastructure is among the

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[138] http://ec.europa.eu/digital-single-market/en/desi

objectives of their digital education strategy. While the actual funds invested are not always easily identifiable, there are some examples of the amount of money top-level authorities are prepared to spend.

In **Germany**, the Federation and the *Länder* have launched a digitalisation pact (*DigitalPakt Schule*) in March 2019 under which the Federation will provide five billion euros and the *Länder* will each contribute with a minimum of 10 % of the amount invested by the Federation over a five-year period for digital equipment in schools. The *Länder* are responsible for the initial and further training of teachers, the revision of curricula, the acquisition of learning software as well as safeguarding and maintenance of digital infrastructure.

In **Ireland**, the Digital Strategy for Schools has committed 210 million euros for the period 2015 to 2020 to support investment by schools in relevant infrastructure, out of which 60 million are distributed in grants to schools.

In **Spain**, the policy *Escuelas Conectadas* (connected schools) is being developed to extend ultrafast broadband access to all Spanish non-university schools. Since 2015, 13 regions have already joined this strategy though the signing of a Memorandum of Understanding, which involves the participation of 11 577 schools; 4 170 016 students will benefit from this policy.

In **Poland**, the government project of the Nationwide Education Network (*Ogólnopolska Sieć Edukacyjna* – OSE) ([139]) aims to reach 30 853 schools and over 5 million potential users (both students and teachers) to overcome digital exclusion and provide equal educational opportunities for all students, particularly those living in low populated areas. Over 372 million euros and 38 million euros per year for project maintenance over 10 consecutive years have been allocated for its implementation.

In some countries, investment in digital infrastructure is still an important need identified in relation to digital education and is therefore a major focus of the strategy. For example:

In **Bulgaria**, the main goal of the strategy adopted in 2014 is to provide equal and flexible access to education and scientific information at any time and from anywhere – from desktop computers, laptops, tablets, and mobile phones. For the first time, a unified digital information environment for school education, higher education and science will be created. The strategy includes three stages. The first stage is devoted to key investment, with the aim that at least 50 per cent of all schools are provided with a wireless network. The introduction of a national e-learning and content management platform is to enable e-learning and the integration of current electronic tools and future electronic textbooks. The mid-term stage, 'Mobility and Security' envisages the provision of durable optical high-speed connectivity to educational institutions, allowing, for example, real-time multimedia tools to be used and joint open online lessons. For 2018-2020, the strategy envisages the creation of a unified learning environment for u-learning (ubiquitous learning), a transition to electronic textbooks for all subjects, virtual classrooms and laboratories, and national online exams and evaluation systems. Currently, the first two stages are being implemented in parallel with the third stage, as financial constraints and changes in government have caused delays.

In **Italy**, many actions of the School Digital Plan are dedicated to the development of school IT infrastructure. The first action is dedicated to the implementation of broadband and connectivity, the second deals with the provision of LAN/WLAN in all schools and in many school environments (classes, labs, staff room, etc.). The third action deals with improving the speed of the internet connection. The fourth action looks to increase the number of digital devices in schools so that digital learning can be improved.

In **Hungary**, strategic actions related to infrastructure include: improving connectivity and providing internet access to classrooms as well as interactive display tools and classroom management services; equipping 40 % of specialist rooms with interactive 3D visuals; providing at least one special computing room and one programmable robot for every 3 students; and to ensure that every teacher has a laptop allowing them to prepare digital lessons and to carry out digital education administration.

([139]) https://ose.gov.pl/

Figure 4.4: Top-level plans to invest in school digital infrastructure in primary and general secondary education (ISCED 1-3), 2018/19

Current
digital infrastructure
investment plans for schools

No current
digital infrastructure
investment plans for schools
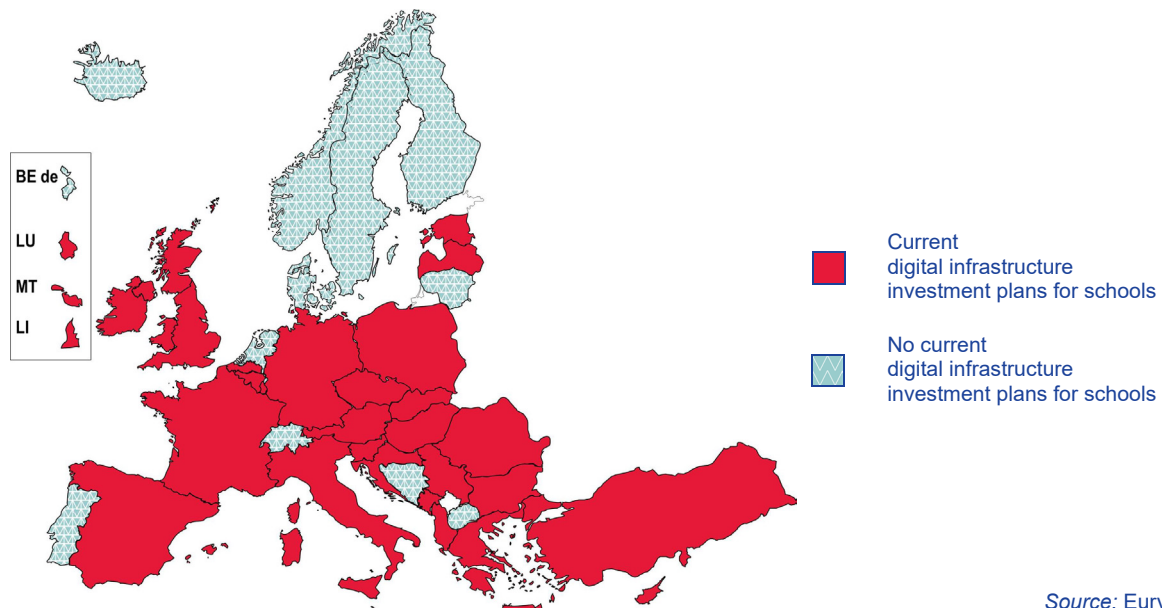
Source: Eurydice.

Explanatory note

Digital infrastructure includes hardware, software, school connectivity, digital learning environments, digital tools and devices.

Country-specific notes

Croatia: The e-Schools programme (2015-2022), of which the first phase was a pilot project (2015-2018), includes general investment in school IT infrastructure in parallel to investment for implementing the compulsory subject informatics into the 5th and 6th grade of primary schools.
Sweden: The national strategy on digital education sets out goals and sub-goals but does not provide resources or definite measures to support schools.
Switzerland: School IT infrastructure is the responsibility of *Canton*s. At cantonal level, there are plans to invest in schools' digital infrastructure.
Turkey: Although there is currently no top-level strategy addressing digital education in schools, investments in IT infrastructure are made to ensure the effective use of digital technologies in schools.

Of course, investing in digital infrastructure does not in itself guarantee any progress in digital education or in the digital competence of students. However, it is to some extent a prerequisite to the use of digital technologies in education. As explained in the introduction, the first policy wave focusing on investment in infrastructure has already been replaced in many countries by attention to training and competence development. Some education systems, such as the French Community of Belgium, for example, have been revising their investment strategy due to lessons learnt from unsatisfactory past experiences.

> In the **French Community of Belgium**, past experience has shown that some initiatives were not effective, for example, the substantial installation of equipment and training focusing on the use of digital tools. Other experiences have proved more beneficial for students and teachers, namely granting digital equipment depending on the quality of pedagogical plans or the professional development of staff and the availability of training in schools. The strategy (*Pacte pour un enseignement d'excellence*) recommends the minimum equipment for administration and pedagogy (hardware, software, networks and internet connections and at least one connected device by classroom). However, the idea is to allow schools to request further specific equipment within the framework of a school plan related to the pedagogical use of technology. The coordination and networking of various organisations will help provide advice on specific investments. Recommended equipment should be: interoperable, user-friendly, durable, based on existing infrastructure, controllable, to be used in class rather than in IT labs, and whenever possible on open licence.

Digital technologies and their uses are constantly and rapidly evolving and so does the need for up-to-date infrastructure. One trend that started more than a decade ago is the 'bring your own device' (BYOD) policy (UNESCO, 2013). The 2nd Survey of Schools shows that there is a high variance in the reported usage rate of students' own digital devices for learning purposes in different countries. Denmark, for example, scores well above the European average with regard to students using their

own laptop during lessons for learning purposes. Also in Estonia, Lithuania, Latvia and Finland students report a higher use of their own digital devices, particularly their own smartphone, compared to using computers provided by the school. A possible explanation for the large country differences could be the implementation of an official BYOD policy, as is the case in Denmark, for example (European Commission, 2019, pp. 42-43).

Allowing students to use their own devices in school settings affects how education authorities plan their investments in school IT infrastructure. Several European countries have reported that they are currently developing a BYOD approach at school, in addition to investing in school digital infrastructure. For example:

In **Estonia**, the strategic measure 'accessing a modern digital infrastructure for learning', aimed to develop digital learning resources and technology that allowed all students and teachers to use personal digital devices in educational settings, in addition to the school's digital infrastructure. This means that the interoperable information systems and services of the State, local governments and schools would be accessible to all learners. This objective has now been reached.

In **France**, investing in infrastructure is the responsibility of the regional level and below (*régions, départements, communes*) and is decided together with schools. The national level can provide financial support depending on the project. In addition, the BYOD approach is encouraged by the Ministry of Education.

4.2.2. Requirements for a school digital plan

Requirements 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 competence 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 (ICILS) 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).

However, only a few European education systems include such requirements in their digital education strategies or regulations. Nevertheless, some interesting examples exist.

In **Ireland**, the Professional Development Service for Teachers – Technology in Education, which is promoting and supporting the integration of ICT in education (see Section 4.1.3), advises and supports schools in developing a Digital Learning Plan. The development of such a plan is required for managing the grants for digital infrastructure distributed to schools within the framework of the Digital Strategy for Schools (see Section 4.2.1).

In **Italy**, the Digital School Plan recommends that the school digital strategy is embedded into the three-year school educational plan (*Piano Triennale dell'offerta formativa* – PTOF), linking it to the training of educational staff. The school digital coordinator is responsible for drafting a school digital plan to be agreed by the teacher council, which is then embedded into the three-year school educational offer.

In **Austria**, motivating schools to develop their own digital strategy is the overall goal of the national digital strategy. However, this is not obligatory for schools. Rather, they are encouraged to take responsibility and recognise the need to actively tackle digitalisation. Each school should therefore develop a plan to implement digital education in the best possible way, and ideally including the following items: teaching digital competences, the pedagogical use of technology in various subjects, optimising infrastructure, collaboration and communication and teacher competences, and teacher training (CPD).

Goal four of the **Slovenian** digital strategy is dedicated to the digitalisation of institutions, which includes a higher level of collaborative leadership (planning, managing and evaluation) and upgrading the activities of the school's e-development teams (for

curriculum, e-content, e-services, etc.). To achieve this goal, the strategy offers assistance to educational institutions for setting up e-development teams to plan, implement, monitor and evaluate digitalisation.

In the **United Kingdom (Wales)**, the Digital Competence Framework (DCF) establishes the expectation that each school will have a 'digital lead' practitioner who will have a key role in developing a clear vision for digital learning in the school and for coordinating how the framework is used to develop greater (cross-curricular) understanding and confidence. The digital competence lead will coordinate identifying and meeting staff development needs and preparing a plan for the implementation of the DCF to develop a positive digital culture within a school. The DCF also intends that schools will have a clear vision for digital learning; develop policies and procedures for embedding digital competence; and incorporate digital competence into school improvement plans.

In some countries, or regions, recommendations or regulations for a school digital plan exist, without being necessarily linked to the current digital strategy. In some German *Länder* for example, schools have to develop a specific school digital plan. In France and Luxembourg, objectives related to digital education have to be included in the general school development plan.

In **Germany**, the media development plans of individual schools are not mentioned as a requirement in the strategy of the Standing Conference. However, they are already compulsory in some *Länder* (e.g. Bavaria and North Rhine Westphalia). Furthermore, within the framework of the digital pact between the Federation and the *Länder (DigitalPakt Schule)*, the existence of a media development plan is a condition for receiving funding for digital infrastructure. In the Land of North Rhine Westphalia, for example, there is already a requirement to have a school digital plan ([140]). Here, the media development plan serves as an instrument to plan the pedagogical use of technologies and to describe the necessary conditions. This approach aims at linking the didactic concept with the technical (infrastructure, connectivity, etc.) and the organisational concept (training and funding). Its objective is to guarantee a pedagogically meaningful use of technologies in schools in a sustainable manner.

In **France**, the general framework for the school digital plan is established at the national level. It requires the *académies* to develop a plan for their area, which then serves as a reference for school development plans. These plans need to include digital education, with specific objectives and measures, as well as indicators to monitor progress.

In other countries, although there is no strategic measure or top-level recommendation/regulation that requires school digital plans, they are being encouraged, by, for example, linking them to funding for digital infrastructure.

In **Estonia**, schools were recommended to evaluate their position regarding digital education and to create a school digital plan. Furthermore, if schools wish to apply for ICT grants for the Information Technology Foundation for Education (HITSA) or from the Ministry of Education and Research they must have a digital plan in place.

4.2.3. Digital leadership in schools

Leadership at school level is an important lever for change. Leaders can motivate staff, set objectives, develop school digital plans, coordinate efforts, and more generally create a climate favourable to innovation. The following analysis looks at two approaches towards developing digital leadership in schools: the training of school heads and the appointment of digital coordinators.

The training and involvement of school heads is essential if schools are to successfully move forward on digital education. In many countries, greater autonomy is being granted to schools and, consequently, heads are playing an increasingly important role in school development, particularly with respect to designing curricula and managing resources (Schleicher, 2012). Therefore, not addressing the needs of school heads in terms of digital professional development would undermine their ability to coordinate school efforts in this area. Delivering digital competence as a key competence and ensuring that technology is used across the curriculum is beyond individual teacher responsibility. A whole school approach is necessary to encourage and sustain change and innovation in teaching and learning (Cachia et al., 2010). Also, the recently published 2nd Survey of Schools on ICT in education shows that positive attitudes towards using ICT for learning and teaching are significantly more common among school heads than among teachers (European Commission, 2019).

([140]) http://www.medienberatung.nrw.de/Medienberatung/Medienentwicklungsplan/

Therefore, while the role of school heads is fundamental, their training is less frequently and less explicitly stated in terms of objectives in current national strategies. Only one third of the education systems have, in fact, explicit measures in this area as part of their current strategy.

In several countries, the central role of schools heads in promoting digital education in schools is recognised as essential in digital strategies. For example:

> The **German** strategy 'Education in the Digital World', recognises the central role of school heads with regard to quality development in schools. It emphasises that school heads have to be prepared and supported by means of qualifications and CPD to be able to promote school development related to digital media.

> In **Ireland**'s digital strategy for schools, leadership is one of the four key themes. The use of digital technologies is also an integral part of all Department funded CPD programmes and support, and it forms part of ITE and induction programmes. The Professional Development Service for Teachers (PDST) with its dedicated Technology in Education Team and its ICT advisors, play a lead role in promoting and supporting the embedding of digital technologies in teaching and learning. They continue to develop and deliver a comprehensive range of CPD programmes comprising face-to-face courses, workshops, online CPD, good practice videos, school-based support including digital learning planning, and a range of other support resources to school teachers and leaders.

> In the **Slovenian** strategy, the third of six main goals is related to e-competences. This entails raising the level of digital competence and enhancing the use of ICT within the overall education system on a premise of comprehensive competence development of teachers, ICT coordinators, school heads and other educational staff. It requires effective forms of training (face to face and online), strengthening professional e-communities, active exchange of good practice, peer learning, and providing quality e-services (counselling, support).
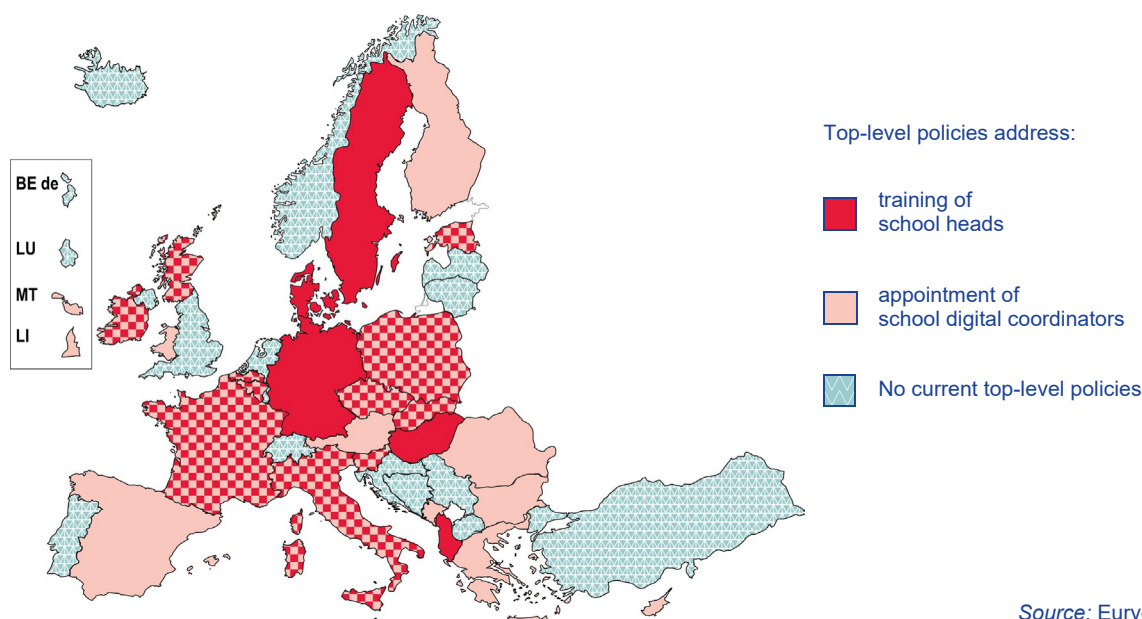
> In the **Scottish** strategy, empowering leaders is one of the four main aims. The objectives are to: develop local strategies that will help educational leaders to ensure that all learners can benefit from an education enhanced by digital technology; provide access to a range of career-long professional learning opportunities for educational leaders, allowing them to make informed decisions about the best use of digital technology to enrich education and promote digital skills development.

Another way of ensuring adequate training for school heads is to include the pedagogical use of digital technologies into competence frameworks or professional standards, as well as into training programmes for prospective school heads or other school managers and teachers (see Chapter 2). This is one of the strategic goals in the Czech digital education strategy, which is also planned in Estonia. Hungary aims to develop a digital competence framework together with measurement and evaluation tools for digital competence requirements, and it plans to provide further training to extend digital education at institution level.

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 faced by teachers 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).

As Figure 4.5 shows, about half of the European education systems have policies to support the appointment of a digital coordinator in schools. Usually, the role is assigned to ICT teachers or teachers specialised in digital education.

Figure 4.5: Digital leadership in schools: training for school heads and appointment of digital coordinators, primary and general secondary education (ISCED 1-3), 2018/19

Top-level policies address:

■ training of school heads

■ appointment of school digital coordinators

▨ No current top-level policies

Source: Eurydice.

Country-specific notes

Croatia: The e-Schools pilot project included the training of school heads. This was the first phase of the wider e-Schools programme (2015-2022) and in the next phase all schools will be included.
Luxembourg: Despite the absence of top-level regulations, all schools have digital coordinators.
Poland: Under the government programme 'Active Board' (for the development of school infrastructure and digital competences of students and teachers, 2017-2019), the Ministry of Education has made it obligatory for all primary schools to appoint a digital coordinator.
Portugal: However, the Education Ministry is supporting the European project 'Learning Leadership for Change' which will validate the impact of shared leadership practices applied to STEM education policies, innovative use of ICT in teaching, and digital citizenship.
Sweden: The national strategy on digital education sets out goals and sub-goals but doesn't provide resources or practical actions to support schools. However an action plan has been presented. One of the goals set out in the strategy is that school heads should be competent to strategically lead digital development work in schools.

This is the case, for instance, in Belgium (Flemish Community), Bulgaria, Estonia, Czechia, France, Spain, Cyprus, the United Kingdom (Wales) and Liechtenstein. However, in France, they must undertake a specific training course. When digital coordinators take on additional responsibilities, they may be compensated for this by a reduction in teaching hours. In Czechia and France, however, digital coordinators receive an additional monetary payment.

In Ireland, post-primary schools have the option to assign specific functions to a post. These might include general coordination, running specific programmes, and providing advice and support to staff and school managers on digital technologies for teaching and learning. Schools in Finland, Slovenia ([141]) and the United Kingdom (Wales) also have a separate digital coordinator post.

In **Finland**, from 2016 to March 2019, around EUR 23.8 million has been spent on tutor teachers. The action plan aims to provide each comprehensive school ([142]) with competent tutor teachers (2 500 tutor teachers in total). The main role of a tutor teacher would be to support teachers in using digital technologies in teaching and promoting new pedagogical approaches.

In the **United Kingdom (Wales)**, under the new Digital Competence Framework (DCF) ([143]), schools are expected to identify a senior lead practitioner responsible for digital competence. They contribute to developing a clear vision for digital learning and a whole-school approach for the teaching of digital skills. They help identify and meet staff development needs, coordinate integrating

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([141]) In small-size schools there are no full-time digital coordinator posts. Digital coordinator's role may be performed by a teacher having appropriate qualification or assumed by school heads or their deputies.

([142]) Comprehensive schools are the schools providing compulsory education.

([143]) https://hwb.gov.wales/curriculum-for-wales-2008/digital-competence-framework/

the DCF into the school plan, and where appropriate, carry out school infrastructure audits. They have often been the ICT subject coordinator in the school before becoming the school's 'digital lead' for the DCF, but this is not always the case. Digital leads may come from a non-ICT background.

In Greece, Cyprus (primary schools), Malta and Poland, the digital coordinator provides support to several schools.

In **Greece**, IT and New Technologies Coordinators are responsible for providing technical support and implementing traditional and new technologies in school units and laboratories. They are based in the Regional Centres for Educational Planning.

In **Cyprus**, in primary schools, the support role is provided by a teacher who may not be based in the school itself, but supports a number of schools in the region. However, in secondary education an ICT/computer science teacher is assigned the task of coordinating technical aspects/maintenance of digital technologies in each school.

In **Malta**, the Education Officers from the Directorate for Digital Literacy and Transversal Skills also act as digital coordinators. They regularly visit primary and secondary schools to identify gaps in teachers' digital competences and to support them accordingly. They support the use of the various technologies available in schools and help teachers to include them in their lessons in order to engage students and facilitate learning.

In **Poland**, as part of the 'Education in the digital society' (*Edukacj@ w społeczeństwie cyfrowym*) programme, which introduces the teaching of programming, the Ministry of National Education appointed coordinators for innovation in education at the regional level *(Voivodship)*. The coordinators' tasks include, among others, supporting schools in running activities and finding the right information and communication technology solutions (e.g. the use of e-textbooks and e-resources; the introduction of electronic record books and appropriate didactic methods).

Despite the fact that the role of digital coordinators varies considerably not only between education systems but also between schools in the same education system, they usually include both pedagogical and technical aspects. The pedagogical role of school digital coordinators consists mainly of providing support and advice to other colleagues on how to integrate digital technologies into their teaching and how to use digital tools and devices. However, digital coordinators can also be responsible for coordinating and organising professional development activities or providing in-house training on demand. They can also be given the responsibility for managing teacher networks and digital platforms and for ensuring that the school is integrated into digital communities. Digital coordinators may assist and advise school heads in drafting and implementing a school digital plan and following this up. They also support the school management in promoting digital education events and activities.

The technical role of digital coordinators, usually in collaboration with ICT teachers, may be to ensure the installation and maintenance of IT equipment, as well as the installation and configuration of software. They may also analyse ICT related needs and coordinate the purchase of new equipment.

4.2.4. Involving and supporting parents in digital education

Parental involvement is essential for the development of student digital competences for many reasons. PISA 2012 data (OECD, 2016b) shows that young people spend more time on internet activities outside school than in school, which means that parents have an important role in encouraging their children to become critical and confident users of technology. A qualitative survey on young children and digital technologies found that 'parents would welcome advice on fostering children's online safety. Advice from schools appeared to be limited, nor did there appear to be substantive communication between school and families on issues related to technology' (Chaudron, 2015, p. 9). The 2nd Survey of Schools on ICT in Education found that the younger the child, the more frequently parents share in their ICT-related activities. However, a large proportion of secondary education students never or almost never discuss the risks of the internet with their parents. Moreover, more than half of secondary education students never or almost never get support from either their

parents or their siblings for homework that requires the use of ICT (European Commission 2019, pp. 89, 96).

Also, in the same way as teacher attitudes towards digital technology and their ability to use it is a critical factor in how they deliver digital education to their students, parents' attitudes and abilities will also determine whether they help or hinder their children's development of digital competences.

Only a few of the countries contributing to this report give examples of policy measures in this area, and these very rarely feature among the main objectives of their digital education strategies. Practical support for parents can, for example, be given through guidance materials such as in France, where a practical guide for parents on the use of digital technologies has been developed ([144]). Other countries organise training for parents or run outreach and prevention campaigns, often linked to the area of safety.

> In the **Flemish Community of Belgium**, the programme 'Safe Online' ([145]) is meant to encourage parental involvement and to train parents. Financed by the Education Department, it has reached hundreds of schools and thousands of parents since its start in 2012. Every school year, a minimum of 150 school sessions are organised across the region for parents and/or parent boards to inform and train them about online safety in five thematic areas: sexuality and relationships in the online world, cyberbullying, online privacy, social media and games.

> In **Cyprus**, the Pedagogical Institute organises seminars for parents on digital education issues, especially on internet safety.

> In **Malta**, the Directorate for Digital Literacy and Transversal Skills within the Ministry for Education and Employment is implementing outreach initiatives for parents including information sessions to involve them in initiatives such as One Tablet Per Child, Family Coding and Digital Literacy week.

> In **Poland**, measures to develop parents' digital skills and their commitment to digital education cover two main areas: promoting online safety and risk prevention, and engaging parents in activities to develop children's digital literacy, including programming. The measures include, for example, the Safe+ programme – a government programme coordinated by the Ministry of National Education. Another example is the projects and programmes for parents implemented by the NASK – National Research Institute: 'Become a friend of your child' programme, which offers webinars on the safety of children and young people on the internet, as well as other brochures and guides.

> In **Slovenia**, the Action Plan for ICT in Education (2006) stipulates that future digitalisation activities should also involve parents. Among the objectives are the training and promotion of ICT applications in the life and learning activities of parents and other stakeholders. Furthermore, parents and other ICT users should, in future, be able to obtain information on new skills and relevant training at workshops and other out-of-school education-related activities.

> **Liechtenstein** also offers different activities such as prevention campaigns, tutorials and training for parents and others. Some important issues covered are, for example, data privacy issues, sexting, and mobbing via social media.

Digital education can, of course, be one of the issues on which schools inform or consult parents (or at least their representatives) as part of normal communication procedures or via the school governing body. Moreover, digitalisation in schools may improve the flow of information between schools and parents, reinforcing the school consultation and participation processes, and helping parents become more familiar with digital issues and the benefits technology brings. For example:

> In **Italy**, one action of the national digital strategy is aimed at improving communication between schools and families through a digital portal where students' achievements and other data are stored and through which communication flows are made easier. Moreover, through the school digital coordinator, families will be involved in specific training sessions to become familiar with digitalisation topics.

> Similarly, the **United Kingdom (Scotland)** is looking for opportunities to use digital technology to engage with parents and carers, allowing them to understand the benefits of digital technology in education. This may be through the involvement of parent councils and parent/carer groups in discussions around the use of digital technology to help realise anytime/anywhere learning.


([144]) *La famille TOUT-ECRAN*, published by CLEMI / réseau Canopé (2017)
https://www.clemi.fr/fileadmin/user_upload/espace_familles/guide_emi_la_famille_tout_ecran.pdf.

([145]) https://www.veiligonline.be/

4.2.5. Development and quality assurance of digital learning resources

Digital learning resources are on the political agenda of many European education systems. In some countries, the development, availability and quality of digital learning resources are addressed in the current strategy. In other cases, actions in this field have originated from different policy documents or specific initiatives, and they usually involve a variety of stakeholders both public and private. In Austria, for example, the quality assurance of digital learning resources has been developed in cooperation with the university colleges for teacher education, and in Romania, e-textbooks have been developed together with professional publishers.

Figure 4.6: Policies to improve the development, availability and quality of digital learning resources, primary and general secondary education (ISCED 1-3), 2018/19

Policies to improve the:

development and availability of digital learning resources

quality of digital learning resources

No policies in these areas
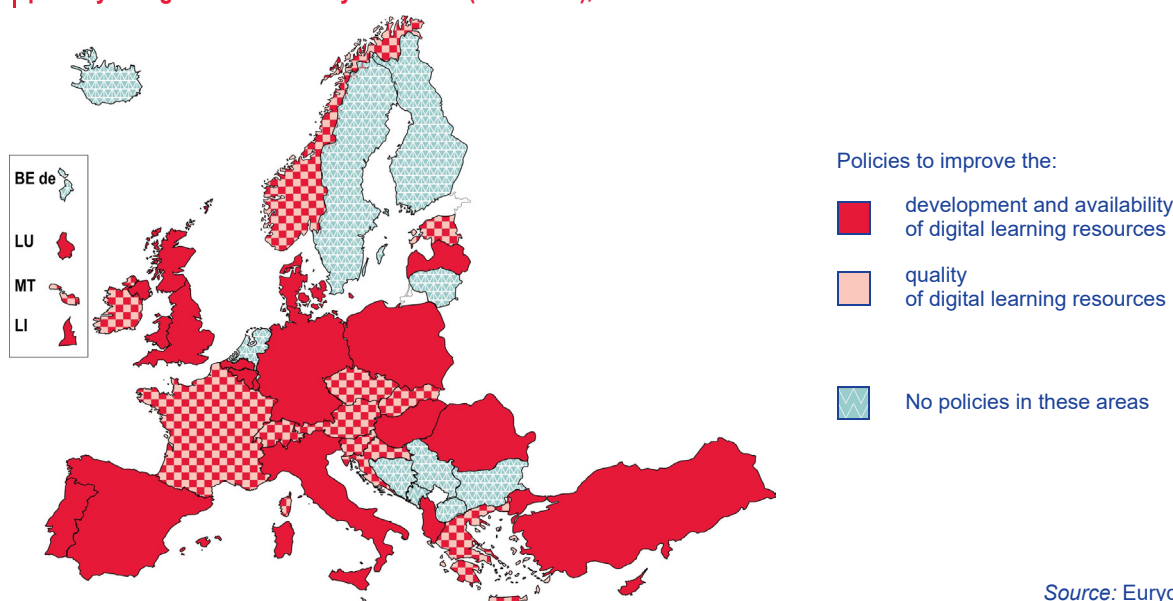
Source: Eurydice.

Explanatory note

'**Development and availability of digital learning resources**' refers to top-level policies that facilitate the development of resources or improve access to them, for example, through funding the creation of a web portal and its content. It does not make any distinction on the basis of the authorship of the digital learning resources (teachers themselves, the body managing the portal, private publishers).

Figure 4.6 shows that in most education systems there are policies in place to improve the development and availability of digital learning resources, including through Open Educational Resources (OER). Additionally, in 11 of these education systems ([146]), top-level authorities have taken practical measures to ensure the quality of digital resources, and Czechia is in this process. OER are not discussed separately as they are usually dealt with in the broader category of digital learning resources and are rarely the subject of specific policy measures, with some exceptions. For example:

> In **Germany**, initiatives in this field are within the competence of each *Länder*. However, the Standing Conference will strive for cross-*Länder* synergies with regard to the use of OER. Specifically it will establish a central office for the promotion of OER material through awareness raising activities, and by interlinking existing activities and stimulating cooperation between stakeholders.

Improving the development and availability of digital resources can be achieved through a range of actions, which are sometimes closely interconnected. For example, some countries promote the use of digital learning resources by financing web portals that become repositories, enabling teachers to share resources. These portals may also provide tools to help teachers to create their own resources, or they may offer e-learning opportunities or other services linked to digital education.

([146]) Estonia, Ireland, Greece, France, Croatia, Malta, Austria, Slovenia, Slovakia, Switzerland and Norway

In the **Flemish Community of Belgium**, one of the central measures in the area of digital education is the support given through the educational portal *Klascement* ([147]). This portal serves as a versatile electronic knowledge centre on digital education by providing access to information, support services, and digital learning resources. As far as the latter is concerned, the portal has a number of subsites dedicated to specific areas of the curriculum, such as STEM and coding ([148]), special needs ([149]), entrepreneurship ([150]) and remembrance education ([151]).

In **Spain**, educational administrations offer tools for spreading the use of digital learning resources, such as for example: Mediateca EducaMadrid ([152]), Mediateca Castilla-La Mancha ([153]) and ALEXANDRIA in Cataluña ([154]).

In **France**, the bank of school digital resources ([155]), supported by the Ministry of Education through its digital school plan, provide digital content and support services covering five subjects (French, mathematics, history and geography, sciences, and foreign languages (English, German and Spanish) for the 3rd and 4th cycle (grades 4 and 5 of primary education and all lower secondary school grades). Moreover, through its multi-service platform the CANOPÉ network ([156]), it provides nearly 6 000 digital learning resources (2 000 of which are free), classified by education level, subject, type of resource, and user profile (e.g. teacher, parent, student).

In **Greece**, there are a number of portals supported by the Ministry of Education. Among these, are the educational web portal www.e-yliko.gr, which gathers digital material produced and certified in the past 10 years by the Ministry of Education for primary and general secondary education; the http://dschool.edu.gr website, which addresses both primary and general secondary education; and the Greek repository of open educational resources *Photodentro* ([157]).

In some cases, these portals have tools which allow teachers to develop their own resources, while elsewhere specific agencies or projects have also been set up to develop them. In some cases, the two approaches co-exist:

In **Turkey**, despite the absence of a comprehensive strategy on digital education, the top-level authority has launched the *FATIH* ([158]) project which offers, among other supporting services, digital education resources and tools that allow teachers to create and share their own e-content with other teachers.

In **Norway**, the *IKTplan* ([159]) website offers teachers material and information on how to produce and use digital learning resources, as well as information on various aspects of concern to teachers, such as copyright issues or verification of sources.

There are also examples of resources that focus on specific subjects or parts of the curriculum.

In **Denmark**, for example, the top-level authority is supporting the creation and use of virtual laboratories for STEM classes in primary and general secondary education.

Policies on digital learning resources may also support textbooks and related materials.

In **Romania**, the Ministry of Education has financed publishing houses to produce digital textbooks for grades I to IV (primary education) and now provides free access to these on its own website ([160]). Moreover, the Ministry has also supported the creation of digital learning resources by teachers, schools and non-profit organisations for grades I to VIII (primary and lower secondary education).

In **Poland**, in addition to other initiatives, the 'Education in Digital Society' programme includes an action on the creation of e-textbooks and accompanying e-teaching materials.

([147]) www.klascement.be

([148]) https://www.klascement.net/kiezenvoorstem/

([149]) http://www.klascement.net/leerzorg/

([150]) http://www.klascement.net/ondernemenopschool/

([151]) http://www.klascement.net/herinneringseducatie/

([152]) https://mediateca.educa.madrid.org/

([153]) http://www.educa.jccm.es/educa-jccm/cm/recursos

([154]) http://alexandria.xtec.cat/

([155]) http://eduscol.education.fr/cid105596/banque-de-ressources-numeriques-pour-l-ecole.html

([156]) https://www.reseau-canope.fr/

([157]) http://photodentro.edu.gr/aggregator/?lang=en

([158]) http://fatihprojesi.meb.gov.tr/en/

([159]) http://iktplan.no

([160]) https://www.manuale.edu.ro/

The top-level authority might also produce or support the production of digital learning resources in contexts not strictly belonging to the educational sector, but with high value or potential for use in schools. For example:

> In the **Flemish Community of Belgium**, the Flemish Institute for the Archiving of the Audio-visual Heritage provides access to a wealth of audio-visual material that can be used as digital learning resources. The materials are contextualised for class use through a dedicated platform for education ([161]). The platform was launched in January 2016 and is currently hosting more than 17 000 audio-visual resources covering all areas of the curriculum.

Finally, in 12 education systems ([162]) the policies include measures to ensure the quality of digital learning resources. In some cases, providers are required to consider quality issues when developing digital learning resources or making them accessible. In other countries, the top-level policies include the development of specific standards or quality requirements. This is the case for the four countries below:

> In **Czechia**, the strategy on digital education includes a specific measure on the creation of a user review system for the evaluation of open educational resources.

> In **Estonia**, the Ministry of Education and Research defines the quality requirements for digital learning resources, taking into account special education needs, and it provides instructional materials for the authors of digital learning resources.

> In **Croatia**, the strategy includes measures to develop standards for digital educational content and their use in teaching and learning.

> In **Austria**, the Ministry of Education has developed quality standards for digital teaching materials. The quality standards are a guide for the development of digital teaching and learning materials including interactive digital textbooks. All providers of digital learning resources are required to adhere to these quality standards.

4.2.6. External school evaluation

This last part of Chapter 4 examines the extent to which digital education is covered in external school evaluation frameworks. This form of evaluation can serve different purposes. For top-level authorities, it can help them monitor how well individual schools are performing and, at macro–level, it can feed into the country-level analyses used to measure overall progress in a particular curriculum area such as digital competence. Individual schools can use external evaluation results to assess their own performance, as well as to identify their strengths and weaknesses.

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, 2015a).

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 analysis looks 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 the quality of digital infrastructure and the level of investment.

([161]) https://onderwijs.hetarchief.be/
([162]) Czechia, Estonia, Ireland, Greece, France, Croatia, Malta, Austria, Slovenia, Slovakia, Switzerland and Norway

Of the countries where external school evaluation is carried out, only 14 ([163]) include aspects related to digital education in their external school evaluation frameworks. For example:

> In **Ireland**, as part of some evaluation models, inspectors may consider how well schools are integrating digital technologies by verifying that the school has the Digital Learning Plan in place; that the Digital Learning Framework is used; and the school is compliant with the criteria on expenditure under the Digital Strategy ICT funding programme.

> In **Spain**, the Autonomous Community of Castilla y León provides a comprehensive set of indicators that evaluate the integration of digital technologies in the teaching and learning processes. These are: management, teachers' professional training, use of technologies for assessment, use of digital learning resources for teaching and learning, digitally enhanced collaboration, networking and social interactions in the school, and last but not least, digital safety and protection.

As mentioned above, evaluation frameworks cover different aspects of digital education but they usually include how well digital technologies are being integrated into the teaching and learning process. The evaluation methods also vary, and may include the use of surveys and classroom observations where appropriate.

> The Ministry of Education in **Estonia**, in collaboration with the Innove Foundation (see Annex 5), assesses how well digital education is being implemented in schools, as part of a broader survey on well-being at school. To do this, it sends a survey to students, teachers and parents. Students are asked among other things, how well teachers guide them in using digital devices for learning, and to what extent they use computers for learning. Teachers, on the other hand, are asked how often they let students use digital solutions during their courses, and what type of activities they engage in. Questions on students' digital competences and the use of digital technologies at school are also addressed to parents.

> In **Malta**, during class observations, external reviewers assess, among other things, how and to what extent teachers use digital technologies to facilitate learning. To elicit trends on a school basis as well as on a national basis, external reviewers use a 4-point scale that ranges from Level 1 – 'no digital learning technologies are used in class to facilitate learning', to Level 4 – 'application of extended knowledge of how digital technologies can be used to create resources which are innovative and stimulate learning'.

> In **North Macedonia**, the criterion related to digital education – 'Planning and Use of ICT in the educational process' – looks at three specific aspects: whether the teacher uses digital technologies in the educational process, the variety of technologies used, and whether the teacher has received the necessary training. If the teacher has not received training on digital education, there is no obligation to evaluate his/her use of digital technologies in the classroom.

In terms of IT infrastructure, it is quite common for external school evaluators to look at the way schools are equipped, their connectivity, and how well the infrastructure is maintained. In Latvia and Romania, this is the only aspect evaluated.

Another aspect that evaluators sometimes consider is the use of digital technologies for school management purposes. This can mean simply using digital communication channels to contact parents and other stakeholders (e.g. website, emailing, social media, etc.) to managing virtual learning environments or collaborative tools. Only Lithuania, Malta, Albania (secondary schools) and Liechtenstein consider the management aspect in their external evaluation frameworks.

Elsewhere, inspectors also consider other specific aspects related to digital education.

> In **Poland**, the criteria for both internal and external school evaluation are set yearly. In the 2017/18 school year, external school evaluation covered the area of internet safety and specifically the responsible use of social media. In 2018/19, the criteria covered the responsible and safe use of resources from the internet.

> In the **United Kingdom (England, Wales and Northern Ireland)**, one of the criteria that inspectors take into account concerns students' safety online. In England, in making their judgement on students' 'personal development, behaviour and welfare', Ofsted inspectors examine to what extent pupils understand how to stay safe online, and the dangers of inappropriate use of mobile technology and social networking sites. The Inspection and Self-Evaluation Framework ([164]) for schools in Northern Ireland contains

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([163]) Czechia, Estonia, Ireland, Spain, Latvia, Lithuania, Hungary, Malta, Poland, Romania, United Kingdom, Albania, Liechtenstein and North Macedonia

([164]) https://www.etini.gov.uk/articles/inspection-and-self-evaluation-framework-isef

indicators on students' e-safety, assessing the capacity of teachers to 'monitor and assess the extent to which children know how to keep themselves safe (including online) and how to seek help'.

Figure 4.7: Criteria relating to digital education in external school evaluation frameworks, primary and general secondary education (ISCED 1-3), 2018/19

ISCED 1

CY   AL

■ Specific criteria relating to digital education

▨ No specific criteria

▨ No external school evaluation
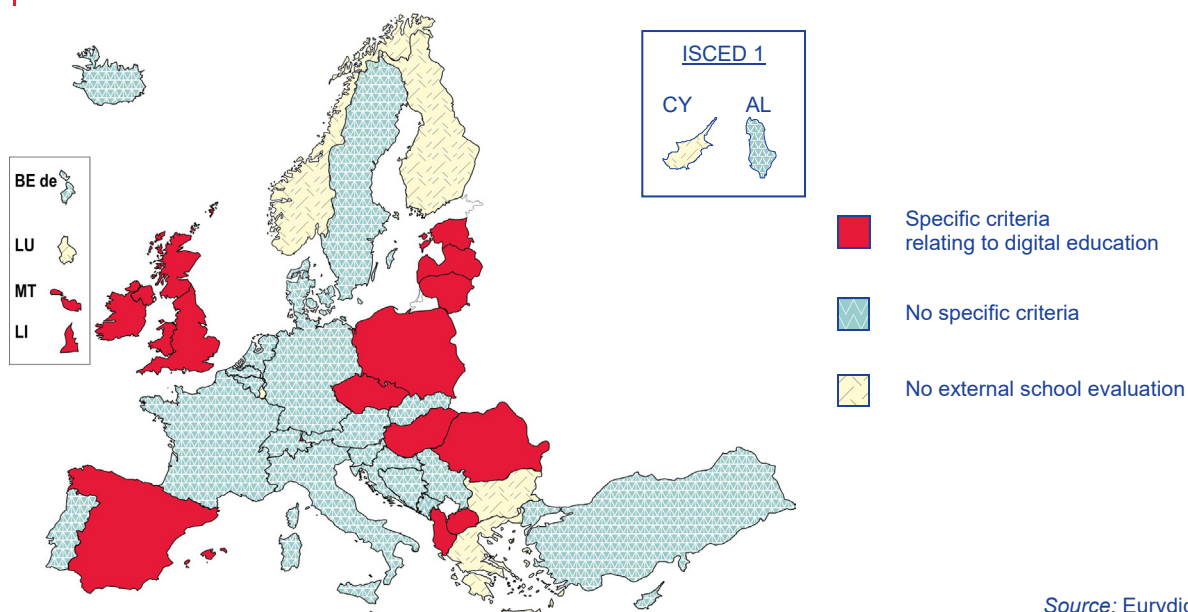
Source: Eurydice.

Explanatory note

The specific evaluation criteria relating to digital education are any criteria explicitly mentioned in evaluation frameworks that are intended to assess how well digital technologies have been integrated into the school's teaching and learning activities or management processes; any references to the quality of the digital infrastructure or the level of investment are also taken into account. Excluded from the scope of this Figure, is the evaluation of ICT related subjects or learning outcomes, or school compliance with prescribed instruction times for these subjects.

External school evaluators report to local, regional or top-level education authorities and are not directly involved in the activities of the school being evaluated. The evaluation covers a broad range of school activities, including teaching and learning and/or all aspects of school management.

Country-specific notes

Germany: External school evaluation is a competence of the *Länder*.
Spain: External school evaluation is a competence of the Autonomous Communities. The Autonomous Communities of Andalucía, Castilla y León, Galicia and Navarra, and the City of Ceuta have specific criteria on digital education in their external school evaluation frameworks.
France: Central regulations provide for external school evaluation to be carried out. However, the evaluation system has been traditionally focused on individual school staff. This system has been reformed recently (2017) focusing more on career evolution and professional development of teachers. Moreover, the reform currently being discussed in parliament (*Pour une école de la Confiance* (For a school of Trust), proposes the establishment of a council for school evaluation. The council should reinforce the role of school evaluation as a monitoring and support tool to produce better quality schools and better student results. In the meantime, the Ministry of National Education and Youth conducts specific evaluations on different aspects of digital education such as digital equipment (ETIC survey), and assesses their impact on pedagogy and pupils' achievements (ELAINE evaluation), although these are not yet part of a comprehensive external school evaluation system.
Croatia: External school evaluation is in the pilot phase and is not yet conducted systematically.
Cyprus: At secondary school level, inspectors usually evaluate the state of IT infrastructure in schools, but there are no explicit criteria in the evaluation framework referring to this or any other aspect of digital education.
Hungary: External school evaluation deals with the integration of digital technologies into the teaching and learning process and IT infrastructure, but the specific criteria are under development.
United Kingdom (SCT): Education Scotland publishes a self-evaluation tool that schools are invited to use. This tool contains specific criteria related to digital education and inspectors consider it during their inspections.
Switzerland: External school evaluation is a competence of the *Cantons*.

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GLOSSARY

I. Definitions

Adaptive tests: interactive tests that automatically adapt questions to the capabilities of students depending on the results of preceding answers. ► On-screen testing ► Practical testing

Certificate: official proof of a qualification awarded to a pupil or student following completion of a particular stage or a full course of education. The award of certificates may be based on various forms of assessment; a final examination is not necessarily a prerequisite.

Closed environment: generally refers to digital technologies that are not connected to the internet and/or are allowed to operate only within a pre-defined environment/programme limiting the use of applications/software to those made available. ► Open environment

Communication and collaboration: in the DigComp 2.0 framework, this is the second of five competence areas and includes six competences: to communicate in digital environments; share resources through digital means; engage in citizenship through digital technologies; link with others and collaborate through digital tools, interact with and participate in communities and networks; cross-cultural and inter-generational awareness and awareness of behavioural norms when communicating and collaborating through digital technologies; create and manage one or more digital identities (Vuorikari et al., 2016).

Continuing professional development (CPD): refers to in-service, formal and non-formal professional development activities, which may, for example, include subject-based and pedagogical training. In certain cases, these activities may lead to supplementary qualifications.

Digital competence: refers to the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking (Council Recommendation of 22 May 2018 on key competences for lifelong learning, 2018/C 189/01, p. 9).

Digital content creation: in the DigComp 2.0 framework, this is the third of five competence areas and includes four competences: to create and edit digital content in different formats; modify, improve and integrate digital information and content; understand and apply intellectual property rights and licences; produce creative expressions, media outputs and instructions for a computing system (programming/coding) (Vuorikari et al., 2016).

Digital competency element (on a certificate): indicates that students have acquired digital competences and, in some cases, states which specific competences have been acquired. It can also provide the assessment results or attainment level(s).

Digital education: broadly speaking, digital education comprises two different but complementary perspectives: the development of digital competences by pupils/students and teachers; and the pedagogical use of digital technologies to support and enhance learning, teaching and assessment. In the European Commission 2018 Digital Education Action Plan, this is phrased as 'how education and training systems can make better use of innovation and digital technology and support the development of the digital competences needed for life and work in an age of rapid digital change' (Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Digital Education Action Plan, COM/2018/22 final). ► Teacher-specific digital competences ► Pedagogical use of technology

Digitalisation: while digitisation commonly describes the mere conversion of analogue into digital information, the terms digital transformation and digitalisation are used interchangeably and refer to a broad concept affecting politics, business, and social issues (Collin et al., 2015; Gimple and Röglinger, 2015; Kane et al., 2015).

Digital learning resources: any digital resource that is designed and intended to be used by teachers and learners for learning. ► Open Educational Resources

Digital technology: any product that can be used to create, view, distribute, modify, store, retrieve, transmit and receive information electronically in a digital form. In this report, the term 'digital technologies' is used in its widest sense, comprising: computer networks (e.g. the internet) and any online service supported by these (e.g. websites, social networks, online libraries, etc.); any kind of software (e.g. programmes, apps, virtual environments, games), whether networked or installed locally; any kind of hardware or 'device' (e.g. personal computers, mobile devices, digital whiteboards), and any kind of digital content, e.g. files, information, data (Conrads et al., 2017).

External school evaluation: seeks to monitor or improve school quality and/or student results. It covers a broad range of school activities, including teaching and learning and/or all aspects of school management. The findings are usually presented in an overall report that does not assign responsibility to individual staff members or appraise the performance of individual teachers. Unlike internal evaluation, external evaluation is conducted by evaluators who report to a local, regional or top-level education authority and who are not directly involved in the activities of the school being evaluated. Evaluation conducted by specialist evaluators and concerned with specific tasks (relating to accounting records, health, safety, archives, etc.) is not regarded as external school evaluation.

Formative assessment: is a range of formal and informal assessment procedures conducted by teachers during the learning process. Usually, it is used to understand student learning needs and monitor academic progress, and where necessary, adjust teaching. It typically involves qualitative feedback and is commonly contrasted with summative assessment, which seeks to monitor educational outcomes. ► Summative assessment

Fully qualified teacher: a teacher who has completed initial teacher education and has fulfilled all the other official accreditation and certification requirements to be employed as a teacher at the level of education concerned.

Information and communication technology (ICT) subjects: includes subjects such as informatics, information and communication technology and computer science. These subjects include a wide range of topics related to the new technologies for processing and transmitting digital information, including computers, computerised networks (including the internet), microelectronics, multimedia, software and programming, etc.

Information and data literacy: In the DigComp 2.0 framework, this is the first of five competence areas and includes three competences: to articulate information needs; judge the relevance, credibility, reliability, and purpose of sources of data, information and digital content; identify, locate, retrieve, store, organise and analyse digital information and data (Vuorikari et al., 2016).

Initial teacher education (ITE): a programme leading to a qualification as a teacher. It usually includes a general and professional component. The general component refers to general education courses and mastery of the subject(s) that candidates will teach when qualified. The professional part provides prospective teachers with both the theory and practical skills needed for teaching and includes in-class placements.

Instruction time: is the amount of time a publicly funded school is expected to spend on teaching students compulsory and non-compulsory curriculum subjects either on school premises or in out-of-school activities which form part of compulsory programmes.

Learning outcomes/objectives: 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, 2004-19). Learning outcomes indicate actual attainment levels while learning objectives define the competences to be developed in general terms.

Massive Open Online Courses (MOOCs): an online course designed for a large number of participants that can be accessed by anyone anywhere, as long as they have an internet connection. They are open to anyone, need no entry qualifications and offer a full/complete course experience, online, and free of charge (Brouns et al., 2014).

National curriculum: is the term used to describe the official programmes of study issued for schools by top-level education authorities. The national curriculum may include learning content, learning objectives, attainment targets, syllabuses or assessment guidelines, and it may be published in any type or any number of official documents. In some countries, the national curriculum is contained in legal decrees. More than one type of curriculum document may contain provisions relating to digital competences and these may impose different levels of obligation on schools to comply. They may, for example, contain advice, recommendations or regulations. However, whatever the level of obligation, they all establish the basic framework in which schools develop their own teaching to meet their pupils' needs.

National tests: are 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 as national tests.

On-screen testing: mainly a replication of traditional 'static' paper tests performed, however, on a digital device. It includes tests based on multiple-choice, open questions, essays, drills, etc. ► Adaptive testing ► Practical testing

Open Educational Resources (OER): teaching, learning and research materials in any medium, digital or otherwise, that reside in the public domain or have been released under an open licence that permit no-cost access, use, adaptation and redistribution by others with no, or few restrictions ([165]). ► Digital Learning Resources

Open environment: generally refers to digital technologies connected to the internet that allow the use of different browsers and a wide variety of applications (e.g. text editing software). ► Closed environment

Pedagogical use of technology: refers to the purposeful use of technology for teaching and learning. Technologies in this context are used as means to achieve defined learning outcomes.

Practical testing: refers to hands-on tasks in the field of digital competences such as programming and/or performing tasks using specific software. ► On-screen testing ► Adaptive testing

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([165]) http://www.unesco.org/new/en/communication-and-information/access-to-knowledge/open-educational-resources/what-are-open-educational-resources-oers/

Problem solving: in the DigComp 2.0 framework, this is the fifth of five competence areas and includes four competences: to solve technical problems; identify digital needs and resources, make informed decisions as to which are the most appropriate digital tools according to the purpose or need; solve conceptual problems through digital means, use technologies to create knowledge and innovate processes and products; update one's own competences and help others to update theirs (Vuorikari et al., 2016).

Quality assurance: is a process designed to achieve or maintain a high level of performance in a specific area. It involves the systematic and critical analysis of a defined area based on established policies, procedures and practices. The collection and analysis of relevant data is usually part of the process. The quality assurance process usually leads to a judgement on the level of performance attained and/or recommendations for improvement.

Regulated profession: is one for which specific requirements must be met by an individual wishing to exercise the profession. Basically, a profession can be regulated by restricting the right to practice to those individuals who have been certified by a competent authority (e.g. certified translator) or by the restriction of the practice of a profession to those who meet the specific requirements (e.g. medical doctor, engineer or teacher). Adapted from: https://www.enic-naric/regulated-professions.aspx

Safety: in the DigComp 2.0. framework, this is the fourth of five competence areas and includes four competences: to protect devices and digital content, understand safety and security measures; protect personal data and privacy; protect health and well-being; and understand the issues around the safe and sustainable use of technology (Vuorikari et al., 2016).

Self-assessment tools: are instruments that assist professionals in evaluating the effectiveness of their performance and help them determine what improvements are required. Within this report, the term refers to online or paper questionnaires which allow teachers to evaluate their digital competence with the help of a set of questions. Usually feedback in the form of a report is provided, identifying areas of strength and areas for improvement ([166]).

Specialist or semi-specialist teachers of digital education: specialist teachers of digital education are those who have specialised in teaching digital competences during ITE or in-service training. Semi-specialist teachers of digital education are those who have specialised in teaching digital competences and up to three other subjects. These teaching posts are mainly found in secondary education.

Specific bodies/agencies: in the context of this report, specific bodies/agencies are those which are legally external to the top-level education authority but supported financially by it (sometimes known as Quangos – Quasi-autonomous non-government organisations). They are responsible for providing support to schools in the area of digital education. This may be their only area of responsibility, or it can be part of a wider remit covering other areas of education or other aspects of the digital agenda.

Summative assessment: is intended to evaluate student learning at the end of an instructional unit by comparing attainment against standards, benchmarks or learning outcomes. It requires the formulation of judgements regarding a student's proficiency in a particular area. It is traditionally linked to marking, grading and/or certification. Also referred to as assessment *of* learning, conventionally, summative assessment takes the form of tests or exams, and can be invested with high stakes, such as for example access to higher education. ► Formative assessment

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([166]) Adapted from: http://publications.jrc.ec.europa.eu/repository/bitstream/JRC107466/pdf_digcomedu_a4_final

Teacher appraisal: the evaluation of individual teachers with a view to formulating a judgement about their work and performance. It can be both formative evaluation and/or summative evaluation and usually results in verbal or written feedback that is intended to guide and help teachers to improve their teaching. It can lead to individual professional development plans, promotion, salary progression and other formal and/or informal outcomes.

Teacher competence framework: a collection of statements about what a teacher as a professional should know, understand and be able to do, which may be used to support the identification of development needs and improve the skills of the teaching workforce. The level of detail in the description of the knowledge, skills and competences may vary. The framework may be set down in any type of official document issued by a top-level education authority. These documents may take the form of legislation (decrees, laws, etc.), regulations for initial teacher education or continuing professional development, or national plans, as well as stand-alone publications focusing on teacher competences or teacher standards. The level of detail provided in these documents may vary when describing the knowledge, skills and competences teachers should acquire (European Commission/ EACEA/Eurydice, 2018a).

Teacher-specific digital competences: the competences needed to support and improve teaching and learning by using digital technologies, as well as the ability to use digital technologies for communication, collaboration and professional development. ► Pedagogical use of technology

Top-level authority: the highest level of authority with responsibility for education in a given country, usually located at national (state) level. However, for Belgium, Germany, Spain and the United Kingdom, the *Communautés*, *Länder*, *Comunidades Autónomas* and the devolved administrations respectively are either wholly responsible or share responsibilities with the state level for all or most areas relating to education. Therefore, these administrations are considered as the top-level authority for the areas where they hold the responsibility, while for those areas for which they share the responsibility with the national (state) level, both are considered to be top-level authorities.

Top-level strategy/action plan: these are official policy documents on an important policy area usually issued by top-level authorities. They set out the specific objectives to be met and/or the detailed steps or actions to be taken within a given timeframe in order to reach a desired goal. In the context of this report a 'specific strategy' means a strategy dealing only with digital education (covering one or more education levels or sectors), whereas a 'broader strategy' also encompasses other aspects of digital development, e.g. infrastructure and connectivity, employment, business, health, etc. or other aspects of education.

II. ISCED Classification

The International Standard Classification of Education (ISCED) has been developed to facilitate comparisons of education statistics and indicators across countries on the basis of uniform and internationally agreed definitions. The coverage of ISCED extends to all organised and sustained learning opportunities for children, young people and adults, including those with special educational needs, irrespective of the institutions or organisations providing them or the form in which they are delivered. The first statistical data collection based on the new classification (ISCED 2011) took place in 2014 (text and definitions adopted from UNESCO, 1997, UNESCO/OECD/Eurostat, 2013 and UNESCO/UNESCO Institute for Statistics, 2011).

ISCED 1: Primary education

Primary education provides learning and educational activities typically designed to provide students with fundamental skills in reading, writing and mathematics (i.e. literacy and numeracy). It establishes a sound foundation for learning, a solid understanding of core areas of knowledge and fosters personal development, thus preparing students for lower secondary education. It provides basic learning with little specialisation, if any.

This level begins between 5 and 7 years of age, is compulsory in all countries and generally lasts from four to six years.

ISCED 2: Lower secondary education

Programmes at ISCED level 2, or lower secondary education, typically build upon the fundamental teaching and learning processes which begin at ISCED level 1. Usually, the educational aim is to lay the foundation for lifelong learning and personal development that prepares students for further educational opportunities. Programmes at this level are usually organised around a more subject-oriented curriculum, introducing theoretical concepts across a broad range of subjects.

This level typically begins around the age of 11 or 12 and usually ends at age 15 or 16, often coinciding with the end of compulsory education.

ISCED 3: Upper secondary education

Programmes at ISCED level 3, or upper secondary education, are typically designed to complete secondary education in preparation for tertiary or higher education, or to provide skills relevant to employment, or both. Programmes at this level offer students more subject-based, specialist and in-depth programmes than in lower secondary education (ISCED level 2). They are more differentiated, with an increased range of options and streams available.

This level generally begins at the end of compulsory education. The entry age is typically age 15 or 16. Entry qualifications (e.g. completion of compulsory education) or other minimum requirements are usually needed. The duration of ISCED level 3 varies from two to five years.

For more information on the ISCED classification, see http://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-isced-2011-en.pdf [accessed July 2019].

ANNEXES

Annex 1a: Curriculum approaches to digital competences according to national curricula for primary and general secondary education (ISCED 1-3), 2018/19 (related to Section 1.2.1)

Curriculum approaches	Subjects/Learning areas	ISCED levels
Belgium (French Community)		
Curriculum reform	In 2018, digital skills are not yet included. The new curriculum will be adopted early 2019 and is based on DigComp for digital competence. The new programmes will be available in 2020. http://www.pactedexcellence.be/wp-content/uploads/2017/10/PACTE-Charte-des-referentiels_ApprouveeGCFWB.pdf http://www.pactedexcellence.be/index.php/tag/referentiels/	
Belgium (German-speaking Community)		
Integrated into other subjects	The information and media competence (IMK) guide supports teachers and schools in reinforcing their pedagogical use of technology and integration of digital competence in curricula. However, this is not compulsory and schools take it up at various speeds.	ISCED 1-3
Belgium (Flemish Community)		
Cross-curricular theme		ISCED 1-3
Integrated into other subjects or learning areas	Dutch, French, English, mathematics, natural sciences technology, geography, history and financial and economic competences	ISCED 3
Curriculum reform	The aim of the reform is to integrate digital competences across the curriculum as an integrated set of knowledge, skills and attitudes that are generic for all levels of education. The revision of primary and secondary education curricula are based on the DigComp framework. Starting from the school year 2019/20, the new curriculum will be gradually integrated, starting with lower secondary education.	
Bulgaria		
Compulsory separate subject	Computer modelling (ISCED 1) Information technology (ISCED 2, 5th to 7th grade) Information technologies and informatics (ISCED 3, 8th to 10th grade)	ISCED 1-3
Curriculum reform	The curricula approved under the terms and procedure of the new ordinance N° 5 of 30.11.2015 on general education come into force progressively: for the pupils who, during the school year 2016/17, enter the I and the V grade, the pupils who, during the school year 2017/18, 2018/19 and 2019/20 are enrolled in grades I, V and VIII, as well as pupils who in the academic year 2020/21 are in grade VIII. The subject 'computer modelling' starts to be studied as a compulsory separate subject in the initial stage of primary education.	ISCED 1-3
Czechia		
Cross-curricular theme		ISCED 1-3
Integrated into other learning areas	e.g. mathematics (according to the individual school curricula)	ISCED 1-3
Compulsory separate subject	Information and communication technologies	ISCED 1-3
Curriculum reform	An extensive revision of the national curriculum is currently being prepared, as one of the objectives set in the Czech Strategy of digital education. While the current national curriculum focuses primarily on technology knowledge and competences to use it, the ongoing revision should move the curricula to a broader understanding, including critical thinking, problem solving, data literacy, safety problems, flexibility, communication and use of digital technology use to improve learning outcomes.	ISCED levels 0-3

Curriculum approaches	Subjects/Learning areas	ISCED levels
Denmark		
Cross-curricular theme	Transversal theme IT and media	ISCED 1-3
Integrated into compulsory subjects	All subject curricula include a section on digital knowledge and competences.	ISCED 2-3
Separate compulsory subject (for some pupils)	Informatics	ISCED 3
Germany		
Cross-curricular theme	Digital competence is to be integrated into the curricula of all subjects, whether compulsory or optional. The information provided in this report is based on the Standing Conference strategy 'Education in the digital world' as this can be considered the national curriculum (upper secondary education is however not covered by the strategy, but by the curricula and education plans of the individual *Länder*).	ISCED 1-2
Curriculum reform	One key topic of the strategy 'Education in the digital world' is the integration of 'competences for the digital world' in the curriculum. These competences are described in a binding competence framework that is to be implemented in all subjects, not by introducing a specific separate subject.	ISCED 1-2
Estonia		
Cross-curricular theme	Digital competence is one of eight competences which occur in all subject curricula.	ISCED 1-3
Optional separate subject	Informatics	ISCED 1-3
Ireland		
Cross-curricular theme	Embedding the use of digital technologies is now part of the curriculum development process. Any new curriculum that is developed ensures that opportunities to use technology and digital media tools to learn and communicate are included.	ISCED 1-3
Integrated into other compulsory subjects and optional learning areas	Social, personal and health education (SPHE): digital media literacy	ISCED 1-2 ISCED 3
Optional short course	Digital media literacy	ISCED 2
Optional separate subject	Computer science (being introduced from 2018 on)	ISCED 3
Curriculum reform	The Digital Strategy provides for a programme of curriculum reform which sees digital technologies embedded in all emerging curricular specifications. Computer science has been introduced at ISCED 3 level from September 2018 in 40 schools (phase 1 rollout) and will be available as an option to all schools from September 2020.	
Greece		
Cross-curricular theme		ISCED 1-3
Integrated into other subjects	ICT may be integrated into the teaching of other subjects at all levels. In secondary education, it can be used in the subject 'project'.	ISCED 1-3
Compulsory separate subject	Information and communication technology (ICT)	ISCED 1
	Information technology	ISCED 2
	Introduction to the principles of computer science (Grade B) Developing applications in programming environments (Grade C) Compulsory for all in grade B and compulsory for some areas of studies in grade C	ISCED 3
Optional separate subject	Information technology applications (Grade A)	ISCED 3
Curriculum reform	The curriculum reform has two aims: 1) Certified knowledge of ICT of all secondary education students (through a national exam system); 2) Enhancement of students' digital competences, giving special emphasis on digital education, ICT literacy, use of digital technology in general, and open technologies and resources, programming, and development of social attitudes and skills (e-citizenship). In particular, as regards ICT and informatics as a distinct learning subject, the inclusion of computational thinking, educational robotics and STEM/STEAM has been planned. Regarding all learning subjects, contemporary scientific and pedagogical principles are taken into account, especially the ones related to the integration of ICT in the educational procedure. It is an on-going process that may occur every year depending on the needs of updating the current curricula.	ISCED 1-3

Curriculum approaches	Subjects/Learning areas	ISCED levels
Spain		
Cross-curricular theme		ISCED 1-3
Integrated into other compulsory subjects	Mathematics, Spanish language, foreign languages, social sciences, natural sciences	ISCED 1
	Mathematics, science-technology, social sciences, languages, arts	ISCED 2-3
Optional separate subject	Information and communication technologies	ISCED 3
France		
Cross-curricular theme	Information and media literacy	ISCED 1-3
Integrated into other compulsory subjects	Mathematics, technology, geography, arts	ISCED 1-3
Optional separate subject	Informatics and digital creation Informatics and digital science (Bac S)	ISCED 3
Curriculum reform	The reform will lead to a new *baccalauréat* in 2021 called *numérique et sciences informatiques*. Within this framework, new courses will be delivered from September 2019: digital sciences and technology during the first year of upper secondary (1.5 h per week, compulsory) and digital and informatics sciences during the last two years (second year 4 h per week, third year 6 h per week, optional). http://www.education.gouv.fr/pid285/bulletin_officiel.html?pid_bo=38502	
Croatia		
Optional separate subject	Informatics (implemented as from 2020/21)	ISCED 1
Compulsory separate subject	Informatics	ISCED 2-3
Curriculum reform	74 schools are participating in the experimental programme 'School for Life' which is part of a comprehensive curricular reform conducted by the Education Ministry and financed from the state budget, European Social Fund and European Commission Structural Reform Support Service. As a support to the participating schools, 81 virtual classrooms for learning, collaboration and communication were created (with 42 724 teachers taking part). Topics covered were getting to know each other and professional development, introduction to the curricular concept, curricular documents (assessment, gifted students, students with special needs, cross-curricular topics), 21st century skills (problem solving, learning to learn, learning outcomes, coaching). Within the programme, 984 ICT teachers participated in 32 training courses. (Numbers reported in March 2019) https://skolazazivot.hr/	
Italy		
Cross-curricular theme	Included in the national curriculum as a key competence	ISCED 1-3
Integrated into other compulsory subjects	Informatics, arts, Italian language, technology	ISCED 1-3
Cyprus		
Integrated into other compulsory subjects	Design and technology – digital technology	ISCED 1
Compulsory and optional separate subject	Informatics/computer science (compulsory in year one).	ISCED 3
Separate subject	Informatics (in 130 out of 331 schools operating as All-Day Optional, ICT is offered as an optional separate subject; in 14 out of 331 schools operating as All-Day Compulsory Primary Schools, ICT is offered as a compulsory separate subject.)	ISCED 1
	Informatics/computer science	ISCED 2
	Informatics/computer science (optional in years 2 and 3) Computer applications Computer networks	ISCED 3
Curriculum reform	Starting in 2018/19, computational thinking will be introduced in primary education. The other digital competences will be introduced later, as part of the same curriculum reform.	ISCED 1

Curriculum approaches	Subjects/Learning areas	ISCED levels

Latvia

Curriculum approaches	Subjects/Learning areas	ISCED levels
Integrated into other compulsory subjects	Mathematics, physics	ISCED 3
Compulsory separate subject	Informatics	ISCED 2
Separate subject	Basics of programming	ISCED 3
Curriculum reform	Since 2015, a pilot project for the subject *Datorika* (computing) invites schools to introduce this subject from the 1st year of primary education. http://www.izm.gov.lv/lv/aktualitates/154-izm-uzsak-digitalo-prasmju-pilnveides-pilotprojektu	ISCED 1

Lithuania

Curriculum approaches	Subjects/Learning areas	ISCED levels
Integrated into other compulsory subjects	Languages (mother tongue and foreign), mathematics, science, technology, arts, social sciences	ISCED 1-3
Compulsory separate subject	Information technologies	ISCED 2
Optional separate subject	Informatics	ISCED 1
	Information technologies, programming, database creation and management, electronic publishing	ISCED 3
Curriculum reform	General education curricula have been updated, which include digital competence as a subject competence and digital literacy as a general competence for all subjects. The curriculum framework for the informatics subject in primary education describes the students' learning outcomes of knowledge, skills and attitudes. It includes the following areas: digital content, algorithms and programming, data and information, problem solving, virtual communication, security and justice. It is being tested in 100 primary schools as from 3 September 2018.	ISCED 1

Luxembourg

Curriculum approaches	Subjects/Learning areas	ISCED levels
Cross-curricular theme		ISCED 2
Optional separate subject	e.g. informatics and media literacy	ISCED 3

Hungary

Curriculum approaches	Subjects/Learning areas	ISCED levels
Cross-curricular theme		ISCED 1-3
Compulsory separate subject	Computer science	ISCED 2-3

Malta

Curriculum approaches	Subjects/Learning areas	ISCED levels
Cross-curricular theme	Cross-curricular learning outcomes in ISCED 3 will be introduced in October 2020.	ISCED 1-3
Integrated into other optional subjects	Computing, design and technology	ISCED 2-3
Compulsory separate subject	ICT	ISCED 2-3
Optional separate subject	VET IT	ISCED 3

Netherlands

Curriculum approaches	Subjects/Learning areas	ISCED levels
Integrated into other compulsory learning areas (School autonomy)	Dutch, foreign language, social studies, mathematics	ISCED 1-3
Compulsory or optional separate subject	Schools have autonomy to organise their teaching, therefore some offer IT as a subject, and some do not.	ISCED 1-3
Curriculum reform	A curriculum renewal process started a couple of years ago and should result in new curriculum building blocks by 2019. One of the nine development teams, consisting of teachers, school leaders, students, parents, scientists, societal organisations etc. deals with the subject of 'digital literacy, which will have a more prominent place in the curriculum. www.curriculum.nu	ISCED 1-3

Curriculum approaches	Subjects/Learning areas	ISCED levels
Austria		
Cross-curricular theme	Media education	ISCED 1-3
Integrated into other compulsory subjects	School autonomy to choose in which subjects	ISCED 1-3
Compulsory separate subject	Digital basic education (*Digitale Grundbildung*)	ISCED 2
	Informatics	ISCED 3
Curriculum reform	The ministry has started a fundamental revision of all curricula aiming at integrating digital education into all subjects. The new subject 'basic digital education' may be either a separate subject or be integrated into other subjects with dedicated hours.	ISCED 1-3
Poland		
Cross-curricular theme		ISCED 1-3
Compulsory separate subject	Computer science	ISCED 1-2
	Information technology	ISCED 3
Curriculum reform	Since 1 September 2017, the new core curriculum on digital education has been introduced to schools. Its main objectives include: introduction of programming from the first grade of primary school; recommendation to use ICT skills in classes other than computer science; increasing the number of teaching hours for computer science (+ 70 hours – from 210 to 280 hours). The new core curriculum has been in force since 2017/18. Until 2019/20, some student cohorts will continue to follow the old core curriculum, which is being gradually phased out.	
Portugal		
Cross-curricular theme		ISCED 1
Compulsory separate subject	ICT	ISCED 1-2
Optional separate subject	ICT applications	ISCED 3
Curriculum reform	Based on a pilot in 223 schools during 2017/18 school year, a new framework for the national curricula was published in July 2018 introducing ICT in all basic education stages, through a cross-curricular approach in lower primary education (grades 1-4); a compulsory separate subject from upper primary to lower secondary education (grades 5-9); and an optional one in upper secondary education (grade 12). In 2018/19, this reform has been implemented in the initial year of each cycle and it will be progressively adopted in the remaining school years up to 2021. Specific guidelines, resources and training actions are being prepared to support teachers to work with this new curriculum framework. As a consequence of the current curriculum reform, students in the beginning of each cycle have a compulsory subject on digital competence, while for students enrolled in other grades, the approach is cross-curricular.	
Romania		
Optional separate subject	Technology of information	ISCED 1
Compulsory separate subject	Informatics and technology of information and communication	ISCED 2-3
Curriculum reform	Since 2017, ICT and informatics become explicit and compulsory subjects in ISCED 1 and 2. Moreover, a new curriculum framework and new syllabi will be developed for ISCED 3, both with specific disciplines (i.e. informatics, ICT) and with a transversal approach (2017-2019).	
Slovenia		
Cross-curricular theme		ISCED 1-3
Integrated into other compulsory subjects	History, mathematics, physics, geography, chemistry, technology, Slovenian, English and German language	ISCED 1-3
Optional separate subject	Computer science	ISCED 1-2
Compulsory separate subject	Informatics	ISCED 3

Curriculum approaches	Subjects/Learning areas	ISCED levels
Slovakia		
Cross-curricular theme	Media education	ISCED 1-3
Integrated into other compulsory subjects	e.g. mathematics, geography, physics, languages etc. (school autonomy)	ISCED 1-3
Compulsory separate subject	Informatics (school autonomy)	ISCED 1-3
Finland		
Cross-curricular theme	ICT competence, multiliteracy, taking care of oneself and managing daily life, thinking and learning to learn	ISCED 1-2
	Multi-literacy and the media, technology and society	ISCED 3
Sweden		
Cross-curricular theme		ISCED 1-3
Integrated into other compulsory subjects	Biology, physics, geography, history, sport and health, chemistry, mathematics, religion, social sciences, Swedish, Swedish as a second language and technology	ISCED 1-2
	History, mathematics, science, religion, social studies, Swedish and Swedish as a second language	ISCED 3
Curriculum reform	In 2017, an update of the national curriculum and syllabi was done to integrate digital competence into schools' overall mission and through several subjects; it takes effect in July 2018. The basis of the revisions has been to enable students to understand how digitalisation affects society, to be able to use and understand digital tools and media, to have a critical and responsible approach and to be able to solve problems and convert ideas into action.	
United Kingdom (England)		
Compulsory national curriculum subject Academies (publicly funded independent schools) do not have to follow the national curriculum	Computing	ISCED 1-3
Optional separate subject	ICT, applied ICT or computer science	ISCED 3
United Kingdom (Wales)		
Cross-curricular skill	Developing ICT	ISCED 1-3
Compulsory separate subject	Information and communication technology	ISCED 1-2
Optional separate subject	ICT, applied ICT or computer science	ISCED 3
Curriculum reform	A new curriculum for 3- to 16-year-olds will be formally introduced in 2022. This will include a compulsory Area of Learning and Experience (AoLE) for science and technology. Within the science and technology AoLE, there will be specific requirements for computing. In addition, digital competence will be one of three cross-curricular themes (literacy, numeracy and digital competence) in the new curriculum.	ISCED 0-3
United Kingdom (Northern Ireland)		
Cross-curricular skill	Using ICT	ISCED 1-3
Optional separate subject	ICT, applied ICT, computer science or digital technology	ISCED 3
United Kingdom (Scotland)		
Cross-curricular theme, Integrated or separate subject	Digital literacy and computing science are separate subject areas. However, they can be taught as separate, integrated or cross-curricular subjects (not specified in guidance). The Scottish curriculum is not statutory in the traditional sense. The subject areas are delivered by means of entitlement instead of compulsion.	ISCED 1-3

Curriculum approaches	Subjects/Learning areas	ISCED levels
Albania		
Cross-curricular theme		ISCED 2-3
Integrated into other compulsory subjects	Natural sciences	ISCED 2-3
Compulsory separate subject	ICT	ISCED 2-3
Bosnia and Herzegovina		
Compulsory separate subject	Basics of informatics	ISCED 2
	Computing and informatics	ISCED 3
Switzerland		
Cross-curricular theme	Media and IT (in *Lehrplan 21* for the German-speaking *Cantons*), MITIC (*médias, images et technologies de l'information et de la communication* in *plan d'études romand* in French-speaking *Cantons*) and technology and media (in *piano di studio* in the Italian-speaking *Canton*) is defined as a cross-curricular module but *Cantons* are free to organise its teaching.	ISCED 1-3
Integrated into other compulsory subjects	Responsibility of *Cantons*	ISCED 1-2
Separate subject	Responsibility of *Cantons*	ISCED 1-2
Compulsory separate subject	Information technology (in force since August 2018 and to be implemented until 2022/23)	ISCED 3
Iceland		
Cross-curricular theme	Using media and information	ISCED 1-3
Compulsory separate subject	Information and communication technology	ISCED 1-2
Liechtenstein		
Cross-curricular theme	Learning areas: interdependencies, visualize expression and perception, diversity and quality, conflict resolution, change and future	ISCED 1-3
Integrated into other compulsory subjects	Mathematics, art and design, natural sciences, 'life skills'	ISCED 1-3
	Statistics	ISCED 3
Compulsory separate subject	Information technology/science	ISCED 1-3
Curriculum reform	The reform includes the specific objective to include and strengthen digital competences. The new curriculum was officially adopted on 18 December 2018 and will enter into force in the school year 2019/20. The curriculum reform is following the new Swiss framework curriculum *Lehrplan 21*. https://fl.lehrplan.ch/index.php?code=b|10|0&la=yes	ISCED 0-3
Montenegro		
Compulsory separate subject	Informatics	ISCED 1-3
Optional separate subject	Graphics with image processing and photography (8th grade) Introduction to programming (9th grade)	ISCED 1
	Algorithms and programming Computer and web presentations Business informatics	ISCED 2-3
North Macedonia		
Compulsory separate subject	Working with computers	ISCED 1-3

Curriculum approaches	Subjects/Learning areas	ISCED levels
Norway		
Cross-curricular theme	Digital skills as one of five basic skills	ISCED 1-3
Optional separate subject	Programming	ISCED 2
	ICT	ISCED 3
Curriculum reform	The current curriculum revision is to take effect from school year 2020/21. The aim is to update the curriculum and to include recent guiding principles such as 'in-depth learning'. The project runs from 2017 to 2020.	
Serbia		
Cross-curricular theme	Digital competences are identified as one of 11 cross-curricular competences	ISCED 1-3
Integrated into other subjects	Teachers are incentivised to integrate digital competences into their subjects, but it is not compulsory	ISCED 1-3
Optional separate subject	From a toy to a computer	ISCED 1
Compulsory separate subject	ICT	ISCED 2-3
Turkey		
Compulsory separate subject	Information technologies and software Technology and design	ISCED 2-3
Optional separate subject	Information technologies and software	ISCED 2-3

Annex 1b: Digital competence areas addressed in terms of learning outcomes in national curricula for primary and general secondary education (ISCED 1-3), 2018/19 (related to Section 1.3.1)

	Information and data literacy			Communication and collaboration			Digital content creation			Safety			Problem solving			No learning outcomes/objectives related to digital competence		
	ISCED 1	ISCED 2	ISCED 3	ISCED 1	ISCED 2	ISCED 3	ISCED 1	ISCED 2	ISCED 3	ISCED 1	ISCED 2	ISCED 3	ISCED 1	ISCED 2	ISCED 3	ISCED 1	ISCED 2	ISCED 3
BE fr																x	x	x
BE de																x	x	x
BE nl	x	x		x	x		x	x		x	x			x				
BG	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
CZ	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
DK	x	x	x	x	x	x		x	x	x	x	x		x	x			
DE	x	x		x	x		x	x		x	x		x	x	x			
EE	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
IE	x	x	x		x	x		x	x	x	x			x	x			
EL	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
ES	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
FR	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
HR		x	x		x	x		x	x		x	x		x	x	x		
IT	x	x		x	x		x	x	x				x	x				
CY		x	x		x	x	x	x	x		x	x	x	x	x			
LV	x	x	x	x	x	x		x	x	x	x	x			x			
LT	x	x	x	x	x	x		x	x	x	x	x						
LU			x			x			x			x			x	x	x	
HU		x	x		x	x		x	x		x	x		x	x	x		
MT	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
NL																x	x	x
AT	x	x	x	x	x	x	x	x	x	x	x	x		x				
PL	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
PT	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
RO		x	x		x	x		x	x		x	x		x	x			
SI	x	x	x	x	x	x	x	x	x	x	x	x						
SK	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
FI	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
SE	x	x	x	x	x	x	x	x	x				x	x	x			
UK-ENG	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
UK-WLS	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
UK-NIR	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
UK-SCT	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
AL		x	x		x	x		x	x		x	x		x	x	x		
BA		x	x		x	x		x	x		x	x		x	x	x		
CH	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
IS	x	x		x	x			x	x	x	x		x	x				x
LI	x	x	x	x	x	x	x	x	x		x	x		x	x			
ME	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
MK	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
NO	x	x	x	x	x	x	x	x	x	x	x	x		x	x			
RS	x	x	x			x	x	x	x	x	x	x	x	x	x			
TR		x	x		x	x		x	x		x	x		x	x	x		

Annex 2: Digital competence frameworks for teachers: name(s), website(s) and short description, primary and general secondary education (ISCED 1-3), 2018/19 (related to Section 2.1.1)

Estonia

The standards for learning, leading, and teaching in the digital age based on the International Society for Technology in Education (ISTE)

https://media.voog.com/0000/0034/3577/files/ISTE_NETS_T_2014.pdf

'The standards for learning, leading and teaching in the digital age' were developed on the basis of the International Society for Technology in Education (IETR). It was validated in 2016 by researchers from two Estonian universities (University of Tartu and University of Tallinn) and is recognised by top-level authorities. Digital skills standards are used as a basis for teacher evaluation (self-evaluation and appraisal) as well as for development of training courses.

The standards have five main categories and 20 sub-categories:

- Encouraging students and helping them to develop their creativity, with four different sub-categories, for example – developing students' creative and innovative thinking and resourcefulness by using digital technologies.

- Using teaching and evaluation methods which are appropriate for the digital era, with four different subcategories, for example – using digital teaching solutions, taking into consideration students' individual needs (different study pace, level of digital competence, etc.).

- Teacher as a role model using teaching and working methods appropriate for the digital era, with four different sub-categories, for example – collecting, analysing and evaluating data via digital resources and using the outcomes for research and teaching activities.

- Acting as a citizen in the digital era, with four different sub-categories, for example – acting as a role model by using digital content and technology safely, legally and by following ethical principles (adhering to copyright rules, referencing sources, etc.).

- Professional development, also with four sub-categories, for example – participating in professional learning communities to find new teaching methods (using digital resources).

Ireland

Digital Learning Framework for Primary Schools (2017)

https://www.pdsttechnologyineducation.ie/en/Planning/Digital-Learning-Framework-and-Planning-Resources-Primary/Digital-Learning-Framework-for-Primary-Schools.pdf

Digital Learning Framework for Post Primary Schools (2017)

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

The Digital Learning Framework for Primary Schools and the Digital Learning Framework for Post Primary Schools are based on the UNESCO ICT Competency Framework (UNESCO, 2011) and other relevant European and international digital competency frameworks.

These frameworks provide a common reference with descriptors of digital standards for pupils, teachers and school leaders promoting innovative pedagogical approaches which embed the use of digital technologies. It includes 32 standards organised in four domains. The Standards are stated as

the behaviours and attributes characteristic of practices in an effective, well-functioning school. The Digital Learning Framework provides Statements of Practice which describe 'effective' and 'highly effective school practices for each of the 32 standards.

Standards for teachers:

- Domain 3: **Teachers' individual practice** (e.g. teachers use a range of digital technologies to design learning and assessment activities for their students. Teachers use appropriate digital technologies to design learning activities that facilitate personalised and differentiated learning. Teachers are aware of, and purposefully use, a range of digital technologies appropriate to the learning objectives and learning needs of their students when designing learning activities. Teachers facilitate students´ active use of a range of digital technologies to address individual learning needs).

- Domain 4: **Teachers' collective/collaborative practice** (e.g. teachers engage in professional development and work with colleagues to help them select and align digital technologies with effective teaching strategies to expand learning opportunities for all pupils. Teachers participate in professional online communities to help them design learning opportunities for pupils across and beyond the curriculum. Teachers collaborate in determining how digital technologies can be used effectively for teaching, learning and assessment).

Spain

Common Digital Competence Framework For Teachers (2017)

http://aprende.intef.es/sites/default/files/2018-05/2017_1024-Common-Digital-Competence-Framework-For-Teachers.pdf

The Common Digital Competence Framework for Teachers focuses exclusively on teachers' digital competences and serves as a reference for teachers and educational administrators. This document is not yet included in national legislation; it may be used for establishing CPD needs and as reference for teachers' appraisal. This framework establishes 21 teacher-specific digital competences organised in five competence areas. This framework also outlines six progressive proficiency levels to help the assessment of competences.

This Framework establishes five competence areas:

- Area 1. **Information and data literacy**: Competence 1.1. Browsing, searching and filtering data, information and digital content. Competence 1.2. Evaluating data, information and digital content. Competence 1.3. Managing and retrieving data, information and digital content.

- Area 2. **Communication and Collaboration**: Competence 2.1. Interacting through digital technologies. Competence 2.2. Sharing information and digital content, Competence 2.3. Citizen participation online, Competence 2.4. Collaborating through digital technologies, Competence 2.5. Netiquette, Competence 2.6. Managing digital identity.

- Area 3. **Digital content creation**: Competence 3.1. Developing digital content. Competence 3.2. Integrating and re-elaborating digital content. Competence 3.3. Copyright and licenses. Competence 3.4. Programming.

- Area 4. **Safety**: Competence 4.1. Protecting devices, Competence 4.2. Protecting personal data and privacy, Competence 4.3. Protecting health, Competence 4.4. Protecting the environment.

- Area 5. **Problem Solving**: Competence 5.1. Solving technical problems, Competence 5.2. Identifying technological needs and responses, Competence 5.3. Innovation and use of digital technologies creatively, Competence 5.4. Identifying gaps in digital competence.

The Common Digital Framework for Teachers establishes three dimensions for each of the competences within its five areas. The first being the foundation dimension in which levels A1 and A2 are included. The second is the intermediate dimension which is covered by levels B1 and B2. Finally, the advanced dimension includes levels C1 and C2.

Croatia

Digital Competence Framework for Users in Schools: Teachers, Associates, Principals and Administrative Staff (2016)

https://www.e-skole.hr/wp-content/uploads/2016/12/OKVIR_digitalne_kompetencije-3.pdf

The Digital Competence Framework for Users in Schools: Teachers, Associates, Principals and Administrative Staff provides a general framework for application of digital technology in education. The competences are arranged using a progression model (initial, medium and advanced levels).

The Framework covers:

General digital competences organised in five areas:

- **Information and data literacy**: ability to browse, search and filter data, information and digital content; ability to analyse, compare and critically assess the credibility and reliability of data sources, information and digital content; ability to manage digital content.

- **Communication and collaboration**: including the communication through the use of digital technologies; the ability to share data, information and content while using digital technology; participating in society using digital technologies; using digital tools and technology for cooperation and creating resources and content together; respecting the rules of behaviour in the digital environment; ability to manage a digital identity.

- **Content creation**: ability to create digital content, use and redevelop digital content, understand the rules concerning copyright and licensing; create computer programmes.

- **Security**: know how to protect devices and digital content and understand the risks and threats in the digital environment; ability to protect personal data and privacy in the digital environment and know how to use and share personal information; ability to prevent health risks when using digital technologies; awareness of environmental impact of digital technologies.

- **Problem solving**: ability to identify and solve technical problems when working in a digital environment; identify different digital needs and technological solutions; use digital tools to create knowledge and innovative processes; ability to identify gaps in digital skills.

Competences for the application of digital technology in education organised in three areas:

- **Teaching and learning**: ability to integrate digital technology into curriculum planning; ability to use digital technologies in teaching; use and create digital education content; use multimedia and operate in the online learning environment; design an environment for active learning and create learning material with the use of digital technologies, monitor and evaluate student progress with the use of digital technologies.

- **Work in the school environment**: ability to organise and manage teaching through the use of digital technologies; keeping data and pedagogical documents in digital form; ability to cooperate with pupils/students, other teachers and parents in the digital environment.

- **Professional education and lifelong learning**: ability to learn through digital technologies, ability to exchange knowledge and experience through digital channels and participate in virtual communities.

Lithuania

Description of the Requirements for the Digital Literacy Programmes for Teachers and Student Support Specialists.

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKEwiA8LWWzPLiAhWOL1AKHRliCngQFjAAegQIARAC&url=https%3A%2F%2Fe-seimas.lrs.lt%2Frs%2Flegalact%2FTAD%2F599d489078af11e89188e16a6495e98c%2Fformat%2FISO_PDF%2F&usg=AOvVaw171gj-FVcuxmL07WjFAp6x

The Requirements for the Digital Literacy Programmes for Teachers and Student Support Specialists issued by the Ministry of Education, Science and Sport (in force since 02/01/2019) lays down a specific framework for teacher-specific digital competences. It is organised in six areas:

- **Information management** (e.g. search, select, critically evaluate and protect information).

- **Communication** (e.g. use digital technologies and tools to communicate with students, teachers, parents etc., share and disseminate reliable information, use digital technologies to participate in society, engage in online communities, communicate securely and ethically through the internet, manage a digital identity).

- **Digital content creation** (e.g. create content in a variety of formats with digital multi-media and technology, understand copyright and licensing issues).

- **Security** (software and hardware protection; personal domain protection; health and the environmental protection).

- **Digital teaching and learning** (use of digital resources; innovative and creative use of digital technologies; development of pupils' digital competences; tackling students' digital literacy problems; use digital tools for assessing student achievement).

- **Addressing the challenges of digital literacy** (solving technical problems; identifying needs and technological solutions; developing of digital literacy; professional development).

Austria

The digi.kompP competence model (2016)

https://www.virtuelle-ph.at/wp-content/uploads/2016/09/digi.kompP-Grafik-und-Deskriptoren-1.pdf

The 'Digital Competence Model' provides a reference framework for teachers' digital professionalisation starting from entry into ITE until the end of the fifth year in the profession. The Digital Competence model provides eight areas of competence and indicates at which stage the competences should be acquired. Teachers are expected to progressively evolve from acquiring the basic general digital competences before starting ITE, to developing specific digital competencies during ITE, including the pedagogical use of technologies and expand and update them through continuing professional training.

The eight levels of development of digital competence are:

- Digital literacy and education

- Digital living skills

- Developing digital materials

- Teaching and learning digitally

- Digitally teaching in the subject

- Digital management processes

- Digital school community

- Digital professional development.

Norway

Professional Digital Competence Framework for Teachers (2018)

https://www.udir.no/in-english/professional-digital-competence-framework-for-teachers/ (in English).

The Professional Digital Competence Framework for Teachers is a guidance document that policy developers, heads of department, teacher educators, teachers, student teachers and others can use as a reference in their work on improving the quality of teacher education and continuing professional development of teachers. The framework can be used in: 1) developing common national frames of reference and directions for teacher education; 2) planning and implementing initial and continuing teacher education; 3) evaluating and following up on teachers' professional digital competence.

The framework is based on national regulations, guidelines for teacher education programmes, the national curriculum, the Basic Skills Framework, and the National Qualifications Framework. The framework consists of seven competence areas, which contain descriptions of knowledge, skills and competences and will be updated regularly in line with the growing influence of digital developments on the teaching profession and education system in general.

- **Subjects and basic skills** (a professional, digitally competent teacher knows and understands how digital developments are changing and expanding the content of subjects, how the integration of digital resources into learning processes can help to achieve competence aims in a subject and address the five basic skills. As a prerequisite for this, the teacher needs to develop their own digital skills. At the same time, the teacher needs to understand what pupils' digital skills entail and how they can be fostered in the different subjects).

- **School in society** (a professional, digitally competent teacher is familiar with perspectives on digital developments and the importance and function of digital media in today's society. The teacher understands their own role and the role of schools in bridging the digital divide and is able to help all children and young people orient themselves and be active participants and contributors in a global, digital and democratic society. The teacher contributes to the development of pupils' digital growth and ensures that they can participate in tomorrow's labour market).

- **Ethics** (a professional, digitally competent teacher is familiar with the schools' core values in relation to digitalisation in society. The teacher has an insight into legislation and ethical concerns as well as the development of pupils' digital growth associated with participation in a digital and democratic society. The teacher contributes to developing pupils' digital judgement, understanding and having the ability to act in line with these).

- **Pedagogy and subject didactics** (a professional, digitally competent teacher possesses pedagogical knowledge, as well as knowledge of subject didactics relevant to the practice of their profession in a digital environment. Based on this, the teacher integrates digital resources into

their planning, organisation, implementation and evaluation of teaching in order to foster student learning and development).

- **Leadership of learning processes** (a professional, digitally competent teacher possesses the competences to guide learning in a digital environment. This entails understanding and managing how this environment is constantly changing and challenging the role of the teacher. The teacher makes use of the opportunities inherent in digital resources in order to develop a constructive and inclusive learning environment and to adapt teaching both to diverse groups of students and students' individual needs. The teacher uses diverse forms of student assessment in a digital environment in ways that contribute to fostering their desire to learn, learning strategies and learning competence).

- **Interaction and communication** (a professional, digitally competent teacher uses digital communication channels for information, collaboration and knowledge sharing with various stakeholders in a way that builds trust and contributes to participation and interaction).

- **Change and development** (a professional, digitally competent teacher is aware that the development of digital competence is a lifelong dynamic, situational and flexible process. The teacher improves their competence and adapts their own practices based on research and development. This also means that the teacher must be capable of driving their own self-development and contribute to a shared culture around learning in a digital environment).

Serbia

Digital Competence Framework – Teacher for a Digital Age, the Ministry of Education, Science and Technological Development (2017)

http://www.mpn.gov.rs/wp-content/uploads/2017/04/Okvir-digitalnih-kompetencija-Final-1.pdf

Digital Competence Framework for teachers includes eight competences:

- **Search, access, store and manage information** includes the ability to e.g. search the internet and find relevant information; critically evaluate the reliability of information sources on the internet; save and organise the information and data collected.

- **Search, adapt and create digital content for learning** comprises the ability to e.g. find information on the internet and download digital teaching materials; adapt digital teaching content to reflect the needs of pupils/students; use different digital tools for creating digital materials and multimedia content.

- **Managing and sharing digital content for teaching and learning** includes the ability to e.g. access and edit previously stored/collected content; communicate with other teachers inside and outside school via online systems; and access learning materials created by others.

- **Managing the teaching environment** comprises the ability to e.g. use tools such as online calendars to manage appointments; use tools for time management; make use of the digital technologies to enrich the learning environment; make digital conference calls to connect with colleagues or other professionals in order to create a richer learning environment for pupils/students; make use of digital technologies – e-mails, closed groups on social networks, cloud etc. to share learning materials with pupils/students; use digital tools to collaborate with pupils/students in an online environment.

- **Teaching and learning** includes the ability to make presentations/interactive presentations (e.g. by using interactive whiteboards) to encourage pupils/students participation; use chats, blogs,

forums to work with pupils/students; use digital tools ranging from smartphones to more demanding tools to encourage pupils/students to use their creativity and imagination; create materials and make them available to students/pupils online (e.g. cloud based).

- **Formative and summative assessment** comprises the ability to e.g. use and/or customise/create test templates in an online environment; use services where pupils/students submit their files so the teacher can provide comments; use templates and adapt them to monitor the pupil/student progress; use templates or adjust/create charts and tables showing pupil/student progress; provide feedback to students e.g. by e-mail, or by using track changes in text, notes etc.

- **Communication and cooperation** in online learning includes the ability to share materials, participate in online discussion groups to share experience and examples of teaching practice; receive notification about professional development opportunities or/and participate in MOOCs.

- **Ethics and security** includes understanding of how to protect own data and devices both for personal and professional use; the ability to use tools such as antivirus software and avoid using tools/files which are inadequate or harmful; and the ability to create and manage digital identities.

Annex 3: Teacher competence frameworks: name(s) and website(s), primary and general secondary education (ISCED 1-3), 2018/19 (related to Section 2.1.1)

Teacher competence frameworks issued by top-level authorities, specifying teacher-specific digital competences applying to all teachers, including specialist and/semi-specialist teachers (i.e. information and communications technology (ICT) teachers).

	Name	Link
BE fr	• Decree of 12/12/2000 on initial training for primary and lower secondary teachers	http://www.gallilex.cfwb.be/document/pdf/25501_000.pdf
	• Decree of 21/02/2001 on initial training for upper secondary teachers	http://www.gallilex.cfwb.be/document/pdf/25595_000.pdf
BE de	(-)	(-)
BE nl	• Decision of 5/10/2007 on teachers' basic competences	http://eindtermen.vlaanderen.be/lerarenopleiding/documenten/BC_0.1.pdf
	• Decision of 5/10/2007 on teachers' professional profile	http://eindtermen.vlaanderen.be/lerarenopleiding/documenten/TCP_0.1.pdf
	• Decision of the Flemish Government on teachers' basic competences (in force in September 2019)	https://codex.vlaanderen.be/Zoeken/Document.aspx?DID=1016506&param=inhoud
BG	• Ordinance No. 2 on the Status and Professional Development of Teachers (2016)	http://zareformata.mon.bg/documents/naredba_12_01.09.2016_prof_razvitie_uchiteli.pdf
CZ	(-)	(-)
DK	• Executive order on the education of teachers for basic education (2013, updated 2015)	https://www.retsinformation.dk/Forms/R0710.aspx?id=174218
DE	• Standards for teacher training in the educational sciences (updated in 2014)	http://www.kmk.org/fileadmin/veroeffentlichungen_beschluesse/2004/2004_12_16-Standards-Lehrerbildung-Bildungswissenschaften.pdf
EE	• The standards for learning, leading, and teaching in the digital age based on the International Society for Technology in education (ISTE) (2016)	https://media.voog.com/0000/0034/3577/files/ISTE_NETS_T_2014.pdf

	Name	Link
IE	• Digital Learning Framework for Primary Schools (2017) • Digital Learning Framework for Post Primary Schools (2017)	https://www.pdsttechnologyineducation.ie/en/Planning/Digital-Learning-Framework-and-Planning-Resources-Primary/Digital-Learning-Framework-for-Primary-Schools.pdf https://www.pdsttechnologyineducation.ie/en/Planning/Digital-Learning-Framework-and-Planning-Resources-Post-Primary/Digital-Learning-Framework-for-Post-Primary-Schools.pdf
EL	(-)	(-)
ES	• Order ECI/3857/2007 of 27/12/2007 on the establishment of the requirements for the accreditation of official higher education diplomas for becoming a professional teacher in primary education • Order ECI/3857/2007 of 27/12/2007 on the establishment of the requirements for the accreditation of official higher education diplomas for becoming a professional teacher at secondary education level, in vocational training and in language education • Common Digital Competence Framework For Teachers (2017) • Castilla y Leon's Teacher Competence Framework (2017) • Galicia's Teacher Competence Framework	https://www.boe.es/diario_boe/txt.php?id=BOE-A-2007-22449 https://www.boe.es/diario_boe/txt.php?id=BOE-A-2007-22450 http://aprende.intef.es/sites/default/files/2018-05/2017_1024-Common-Digital-Competence-Framework-For-Teachers.pdf http://csfp.centros.educa.jcyl.es/sitio/upload/Modelo_de_Competencias_Profesionales_del_Profesorado_Definitivo_JCyL.pdf http://www.edu.xunta.gal/centros/cafi/aulavirtual2/file.php/1/competencias_profesionais/competencias_profesionales_docentes.pdf
FR	• Order of 01/07/2013 on the competence framework for education staff	http://www.education.gouv.fr/pid25535/bulletin_officiel.html?cid_bo=73066
HR	• Framework for Digital Competence of Users in Schools: Teachers, Associates, Principals and Administrative Staff (2016)	https://www.e-skole.hr/wp-content/uploads/2016/12/OKVIR_digitalne_kompetencije-3.pdf
IT	• Decree n° 249 of 10/09/2010 on the definition, requirements and modalities of initial teacher education for pre-primary, primary and secondary teachers • Decree n° 850 of 27/10/2015 on objectives, evaluation, training and evaluation criteria of teachers and other educational staff during induction and probationary period	http://www.miur.it/Documenti/universita/Offerta_formativa/Formazione_iniziale_insegnanti_corsi_uni/DM_10_092010_n.249.pdf http://neoassunti.indire.it/2018/files/indicazioni_bilancio_iniziale.pdf
CY	(-)	(-)
LV	• Procedures for the Organisation of the Quality Assessment of the Professional Activity of Teachers (2017)	https://likumi.lv/ta/en/en/id/293176-procedures-for-the-organisation-of-the-quality-assessment-of-the-professional-activity-of-teachers
LT	• Description of Requirements for Teachers' and Student Support Specialists' Digital Literacy Programmes	https://eseimas.lrs.lt/portal/legalAct/lt/TAD/599d489078af11e89188e16a6495e98c?positionInSearchResults=0&searchModelUUID=aeda6e38-3b08-48f1-98ac-27caea94a506
LU	• Teacher competence framework (2015)	https://ssl.education.lu/ifen/documents/10180/730302/Referentiel%20de%20competences.pdf
HU	• Decree 326/2013 on the system of promotion for teachers and their status as civil servants	https://net.jogtar.hu/jr/gen/hjegy_doc.cgi?docid=a1300326.kor
MT	(-)	(-)

	Name	Link
NL	• Decree of 16 March 2017 amending the Decree on competence requirements for teaching staff and the Decree on aptitude requirements for teaching staff BES in connection with the re-evaluation of the competence requirements for teachers and teachers	https://zoek.officielebekendmakingen.nl/stb-2017-148.html
AT	• The digi.kompP competence model (2016)	https://www.virtuelle-ph.at/wp-content/uploads/2016/09/digi.kompP-Grafik-und-Deskriptoren-1.pdf
PL	• Regulation of 17/01/2012 on initial teacher training standards	http://prawo.sejm.gov.pl/isap.nsf/DocDetails.xsp?id=WDU20120000131
PT	(-)	(-)
RO	• Order n° 4476 of 06/07/2016 on lifelong learning professional standards for teachers	https://www.edu.ro/sites/default/files/_fi%C8%99iere/Invatamant-Preuniversitar/2017/formare%20continua/OM_4476_2016_PROFESOR_Standarde_profesionale_formare_continua.zip
SI	• Rules on traineeship for professional staff in the field of education (2006)	http://www.pisrs.si/Pis.web/pregledPredpisa?id=PRAV6697
SK	• Description of study fields (2002): o 1.1.1. Teaching of academic subjects	https://www.portalvs.sk/sk/studijne-odbory/zobrazit/10101
FI	(-)	(-)
SE	(-)	(-)
UK-ENG	• Teachers' Standards (2011) • Keeping Children Safe in Education, Guidance (last updated in 2019)	https://www.gov.uk/government/publications/teachers-standards https://www.gov.uk/government/publications/keeping-children-safe-in-education
UK-WLS	• Professional Standards for Teaching and Leadership (2017) • Qualified Teacher Status Standards (2009) • Keeping Learners Safe (2018)	https://learning.gov.wales/docs/learningwales/publications/170901-professional-standards-for-teaching-and-leadership-en.pdf https://gov.wales/legislation/subordinate/nonsi/educationwales/2009/3220099/?lang=en https://beta.gov.wales/keeping-learners-safe
UK-NIR	• Teaching: the Reflective Profession, incorporating the Northern Ireland Teacher Competences (2011) • Safeguarding and Child Protection in Schools (2017)	https://gtcni.org.uk/userfiles/file/The_Reflective_Profession_3rd-edition.pdf https://www.education-ni.gov.uk/publications/safeguarding-and-child-protection-schools-guide-schools
UK-SCT	• The standards for registration (2012) • The Standard for Career-Long Professional Learning: supporting the development of teacher professional learning (2012) • The Standards for Leadership and Management: supporting leadership and management development (2012)	http://www.gtcs.org.uk/web/FILES/the-standards/standards-for-registration-1212.pdf http://www.gtcs.org.uk/web/FILES/the-standards/standard-for-career-long-professional-learning-1212.pdf http://www.gtcs.org.uk/web/FILES/the-standards/standards-for-leadership-and-management-1212.pdf
AL	(-)	(-)
BA	(-)	(-)
CH	(-)	(-)
IS	(-)	(-)
LI	(-)	(-)

	Name	Link
ME	• Competence framework for teachers and school heads (2016)	http://www.zzs.gov.me/naslovna/168346/NACIONALNI-SAVJET-ZA-OBRAZOVANJE-USVOJIO-STANDARDE-KOMPETENCIJA-ZA-NASTAVNIKE-I-DIREKTORE-U-VASPITNO-OBRAZOVNIM-USTANOVAMA.html
MK	• Basic professional competences and standards (2016)	http://bro.gov.mk/docs/USAID/MKD/01%20Osnovni%20profesionalni%20kompetencii%20i%20standardi%20za%20nastavnici.pdf
NO	• Regulations relating to the framework plan for primary school teacher education for years 1-7 (2016)	https://lovdata.no/dokument/SF/forskrift/2016-06-07-860
	• Regulations relating to the framework plan for primary school teacher education for years 5-10 (2016)	https://lovdata.no/dokument/SF/forskrift/2016-06-07-861
	• Regulations on the curriculum for teacher education for Steps 8-13 (2016)	https://lovdata.no/dokument/SF/forskrift/2013-03-18-288?q=lektorutdanning
	• Professional Digital Competence Framework for Teachers (2018)	https://www.udir.no/in-english/professional-digital-competence-framework-for-teachers/
RS	• Digital Competence Framework – Teacher for a Digital Age, The Ministry of Education, Science and Technological Development (2017)	http://www.mpn.gov.rs/wp-content/uploads/2017/04/Okvir-digitalnih-kompetencija-Final-1.pdf
TR	(-)	(-)

Annex 4: Top-level strategies encompassing digital education in primary and general secondary education (ISCED 1-3), 2018/19 (related to Section 4.1.1)

Belgium – French Community

Pacte pour un Enseignement d'excellence

The strategy focuses on skills (there is a new common core curriculum in preparation), media literacy, training measures for teachers, digital equipment, dissemination and sharing of education resources. Students should have knowledge and understanding of the use and creation of digital tools and applications while safeguarding their digital identity. Digital education will take place largely within existing subjects (cross-curricular approach) and potentially also through technical workshops.

> **Timeframe**: 2016-2030 (ISCED 0-3). A specific digital strategy is expected in 2019 for ISCED levels 5-8.
>
> **Website**: http://www.pactedexcellence.be/wp-content/uploads/2017/05/PACTE-Avis3_versionfinale.pdf

Belgium – German-speaking Community

Currently there is no strategy for digital education. However, a framework-oriented guide (Information and Media Competence – IMK) for the development of information and media competences has recently been developed. It is intended to encourage the development of digital competence and the training of teachers, but is not binding.
> **Website**: http://www.ostbelgienbildung.be/desktopdefault.aspx/tabid-3969/7117_read-41353

Belgium – Flemish Community

Education Policy Note (2014-2019) and Media Literacy Concept Note

The Education Policy Note focuses on strengthening innovative learning environments and emphasises the need for e-safety. This also applies when technology is used by pupils for personal reasons e.g. to prevent cyber-

bullying. The Policy Note mentions the need for digital and media literacy. MOOCs and e-learning methodology could serve as training tools for teachers.

The Media Literacy Concept Note defines several strategic objectives: creating a sustainable and strategic framework for media literacy (creating vision and a sustainable policy framework), stimulating and enhancing competences (focusing on efficient, critical and safe use of media and developing new competences), creating an e-inclusive society (aiming to secure equal opportunities for all and to bridge the digital divide), creating a safe and responsible media environment (tackling privacy challenges, cyberbullying, copyright and enforcement issues), involving parents, teachers and other relevant persons in tackling these challenges, strengthening media literacy).

Timeframe: 2014-2019 (ISCED 1-4 and 5-7)

Website: https://www.vlaanderen.be/nl/publicaties/detail/beleidsnota-2014-2019-onderwijs and https://mediawijs.be/sites/default/files/artikels/bestanden/conceptnota_mediawijsheid.pdf

Bulgaria

Strategy for the Effective Implementation of Information and Communication Technologies in Education and Science in the Republic of Bulgaria

The main goal of the strategy is to provide equal and flexible access to education and scientific information at any time and from anywhere. The objectives are: increasing the interest and motivation of students to use innovative IT-based methods; providing students in isolated regions with opportunities to succeed, providing access to high-quality educational resources; promoting interactive learning and critical thinking; raising students' interest in technology; promoting technology education and more.

Timeframe: 2014-2020

Website: https://www.mon.bg/upload/6543/strategia_efektivno_ikt_2014_2020.pdf

Czechia

Digital Education Strategy 2020

The strategy aims to create the right conditions and set up processes that ensure learning objectives, methods and forms to correspond to the current state of knowledge, the demands of social life and the labour market affected by digital technologies and the information society in general. The mission of the Digital Education Strategy is to initiate changes both in the area of methods and forms of education, as well as in the field of education objectives.

The strategy sets out three priority objectives: opening education to new methods and ways of learning through digital technologies; improving students' competences in information and digital technologies; developing students' computational thinking.

Timeframe: 2014-2020 (ISCED 0-3; IVET and ITE)

Website: http://www.msmt.cz/uploads/DigiStrategie.pdf

Denmark

Action plan for technology in education

The main objective is to ensure that children, youth and adults have the necessary digital competences at all levels of education. It entails a project to support access to and the use of virtual laboratories.

Timeframe: 2017-2020 (ISCED 1-3)

Website: https://uvm.dk/publikationer/folkeskolen/2018-handlingsplan-for-teknologi-i-undervisningen

Germany

Education in the digital world (KMK)

The KMK strategy sets out the goal that every pupil should be able to use a digital learning environment and have access to the internet, wherever deemed useful in lessons from a pedagogical point of view, by the year 2021. The *Länder* commit themselves to creating the prerequisites for all students who enter primary or lower secondary school in the 2018/19 school year to acquire the competences laid down in the strategy of the Standing Conference throughout compulsory schooling.

Timeframe: 2016-2021 (ISCED 1-2 and 5-8)

Website: https://www.kmk.org/fileadmin/Dateien/veroeffentlichungen_beschluesse/2018/Strategie_Bildung_in_der_digitalen_Welt_idF._vom_07.12.2017.pdf

Estonia

Estonian Lifelong Learning Strategy 2020

The strategy supports the use of modern digital technology in learning and promotes access to current digital tools/infrastructure (e.g. personal digital devices, cloud solutions, open linked data etc.). It aims to include digital culture in the curricula at all education levels so school leavers should have achieved at least a basic level of digital skills. This should lead to improved digital skills across the population. Moreover, the strategy mentions training courses for teachers and encourages the sharing of good practice; it also supports the creation of assessment models for digital competences, and addresses the issue of competence recognition.

Timeframe: 2014-2020 (all education levels)

Website: https://www.hm.ee/sites/default/files/estonian_lifelong_strategy.pdf

Ireland

Digital Strategy for Schools 2015-2020 Enhancing Teaching, Learning and Assessment

The Digital Strategy provides for a programme of curriculum reform which sees digital technologies embedded in all emerging curricular specifications. It has been developed around four key themes: Teaching, Learning and Assessment using ICT; Teacher Professional Learning; Leadership, Research and Policy; ICT Infrastructure.

Timeframe: 2015-2020 (ISCED 1-3)

Website: https://www.education.ie/en/Schools-Colleges/Information/Information-Communications-Technology-ICT-in-Schools/Digital-Strategy-for-Schools/Digital%20Strategy%20Information.html

Greece

National Digital Strategy 2016-2021

The strategy aims at strengthening IT infrastructure and digital skills within the whole education system with a special focus on primary and secondary education, as well as lifelong learning. It promotes the use of new media and technologies in schools as well as the use of internet in the home environment. Student competitions on technological innovation and digital skills are to be organised and in line with this, student will become familiar with STEM profiles. New media should be supported as teaching tools and these will be regularly updated; modern evaluation systems will use ICT as a point of reference. The CPD for teachers in the use of ICT in the teaching process will continue. Current curricula focus on digital education and they will be constantly updated to improve students' digital skills.

Timeframe: 2016-2021 (all education levels – lifelong learning)

Website: http://mindigital.gr/index.php/κείμενα-στρατηγικής/220-digital-strategy-2016-2021

Spain

Ministerial level

Common Digital Competence Framework 2017

This strategy is intended to provide a national framework for teachers' digital competences, and to provide them with a space where they can self-assess their level of competence and create a portfolio with evidence of their digital competence.

Timeframe: 2017 – no end date (for teachers in ISCED 1-3)

Website: http://aprende.intef.es/sites/default/files/2018-05/2017_1024-Common-Digital-Competence-Framework-For-Teachers.pdf

Autonomous Communities

Andalucía – Digital Education Strategy

This specific plan aims to promote teacher training (CPD), the development of student digital competences, the creation and provision of OER, and the provision of infrastructure and services to schools.

Timeframe: 2018-2023 (ISCED 1-3)

Website: https://www.juntadeandalucia.es/boja/2018/124/1

Canarias – Plan for the Technological Modernisation of the Canary Education System

The main aim of this plan is to improve school infrastructure (quality internet connection, virtual environments for school management and communication between the different members of the educational community, provision of computer equipment), as well as the development of high-quality OER.

Timeframe: 2015-2020 (ISCED 1-3)

Website: http://www.gobiernodecanarias.org/cmsweb/export/sites/educacion/web/_galerias/descargas/proyectos_legislativos/plan-modernizacion-tecnologica-sistema-educativo.pdf

Extremadura – INNOVATED, Extremadura Digital Education Plan

The main aim of this plan is to support schools in the development of their own digital education strategies that promote the integration of ICT in teaching and learning methods. Through the implementation of several programmes for both teachers and students, INNOVATED will promote the improvement of student digital competences, the provision of teacher training (CPD), the development of an assessment of teacher digital competence, the promotion of OER, and the dissemination of good digital education practices.

Timeframe: 2018 – no end date (ISCED 1-3)

Website: https://emtic.educarex.es/innovatedsite

Galicia – Galician Digital Education Strategy

This strategy is put into action through various programmes that aim to develop student and teacher digital competences, promote the creation and use of OER, improve the schools' computer infrastructure and improve communication with families.

Timeframe: 2017-2020 (ISCED 1-3)

Website: http://www.edixgal.com/2018/03/edudixital-estratexia-galega-para.html

Navarra – Integratic/ikt Programme for the Digitalisation of Classrooms

This programme aims to improve student digital competences through the improvement of school computer equipment and the provision of both CPD and digital spaces for teachers to create and share OER and good practice.

Timeframe: 2009-2020 (ISCED 1-2)

Website: http://parapnte.educacion.navarra.es/2010/09/28/integraticikt-sitio-escuela-2-0-en-navarra/

France

Schools change with the digital age (from 2015-2018) – Digital technologies serving a school of trust (new title as from 21/08/2018)

The five current priorities are: to put school data at the centre of the digital strategy, to teach for the 21st century using digital technologies, to support and strengthen teachers' professional development, to develop students' digital competences and to create new links with other stakeholders and school partners.

Timeframe: starting in 2015 (all education levels but also dedicated projects for ISCED 2)

Website: http://ecolenumerique.education.gouv.fr and https://www.education.gouv.fr/pid37987/for-school-trust.html

Croatia

Strategy of Education, Science and Technology

The strategy aims to make digital resources more accessible. E-learning, multimedia, interactive materials, digital libraries and archives will be made available. In line with this, the strategy emphasises the importance of teachers´ continuing professional development. The strategy recalls the necessity of defining standards for educational resources (pedagogical models of ICT use in teaching/learning, model for developing digital resources – including OER).

Timeframe: starting in 2014 (ISCED 0-8). A specific digital strategy on digital maturity of schools and the education system of the Republic of Croatia is expected in 2019 for ISCED levels 1-3.

Website: https://narodne-novine.nn.hr/clanci/sluzbeni/2014_10_124_2364.html

Italy

National Plan for Digital Schools

This strategy includes objectives related to students' information and data literacy, digital content creation and computational thinking; the development of innovative school buildings, school digitalisation, research units on the impact of digital media and devices, training for school staff, and the development of digital learning resources and OER.

Timeframe: 2016-2020 (ISCED 0-3)

Website: http://www.istruzione.it/scuola_digitale/allegati/2016/pnsd_en.pdf

Cyprus

Strategic Plan of the Ministry of Education and Culture

The main aspects of the strategy related to digital education are: to integrate basic digital competences in the primary school curriculum; to provide certification (ECDL) of secondary school students' digital competences; to improve schools' Information and Communication Technology of (hardware, software, networking) in order to support both education and administration; to provide support to teachers to assess and improve their digital competences; to enhance the use of ICT educational tools in the classroom; to provide a better internet for all children, with emphasis on internet safety.

Timeframe: 2018-2020 (ISCED 1-8)

Website: http://www.moec.gov.cy/download/monada_politikis_stratigikou_schediasmou/moec_strategicplan_2018_2020.pdf

Latvia

Guidelines for the Development of Education 2014-2020

The strategy supports the development of digital skills in schools as well as within the framework of non-formal learning. The use of digital learning tools and innovative digital learning content in instruction at primary and secondary levels is supported, and the digitalisation of educational institutions emphasised.

Timeframe: starting in 2014 (all education levels)

Website: https://likumi.lv/doc.php?id=266406

Lithuania

Currently there is no strategy for digital education. The strategy expired in 2016. A new strategy for the deployment of ICT in general education is currently being developed.

Luxembourg

Digital (4) Education Initiative

The objectives are two-fold: 1. Digital education: preparing young people to thrive in a continuously changing, complex work environment and to become active citizens in both the public and private spheres. 2. Digital for education: the promotion of new learning strategies and innovative pedagogical projects using digital tools in schools and extra-curricular activities. The four domains targeted are the 21st century skills: communication, collaboration, creativity and critical thinking. These will be considered when preparing students to assume different roles in their lives as: digital citizens, digital peers, digital learners, digital workers and digital entrepreneurs.

Timeframe: starting in 2015 (ISCED 1-3)

Website: http://www.men.public.lu/catalogue-publications/themes-transversaux/dossiers-presse/2014-2015/150520-digital-4-education.pdf

Hungary

Digital Education Strategy of Hungary, 2016

This strategy defines 14 action lines covering the goals from a broader, interconnected perspective and implemented with the support of the ESF. Main developments include: infrastructure, curriculum and content development, digital competences of pupils, teachers and school heads, measuring schools' digital maturity, monitoring systems, e-learning materials and in-service training programmes for teachers (app. 60 000 will be trained).

Timeframe: 2016-2020/22 (ISCED 0-8)

Website: http://www.kormany.hu/download/0/cc/d0000/MDO.pdf

Malta

Digital Malta: National Digital Strategy 2014-2020

Related to education, the strategy focuses on the challenge of capacity building, i.e. improving teachers´ digital competences and in line with this, teaching methods. It emphasises, that students should fully benefit from digital literacy, and promotes citizens' access to and use of ICT. The focus should be on improving ICT competences, media literacy and safe use of the internet. Moreover, female participation in STEM education should increase and the quality of ICT education and training programmes assured.

Timeframe: 2014-2020 (ISCED 1-8)

Website: https://digitalmalta.org.mt/en/Documents/Digital%20Malta%202014%20-%202020.pdf

Netherlands

Currently there is no strategy for digital education. However, a digitalisation strategy/agenda was presented in March 2019. Moreover, the Ministry of Education, Culture and Science founded a network for media literacy in 2008: the *Mediawijzer*. Its purpose is to enable all children and young people in the Netherlands to use media wisely. The network does this by working with a strong network of organisations to develop initiatives aimed at education, parents/educators and youth. More than 1 000 organizations, companies, independent professionals and institutions in the field of media literacy are affiliated with the network.

Timeframe: grant is renewed every five years (young people between 0-18 years, no specific educational levels).

Website: www.mediawijzer.net

Austria

School 4.0

The strategy focuses on four pillars: basic digital education in primary and lower secondary school, digital skills for educators, infrastructure and IT equipment, digital learning tools and digital education media. In the first half of 2019, it will be replaced by the Masterplan Digitalisation in Education.

Timeframe: 2017-2019 (ISCED 1-3)

Website: https://www.schule40.at/

Poland

Strategy for responsible development

The strategy mentions the use of ICT in education as one of the means to ensure quality education. The pupils should be able to independently search for, modify and use information. Developing digital competences should take place at all ages (lifelong learning) and not only take the form of formal learning, but also non-formal and self-learning. All schools should have access to new technologies including fast connections and online services.

Timeframe: 2017-2020 (and perspectives up to 2030) (ISCED 1-3, ISCED 6-7 and lifelong learning)

Website: http://isap.sejm.gov.pl/isap.nsf/download.xsp/WMP20170000260/O/M20170260.pdf and https://www.miir.gov.pl/media/51477/SOR_2017_streszczenie_en.pdf (summary in English)

Portugal

Portugal INcoDe.2030 National Digital Competences Initiative

The strategy focuses on five axes: inclusion (aim to ensure access to digital technologies for all, including those who have already left education and training), education (focus on digital literacy and digital competences at all education levels as well as within lifelong learning, by involving all actors in education), qualification (focuses on assuring digital skills for the labour market, including professional training in digital competences), specialisation (promotes specialisation and advanced training in digital technologies), and research (e.g. generation of new knowledge and participation in international research programmes and networks).

Timeframe: 2018-2030 (ISCED 1-3 and unspecified undergraduate and postgraduate levels)

Website: http://www.incode2030.gov.pt/sites/default/files/incode2030_en.pdf

Romania

National Strategy Digital Agenda 2014-2020 for Romania

One of the areas the strategy focuses on is ICT in education. The goals are: to provide ICT infrastructure in schools (leading to improved digital literacy among students, social inclusion of those in disadvantaged areas, better management of educational materials etc.); to develop the digital skills of pupils and teachers; to use ICT (OER, Web 2.0) in the learning process including in lifelong learning.

Timeframe: 2015-2020 (all educational levels)

Website: https://www.comunicatii.gov.ro/agenda-digitala-pentru-romania-2020/

Slovenia

Strategic guidelines for further implementation of ICT in the Slovenian education until 2020

The vision of the guidelines is to open up possibilities of education in an open, innovative and sustainable learning environment facilitated by innovative use of ICT that will enable individuals to gain knowledge and develop skills, key competences, as well as competences of the 21st century that are essential for successful integration in society. The objectives of the strategy refer to: didactics and e-material, platforms and cooperation, e-competences, computerisation of institutions, e-education (higher education, adult education) and evaluation.

Timeframe: 2016-2020 (+) (ISCED 1-3 and 5-8)

Website: http://www.mizs.gov.si/fileadmin/mizs.gov.si/pageuploads/URI/Slovenian_Strategic_Guidelines_ICT_in_education.pdf

Slovakia

Strategy for the computerisation and digitalisation of the education department to 2020

Objectives of the strategy include: improving access to digital education content and its flexible inclusion into educational programmes; the modernisation of ICT infrastructure in schools; improving the digital competences of educational staff and improving teacher training in the pedagogical use of technology.

Timeframe: 2014-2020 (ISCED 1-3 and 5-6)

Website: https://www.minedu.sk/koncepcia-informatizacie-a-digitalizacie-rezortu-skolstva-s-vyhladom-do-roku-2020/

Finland

Government action plan: Finland, a land of solutions

Among other objectives, the strategy strived to create a digital learning environment for teaching and offer a variety of different ways of learning. In line with this, the introduction of new pedagogical approaches and teacher training was supported.

Timeframe: 29 May 2015 – 5 June 2019 (all educational levels)

Website: https://valtioneuvosto.fi/documents/10184/1427398/Ratkaisujen+Suomi_EN_YHDISTETTY_netti.pdf/8d2e1a66-e24a-4073-8303-ee3127fbfcac/Ratkaisujen+Suomi_EN_YHDISTETTY_netti.pdf

Sweden

The national strategy for digital education (2017)

As a way of reaching the goals in the strategies, the development of an action plan for digital education began in spring 2018. In March 2019, the action plan was presented. It summarizes nine overall needs of the school organizers who need to be met at national level and 18 initiatives and activities that are considered important for the goals of the strategy to be realized. The matter will be prepared further within the Government Offices. Through the platform skoldigiplan.se, the action plan is currently being developed in cooperation with the entire school system. The platform will be filled with material about ongoing activities in the country concerning the digital transformation in schools, with learning examples and important actions for continuing development and equivalence. Other measures include digitally transforming the national standardised tests.

Timeframe: 2017-2022 (+) (ISCED 1-6)

Website: https://www.regeringen.se/4a9d9a/contentassets/00b3d9118b0144f6bb95302f3e08d11c/nationell-digitaliseringsstrategi-for-skolvasendet.pdf

United Kingdom (England)

Industrial Strategy: Building a Britain Fit for the Future

The strategy includes priorities to establish a high quality technical education system and invest additional financial resources in maths, digital and technical education (to help tackle the shortage of STEM skills). It includes measures to tackle regional disparities in education and skills levels; to reskill and up-skill adults (with a focus on digital training); and to introduce new technical qualifications for 16- to 19-year-olds including in digital skills. The strategy also contains a commitment to establish the new National Centre for Computing Education and establishes targets to upskill computer science teachers.

Timeframe: 2017 – long term (ISCED 1-3 and 5-8)

Website: https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future

United Kingdom (Wales)

Digital Competence Framework (DCF)

The Digital Competence Framework (DCF) introduces digital competence as one of three cross-curricular themes (literacy, numeracy and digital competence) in the new curriculum. These will be the responsibility of all teachers. The DCF establishes the expectation that all schools will have a 'digital lead' who will have a key role in developing a clear vision for digital learning, and for coordinating how the DCF is used to develop greater cross-curricular understanding and confidence. The digital lead will also coordinate identifying and meeting staff development needs and preparing a plan for the implementation of the DCF, the overarching aim of which is to develop a positive digital culture within the school, and to provide learners with high-level digital skills to ensure they are digitally competent and evolve into enterprising, creative and critical thinkers.

Timeframe: published in 2016 – formal implementation in 2022 (ISCED 0-3)

Website: https://hwb.gov.wales/curriculum-for-wales-2008/digital-competence-framework/

United Kingdom (Northern Ireland)

Innovate NI: Innovation Strategy for Northern Ireland 2014-2025

One of the aims of the Innovation Strategy is to ensure that the education system provides the skills sought by innovative companies. To that end, the strategy includes targets to ensure that ICT and cross-curricular skills are further embedded in the teaching and learning process in schools and colleges, and that the development of STEM education and entrepreneurship skills are supported.

Timeframe: 2014-2025 (ISCED 1-3 and 5-8)

Website: https://www.economy-ni.gov.uk/publications/northern-ireland-innovation-strategy

United Kingdom (Scotland)

Enhancing learning and teaching through the use of digital technology (2016)

The four main objectives of the strategy are as follows: (1) Develop the skills and confidence of educators in the appropriate and effective use of digital technology to support learning and teaching; (2) Improve access to digital technology for all learners; (3) Ensure that digital technology is a central consideration in all areas of curriculum and assessment delivery; (4) Empower leaders of change to drive innovation and investment in digital technology for learning and teaching.

Timeframe: 2016 (for the next 3-5 years) (ISCED 0-3)

Website: https://beta.gov.scot/publications/enhancing-learning-teaching-through-use-digital-technology/

Albania

Strategy for the development of pre-university education 2014-2020

Under objective b: inclusive education, the strategy provides for improving the digitalisation of the learning process. This measure includes several activities for the period up to 2020 such as improving school infrastructure with regard to the use of digital technology; providing access to high speed internet for schools and access to technical assistance; and improving infrastructure to ensure communication between schools and regional education units etc. It also includes other measures for improvements in curricula in order to create high content digital materials in the Albanian language, awareness raising with regard to protecting students from the dangers of the internet etc.

Timeframe: 2014-2020 (ISCED 2-3)

Website: https://www.arsimi.gov.al/strategjia-e-zhvillimit-te-arsimit-parauniversitar-2014-2020/

Bosnia Herzegovina

Currently there is no strategy for digital education.

Switzerland

Common strategy of the 26 Cantons

Strategy of the Swiss Conference of Cantonal Ministers of Education for the handling of change through digitalisation in the field of education

The goal of the strategy of the Swiss Conference is that students are competent in the field of digitalisation and supported in their development to become responsible and critical citizens in a digital world. The strategy refers to a digital competence framework that is to be introduced into curricula. Another goal is the development of schools' and school heads' competences and resources in order to be able to use the potential of digitalisation. The strategic goals will be translated into practical measures by spring 2019.

Central government

Action plan for Education, Research and Innovation by the Confederation

The Federal Department of Economic Affairs, Education and Research (EAER) has conducted a study of the challenges of digitalisation for education and research in Switzerland and has drawn up an action plan for digitalisation in the Education, Research and Innovation (ERI) sector in 2019 and 2020. Concrete measures are planned in eight action areas.

Timeframe: starting 2018-2020 (ISCED 1-3 and 5-6) (Strategy of the Swiss Conference); 2019-2020 (ISCED 1-6) (Action plan of the Confederation)

Website: https://edudoc.ch/record/131562/files/pb_digi-strategie_f.pdf and
https://www.sbfi.admin.ch/sbfi/en/home/seri/digitalisation.html

Iceland

White Paper on Education Reform, 2014

The White Paper mentions the need to adapt education to the needs of the 21st century. This brings a set of skills such as creativity, communication, critical thinking, technology skills etc. In line with this, it is necessary to assure access to and familiarity with information technology. Therefore, there is a need to incorporate digital technologies into teaching and enable students and teachers to use a variety of teaching/learning methods.

Timeframe: starting 2014 (ISCED 1-3).

Website: https://www.stjornarradid.is/media/menntamalaraduneytimedia/media/ritogskyrslur/White%20Paper%20on%20education%20reform%202016.pdf

Liechtenstein

STEM-Initiative – Promotion of interest and competences in STEM 2017-2021

The main goal of the initiative is to promote interest and competences in mathematics, information sciences, natural sciences and technology at all levels of school education. The objective is to equip students with necessary competences to deal with increasing digitisation in education and work. The laboratory environment (pepperMINT-Laboratory) offers an appealing environment which will raise students' interest in discovering and inventing, and offer them an opportunity to experience intelligent technology through an interdisciplinary approach.

Timeframe: 2017-2021 (ISCED 1-3).

Website: https://www.llv.li/#/1471/mint-forderung and https://www.peppermint.li/

Montenegro

Strategy for the Information Society Development of Montenegro up to 2020

The strategy focuses, among other topics, on e-education. The main goals are to increase the number of computers in schools, and to train more teachers to use computers, particularly with respect to cybersecurity. The number of children being able to use the internet safely should increase. Furthermore, the education system should help pupils/students to acquire skills such as creativity, teamwork, problem solving, critical thinking, ICT skills and to use them in a changing environment. The strategy also emphasises the need for new teaching methods, non-formal learning and lifelong learning.

Timeframe: 2016-2020 (ISCED 1-3 and 5-6)

Website: http://www.mid.gov.me/ResourceManager/FileDownload.aspx?rid=251855&rType=2&file=StrategijaMID_finalENG.pdf

North Macedonia

Strategy for Education 2018 – 2025 and Action Plan 2018

The aim of the strategy is to support pupils/students to develop critical thinking and become active citizens. To reach these goals the strategy mentions the necessity of developing a set of competences which also include technology and digital competence. This brings the need to incorporate digital technology and ICT into teaching as well as the necessity of providing training to teachers in the use of the new technologies and ICT in education.

However, the statements in the strategy are not followed up to the desired level in the Action Plan in terms of concrete goals, indicators, establishing a responsible body, as setting a time frame for putting the measures/goals in place.

Timeframe: 2017-2021 (ISCED 1-3)

Website: http://mrk.mk/wp-content/uploads/2018/10/Strategija-za-obrazovanie-ENG-WEB-1.pdf and http://mon.gov.mk/index.php/2014-07-23-14-03-24/vesti-i-nastani/2549-2018-2044

Norway

Future, Renewal and Digitalisation (2016)

The main objectives are that students should have sufficient digital competence for everyday life and to succeed in education and work, but also to participate in society. ICT should be used in schools to improve students' learning outcomes.

Timeframe: 2017-2021 (ISCED 1-3 and 7 (ITE))

Website: https://www.regjeringen.no/no/dokumenter/framtid-fornyelse-og-digitalisering/id2568347/?q=digitalisering

Serbia

Strategy for Education Development in Serbia 2020

The strategy focuses on making pupils/students literate for life in the modern world. Emphasis is put on developing enriching teaching end extra-curricular activities (including scientific, technical and entrepreneurial activities) and improving the quality of teacher training. The strategy acknowledges the need to continue equipping schools with computers and internet connections (there is a gap between cities and villages). Resources provided by school libraries and communication technologies should be used in teaching/learning. Pupils/students should be able to acquire media literacy.

Timeframe: 2012-2020 (all education levels)

Website: http://www.mpn.gov.rs/wp-content/uploads/2015/08/strategija_obrazovanja_do_2020.pdf

Turkey

Currently there is no strategy for digital education.

Annex 5: Name(s) and website(s) of national bodies/agencies with responsibilities in supporting digital education at school, primary and general secondary education (ISCED 1-3), 2018/19 (related to Section 4.1.3)

	Name	Link
BE fr	(-)	(-)
BE de	(-)	(-)
BE nl	*Mediawijs* Knowledge Centre for Media Literacy	www.Mediawijs.be
BG	(-)	(-)
CZ	(-)	(-)
DK	*Styrelsen for it og læring* National Agency for IT and Learning	https://www.stil.dk/
DE	(-)	(-)
EE	*Hariduse Infotehnoloogia Sihtasutuse* Information Technology Foundation for Education	https://www.hitsa.ee
	Sihtasutus Innove Foundation Innove	https://www.innove.ee
IE	Professional Development Service for Teachers – Technology in Education	www.pdsttechnologyineducation.ie
EL	*Ινστιτούτο Τεχνολογίας Υπολογιστών και Εκδόσεων (ΙΤΥΕ) «Διόφαντος»* Computer Technology Institute and Press (CTI) 'Diophantus'	http://www.cti.gr/en/
	Ινστιτούτο Εκπαιδευτικής Πολιτικής (ΙΕΠ) Institute of Educational Policy (IEP)	http://www.iep.edu.gr/en/
ES	(-)	(-)
FR	*Réseau Canopé* Canopé Network	https://www.reseau-canope.fr/
HR	*Hrvatska akademska i istraživačka mreža* Croatian Academic and Research Network	https://www.carnet.hr/en
IT	(-)	(-)
CY	*Παιδαγωγικό Ινστιτούτο Κύπρου* Cyprus Pedagogical Institute	http://www.pi.ac.cy
LV	(-)	(-)
LT	*Švietimo informacinių technologijų centras* Centre of Information Technologies in Education	https://www.itc.smm.lt/en/centre-of-information-technologies-of-education
	Ugdymo plétotés centras Education Development Centre	https://www.upc.smm.lt/veikla/about.php
LU	(-)	(-)
HU	*Digitalis Pedagogiai Modszertani Kozpont* Centre for Digital Pedagogy and Methodology	https://dpmk.hu/digitalis-pedagogiai-modszertani-kozpont/
	Oktatási Hivatal The Educational Authority	www.oktatas.hu
MT	Malta Information Technology Agency	https://www.mita.gov.mt/en/Pages/MITAHome.aspx
NL	*Kennisnet*	https://www.kennisnet.nl/about-us/
AT	*Kompetenzzentrum eEducation Austria* Competence Center eEducation Austria	https://eeducation.at
	Virtuelle Pädagogische Hochschule The Virtual Educational College	https://www.virtuelle-ph.at/

	Name	Link
PL	*Fundacja Rozwoju Systemu Edukacji* Foundation for the Development of the Education System	www.frse.org.pl
	Instytut Badań Edukacyjnych, The Educational Research Institute	www.ibe.edu.pl
	Ośrodek Rozwoju Edukacji Centre for Education Development	www.ore.edu.pl
	Centrum Projektów Polska Cyfrowa, CPPC Digital Poland Project Centre	https://cppc.gov.pl/
	NASK – Państwowy Instytut Badawczy National Research Institute	www.nask.pl
PT	(-)	(-)
RO	(-)	(-)
SI	*Zavod Republike Slovenije za šolstvo* National Education Institute Slovenia	https://www.zrss.si
	Akademska in raziskovalna mreža Slovenije The Academic and Research Network of Slovenia	http://arnes.splet.arnes.si/
SK	(-)	(-)
FI	*Opetushallitus Utbildningsstyrelsen* Finnish National Agency for Education	https://www.oph.fi/english
SE	*Skolverket* Swedish National Agency for Education	https://www.skolverket.se/
	Sveriges Kommuner och Landsting Swedish Association of Local Authorities and Regions	https://skl.se/
UK-ENG	National Centre for Computing Education	https://teachcomputing.org/
UK-WLS	National Digital Learning Council	https://hwb.gov.wales/community-ndlc
	Hwb – Digital Learning for Wales	https://hwb.gov.wales/
UK-NIR	C2K	http://www.c2kni.org.uk/
UK-SCT	Education Scotland	https://education.gov.scot/
AL	*Instituti i Zhvillimit të Arsimit* Institute for Education Development	http://izha.edu.al
BA	(-)	(-)
CH	Educa.ch	https://www.educa.ch/en
IS	*Miðstöð skólaþróunar* Centre of School Development	http://english.unak.is/research/research-institutes/school-development-centre https://www.msha.is/
LI	(-)	(-)
ME	*Zavod za skolstvo Crne Gore* Bureau For Education Services	http://www.zavodzaskolstvo.gov.me/
MK	(-)	(-)
NO	*Utdanningsdirektoratet* The Norwegian Directorate for Education and Training	https://www.udir.no/in-english/
RS	(-)	(-)
TR	(-)	(-)

EURYDICE NATIONAL UNITS

ALBANIA

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European Integration and Projects Department
Ministry of Education and Sport
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Finance and Economy)

AUSTRIA

Eurydice-Informationsstelle
Bundesministerium für Bildung, Wissenschaft und
Forschung
Abt. Bildungsentwicklung und –monitoring
Minoritenplatz 5
1010 Wien
Contribution of the Unit: Joint responsibility

BELGIUM

Unité Eurydice de la Communauté française
Ministère de la Fédération Wallonie-Bruxelles
Direction des relations internationales
Boulevard Léopold II, 44 – Bureau 6A/008
1080 Bruxelles
Contribution of the Unit: Joint responsibility

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BOSNIA AND HERZEGOVINA

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CROATIA

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Digital Education at School in Europe

This Eurydice report sheds light on two different but complementary perspectives of digital education: the development of digital competences relevant to learners and teachers on the one hand, and the pedagogical use of technologies to support, improve and transform learning and teaching on the other.

The report covers different areas of digital education starting by an overview of school curricula and learning outcomes related to digital competence. The development of teacher-specific competences during initial teacher education and throughout their career is addressed as well as the assessment of students' digital competences and the use of digital technologies for assessment. Finally, the report gives some insight into current national strategies and policies on digital education at school. The annexes add specific information by country, on school curricula, teacher competence frameworks, top-level strategies and agencies supporting digital education at school.

The report covers digital education at primary and general secondary levels for the school year 2018/19 in all 28 EU Member States, as well as Albania, Bosnia and Herzegovina, Switzerland, Iceland, Liechtenstein, Montenegro, North Macedonia, Norway, Serbia and Turkey, 43 education systems in total.

The Eurydice Network's task is to understand and explain how Europe's different education systems are organised and how they work. The network provides descriptions of national education systems, comparative studies devoted to specific topics, indicators and statistics. All Eurydice publications are available free of charge on the Eurydice website or in print upon request. Through its work, Eurydice aims to promote understanding, cooperation, trust and mobility at European and international levels. The network consists of national units located in European countries and is co-ordinated by the EU Education, Audiovisual and Culture Executive Agency. For more information about Eurydice, see http://ec.europa.eu/eurydice.