CIDREE **YEARBOOK 2021**

Digital Literacy: Curriculum Development and Implementation in European Countries

Imprint

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LAYOUT AND COVER DESIGN
BuroDaan, Hardenberg

ISBN
978-90-329-0506-4

HOW TO CITE THIS PUBLICATION
Tolboom, J.L.J. & Van Rooyen, L. (Eds.) (2021). Digital Literacy: Curriculum Development and Implementation in European Countries. CIDREE Yearbook 2021. Amersfoort: SLO, Netherlands Institute for Curriculum Development.

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SLO serves as the national institute for curriculum development in the Netherlands. We are an independent, non-profit organisation, bridging the contexts of policy, research and practice. A major characteristic of the work of SLO is the interaction between various levels of curriculum development (national, school, classroom, pupil). A main challenge for SLO is the strengthening of (both longitudinal and horizontal) coherence of curricula. Our activities focus on primary, special, secondary and vocational education and comprise all subjects.

CIDREE
CIDREE stands for the Consortium of Institutions for Development and Research in Education in Europe. CIDREE is a network of educational organisation involved in curriculum development and/or educational research, set up in 1990 to establish closer working relationships at a European level.

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President's Foreword

THE TOPIC FOR THIS YEAR'S CIDREE YEARBOOK IS CURRICULUM DEVELOPMENT AND IMPLEMENTATION IN EUROPEAN COUNTRIES FOCUSING ON DIGITAL LITERACY IN SCHOOLS. I HAVE BEEN LOOKING FORWARD TO THE YEARBOOK, AS THE TOPIC IS RELEVANT AND EXCITING FOR MANY REASONS.

Digital life and digitalised society
The daily lives of children and adolescents are more digitalised than ever before, therefore it is crucial for schools to meet the pupils at the point where they are in their digital lives.

Digital literacy is a complex term. The CIDREE Yearbook defines digital literacy as encompassing skills that relate to using ICT effectively, efficiently and responsibly, combining basic ICT skills, computational thinking, media literacy and information literacy.

I believe that such broad access to digital competence in schools is necessary in order to meet current and future challenges. With an ever-increasing digitalised life, it becomes more important for children and adolescents to develop digital judgement, and to learn how to cope with digital challenges in a good and safe way.

HEGE NILSSEN
PRESIDENT

President of the CIDREE board

Digital development in today's society is fast-paced. To take advantage of the possibilities within digitalisation, there is a continuous need for specialised digital competence and a high level of general digital competence in society.

The labour market relies on the education system educating employees with advanced digital knowledge, skills and competence needed to work in different occupations. At the same time, all citizens need general digital competence to use the developed services, to perform duties using ICT, to make sound choices in their digital lives and to secure privacy.

Digital competence in schools
Competence in using tools and to communicate via digital media are important areas within the digital competence that schools must offer.

Other important areas within digital literacy are digital judgement and reflection on our technological society. I believe it will be important in the future to be aware of how

social media, and continuously new media technologies, influence and change our daily lives. Similarly, an important question to ask in schools is how we can influence new technology through our own usage.

The creation of technology is also an important competence, as this helps to ensure welfare and solve common problems in the world today. To ensure digital value creation in the future, I am convinced that we need new generations that are not only capable of consuming, but also capable of creating.

Professional digital competence
Several of the contributions to the yearbook address professional questions. In order to utilise the digital possibilities, I believe it is essential for school staff to work together with a common understanding of the type of digital competence the pupils shall develop. I also believe it is crucial for teachers and school management to cooperate on the type of digital competence the teachers need.

Professional digital competence can be linked to the teachers' own professional practice and knowledge enhancement. At the same time, this means that teachers must also have the competence to support pupils in their development of competence in using digital technologies in self-learning. There are many development needs in connection with learning and didactics.

I do believe that a large challenge in digitalised schools is to create enough situations where teachers actually teach useful ways of working with subjects digitally. I believe that digital tools should be used in a pedagogically sound manner, namely, to create teaching situations where digital tools are used to exploit the best possible potential for learning.

Common digital practices
Many schools and teachers work diligently on the academic and pedagogical possibilities that lie within digital technologies. At the same time, I believe that adequate adaptation to enable the pupils to develop their digital competence requires systematic professional cooperation between the teachers.

In conjunction with this, productive questions such as how digital practices can be integrated into the subjects and how common practices can be created in schools can be asked. To develop good digital practices, it is crucial that digital technology does not only turn into what each teacher wants to do – it should become a joint project.

I have noted that several of the contributions point out the responsibility and role of teacher training programmes. I believe that teacher training institutions must be aware of their responsibility for contributing to the digital competence of teachers.

Even though we have had computers and digital literacy in schools for a while now, we can say that we still have the potential to develop and improve. This applies to work related to the competence the pupils shall acquire, pedagogical use of ICT and, not least, the competence of teachers at the crossroad between subject, didactics and technology.

The yearbook sheds lights on our current situation, and I hope it contributes to good discussions and reflection on the best way forward.

Happy reading!

Digital literacy in European curricula

An introduction to the CIDREE yearbook 2021

The curriculum catching up with science and society
Already ten years before the publication of this CIDREE yearbook, scientists declared the world was embracing a fourth scientific paradigm: that of data-intensive scientific discovery (Tolle, Tansley, & Hey, 2011) (Hey & Trefethen, 2020). Of course, the yields of the former three paradigms are not to be neglected, as science is usually adding knowledge rather than replacing.

Experimental science has brought us the idea that systematic observations and descriptions help in understanding the world. Theoretical science has put effort into the formulation of these observations and descriptions in terms of 'laws', as for instance manifested in the astonishing work of sir Isaac Newton (1760). Computational science caught these laws into computerized models, adding simulations to the scientific toolkit (Wilensky, 1999). In the domain of mathematics, as an example, computational experimentation with the population model of Verhulst (1838) and atmospheric models (Lorenz, 1963) led to the formulation of chaos theory, as had been theoretically predicted by Poincaré (1890) In our current era, the abundancy of ubiquitous data, generated by the emerge of the internet of almost everything, facilitates scientists in discovering patterns in the raw data, even without an at forehand explicit law to be tested, thus leading to data-intensive scientific discovery.

Might this classification into scientific paradigms be biased by a contemporary perspective, it is still worthwhile to take a look at how these four paradigms, emerging in time, are reflected in secondary school curriculum. When taking the Dutch strand, the computational paradigm is just reflected in the STEM curriculum, where labs are organised utilizing sensor techno-

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logy to capture the yields of experiments and simulations can be run, beside the elective theme Computational Science of the elective subject Computing. The data-intensive paradigm is only faintly represented in the domain Statistics of the applied mathematics curriculum. That is, the first and second paradigm are still dominating the Dutch secondary school curriculum.

At the same time we see that not only science but society as a whole is overwhelmed by the opportunities that are offered by digital technology. Price Waterhouse Coopers (PWC, 2021)ranked the largest publicly-traded companies by their market capitalization in U.S. dollars. In the top-ten of this list, there were five tech companies (Apple, Microsoft, Facebook, Alphabet, Tencent), two tech-retail companies (Amazon, Alibaba Group) and one automotive company (Tesla Incorporation). All of these firms have digital technology in their very core business. It is not exaggerated to state that digital technology dominates modern science and society.

To this CIDREE yearbook fourteen European countries have contributed. This is more than to any yearbook since CIDREE started in 2001 with publishing such a report on a yearly base around an actual European theme. This stresses the urge that is widely felt in order to make sure our curriculum catches up with the turbulent developments as regards digital technology.

COMMON EXPERIENCES

The work on developing, implementing and assessing digital literacy in education is still “in progress”. When reading the fourteen chapters this CIDREE, one can see that all of the countries on a global level are struggling with the same issues.

Of course, first one has to define what exactly is meant by ‘digital literacy’. Fortunately, there is DigComp 2.1 (Carratero-Gomez, Vuorikari, & Punie, 2017) to refer to. But even then, choices are to be made, and these are being explicated in the chapters of this yearbook.

One fundamental misconception is worth mentioning. In facilitating students’ acquisition of digital literacy digital means can be utilized and this is done on a vast scale. But a sharp distinction is to be made between ‘education WITH ict’ on the one hand and ‘education IN ict’ on the other. This dividing line is nevertheless hard to draw for two reasons. First, in academic and educational practice, the experts on both topics are usually the same professionals. Take a secondary school as an example. The computer science teacher is usually also the expert on digital literacy and is the organization’s ict coordinator as well. So socially, they are commutative. Second, when teaching digital literacy, digital devices and digital resources are relatively intensive used. This way, ‘education WITH ict’ and ‘education IN ict’ are correlated and therefore are more easily exchanged.

We see in all countries the question ‘Is digital literacy to be taught as an independent topic or as an interdisciplinary topic, integrated into the existing subjects?’ posed and to some extent answered. No matter what choices are made with respect to the digital literacy curriculum, roughly, the learning goals can be split up into three categories:

1. matching with an already existing learning goal from an existing subject;
2. an already existing learning goal from an existing subject can be reformulated in such a way, the digital literacy learning goal fits in;
3. the digital literacy learning goal is completely new to the existing curriculum.

While the first category is a matter of making appointments with the existing subjects, the categories 2 and 3 come with their own challenges. Are, in the first place, the stakeholders of the curriculum of the existing subjects prepared to reformulate their learning goals in a ‘digital literacy way’? And how can we create curricular space for the learning goals belonging to the third category, that can be seen as ‘extra goals’ as regards the existing curriculum?

Above these challenges, in all of the chapters of this yearbook, there is another huge shared issue: the professionalization of the teachers. Most of these have been educated in an era in which digital literacy was not such a big deal, when one was able to use a text processor. As we demonstrated above, this has dramatically changed. How to catch up teachers’ professional competence with this seems for all of the participating countries the most important question when it comes to implementation. As Hege Nilssen, president of the CIDREE board, stated in her foreword of this yearbook that school administrations, teachers and teacher training institute should collaboratively anticipate on the new demands the labour market puts on their future employees (Frey & Osborne, 2017). It seems a logical role for national authorities and the European Union to facilitate the educational system to make this shift towards a digital literacy incorporated.

TERMINOLOGICAL COHERENCE

Information and communication technology (ICT) is a domain that is full with buzz words and TLA’s (three letter acronyms). In a rapidly changing context, digital engineers hardly have time to coin their terminology before a new hype rushes round.

In an educational setting, this is not much better. It is therefore no surprise that it took some time to establish a common language in which to formulate the learning goals. Most of these goals use the adjective ‘digital’ and describe skills or competences. Almost all of the contributing countries refer to DigComp 2.1, the framework for digital competences as formulated by the European Union. With respect to the reference conceptual model published in DigComp 2.0 (Vuorikari, Carretero Gomez, Punie, & Van Den Brande, 2016), eight proficiency levels and examples of use applied to the learning and employment field were added.

As these countries have independently from each other chosen to underpin their national curriculum as regards digital literacy by this reference conceptual model, the importance of such a model can hardly be overestimated.

In computing, professionals are of course used to working with reference models. The OSI model (Zimmerman, 1980), for instance, being a more general approach for computer networks than the already existing TCP-IP (Cerf & Kahn, 1974), decades ago already

demonstrated the value of a reference framework, for the sake of inspiration and standardization. Although in education these two not always go side by side in a happy marriage, ACM and IEEE, being organizations of collaborating professionals have copied this approach to an educational setting. This most recently resulted in Computing curricula 2020 (CC2020) paradigms for global computing education (Clear, et al., 2020). We conclude that collaboratively working with these kinds of frameworks is a huge success in scientific as well as in educational practice. Facilitating organizations, of professional nature like ACM and IEEE, or of political nature, like the European Union, are very powerful and thus important for this kind of collaboration.

CIDREE, being the consortium of institutions for development and research in education in Europe, plays a similar role, albeit on a specific and thus somewhat smaller scale. As an editor, I am grateful to CIDREE's board for the opportunity to unite curricular creativity, with a relevant and interesting yearbook 2021 as a result.

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BELGIUM (FLANDERS)

General description of the division Qualifications and Curriculum within AHOVOKS: This division consists of a multidisciplinary team of researchers and advisers. Next to their initial subject training, all members of the team are educational specialists. The division is engaged in the following curriculum aspects: contents of the basic and specialised curriculum, structures and qualifications, and evaluation at system level.

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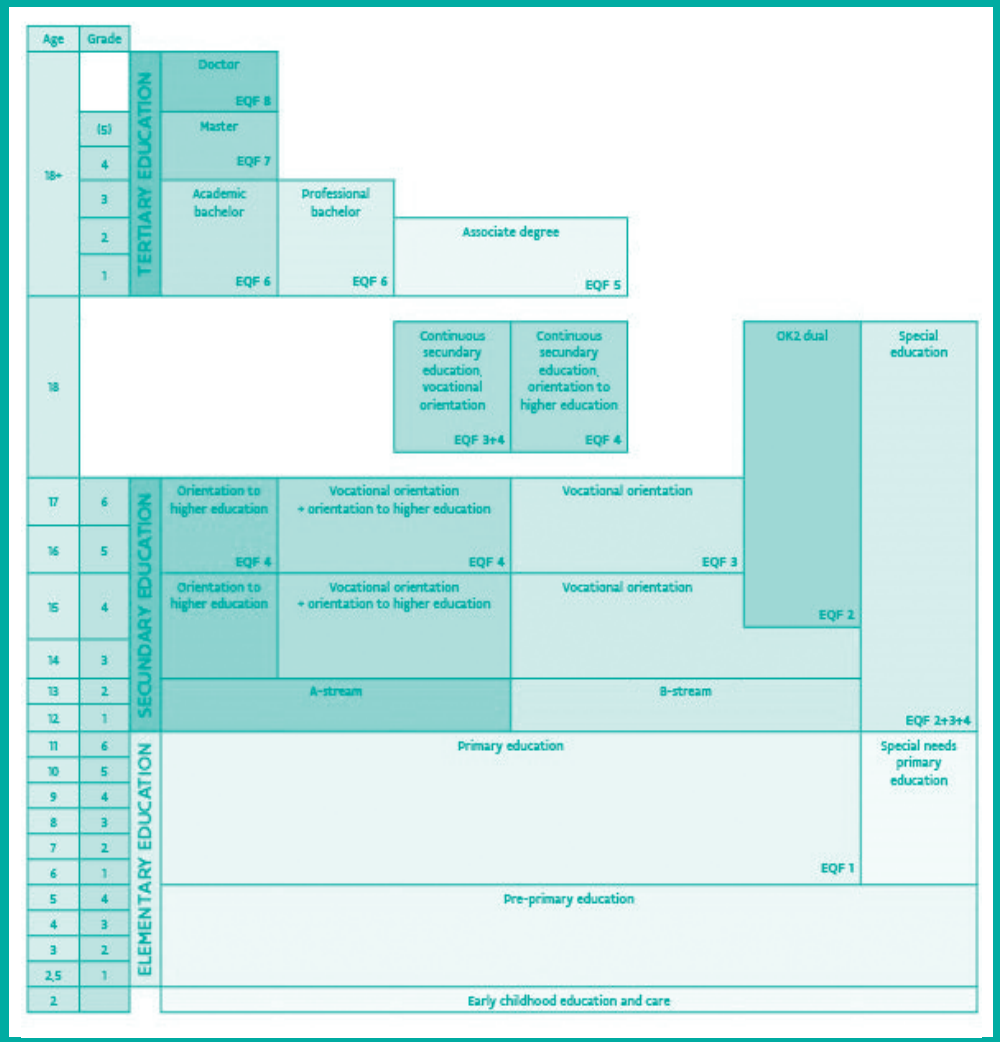
Advisor at the Ministry of Education in Flanders in the 'Qualifications and Curriculum' division and CNC for Flanders. He has been involved in the recent curriculum reforms in secondary education, amongst others as a chairman in some commissions that define the learning objectives for languages, for art and cultural education and for citizenship. He was project leader of the learning objectives specifically preparing for higher education. Currently he is collaborating on the curriculum reforms for primary education. Furthermore he is involved in evaluation of the implementation of the new curricula, in EQF level 5 higher education and to a lesser extent in professional qualifications.

Digital competences in the new curriculum for secondary education in Flanders

ABSTRACT

In Flanders there have been learning objectives for all schools since 1997. However, digital competences came much later, in 2007. Until recently, the digital competences were vague and uncomplete, focusing mainly on ICT competences and on media literacy. Since 2018 a big reform of compulsory education has been taking place, both on content (learning objectives) and structure (study programs). Recently the learning objectives for secondary education have been approved by the Flemish Parliament. In this paper we describe the process and evaluate the end result, specifically in relation to digital competences. An important success factor was the methodological and content related framework that was defined in legislation: 16 key-competences were defined amongst which 'Digital competences'. Also the collaboration with academic experts and committed teachers proved crucial. Together with the experts of the division Qualifications and curricula, the academic experts composed a reference framework and defined components per key-competence. For Digital competences there are three components: (1) ICT skills, (2) computational thinking and acting and (3) media literacy. These components were further concretized in learning objectives during commission meetings. The commissions consisted of teachers, representatives of school boards and academic experts. All of this led to thoroughly reformed learning objectives for digital competences in secondary education. In this paper, we evaluate the completed process and the end product. We consider the critical success factors and obstacles that have determined the process and the result.

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN BELGIUM (FLANDERS)

General explanation of the realisation of new learning objectives

INTRODUCTION TO MODERNISING SECONDARY EDUCATION

Since 1997, Flanders has had learning objectives that apply as minimum goals and must therefore be achieved by the majority of pupils. In the past, updates have been made for some contents, but not in a systematic way. It was not until 2007 that learning objectives were formulated on the subject of digital competences. The focus was on ICT skills and the learning objectives were formulated very generically, for example:

- The pupils can use ICT to creatively shape their own ideas.
- The pupils can use ICT to communicate in a safe, responsible and effective way.

Since 2018, Flemish secondary education (see the figure Educational system for an overview of the Flemish educational system and the position of secondary education in it) has undergone a thorough reform, both in terms of structure (education programmes) and content (revision of learning objectives). This article mainly deals with the substantive reform, in which we look extensively at the catch-up movement that we have made in Flanders with regard to digital competences in the curriculum. For a good understanding of the substantive reform, we will first briefly outline the main points of the structural reform.

STRUCTURAL REFORM

In Flanders, education is compulsory for everyone up to the age of 18. In the first stage of secondary education (12-14 years), the curriculum is largely general (basic education). The general part is supplemented with optional goals that mainly depend on the choice of study in the second stage (14-16 years) and later the third stage (16-18 years). In the second stage, the share of common basic education decreases and the specific education programme increases. In the third stage, the share of the common basic education becomes even smaller and the specific education programme even larger. The structure in which the education programmes are placed has recently been adapted to create a more transparent and efficient range of studies (https://youtu.be/uitWavLR2Fk)

In the new structure, 3 orientations are distinguished:

- Orientation towards higher education;
- Orientation aimed both at higher education and at the labour market;
- Orientation aimed at the labour market (Vocational orientation).

SUBSTANTIVE REFORM

The development of the new learning objectives has taken years, ranging from conducting scientific studies to conducting a social and political debate. The social and political debate raised the question of updating and strengthening the curriculum, including for the orientations that prepare directly for the labour market (vocational orientation). Thus more attention was asked for 21st century competences and citizenship competences, competences around sustainability and ICT skills. Finally, in the spring of 2018, a legal framework was approved with a number of methodological and substantive guidelines for the development of the new learning objectives. That framework was further operationalised in consultation with stakeholders and was very supportive in order to arrive at a coherent curriculum. Here you will find more information about the Flemish learning objectives (https://youtu.be/1_qZBLZFsVc).
The distinction made in the curriculum between basic literacy, basic education and specific education is important:

- Basic literacy (only in the first stage): learning objectives to be achieved by every pupil;
- Basic curriculum: learning objectives to be achieved by the majority of the pupils (population level);
- Specific curriculum: learning objectives specific to pupils from a certain education programme;
- General framework and approach to substantive reform;
- The framework specified by legislation can be divided into three aspects:
  1. Content framework: key competences for basic literacy and basic curriculum and science domains for the specific curriculum;
  2. The development process and the actors involved;
  3. Formal criteria that the learning objectives must meet (Format).

The three aspects together contributed to the end result, as we will explain below.

KEY COMPETENCES AND SCIENCE DOMAINS

Key competences

16 key competences have been established as a substantive framework for the development of learning objectives for basic literacy and basic curriculum. These 16 key competences are derived from the societal debate on what schools should teach the next generation. They are also based on the European key competences that form the frame of reference for European policy on lifelong learning and participation in our rapidly changing society.

Below you find the 16 Flemish key competences:

1. Competences in the field of physical, mental and emotional awareness and in the field of physical, mental and emotional health;
2. Competences in Dutch;
3. Competences in other languages;
4. Digital competence and media literacy;
5. Socio-relational competences;
6. Competences in mathematics, exact sciences and technology;

7. Citizenship competences, including competences for living together;
8. Competences related to historical awareness;
9. Competences related to spatial awareness;
10. Competences in sustainability;
11. Economic and financial competences;
12. Legal competences;
13. Learning Competences including research competences, innovation thinking, creativity, problem solving and critical thinking, systems thinking, information processing and collaboration;
14. Self-awareness and self-expression, self-direction and agility;
15. Development of initiative, ambition, entrepreneurship and career competences;
16. Cultural awareness and expression.

Regulations stipulate that all key competences must be covered in all stages and education programmes. The key competences guarantee a broad basic education. Digital competence and media literacy is one of the 16 key competences, a clear signal that explicit emphasis must be placed on this in the curriculum. However, Parliament has not further clarified how extensively or in-depth the key competence Digital competence and media literacy should be addressed. The concrete implementation of the key competences was left entirely to the development committees (see below for a description of how this was concretely implemented for the digital competences).

Science domains

In addition to basic literacy and basic education, education programmes also contain specific curricula. Depending on the purpose, the specific curriculum prepares for higher education, the labour market or both. For courses in the third stage that prepare for transfer to higher education, relevant science domains were selected on the basis of logical further study programmes in higher education and divided into parts of science domains. The learning objectives for the specific curricula were developed for each part of a science domain.

16 science domains have been defined:

1. General study-competences;
2. Modern languages;
3. Classical languages;
4. Art and Culture;
5. Philosophy;
6. Mathematics;
7. Computer Sciences;
8. Biology;
9. Chemistry;
10. Earth Sciences;
11. Physics;
12. STEM;
13. Movement sciences;
14. Behavioural sciences;
15. Social sciences;
16. Economics.

Pupils choose an education programme based on their interest and talent in specific science domains. The specific education deepens and broadens the competences offered in the basic education. As a result, pupils develop their cognitive reasoning competences in line with their talents and interests and are prepared for content that is also addressed in higher education.

DEVELOPMENT PROCESS

The regulations stipulate that the development of learning objectives takes place in **development committees** consisting at least of teachers, representatives of associations of school boards (education providers) and academic experts. Various development committees were set up. For each development committee, learning objectives were developed for various key competences that are related in terms of content. For example, the learning objectives for digital competences were developed in the same committees as for initiative and entrepreneurship and for the learning competences. Compared to the development of the previous generation of learning objectives, academic experts and teachers became more involved in the development process. Their involvement was an added value for the development process because of their substantive expertise and experience in the classroom.

During the development process, the greatest possible consensus was always sought. This sometimes took a lot of time, but it has paid off. At the end of the development process, a consensus had been reached on all the learning objectives, except for one learning objective, namely programming for everyone. Academic experts and education providers could not agree on this. Ultimately, the Government of Flanders took the plunge by including the learning objective in question for the orientation to higher education and not for the vocational orientation. For the orientation aimed at both higher education as well as labour market an adapted learning objective was formulated.

ORIENTATION TO HIGHER EDUCATION	ORIENTATION AIMED AT BOTH HIGHER EDUCATION AS WELL AS LABOUR MARKET	VOCATIONAL ORIENTATION
4.5 The pupils program solutions to problems in a systematic way using self-designed algorithms.	4.5 The pupils solve a complex problem digitally by adapting a given algoritm.	/

TABLE 1. OVERVIEW OF THE ONLY LEARNING OBJECTIVE ABOUT WHICH NO CONSENSUS WAS REACHED WITHIN THE DEVELOPMENT COMMITTEE. NOTE THAT A LEARNING OBJECTIVE CONTAINS A COMPETENCE FORMULATED IN ONE SENTENCE AND KNOWLEDGE ELEMENTS. THE KNOWLEDGE ELEMENTS ARE NOT GIVEN IN THIS TABLE. FOR A COMPLETE LEARNING OBJECTIVE SEE BELOW.

In addition to the development committees, a **validation** committee also acted to monitor the coherence, consistency and evaluability of the entirety of the learning objectives. The validation committee looked at that entirety at three particular points: an informal feedback occasion, an initial validation and a final validation. Based on the comments of the validation committee after the informal feedback and after the first validation, the development committees considered adjusting learning objectives or

where appropriate argued why an adjustment was not made. After the final validation, all the learning objectives were transferred to the Government of Flanders.
The validation committee played an important role in the realization of high quality learning objectives.

The **Government of Flanders** subsequently made a number of adjustments based on concerns from schools and associations of school boards. For example, at the end of the development process, concerns arose about the breadth of the basic curriculum that would be at odds with the specific curriculum in a number of education programmes. Finally, the learning objectives were laid down in legislation by the Flemish Parliament.

FORMAT

It has been established by decree that the learning objectives must be limited in number, formulated sparingly, clear, competence-oriented and evaluable. They must include knowledge, skills, insights and, if applicable, attitudes. These are many criteria that are often at odds with each other. To meet these criteria, a format has been developed based on Bloom's revised taxonomy: each learning objective includes one sentence and the associated knowledge. This knowledge is divided into four categories: factual knowledge, conceptual knowledge, procedural knowledge and metacognitive knowledge. Not all knowledge categories need to be included in every learning objective. In addition, competence levels were assigned to each learning objective.

The format has helped to achieve a coherent and consistent set of clearly interpretable and evaluable learning objectives. The format does require some interpretation and the learning objectives sometimes seem complex at first sight, but they form a necessary basis for the quality of education throughout Flanders.

Below you can find an example of a learning objective for basic education in the third stage for pupils who move on to higher education (from Digital competences and media literacy):

4.5 The pupils program solutions to problems in a systematic way using self-designed algorithms.
Including knowledge

**** Factual knowledge***

- *Algorithm*
- *Program*
- *Programming language*

**** Conceptual knowledge***

- *Concepts of computational thinking: decomposition, pattern recognition, abstraction, algorithm*
- *Organisation, modelling, simulation and digital representation of information*
- *Steps in programming: problem analysis, design, implementation and evaluation of the solution including debugging*
- *Principles of programming: sequence, repeat structure, choice structure*
- *Built-in functions*
- *Elements of programming languages: variables, data structures, data types, operators, parameters, conditions, procedures or functions*
- *Characteristics of algorithms such as performance, reusability, implementability*

**** Procedural knowledge***

- *Applying the steps in programming*
- *Applying principles of computational thinking in accordance with the designing of an algorithm*
- *Applying principles of organisation, modelling, simulation and digital representation of information*
- *Applying debugging principles*
- *Applying programming principles: sequence, repeat structure, choice structure*
- *Applying control structures and simple data structures when formulating algorithms*
- *Applying principles to algorithms consisting of designing and implementing a number of collaborative procedures in one programming environment*
- *Applying reflection skills*

**** Metacognitive knowledge***

- *The self-applied principles of computational thinking and acting*

INCLUDING DIMENSIONS OF THE FINAL ATTAINMENT TARGET
COGNITIVE DIMENSION: CREATING

DIGITAL COMPETENCES IN THE NEW CURRICULUM

As described above, the legislator has laid down 16 key competences around which content competences must be included in the Flemish curriculum. However, those 16 key competences were not further substantiated. AHOVOKS has therefore, in consultation, taken a number of steps to arrive at a demarcation of contents.

SUBSTANTIVE FRAMEWORKS

A very first step in preparation for formulating the learning objectives was to look up and establish substantive framework for each key competence. These frameworks helped to delineate a key competence, to characterise its relevant components and to distinguish it from other key competences (see references below for the framework for Digital competence and media literacy). They were used to formulate a proposal that was put on the table by AHOVOKS at the start of the development committees and subsequently used to define and edit the proposed learning objective within the development committees.

BUILDING BLOCKS

Building blocks were formulated for each key competence based on the frameworks. These building blocks form the substantive basis for shaping the learning objectives throughout secondary education. The key competence 'Digital competence and media literacy' was divided into three building blocks:

- Using digital media and applications to create, participate and interact (digital skills);
- Computational thinking and acting;
- Dealing responsibly, critically and ethically with digital and non-digital media and information (media literacy).

Both in the European key competences and in the definition of digital competences as put forward by the editors of the CIDREE yearbook, digital competences also includes information literacy. In Flanders, that part is included under another key competence, namely the learning competence. It is included under the building block: "Use suitable (learning) activities, strategies and tools to acquire, manage and process information critically digitally and non-digitally, taking into account the intended learning result and process". This is a conscious choice because information processing and acquisition are not limited to digital information and are an important aspect of the learning competence. Because the learning objectives for both key competences were developed within one development committee, there was coordination and a guarantee that information literacy is sufficiently addressed, also with regard to digital information.

REALISATION IN LEARNING OBJECTIVES

The learning objectives were developed on the basis of a starting proposal that was prepared by the process supervisor of AHOVOKS with expertise in digital competence and in close consultation with academic experts. During numerous committee meetings, the starting proposal was reviewed and all committee members were given ample opportunity to formulate thoughts, adjustments and additions. When establishing the learning objectives, the broadest possible consensus was always sought. This took a lot of time for certain contents. Nevertheless, this has been achieved for all learning objectives within all key competences, except for one learning objective regarding programming under the building block Computational thinking and acting (see above).

Below, we summarise per building block which content with regard to information literacy (learning Competences) and the digital competences (digital skills - computational thinking and acting – media literacy) have been addressed in the Flemish curriculum since the reform. Parts of the science domain Computer science, which were used to develop the specific curriculum, are also explained. A more extensive explanation and overview of all the learning objectives is available at www.onderwijsdoelen.be (only in Dutch).

INFORMATION LITERACY (FROM THE LEARNING COMPETENCE)

Basic literacy

In today's information society it is important that pupils have information literacy so that they can participate in society as full citizens. It is therefore necessary that pupils be taught skills so that they can acquire and process information efficiently and effectively in functional contexts. When looking for digital information, pupils must have an idea of their information needs in advance. In order to acquire targeted information, they must be able to select digital sources and information on the basis of a provided search strategy to answer a submitted information request. In addition, it is essential that pupils can assess the selected sources and information on the basis of guiding questions for usability, correctness and reliability, in order to be able to process the information in a targeted manner. The pupils should also be able to manage the digital information.

Basic curriculum

In comparison with basic literacy, the bar is being raised for the basic curriculum. The Government of Flanders is aiming for the largest group of young people after the first stage to use the most efficient and effective search strategies when acquiring (digital) information. In the second stage, they are also expected to be able to critically assess the suitability of a search strategy. In the third stage, the pupils must critically assess the search strategies used and adjust where necessary. Pupils are also expected to act data-wise and thus take into account the impact of digital and non-digital factors.

Because the quality of (digital) information varies, we expect pupils to be able to evaluate its usability, correctness and reliability. In the first stage, they were offered guiding questions. In the second stage, they use criteria to assess sources and information. In the third stage, pupils are expected to be able to use multiple sources to compare their usefulness, correctness and reliability.

The pupils must be able to process the (digital) information afterwards into a coherent and usable whole. In the second stage we expect pupils to process the (digital) information in a strategic way. The processing is therefore always in line with the objective. In the third stage we expect that pupils also take contradictory information into account. Second stage pupils are expected to refer to the sources used in a bibliography. This is a simple reference (title, author, year) to the source (s). In the third stage, the reference to sources is extended to a simple scientific notation in a bibliography. In addition, pupils are also expected to correctly refer to sources when citing and paraphrasing.

In accordance with presenting the processed information, pupils in the first stage are offered a (digital) method. In the second stage it is expected that the pupils themselves will choose a (digital) presentation form to present the processed information. In the third stage, pupils must also take into account the effectiveness of the chosen presentation method. The presentation method must be target group-oriented and attractive.

So that information can be retrieved quickly and efficiently, pupils in the second stage manage the information on the basis of a self-chosen structure that they design themselves. In the third stage, the pupils must be able to manage and retrieve information efficiently and effectively.

DIGITAL SKILLS

Basic literacy

The Government of Flanders has laid down in the learning objectives that every pupil must be able to create digital content and share it in functional contexts, in order to support the pupil's learning and self-development. Pupils must be able to communicate digitally and be able to participate through digital media and applications in both in-

school and extra-curricular activities. After all, those who do not have these digital competences are in danger of being left out in a society that is becoming increasingly computerised. Moreover, both private and public institutions are busy computerising their services to a great extent, as a result of which citizens are increasingly dependent on technological innovations. That is why the above-mentioned competences can be achieved by each individual pupil after the second year of the first stage.

Basic curriculum
In comparison with basic literacy, the bar is being raised for the basic curriculum. The Government of Flanders is aiming to allow the largest group of young people after the first stage to work effectively and efficiently with digital infrastructure and applications. This may concern applications such as online and offline word processor, spreadsheet, calculation app, digital image processing and a graphical programming language with regard to the digital creation of content. In order to be able to share digital content, young people must be able to use digital infrastructure and applications, such as browsers, electronic mail and social media applications. Finally, for them to be able to collaborate digitally and participate in initiatives, they must also be able to efficiently use applications such as electronic mail, chat and messaging, social media applications and other cloud applications.

At the end of the second stage, the ambition is that young people show self-confidence in exploring and using digital infrastructure and applications and that they demonstrate that they use standard functionalities of digital infrastructure and applications in a targeted and adequate manner.

Throughout the third stage, we further strengthen young people's self-confidence in exploring and using digital infrastructure and applications. The aim of the learning objectives is to make young people skilled in adapting settings of infrastructure and applications and in combining multiple applications. As a result, they transfer knowledge and skills acquired when using one application to another application. In addition, attention is also paid to data management.

COMPUTATIONAL THINKING AND ACTING

Basic literacy
Basic literacy is not delineated within the computational thinking and acting building block.

Basic curriculum
At the end of secondary education, the Government of Flanders expects most pupils to be able to cope with the rapid technological evolutions in all social sectors. This requires a thorough knowledge of the underlying operating principles of digital technology.

In the first stage, the foundation is laid by learning knowledge and skills to understand the underlying operating principles and to use them easily. For example, pupils should understand what input, processing and output mean in the context of digital trading and how the communication between digital systems (such as the internet, the communication between tablet and printer) proceeds. Solving problems digitally requires insight into various principles of computational thinking and acting.

At the end of the second stage, young people must be able to distinguish hardware (mobile phone, tablet, PC...), operating systems and applications without any problems. They can link input, processing and output to communication within and between digital systems. Young people are enabled to solve problems digitally by applying the principles of computational thinking and acting. They learn to design and implement algorithms consisting of a number of collaborative procedures in a programming environment (not included for the orientation aimed at the labour market).

Due to the accelerated technology and the shortened lifespan of digital infrastructure and applications, it is important that young people at the end of secondary education (third stage) are able to assess the building blocks of digital infrastructure in relation to private use and use in a social context. By teaching the principles of computational thinking and acting, we make young people more resilient in a society in which algorithms and programming languages are increasingly guiding life.

MEDIA LITERACY

Basic literacy
Media literacy is given special attention in the learning objectives. The Government of Flanders has established that each individual pupil learns to respect the privacy of others and learns to observe copyright and portrait rights. Our digital society offers many possibilities that can be used by a pupil for his learning and personal development. Which digital media and applications they best use for this in relation to the goal they want to achieve is a basic skill. Being aware of the influence of media use on his / her own and other people's mental and physical health and learning to be aware of security risks and privacy aspects arm the pupil in dealing with those digital media and applications.

Basic curriculum
We aim for young people to be able to use the informative and opinion-forming media and social media independently and critically. To this end, it is important that they understand the influence of mediatisation and technologization of society and understand the role media play in the conception of reality. Image literacy is an important aspect of this. In the learning objectives it is established that the pupils learn to act safely and responsibly in the digital world at a population level by letting them know and apply some basic rules related to privacy, copyright and portrait rights.

Frequent online media behaviour can subject children and young people to risks such as violent or offensive images, cyberbullying, privacy risks or unwanted contacts with strangers. That is why the first stage focuses on building resilience in dealing with digital information and communication.

In the second stage, we aim to provide young people with insight into how digital media and applications influence the learning, work and leisure of an individual. Concepts such as data literacy, digital identity, advertising literacy and e-commerce are discussed, as well as the impact of the mediatisation of the individual's living environment and the role of media and applications in image formation. Furthermore, pupils learn to act safely and responsibly in the digital world by getting to know and apply rules related to privacy, copyright and portrait rights. It is important that pupils can evaluate the possibilities and risks of their media behaviour and that of others. Crucially, they are able to estimate the influence of media use on their mental and physical health and that of others.

The learning pathway through the three stages of secondary education under this building block aims to teach young people knowledge and skills and to develop the attitude of adopting appropriate media behaviour consistently. For this it is important that young people are aware of the social implications of building computer systems, such as the collection of rare materials, working conditions and recovery of these materials and of the social implications of large-scale data communication such as impact on the labour market, the environment and behaviour. Furthermore, the third stage also focuses on safe and responsible behaviour in the digital world by making pupils consciously deal with rules related to privacy, copyright and portrait rights.

SPECIFIC CURRICULUM

Third-stage programmes that prepare for transfer to higher education contain, in addition to basic literacy and basic curriculum, specific curriculums based on a selection of components from a science domain. The following components are distinguished for the science domain Computer Science:

1. Computer sciences: Algorithms and programming;
2. Computer sciences: Software development;
3. Computer sciences: Modelling and simulation;
4. Computer sciences: Information and data management;
5. Computer sciences: Data communication, computer and network architecture;
6. Applied computer sciences: Software processing;
7. Applied computer sciences: Introduction to data communication, computer and network architecture.

The first five components (Computer sciences) are mainly linked to education programmes that prepare for transfer to academic higher education. The last two components (Applied computer sciences) are mainly linked to education programmes that prepare for transfer to professional higher education. For example, an education programme such as Computer Science and Communication Sciences, which prepares for an academic bachelor's degree programme such as Information Technology or Computer Science, is linked to the specific learning outcomes of the first five components. The component 'Applied IT sciences: software processing' is linked to practice-oriented education programmes such as Automotive Engineering, which prepares for transfer to a professional bachelor's degree programme such as Automotive Technology or Electromechanics.

IMPLEMENTATION IN PRACTICE

In Flanders, the government establishes through learning objectives what pupils must know and be able to do. However, the implementation of those learning objectives up to the level of educational practice involves many steps in which the government is not involved: a more detailed curriculum per education provider, learning material, implementation of classroom practice. Now that the learning objectives have been thoroughly reformed and new content has been added, we are curious about how they will be implemented.

Specifically for the learning objectives with regard to digital competences, the implementation will require a lot of adjustment from schools and teachers. In Flanders, professionalisation and further training are largely taken up by pedagogical counselling services. These pedagogical counselling services are organised by intermediary organisations (the education providers). Most school boards are affiliated with an education provider for logistical and pedagogical-didactic support. The government is therefore not directly involved in professionalisation or further training processes, but does provide incentives for it.

In addition, the government wants to create the preconditions for introducing digital competences into education, not only as part of the curriculum, but also as part of how learning takes place. The government has recently released additional resources to catch up in the field of digitisation . The use of these resources is clearly specified: a laptop for all pupils from the age of 10, developing an ICT policy at school, introducing the ICT coordinator as a separate function, further training for teachers and teacher trainers. The aim is mainly to stimulate digital didactics, but it will undoubtedly also have a positive impact on the learning of digital competences.

Furthermore, elements have been built into the concept of the learning objectives that give the schools a lot of freedom in how they can achieve the learning objectives. For example, the learning objectives are not linked to courses. The key competences and science domains were useful for structuring the development of learning objectives. However, the learning objectives of one key competence do not have to be offered together within one subject. The schools have the freedom to link learning objectives to subjects according to their own pedagogical-didactic vision. This is done in a more detailed curriculum created by the education providers or an individual school board.

Given the freedom that schools have, the digital competences in one school can be offered as a separate subject while another school offers those competences fully integrated in other subjects. We certainly encourage the latter. Indeed, the digital aspect has repeatedly been included in the learning objectives of other key competences. Within the learning competence, more specifically in information literacy and in problem-solving thinking, reference is made to digital competences (see above). Regarding maths and science competences, it is mentioned that they sometimes need to be performed with or without digital tools. Within geography, digital tools are part of the learning objectives. This shows how the digital aspect is strongly intertwined with our daily life.

Conclusion

In the development of new learning objectives, Flanders was faced with catching up with regard to digital competences in the curriculum. The new learning objectives are certainly a strong improvement over the old learning objectives. The components (digital skills - computational thinking and acting – media literacy – information literacy) that we encounter in the curriculum of many European countries have also been introduced in Flanders with these new learning objectives. As mentioned earlier however, the learning objectives for pupils from labour market-oriented education programmes are still more limited than in neighbouring countries.

In addition, the Flemish curriculum differs from that of other European countries in the degree of detail and the didactic tips it contains. After all, the government has no direct impact on the implementation of the learning objectives (see 'Implementation in practice'). The government determines the content of the curriculum, but not the way in which it is implemented.

In addition to the learning objectives for the basic curriculum, basic literacy learning objectives (thus to be achieved with every pupil) have also been formulated under the key competence of Digital competence and media literacy (only for the first stage). This is a recognition of the importance of digital competences to full participation in society. An evaluation of basic literacy in the first stage will soon be made, with a view to the possible roll-out of that concept to the higher stages. We look forward to the results of that evaluation.

In addition, specific learning outcomes have been formulated for digital competences. These occur in a number of fields where we expect pupils to need more digital competences than foreseen in the basic curriculum, especially with a view to progression to higher education. In some highly specialised fields the bar is set very high with regard to digital competences. We are convinced of its importance for future prosperity development and look forward to the success of these education programmes with great anticipation.

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ESTONIA

EINAR RULL

Einar Rull works as an analyst at the Education and Youth Board in Estonia.

He got his computer programmer certificate in year 1974 in secondary school Nõo and studied later Mathematics and Pedagogy in Tartu University (Cum Laude). After university he run an automated learning class in Tallinn Technical University in Chair of Higher Mathematics, which digitally assessed students' learning in 1980-s.

Working in Ministry of Foreign Affairs in 1990-s he was early adopter of Internet and published government information materials in Usenet newsgroups earlier than it was done by White House in Washington, which was later mentioned in Bill Clinton speech.

Thank to success, what appeared in using Internet to mobilise foreign Estonian communities in re-establishment of independence, Estonian Ambassador in USA (later President), Toomas Hendrik Ilves announced in 1995 the idea of quick and massive internetiation of schools and teaching of ICT skills to everybody (Tiger Leap Programme).

In Education and Youth Board Einar Rull has been involved in development of electronic assessment bank (EIS) and has presented about it on numerous international conferences in Finland, Norway, Georgia and Latvia. He has welcomed numerous foreign delegations in Education and Youth Board, shared the Estonian PISA success story and discussed about the development of digital literacy and application of digital technology in Estonian schools.

KATARIINA VAINONEN

Katariina Vainonen is a e-assessment specialist who works in Estonian Education and Youth Board since 2018. Katariina believes that modern technologies allow making assessment not only a way to test knowledge, but also allows the student to receive clear feedback and to develop, seeing your strengths and weaknesses to become part of the developing world. Working in Estonian Education and Youth Boar she mainly develops the test digital skills test. Also, she is involved in development other test for measuring general competences, like learning to learn, communication, mathematics competences and others. Part of her work has been development of Examination system (EIS) in collaboration with colleagues.

Katariina holds a Bachelor of Arts in Philology from University of Tartu. Currently she is writing a thesis as the last step before being awarded a master's degree in educational technology at Tallinn University.

Digital Literacy: from Punching Punch Cards to Behaving in Cyberspace

ABSTRACT

Estonia has adopted European the DIGCOMP 2.1 framework and has defined digital competency in this context for students and teachers. In Estonia, corresponding teacher training also has been organized: numerous courses were offered with fancy names for teaching all aspects of digital competency.

Since September 2015, Estonia had also used an earlier version of the DIGCOMP framework, combining it with the ISTE Standards (USA). Digital competence was meant as an additional key competence in line with already accepted competences of the European framework of Key Competences for Lifelong Learning.
A couple of schools started to teach computer programming already in 1965. The curriculum followed included computer architecture, coding in FORTRAN and punching punch cards.

Schools got their hands on first desktop computers 1986, when a Soviet military technology company in Estonia started to produce desktop computers called „Juku "for schools. They often stood idle because of the lack of trained staff and learning materials.

After Estonia regained independence from the Soviet Union in 1991, dealing with computers took a more serious turn. Estonian first national curriculum mentioned informatics as a cross-curricular topic, it was an optional subject and distanced from coding. The next version of the curriculum in 2002 already listed learning outcomes of cross-curricular topic „Information Technology and Media ", it proposed a test for upper-secondary school students and testing was carried out.

The next curriculum in 2011 included an informatics syllabus for primary school and lower secondary school levels as an optional subject. No other subject representatives were ready to share their curriculum time with informatics. Informatics as a subject did not become a compulsory part of the curriculum. However, the schools now have education technologists with MA qualification who assist other teachers in using digital technology in their educational practice.

An even larger breakthrough came in the year 2014. To harmonize Estonian education principles with European frameworks, digital focus in lifelong learning was added to the list of general competences in strategic goals in the Lifelong Learning Strategy 2020 and corresponding application courses like Digital Turn were developed thereafter. National tests of digital competences for lower and upper secondary school students have been in development since 2018. The national test in 2019 focused not only on knowledge and skills but also on attitudes and behaviour. Some of the test items used self-reporting, in some others students had to solve a task applying a specific digital competence. After the evaluation, the test model was tested using different analytical methods. Unfortunately, such a theoretical model did not show a good fit (Innove, 2019). A study by Pedaste, Kalmus and Vainonen (2021) revealed an eight-factor model of digital competence. It allows us to differentiate sub-competences in order to be more specific in understanding the acquisition of digital competences by students.

There have been significant changes in goals and content of teaching digital skills during the last 25 years. In 1996, the curriculum mainly focused on the skills needed to work with MS Office software and on how to find information using the Internet. In 2002, the curricular focus was limited to those digital skills that are needed for learning in school and there was a hope, that these skills might be applicable also after school. Computers were used mostly for text processing aims. In the 2011 curriculum, usage of Web 2.0 applications was added.

GENERAL CONCEPTIONS ABOUT DIGITAL LITERACY IN THE CONTEXT OF CIDREE COUNTRIES

What is digital literacy? Why do we need it? Is the interface not enough intuitive? Or should we use the term "digital literacies" only in plural, since different platforms demand different literacies? If all literacies are digital in the future, (once even a car is a computer on wheels), maybe we could omit the adjective "digital" and refer to just "literacy" without this adjective. Classical literacy as being paper-based literacy would belong to the past.

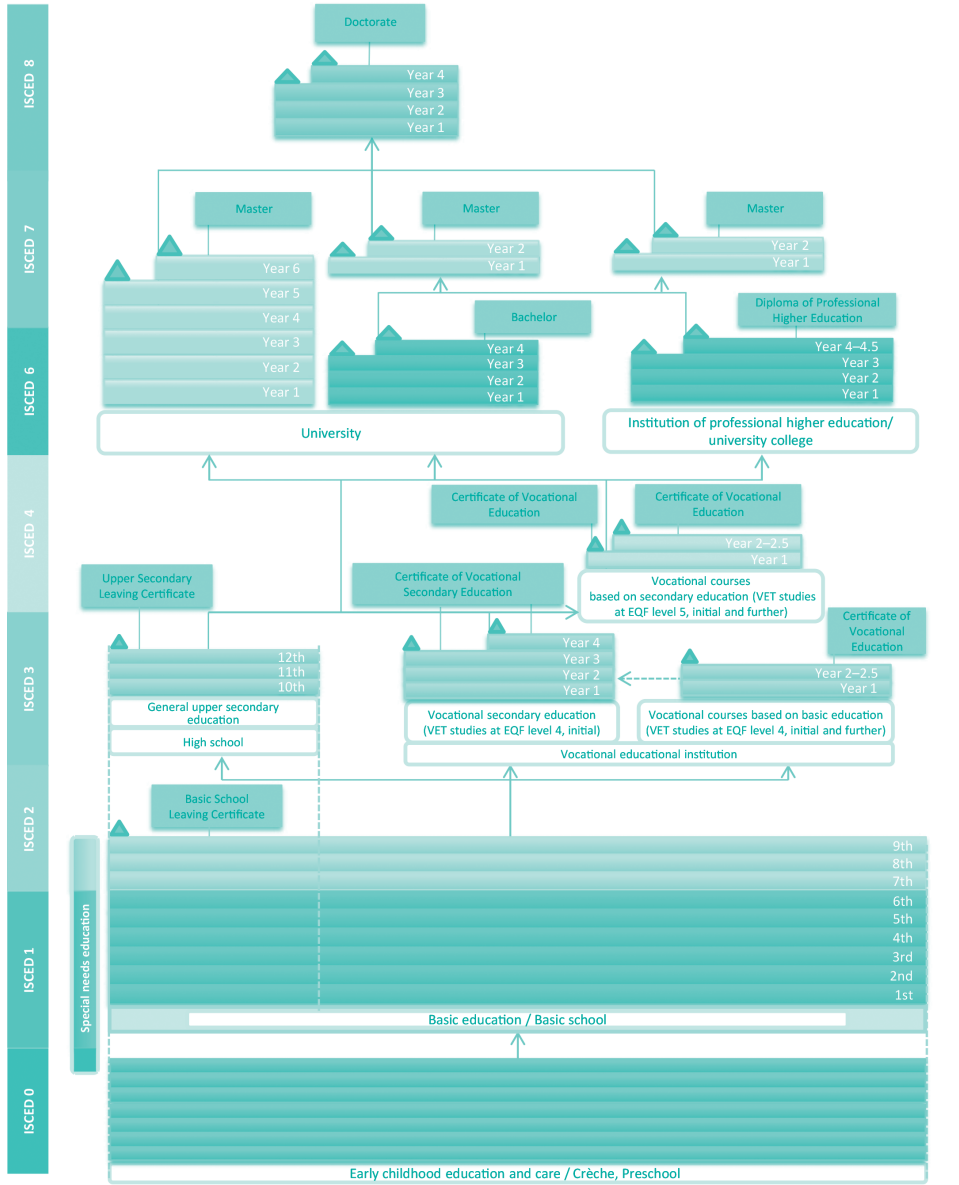
To start teaching computers (and informatics) in 1960-s, there was no need to have a generally agreed concept of digital literacy. Having an old university mainframe computer in an upper secondary school location, was enough to inspire enthusiasts in 1965 to start. Computers are doing calculations, so maybe this new skill is a subsection of Math? It was taught in Math classes and not in Physics classes. You can even assess student's specific computer handling skills and certify obtained qualification in one or several school without problem. Digital literacy consisted of computer architecture, data structures and coding in FORTRAN.

Next significant cultural jump in applying digital tools could be dated back to the year 1986, when one Soviet military technology company in Estonia started to produce desktop computers for schools. Often these computers stood idle, because of a lack of software programs and qualified teachers. It was another shiny learning tool, collecting dust. Students were taught about desktop computers architecture, operating systems, coding and running programs, and … playing games. It was still not this digital literacy what we have today.

Computerization of working processes and the rise of the Internet started to show their early promising signs in society, and this was soon reflected in political speeches. In 1996, president of Estonia Lennart Meri declared a program, called Tiger Leap (HITSA, 2021). The goal of the program was to digitalize society in general. Dealing with this quite embryonic but modern understanding of digital literacy in schools came from its larger context. It was no longer restricted to computer architecture, data structures and coding, but rather focused on everyday use of computers and the Internet. Schools got substantial funding to develop digital skills of the teachers. If schools hired an education technologist as an extra specialist for this activity, 50% of the employment costs were compensated by Tiger Leap Foundation. Education technologists had a MA degree, and their role was to assist other teachers in implementing digital technology in their lessons and to teach student's digital skills, which were not even part of the curriculum for all subjects. To have computer lessons as a separate subject was unrealistic, as this would imply less teaching hours for other subjects.

In 1996, the first Estonian national curriculum (Estonian Government, 1996) mentioned informatics as a cross-curricular topic and as an optional subject in upper-secondary level and distanced from coding, technical knowledge and simple text format. The term

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN ESTONIA

"informatics" broadly describes the study and practice of creating, storing, finding, manipulating, and sharing information. But Informatics in school was rather a more specific academic field, consisting of computer science, information science and information technology. The 1996 curriculum introduced four 35-hour modules, which were inspired by The European Computer Driving License Foundation framework EDCL/IDCL (ICDL, 2021).

Next, the national curriculum in 2002 (Estonian Government, 2002), listed measurable learning outcomes of cross-curricular topic „Information Technology and Media ".

The next version of the curriculum in 2011 (Estonian Government, 2011) included an informatics syllabus (4 optional courses, 4x35 hours) for the end of primary and lower secondary students as an optional subject and as a cross-curricular topic „Technology and Innovation ". Optional subject content and outcomes were determined. There were only a few schools which did not teach informatics after 2011.

An even larger breakthrough was established in 2014. Estonia had already introduced a list of general competences in its curriculum. The corresponding EU framework for key competences served as an example, but digital literacy was not yet included. To streamline everyday European cooperation in education, digital focus in lifelong learning was added to the list of general competences in strategic goals in Lifelong Learning Strategy 2020 (MoER [Ministry of education and Research], ECA [Estonian Cooperation Assembly] & EF [Education Forum], 2014) and corresponding application programs were developed thereafter. Digital competence is defined in the national curriculum document as follows:

"The ability to use renewable digital technologies to cope in a rapidly changing society, both through learning, citizenship and community interaction; to find and store information by digital means and to assess its relevance and reliability; participate in digital content creation, including the creation and use of texts, images, multimedia; use digital tools and techniques suitable for problem solving, communicate and collaborate in different digital environments; be aware of the dangers of the digital environment and be able to protect their privacy, personal data and digital identity; follow the same moral and value principles in the digital environment as in everyday life." (MoER, 2018)

In the Estonian context, digital competency is an ability to solve (during the learning in a technology rich environment) problems with digital technology and it is defined as consisting of 5 elements according to DIGCOMP 2.1 framework (HITSA, 2016) as follows:

1. Information management;
2. Communication in digital environments;
3. Content creation;
4. Security issues;
5. Problem solving.

The national curriculum standards for students have been elaborated for the end of grades 3, 6, 9, 12 and for vocational schools.

TRENDS IN DEVELOPING CURRICULA ON DIGITAL COMPETENCY

Estonia started teaching computers, as already mentioned, in the 1960s with clear academic approach: computer science, data structures and informatics. Later, it moved closer to the needs of labor market and then to the needs of learning in schools. But currently coding is again very popular, even in kindergartens, and so we are again moving closer to academic focus. Will this trend continue? It is hard to predict. There are several options for the future: status quo, adding academical focus, stressing more learning skills or skills, needed practically in everyday life.

Introducing Digital Turn, in 2015 Estonia originated on DIGCOMP 2.0 and ISTE (International Society for Technology in Education) frameworks. Earlier, in 1995, ECDL was used. In 2018, schools switched to DIGCOMP latest model. Informatics has always been in underprivileged position: only a cross-curricular topic and an optional subject. Curriculums are overburdened, and no subject is easily giving away his highly protected curricular time to teach digital literacy instead.

The curriculum in 1996 (Estonian Government, 1996) mainly focused on teaching MS Office software and the general use of Internet, having in mind future workplace needs. But as we know, different workplaces need very different digital skills, therefore it was an unrealistic goal and attention was turned towards professional use of digital technology in school during lessons instead. If student succeeds in schools, adaptation to digital skills, needed in different workplaces, would be easier.

So, the curriculum in 2002 (Estonian Government, 2002) limited focus to the needs of learning in school by using the best technology needed for learning. And what happened? Computers were used mostly as automated typewriters, for writing overviews and essays in different subjects. In year 2011 curriculums for Basic (Estonian Government, 2011) and Upper-secondary Schools (Estonian Government, 2011a), usage of Web 2.0 applications was added.

The concept of digital skill was introduced in September 2015 as an additional key skill and as an amendment to the current curriculum. Digital skill was verbalized in the context of already existing key skills. It could be an optional subject, but the key skills were obtained during all subject lessons as well as outside regular schoolwork. To increase opportunities in learning digital skills, many government programs were proposed, most of them turned to be very popular and loved by students.

To incorporate digital culture into learning process, the topic of information technology was updated in several ways. ICT skills were added to professional standards and innovative projects were introduced. Also, teacher training was improved, more digital learning materials were provided, appropriate didactic centers were opened in universities, digital innovation in schools was supported by using professional communities and teachers were provided with better support.

WHAT KIND OF INFORMATICS COURSES DO WE CURRENTLY HAVE?

- **Grade 5-6:** "Learning with Computer"
  (writing an essay, preparing a presentation, data sheet, internet search).
- **Grade 8-9:** "Information Society Technologies"
  (online collaboration, e-services, creating a personal learning environment, digital content production project).
- **Grade 10:** "Computers in Research"
  (finding information for research project, collecting and organizing data, statistical data analysis, presentation of results).
- **Grade 11:** "Programming and Software Development"
- Related courses **"Geoinformatics"** and **"Mechatronics & Robotics"** were used, if you were involved on Science oriented streaming in upper-secondary.

About 40% of schools do not teach informatics as a separate subject in grades 1 – 9 but try to integrate it into teaching of other subjects.

SOME EXAMPLES FROM DIFFERENT AGE LEVELS

- **In preschool,** teachers teach and use LEGO WeDo, Kodu Game Lab, tablets (apps), computer programs for making animations etc.
- **In primary school,** teachers teach and use Kodu Game Lab, Logo MSW, Scratch, LEGO Mindstorms EV3, development of mobile apps. Also, usage of many different programs and environments to support the teaching of various subjects (music, mathematic, physics, biology) like e-labs for example.
- On **secondary and vocational education** level, teachers teach and use different programming languages (Python, JavaScript etc.), use Codecademy.com courses, 3D graphics, robotics, programs for creating games, webpages and apps.

Web 2.0 has been a disruptive technology in context of previous behavioral patterns of learning, turning students into active creators, but use of ICT also rises health issues.

IMPLEMENTING CURRICULA WITH DIGITAL LITERACY

Informatics is not a compulsory subject. But once digital skills are assessed in all schools and results are made public, it has put a responsibility on the school leadership to implement curriculum and to do something for not to fail. If schools do not have informatics as a compulsory subject, they have still different options available.

As mentioned, most of Estonian schools have hired educational technologists. It is a way to teach digital skills in all subjects. Educational technologists have also been extremely helpful during COVID crisis in organizing distance learning in schools. They also have their own professional networks to exchange the news about the latest technological developments. According to the 2011 curriculum, every subject involves also digital skills components. For example:

- learning of Mother Tongue or Foreign Languages will introduce digital communication tools, translation techniques, participation on forums, using email, social networks and blogs, and text analysis.
- Mathematics promotes usage of different statistical programs, simulations and modelling, data visualization and research techniques.
- Sciences, Languages and History include maps, videos and use of corresponding learning environments.
- Social Sciences involves individual and group activities, participation in international cooperation, using diagrams and data analysis.
- Art and Music are to inform about online museums, archives and databases, Creative Commons standards, sharing of data principles, usage of videos and animations.
- Informatics (as optional subject) is to focus on virtual identity, web meetings, wikis, podcasts, internet safety and security.
- (Lorenz, Laanpere, & Kikkas, 2016).

How to achieve all this? One way is to participate in different ICT oriented projects. Schools write proposals and, if they are lucky, get money and participate. Some projects are hugely popular. Some projects, initiated in Estonia, have spread over the World.

Previously mentioned Tiger Leap Program (HITSA, 2021) was launched on February 21, 1996 on television by Estonian President Lennart Meri and focus was not only on schools but on society in general. The program intended to computerize the whole society and event can be called as the birth of Estonian digital society. It had also school dimension: adjusting the education system to the needs of rapidly evolving information society by equipping schools with modern information and communication technology, linking schools to internet, providing ICT education to teachers, promoting development of teaching/learning software, etc.

To achieve all these long reaching goals, Tiger Leap Foundation was created a year later in 1997 by the Ministry of Education and private sector ICT firms.

As a result of the 1996 Tiger Leap program all schools in Estonia were connected to Internet. 90% of schools had fixed internet connection, 10% had modem connection, 98% of schools got computers for their schools. Universities started to prepare education technologists for schools. Education specialists created their professional communities: in universities 2004, vocational education 2006 and general education 2009.

In 2001, Tiger Leap Plus program goal was to apply ICT for creating a learning society in schools, where computers would be used as a natural component of learning process. So, Tiger Leap Plus focused on adding ICT dimension to variety of subjects in curriculum.
In 2006, Learning Tiger was proposed. It involved e-learning and Moodle.

In 2012, we were back to Basics, (to year 1965, having in mind coding) with Proge Tiger (Coding Tiger): introducing coding lessons in Estonian schools. The goal of the Proge Tiger program was to enhance learner's technological competence. Focus of the program was on integrating of engineering, design, technology, and ICT into learning. Target group of this program was preschools, primaries, secondary and vocational schools. It was one of the best EU projects in digital skills and got EC award „European Digital Skills Award 2016".

More than 300 schools were provided with robotic kits or technological resources. Web based learning materials database was created by education technologists in 13 regions of Estonia. It started as a coding exercise: teaching coding for students. It is now a wider technology program, covering engineering, sciences, design, and technology.

In 2014, after updating existing general competences with digital competence in the framework of lifelong learning, a program Digital Turn in the context of Lifelong Learning Strategy 2020 was approved, which also introduced Bring Your Own Device (BYOD) approach, e-textbooks, e-exams. Program was co-financed by European Union. Main aim of the program was to have a more holistic (in sense of curriculum) approach to the development of digital competences in schools to use all opportunities, provided by digital technologies in student' learning.

Robotex is an organization, established in 2001 in Estonia (Robotex International, 2021), to support small children to be inventors, engineers, and creators of start-ups and to organize international competition Robotex, which also includes exhibitions. Robotics competition Robotex International is the largest in the world robotics competition. Already in 2016 it had more than 16 000 guests and robots, 3700 participants, 8200 Facebook fans, 23 competitions, 40+ workshops, 15 000 spectators and was the largest in the EU. In 2018 it was the largest in the world. In 2020 there were international regional competitions in China, India, Cyprus, and Finland. In 2021 it was postponed because of Covid-19. Local competitions like Robomadin 2018 („Robo-tumult ") were organized in Estonia. Tasks included following line (mBot, lego), VEIX IQ. Competition is more popular among girls.

E-safety and Cyber Nut competitions. The NATO Cooperative Cyber Defense Centre of Excellence is a multinational and interdisciplinary cyber defense hub, situated in Estonia. So, you could expect that high priority of net security is also reflected in education by presence of programs, competitions, and opportunities to specialize. Corresponding programs are co-financed by MoD and MoES.

E-safety is necessary for future work life, education, and for participation in e-society. Most of cyber-attacks are successful because of users' incompetence and results are costly. Important questions are privacy and data protection, cyberbullying, hate speech, manipulation, and social engineering. E-safety program Smartly in Internet involved cooperation between different institutions, providing web-constables on educational landscape. There are corresponding e-courses to rise teachers' awareness (Lorenz & Kikkas, Digital literacy in information society, 2019). There are Cyber Nut competitions on cyber security for more advanced students.

ASSESSMENT OF DIGITAL COMPETENCY

First testing of ICT competency in Estonia is colorfully described by the Tiger Leap enthusiasts Anne Villems and Liina-Mai Tooding (Villems & Tooding, 2006). Five years after starting of the Tiger Leap initiative - in year 2001 activists of corresponding foundation and members of the ICT board in national examinations center cautiously raised the question about the level of ICT competences of students after five years of the program.

It is enormously difficult to get government funding to organize national testing of something what is not in curriculum. The funds of Tiger Leap Foundation were used to organize the first pilot. Test was composed by the ICT board of national examinations center.

It was difficult to find any good examples of regular ICT testing from another countries, as all countries were rather pioneering in this area.

The main objective of the project was to develop a methodology to answer the question: how students achieve the ICT skills mentioned in the national curriculum at the end of 9th grade. The level work consisted of two parts: theoretical (test on paper or computer) and practical, where it was necessary to do practical tasks behind a computer, gave 2/3 points. Theoretical part was a typical computer-based knowledge test. The practical part tested the skills of using MS Office software and of some Internet tools. The development of the level work lasted for 4 years, during which it was tested in schools and modified according to the results.

The results showed that most of the students have succeeded in achieving the knowledge and skills described in the curriculum. The results were analyzed by comparing boys and girls and students living in urban and rural areas. In addition, the correlation between the two parts of the test was looked at and found to be weak, but both parts measure a slightly different aspect of students' knowledge and abilities. From earlier

polls we knew, that 91% of 4-graders and older students already used internet (Villems & Tooding, 2006) and 75% of students had internet connection at home (Toots & Laanpere, 2004). Nearly all schools were equipped with computer classes but used quite different hardware and software. Even user interfaces were in Estonian, English, or Russian languages. So, there already existed the knowledge about the quantity of the ICT usage and now came the long-expected data about the quality too.

Year by year, results were increasing, as expected with all new tests. The share of students below the passing mark decreased. Results of the last year dropped slightly because of the significant test redesign. Curriculum was the same, but technology changed and so did the questions.
In general, the test results were not much different, if compared to the results of the other sample-based tests. It discriminated well in the higher ability end and there were not too many students below the passing mark either. Test was not too easy, and majority of students got positive results. It was possible to see from the results, that families, living in larger cities, were better equipped with computers than the rural ones.
Test developers assumed that accumulated experiences would also be used for testing of the ICT competences during the application period of the next curriculum, but testing was discontinued. Testing of digital competencies on national level continued about 10 years later and some insight about ICT skills we also got from PISA 2009 and 2012 surveys results.

Informatics is not taught in all schools and large differences exist between schools. Curriculum still does not state expectations in informatics clearly in a measurable way. In larger schools, students are more digitally skilled than in smaller schools. Once all learning is scattered into different subjects, result lacks overall coherence. To improve the situation, corresponding national curriculum standards for students were more precisely elaborated for the end of grades 3, 6, 9, 12 and for vocational schools. Further digital competence testing was planned in 2017.

DIGITAL COMPETENCE E-TESTS

Latest measurement on digital competence was planned as an effectiveness indicator for program „Digital Turn ". It also was intended to be an instrument for teachers in adapting teaching and planning activities in or out of school.

Our students do not always behave like "digital nomads", at least in testing conditions. Once all teachers in school are responsible for development of students' digital competencies, it might easily be that nobody takes the responsibility. Influence of home is often stronger than influence of school because digital skills are more often used for doing homework than during the lessons in school. What can school do to improve students' digital competencies in the best way? More information was needed.

ELABORATION OF THE TEST AND TESTING

Testing was based on the latest edition of the European DIGCOMP (Carretero, Vuorikari, & Punie, 2018) framework and national version of learners' digital competency model (HITSA, 2016). Framework was analyzed and adapted already in 2016 to determine, what student should know and be able to do at the end of lower and upper secondary stages. Testing items were elaborated by corresponding working group.
First trial of testing of items of digital competencies was organized in 2018 and consisted of 12 items for 9-graders and 11 items for 12-graders. Some background questions were also used for measuring attitudes and behavior.

In 2019, working group proposed 106 test items, which were authored in IMS QTI 2.0 interoperable electronic assessment bank EIS (Eksamite Infosüsteem EIS). Self-report questionnaires were used to map attitudes and habits. During the testing in 2019, only 59 items were used. Trials were carried out in 4 different sessions and they involved 750 students altogether (grades 8, 10 and 11) in a way to prepare an official pre-test in March 2019. Based on the statistical analysis of trials, it was proposed to use the same test for 9-graders and 12-graders. The only difference was in verbal feedback, given to students. Norm-based grading approach was separately used to different age group. Feedback had three versions: separately for students in lower quartile, higher quartile and for the middle part of students. The group, consisting of average students, was twice larger than others, but it worked well. Vocational education track students were statistically included into 12-graders group. Feedback for the whole school was also provided.

There were 5 areas of measurement:

TEST MODEL

INFORMATION AND DATA LITERACY	COMMUNICATION AND COLLABORATION	DIGITAL CONTENT CREATION	SAFETY	PROBLEM SOLVING
8 items	9 items	9 items	10 items	6 items
22 points	22 points	22 points	22 points	21,5 points

About one thousand 9th-graders and the same number of 12th-graders participated in the test, which took a bit more than an hour to complete. Average results of groups were 25 and 29 points with standard deviation of 5,5 points both. Vocational education students' average was closer to that of the lower secondary students, what is rather usual also in all other upper secondary tests. There was visibly larger scattering of results in upper end of the ability spectrum, because of the beneficial influence of extra courses, available in some upper secondary schools.

According to study (Pedaste, Kalmus, & Vainonen, 2021), five DIGCOMP competence areas did not cause a clear factor structure in the test. They are indeed usually interpreted as unidimensional. But surprisingly, the study revealed an eight-factor model of digital competence, described in the first section of this article. For each of these dimensions, sample tasks that can be used to assess and develop digital competence, were also described. Findings in the study might be very useful for observing of the development of particular aspects of digital competence and corresponding personal needs of learners or their groups. Could this 9 factors cover the whole digital competencies cur-

riculum in the course of future development of digital technologies and corresponding competencies, that will be interesting to see.

In 2021, there exist plans to experiment with digital competencies tests again. This time participants will be 8th-graders (sample of 2000 students), 11th-graders (sample of 2000 students) and 2nd year vocational students (sample of 1000 students). It is also encouraged to participate outside the official sample. No grades will be given, only feedback will be provided. Test will last 60 minutes. Use of internet is allowed. Running the test one year before the completion of the lower and upper secondary studies enables schools to deal with students' knowledge gaps and learning loss due to Covid 19. Common anchor elements will be used to enable linking with the results of previous years.

Conclusion

So, we can see that the history of digital literacy began back in the 1960s with the appearance of the first computers at the university. Then it was considered part of mathematics, because computers were used for calculations. In the late 1980s, when computers appeared in schools, it became clear that in order to teach students to use them, a separate subject was needed. In 1996, Estonia began to actively use digital technologies in education. The Internet and more and more computers appeared in schools. We started working on the school curriculum and now digital literacy is a part of all subjects studied at school. The concept of digital literacy in Estonia is based on the DIGCOMP framework. Every year, government testing is conducted, and there are many programs and competitions that help students develop their digital literacy. Now we see how Estonia is developing in and will continue to do so.

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FRANCE

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From home to school, and vice versa? Digital education in France

ABSTRACT

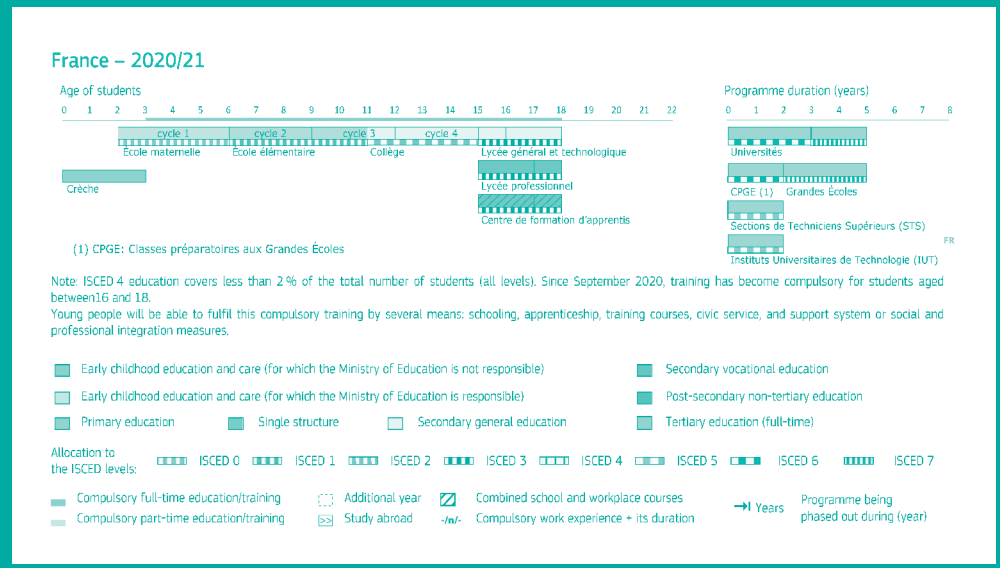
1. Digital practices of French children and teenagers
   What do we mean by “digital literacy”? What are the digital practices of French children and adolescents? What do they learn with digital technology?
2. The school and children’s digital culture
   How do French schools deal with digital literacy within the school curriculum?
   What conception of digital literacy is the French school developing?
3. Promoting equal opportunities through an emancipating digital culture
   How can digital literacy be developed to promote equal opportunities?

Throughout the world, the Covid-19 pandemic has forcefully questioned the role of digital technology in distance education and the relationship between school and family. Many questions have been raised about the support teachers need to set up new teaching methods and the relevance of the technical devices available for distance learning (Vidal, 2020). However, this distance learning, which was generalised over several months, also highlighted the great disparities in the mastery of digital skills by pupils. These children and teenagers, commonly referred to as “digital natives” (Prensky, 2001), have been confronted with significant difficulties, both in the technical mastery of the tools used and in the mastery of information and media skills. Awareness of these disparities in France has been accompanied by a great deal of incomprehension: how can we explain such difficulties on the part of these children and teenagers who were “born with digital technology” and who belong to a country that promotes digital education throughout the school years?

In fact, for many years, the French education system has offered digital training programmes that change very often. The difficulty is considerable: faced with an object that is shared socially, and with which children and teenagers develop skills outside the classroom, how can we propose an appropriate training programme within the school system?

In this contribution, we will look at what we know in France about the digital skills of our children and teenagers. Then we will discuss how these skills are taken into account in school and how the French curriculum configures digital education. Finally, we will propose ways to improve students’ digital skills in order to promote equal opportunities, a key objective of the French school system.

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN FRANCE

DIGITAL PRACTICES OF FRENCH CHILDREN AND TEENAGERS

First of all, some terminological clarifications are necessary. The terms “use” and “practice” are often used interchangeably. However, these two terms do not mean the same thing. Indeed, digital usage refers to the conduct of an individual in relation to an object, i.e. what the individual chooses to do with the tool among the potential uses of the latter. For example, we know that the majority of uses of social networks are related to interpersonal communication. Knowing the digital uses is interesting, but it is not enough. We need to look at digital practices, i.e. the concrete way in which individuals use a tool, but also how they represent themselves and what they feel when they carry out a digital activity. It is the practices that tell us about the skills and knowledge of individuals about an object, in this case digital. Generally speaking, digital literacy is considered to be “the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyse and synthesise digital resources, construct new knowledge, create media expressions, and communicate with others, in the context of specific life situations, in order to enable constructive social action; and to reflect upon this process” (Martin, 2005: 135).

In France, the Ministry of Education refers more specifically to the definition given by the Organisation for Economic Co-operation and Development (OECD): literacy refers to ‘the ability to understand and use written information in everyday life, at home, at work and in the community to achieve personal goals and to hear one’s knowledge and abilities’ (OECD, 2000). It is clear here that digital literacy should not be reduced to computer skills or reading and writing skills: literacy learning involves communicative skills in everyday life, both written and oral, at school and at home or in the workplace, via digital tools.

A WIDE VARIETY OF USES AND PRACTICES AMONG YOUNG PEOPLE

The literary learning of children and teenagers linked to the use of digital technology is difficult to perceive. On the one hand, this learning is often not very visible because it develops informally, outside of traditional evaluation frameworks. On the other hand, it is learning that children and teenagers themselves do not formalise, they are not very aware of it.

Consequently, studies are multiplying to characterise young people’s digital uses. Surveys quantifying the time spent using digital tools or the number of accounts on a social network are multiplying. Thus, we know that the rate of digital equipment among children and teenagers is constantly changing. In 2009, Olivier Donnat was already talking about a “rise in the power of screen culture” (Donnat, 2009), leading to an intensification of juvenile hyperconnection (Coëffé, 2015). Tablet equipment in households with children is constantly increasing: 22% in 2013, 46% in 2014, 62% in 2015 and around 70% in 2016 (Octobre, 2018), bearing in mind that in 2017 36% of 7-12 year olds and 34% of 13-19 year olds had their own tablet (Schmutz, Guillaume, Lorenzi, 2017). 97% of 12-17 year olds have a computer at home (Brice et al., 2015). The presence of young people on social networks is becoming more and more dense over time: in 2021, 78% of 11-14 year-olds and 75% of 15-18 year-olds have a YouTube account, 75% of 11-14 year-olds and 88% of 15-18 year-olds have a Snapchat account, and 58% of 11-14 year-olds and 89% of 15-18 year-olds are registered on Instagram (Génération Numérique, 2021). Nomadic use of the Internet is also on the rise, in line with the massive equipment of children and teenagers with smartphones: 81% of 13-19 year-olds have their own smartphone (Schmutz, Guillaume, Lorenzi, 2017), and the latter is also the preferred medium for daily information for 74% of 15-19 year-olds (Ministry of Culture, 2018). According to the Junior Connect’ 2018 study, 13-19 year-olds are connected on average 15:11 hours per week (i.e. 1.5 hours more than in 2015); 7-12 year-olds spend an average of 6 hours 10 minutes on the web per week (45 minutes more than in 2015), and 1-6 year-olds 4 hours 37 minutes (compared to 3 hours 42 minutes in 2015).

While these data tell us about the digital equipment of children and teenagers, and their access to networks, they do not tell us about their digital practices and the literary learning that goes with it. There is a tendency to think that having an account on social networks or a smartphone leads to the development of digital skills. The social reality is much more complex. There is an important distinction to be made between frequency of use and skill development, as well as between appetence and expertise (Cordier, 2015).

The degree of general mastery of the computer tool appears to be very disparate depending on the children and teenagers observed. Of course, regular use of the computer encourages ease of use of the keyboard and mouse (provided that the child or adolescent has a computer, not a smarthone). Knowing how to handle the computer tool reduces the cognitive cost of information processing tasks, for example. But being comfortable using computers is not enough to be digitally literate. For several years now, French researchers specialising in computer literacy have been showing in their studies that children and teenagers have a poor command of computer vocabulary and concepts (Baron, Bruillard, 2001; Fluckiger, 2007). Moreover, the technical skills developed by children and teenagers on social networks are ‘limited and local in character’ (Fluckiger, 2008: 54). School mobilises completely different requirements in terms of information use and learning; indeed, pupils are aware of this as early as primary school (Fluckiger, Reuter, 2014).

In the field of information retrieval, there is also a gap between the feeling of mastery of the computer tool and the skills of information processing. Digital skills are severely lacking: children and teenagers use tools but are unaware of how they work technically (for example, how a search engine generates results or the consequences of the algorithm on the recommendations made by a platform). These shortcomings prevent them from exercising a critical mind when faced with information (Cordier, 2015). Based on these observations, in 2011 the Castor Competition was created in France. It is an international competition (initiated in 2004 in Lithuania) which aims to “make young people and their teachers discover computer science in a different way through

original methods" (Tort, Dagiene, 2012). The ECDL Foundation, the certification authority for digital skills training programmes, also warns of the low level of computer literacy among children and students alike (Cited by Octobre, 2018). Another important programme provides a better assessment of the computer and digital skills of French pupils: the International Computer and Digital Literacy Skills Study (ICILS), a statistical survey launched in 2018 of 13-year-old pupils from twelve countries[1]. This study confirms the average level of French pupils in the field of computing. Above all, it highlights the role of the social and cultural family environment on the performance of French pupils in terms of digital literacy.

This is an essential element, which is of great concern to researchers and education professionals as well as to the French government: the social inequalities linked to the digital uses and practices of children and teenagers. French research has been concerned with the issue of social inequalities in access to and appropriation of digital technology for several years now. The cultural practices of the French show a very strong link between "social determinants" and associated practices (Gire, Granjon, 2012). More recently, the sociologist Dominique Pasquier has devoted a study to 'the Internet of modest families' by surveying families living in rural areas. The researcher shows a great heterogeneity of use, and difficulties in carrying out complex professional or administrative tasks with digital tools (Pasquier, 2018).

In France, there is much concern about the social and professional integration of young people who have left compulsory school with little or no qualifications[2]. These young people experience significant difficulties in searching for information online, evaluating information online but also in using professional digital tools such as e-mail or word processing (Davenel, 2015; Emmaüs Connect, 2017). This correlation between cultural capital and social inclusion thanks to digital technology is not negligible: the fact of having to use digital tools to look for a job and then to work in a profession is frightening for these young people; many of them do not feel capable of entering the professional world because of their lack of digital literacy (Le Mentec, 2011).
However, it should not be assumed that only young people without a diploma have difficulties with digital technology. There are major disparities between children and teenagers in school: 'Depending on the family, the peer group and the territories in which they are located, teenagers will engage in digital practices with greater or lesser confidence, ease and boldness' (Plantard, André, 2016: 123). The quantity but also the quality of digital equipment at home has an impact on the practices of children and teenagers, and consequently on digital literacy learning.

LITERACY AND SOCIAL LEARNING

There is no doubt that digital activities are a source of learning for children and young people. Digital skills evolve over time, through different experiences and the different equipment and platforms used.

[1] Cf. https://www.education.gouv.fr/icils-2018-evaluation-internationale-des-eleves-de-quatrieme -
[2] In France, school is compulsory until the age of 16.

French researchers are committed to studying the practices of children and teenagers, and to understanding the literary learning associated with these practices. Thus, children and teenagers develop reading and writing skills with digital technology. These skills are also social, as reading is shared on platforms, and exchanges between readers feed the individual reading experience (Détrez, 2016). Writing skills also develop with digital technology. There has been a significant increase in the amount of writing produced by teenagers using digital tools: publications on social networks, blogs, fiction, fan fiction, etc. (Octobre, 2018). Research shows that SMS is a means of written production that should be given attention: writing by means of SMS leads everyone to take a new look at language (Joannidès, 2014; Penloup, 2018). Teenagers confide the pleasure they feel when they share their writings or reading experiences on collaborative platforms (Whattpad for example). Their practices show great creativity (Chapelain, 2017). However, these literary skills of reading and writing are complex and it is important to be aware of them. Reading and writing are cognitively demanding tasks, and when one is in front of a screen one reads at the same time as one writes, and vice versa (Rouet, 2016).

Like reading and writing, online informational activity is very demanding. It is necessary to know how to use search tools and understand how they work (Simonnot, 2012), not to get lost in the mass of information with which hypertextual navigation confronts us (Rouet, Tricot, 1995; Ertzscheid, Gallezot, 2003). Informational activity also implies knowing how to evaluate the reliability of information. This skill is mastered in very different ways by young people, especially as it requires cultural capital and knowledge of sources and authors (Salut, 2014; Cordier, 2018). Here again, the fact that information is often sought on the internet does not guarantee the development of digital skills.
French research on the information practices of children and teenagers shows that they like to find out about their leisure activities, current events and daily life. The web is a privileged source of information, with Google, Wikipedia and digital social networks as key resources. Children and teenagers invest intensively in YouTube to access information, whether it is to learn for their leisure, their personal development, for fun and relaxation, or for academic learning. Social media and networks have become the preferred way for young people to access information, especially news (Mercier, Ouakrat, Pignard-Cheynel, 2017; Ministry of Culture, 2018). Children and teenagers also seek information online to do schoolwork and presentations. This informational activity becomes increasingly important as they grow up (Merklé, Octobre, 2012).

In addition to the literary learning developed thanks to digital technology, the digital practices of children and teenagers contribute to their daily socialisation. Unfortunately, this fact is still little recognised, and there is a tendency to misjudge the digital practices of children and teenagers, particularly on digital social networks. It is often considered that they are wasting their time on social networks, whereas these are tools that completely support their socialisation[3].

[3] By socialisation we mean the process by which an individual integrates a society, acquiring ways of doing, thinking and being (Darmon, 2010).

On digital social networks, children and teenagers learn to know themselves better (Balleys, 2015). Digital identity plays an important role in self-knowledge, which is achieved through the eyes of others. Moreover, as in the playground (Delalande, 2009), on digital social networks children and teenagers learn to live together, to regulate their relationships and to experiment with social norms. Thus, children and teenagers undeniably build important links between themselves by means of digital tools, whether we think of the mobile phone as soon as it enters daily juvenile life (Metton, 2004), or digital social networks and other means of instant messaging. These interactions and this construction of an intense juvenile sociability are part of a real social learning process (learning about oneself, others, and interactions with others).

Children and teenagers also use networks to increase their knowledge and skills in areas of interest to them. Think of those video game players who develop scenarios and strategic skills together. Think of the teenagers who exchange on forums about cultural or political topics, or about a leisure activity. Participation in online communities allows people to share their passion, but also to socialise, and to support their own learning while also supporting that of others (Cordier, 2020).

Finally, digital activities allow people to learn together to learn. High school students make extensive use of digital devices to help each other with schoolwork (Cottier, Michault, Lebreton, 2016). Video games are also considered by some researchers as levers for learning to collaborate. Video games can encourage the learning of collective life rules, with socialisation within the guild taking place, for example, through ontractualised forms of expression within the group (Berry, 2009): we learn together to play, and together to be players.

THE SCHOOL AND CHILDREN'S DIGITAL CULTURE

The previous section shows the diversity and richness of children's and teenagers' digital practices. Unquestionably, with digital technology, the development of literary and social learning outside the classroom is exponential. This learning is linked to the experiences of children and teenagers in everyday situations. Yet learning linked to everyday life has traditionally suffered from a very negative image, or even total ignorance (Brougère, Ulmann, 2009). Today, the Covid-19 crisis has accelerated awareness of the existence of this learning and the need to take it into account in schools. The different contexts in which digital practices are deployed deserve a great deal of attention (Furlong, Davies, 2012). French schools are multiplying initiatives to support children and teenagers in learning about digital culture.

DIGITAL TECHNOLOGY: A TOOL FOR TEACHING OR A TEACHING OBJECT?

In France, public policy on digital technology is very proactive. Equipping schools with computers and tablets has been a concern of governments for many years. Similarly, there is a large number of institutional texts encouraging digitally-based teaching.[4]

These texts sometimes deal with computer skills, sometimes with digital culture, oscillating between the digital as a tool for teaching and the digital as an object of teaching.

In July 2013, the "Law on the Orientation and Programming of the School of the Republic" testifies to a desire to develop students' citizenship. Following this, in 2015, a "Digital Education Plan" was put in place, which emphasised the need to "bring schools into the digital age". This involves a massive equipment plan for schools, for teachers and for pupils. The 'deployment of digital technology' is illustrated by the fact that, at the start of the 2016 school year, 1,510 collèges will be equipped with tablets for pupils in the 5th grade (aged 12), i.e. approximately 175,000 pupils. Digital technology is thus announced as a tool for school learning. The aim is to 'create favourable conditions for the widespread use of digital technology in education'. It is clear that the vision conveyed here is that of digital technology as a learning tool, at the service of teaching, and not that of a digital culture, which develops concepts and includes knowledge on platforms and networks.

In July 2019 a new law is introduced, called "Law for a School of Trust in July 2019"[5]. This law aims at setting up a major public policy on digital education. Here again, a massive equipment plan is planned for schools. The educational concerns highlighted by the Ministry of Education in the digital domain are cyberbullying and data protection. As part of a European movement (the DIGCOMP framework), the Reference Framework of Digital Competences comes into force at the start of the 2019 school year[6]. Sixteen skills are identified within 5 main areas: Information and data, Communication and collaboration, Content creation, Protection and security, Digital environment. The aim is to "certify the digital skills of pupils throughout their schooling". In the institutional speeches, we can see that the emphasis is placed on data education and the protection of personal data, and an International Data Protection Training Framework, published by the CNIL (Commission Nationale Information et Libertés) completes the certification offer.

4 It should be remembered that in France, school curricula are applied throughout the country according to the same ministerial directives and expectations. An Orientation Law recalls and/or establishes the general principles and objectives that the education system must pursue.
5 Cf. https://www.education.gouv.fr/la-loi-pour-une-ecole-de-la-confiance-5474
6 Cf. https://www.education.gouv.fr/bo/19/Hebdo37/MENE1915146D.htm

TAKING INTO ACCOUNT THE STUDENT AS A SOCIAL BEING: A DIFFICULT CHALLENGE

Analysis of French public policies on digital education informs us of the way society views the digital practices of children and teenagers.

Official French texts are unanimously characterised by the mention of digital activities, and more broadly informational activities, that pupils carry out outside the school sphere, in particular in their leisure activities. The school must therefore take into account the pupil as a social being confronted with multiple experiences and situations beyond the classroom. The 2013 Framework Law takes into account the fact that pupils use information-communication tools both in the school sphere and outside of school: pupils must learn "to use the digital communication and information tools they encounter on a daily basis with discernment".

However, the view of children and young people's digital practices is a worried look. The lack of "responsibility" on the part of young Internet users, particularly with regard to managing their digital identity on the networks, is regularly pointed out. The school's objective is to develop "responsible behaviour" and "responsible use".

This worried look of young people's digital practices was reinforced after the attacks of 7 January 2015, and above all its range of concerns was broadened. While the concern for the traces left during browsing remains a preoccupation, we note that institutional texts now systematically allude to the permeability of young people to conspiracy theories, the risks of radicalisation and fake news as elements that endanger democracy and the exercise of critical thinking. We are therefore concerned about the ability of young students to assess the reliability of information, to "interpret" information, but also to control their "online self-representation". It is a whole societal fear that is expressed here, that of seeing its young people succumb to disinformation and radicalisation movements, turning them away from republican values.

The learning developed in the framework of leisure in the 2013 Law is then placed in the background of educational concerns in favour of a major concern: that of a political world turned upside down and the fear that French children and teenagers will not exercise enlightened citizenship.

PROMOTING EQUAL OPPORTUNITIES THROUGH AN EMANCIPATING DIGITAL CULTURE

Since 2013, French schools have been entrusted with a new mission: "to develop the knowledge, skills and culture necessary for the exercise of citizenship in the contemporary information and communication society". The introduction of media and information literacy (MIL) and digital education is an important part of this civic construction. However, the challenge is colossal, and several elements deserve particular attention in order to truly work for equal opportunities by providing all children and teenagers with an ambitious digital culture. French researchers are playing a very active role in this societal and political reflection on digital education.

COMBATING INEQUALITIES THROUGH DIGITAL EDUCATION IN SCHOOLS

First and foremost, recognising inequalities in access to digital technology is a key requirement if we are to be able to fight social inequalities collectively and not make schools a place where they are reproduced. In spite of proactive political discourse, digital equipment in schools is still lacking. In many primary schools (children aged 3 to 10), the teacher does not even have a connected computer in the classroom, and the computer room, when it exists, is hardly operational. In secondary schools (11-18 year olds), there is more equipment, but it is not very efficient. This obviously has an impact on teaching situations and teaching and learning practices.

However, equipping schools is not enough. As we have seen, French researchers unanimously note a lack of technical skills and digital knowledge among pupils. The link between digital practices outside school and school requirements in the digital field is important to make in a concrete way. It has been observed that teenagers who mobilise important digital skills, in video games for example, do not transfer these skills to the school environment.

In order to help these transfers, it is necessary to recognise the existence of these digital practices and literary learning outside of school. Researcher Marie-Claude Penloup argues that this "ignored knowledge (...) can serve as a support for the achievement of institutionally targeted learning" (Penloup, 2007: 07). Online reading and writing are both common and very demanding youth practices, as we have seen above: in this sense, teachers must help children and teenagers to read and write on networks (Amadieu, Tricot, 2014; Penloup, 2018). Digital tools can improve the structuring of writing as well as its general quality (Amadieu, 2018). Finally, online information practices cannot be ignored, as they are important for children and teenagers, and raise crucial educational issues: learning to evaluate information, understanding how platforms and algorithms work, identifying one's information needs, and carrying out a rigorous and effective research process. The goals to be achieved in this area of digital information literacy are essential to ensure equal opportunities for children and young people.

FOR A SHARED DIGITAL CULTURE

In order to develop an ambitious digital culture among all French children and teenagers, educational situations involving digital technology must make it possible to create links between the digital practices of children and teenagers. Generally speaking, the more children and teenagers are confronted with a variety of learning situations, the more they can develop rich practices and learn to mobilise the relevant skills at the right time. This also implies that the digital uses and practices of children and teenagers should be considered in a benevolent manner, rather than constantly pointing out their flaws or their uselessness (adult views on juvenile behaviour).

Moreover, I am keen to campaign here for a digital culture that is not limited to a utilitarian vision of the digital world. Using and manipulating are not enough. We need to understand, we need to explain. Digital technology is not a toolbox, it is not a sum of software and applications. Digital technology is a culture, mobilising concepts and skills in extremely varied situations. The French school must be the place where all children and teenagers, whatever their origin, whatever the economic wealth of their parents, gain access to an understanding of the technical tools and the economic, cultural and social logic underlying the platforms. In addition to a technical culture, with Olivier Le Deuff I advocate a citizen's conception of digital culture that gives everyone the means to act consciously on the networks (Le Deuff, 2009).

In general, digital literacy should definitely be thought of not as a procedural technique but as a set of words, concepts and approaches in information and communication.

Conclusion

In France, scientific, professional and educational events are multiplying to consider the integration of digital education, but divisions also persist within the education system, between those who consider this education natural in the current context, and those who are worried about the domination of screens in schools, and call for a re-centring on what they consider to be "fundamental learning" (reading, writing, counting, without screens). More concretely, in schools, the situations appear to be quite disparate, if only in terms of equipment, which partly conditions the possibilities of applying digital education in the classroom; primary school teachers in particular have great difficulty in thinking about effective digital education in their schools.
In addition to the question of equipment, there is also the question of the conception of digital technology, which is still too often seen as a set of tools to be used for learning, rather than as a culture of information and communication.

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HUNGARY

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My name is Fási Andrea and I am from Hungary (e-mail: fasi.andrea@oh.gov.hu). Workplace: Educational Authority.

I graduated as an English-Geography teacher in Eger in 1997. I taught students from age six to nineteen in public education from 1997 to 2018. I have also participated in adult education in a private language school. I have been an examiner of ECL Language Exam for years. I have always been interested in trying new methods in teaching and build in using digital tools during my lessons. Since 2018 I have been leading a European Union Project, which deals with digitalism in education, finding new ways and methods of teaching making learning more enjoyable for students.

Digital competence in Hungarian public education

ABSTRACT

The review of the Hungarian National Curriculum 2011[1] was completed in 2020. The new curriculum (NAT 2020 – National Curriculum 2020)[2] was introduced into public education in grades 1-5-9. Public education in Hungary consists of primary education (ages 6 to 14, grades 1 to 8) and secondary education (ages 14 to 18, grades 9 to 12). The Hungarian National Curriculum presents in detail the necessary competences and knowledge that different age groups should have in various literacy areas when leaving the educational system. Based upon this new National Curriculum, new books were created for students. These books are also available in digital form[3] and are rich in interactive, generative websites. The 'Smart Portal' (Nemzeti Köznevelési Portál – National Public Education Portal) also made a big step forward as it presents more and more useful interactive contents in a growing number of educational fields, which contributes to the everyday work of teachers in education.

The developers of the Hungarian National Curriculum included the recommendations of the European Parliament and Committee in connection with required key competences for lifelong learning. Among these competences, several fields are transversal (embracing different cultural fields and age groups), enabling students to develop basic skills that support their lifelong learning.

Digital competence is one of the transversal key competences for which a learning opportunity is created in the National Curriculum, in detail and specified for the different subjects. The documentation as published describes how the possibilities of the recommendations in the digital competence framework DigComp 2.1[5] in five key competence fields (1. Information and Data Literacy, 2. Communication and Collaboration, 3. Digital Content Creation, 4. Safety, 5. Problem Solving) and the connected twenty-one sub-fields are to be exploited to contribute to more effective learning and teaching.

In 2020 an unexpected event highlighted the importance of digital competencies. The pandemic made the success of digital learning and teaching methods of the direct (teachers, students) an indirect (parents) participants of public education visible. In March 2020, schools in Hungary were closed during the lockdown and teachers and students had to rely on digital methods, contents and platforms in order to facilitate distance education for all age groups. This situation highlighted that the digital competence level of the participants of education is heterogeneous and there is a need to draw an integrated expectation with respect to this level. This level serves as a starting point for further improvement.

Since 2017, a European Union Project[6] in Hungary has been working on a method to use digital tools, methods and contents to make Hungarian education more modern and successful. One of the project focuses is the formation of a digital requirement system for students, teachers, school leaders and schools with the aim of creating a clear, measurable and evaluable system for schools and other stakeholders in public education. By measuring and evaluating their digital competencies, their learning paths can be made explicit.

The determination, improvement and evaluation of digital competence levels of educators are based on a recommendation joint the Digital Competencies Progress System of Hungarian Pedagogue.[7] This recommendation on its turn is based on the DigCompEdu[8] EU.

Following the guidelines of this recommendation, the changes in the Hungarian Pedagogue Progress System are now being formulated. After its completion, the digital competencies of teachers can be measured and evaluated in more detail. One of the main aims is to improve teachers' digital skills and competencies, so they will be able to improve these skills and competences of their students in a proper way.

Hungary joined MENTEP (Mentoring Technology-Enhanced Pedagogy)[9] and uses the accompanying online self-evaluating tool. It helps Hungarian teachers – besides teachers from 18 other countries – to evaluate their digital competence in their mother tongue.

Students' (and thus: future employees') digital competence levels were framed according to DigComp 2.1 EU.

The digital parameters of public schools had to be framed as well. The 'Digital Register System'[10] (Digitális Névjegy Rendszer) was used as a base. This base uses the DigCompOrg Framework[11] (which is widely used in the EU) and the European self-evaluating system SELFIE[12] as inputs.

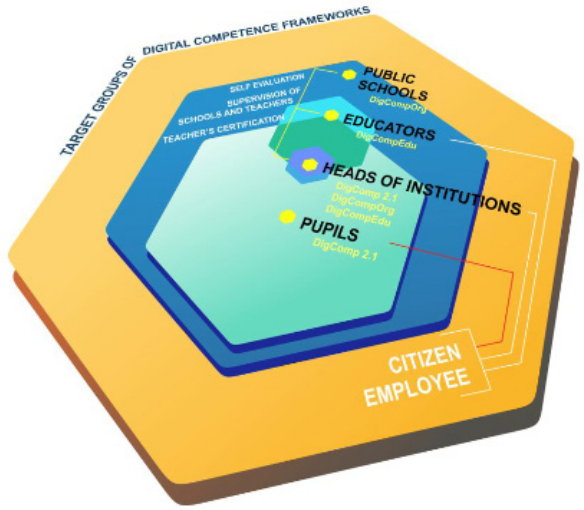
As the final goal of the project is to increase students' learning efficiency, the main focus is on developing their digital competence. To reach this goal, several products were developed in the project, each of which offers a small degree of support for children and adolescents on their way to active citizenship, social integration and their future jobs.

1 CXC. law of national public education, 2011; https://net.jogtar.hu/jogszabaly?docid=a1100190.tv
2 National Curriculum 2020; https://magyarkozlony.hu/dokumentumok/3288b6548a740b9c8daf918a399a0bed1985db0f/megtekintes
3 Books and study aids; https://www.tankonyvkatalogus.hu/
4 Recommendation of the European Parliament and Committee (18th Dec.,2006); https://eur-lex.europa.eu/legal-content/HU/TXT/?uri=celex:32006H0962
5 DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use https://publications.jrc.ec.europa.eu/repository/bitstream/JRC106281/web-digcomp2.1pdf_(online).pdf
6 EFOP-3.2.15-VEKOP-17-2017-00001 Measuring, evaluating and digital development connected to the framework of public education, forming and renewing of innovative education management methods https://www.oktatas.hu/kozneveles/projektek/efop3215
7 The Hungarian recommendation joint Hungarian Pedagogue Progress System based on DigCompEdu (2017. XII.) EU https://www.oktatas.hu/pub_bin/dload/unios_projektek/efop3215/Javaslat_a_pedagogusok_digitaliskompetencia_szintjeinek_meghatarozasahoz_2020_04_30_MK.pdf
8 DigCompEdu https://ec.europa.eu/jrc/en/digcompedu
9 MENTEP http://mentep-sat-runner.eun.org/
10 Digital Register System https://dnr.dpmk.hu/page.php?pid=86
11 DigCompOrg Framework https://ec.europa.eu/jrc/en/digcomporg/framework
12 SELFIE https://ec.europa.eu/education/schools-go-digital_hu

THE IMPROVEMENT OF STUDENTS' DIGITAL COMPETENCE IS A HIGHLIGHTED TASK IN THE NATIONAL CURRICULUM WHICH BECAME OPERATIVE SEPTEMBER, 2020

As a result of the latest revision of the National Core Curriculum in 2011, the new draft was published in August 2018. Following professional, social and political consultation, the final version of the National Curriculum was introduced in Hungarian public education in September 2020, together with the framework curricula.

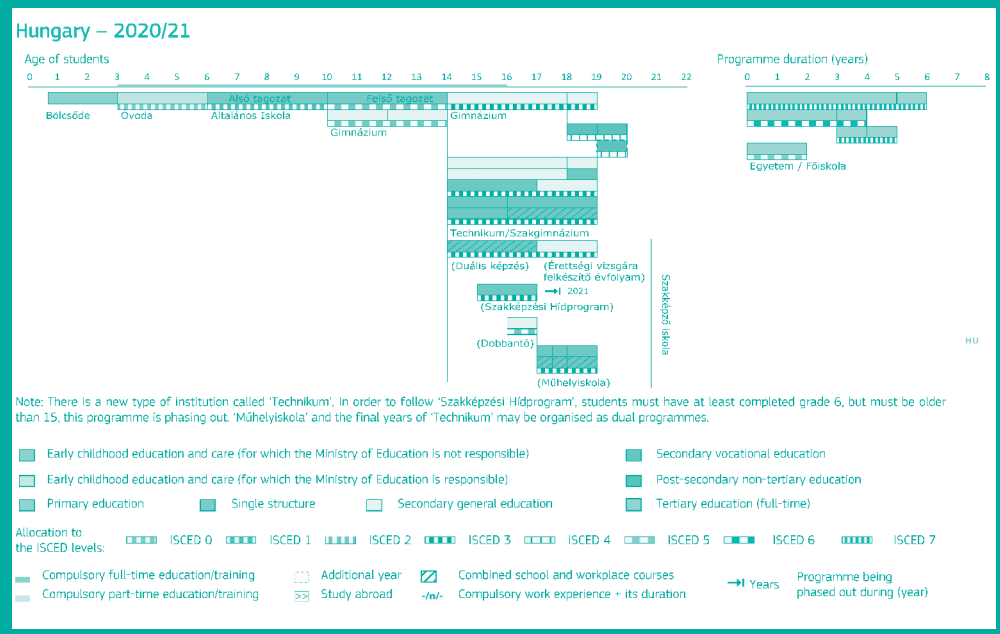
These documents set the aims of education at primary and secondary level, the subject system, the subjects, their content and requirements, the tasks for developing cross-curricular knowledge and skills and the timeframe which meet the requirements. The policy emphasises the importance of differentiated, active learning and brings together principles to support effective learning.



Following the EU recommendation, the National Curriculum and the framework curricula are based on key competences, which includes digital competence as a separate area. A new feature of the 2020 curriculum regulations is that each subject description has a separate place for the use of digital tools and methods, and the application and development of pupils' digital competences. The expectations include learning activities that are recommended to be carried out in digital form.

The concept of the new National Curriculum therefore identifies the development of digital competences as transversal competences and an area of development in all subjects. An important result is that the area of Technology has been included as a completely new learning area in the subject system with two new content areas,

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN HUNGARY

Technology and Design and Digital Culture, which will be taught throughout the 12th grade of public education. With this step, the National Curriculum has taken a larger role in the field of digital transformation.

The Digital Pedagogical Development Group of the relevant project has examined and analysed the extent to which the digital developments in the content of the curricula of several subjects are in line with the recommendations of the DigComp 2.1-based Digital Literacy Framework for Hungarian learners.

As the summary chart below shows, the most significant digital literacy developments for pupils are in upper primary and the 9-10th grades of secondary school. They also emerge in lower secondary school, but their importance is not yet as significant at this stage of learning. In the 11th and 12th grades, the focus is on consolidating and applying the knowledge acquired. Of the five areas, Information and Communication are the most targeted areas for development, but Content Development is also prominent in some subjects. The areas of competence least focused on in the framework are Security and Problem Solving and, unfortunately, there are still some competences which are not yet reflected in the subject development descriptions.

SUBJECTS	GRADES
Visual Culture	1-4; 5-8; 9-10
Music	1-4; 5-8; 9-10
Drama	7-8; 12
Film and Media	11-12
Technology and Design	1-4; 5-8
Digital culture	5-8; 9-10
Mathematics	1-4; 5-8; 9-12
Hungarian Literature and Grammar	1-4; 5-8; 9-12
Foreign Language	1-4; 5-8; 9-12
History	5-8; 9-12
Civic Education	8; 12
National and Ethnological Studies	5-8
Ethics	1-4; 5-8
Geography	5-8; 9-10
Science	3-4
Chemistry	7-8; 9-10
Biology	7-8; 9-10
Physics	5-8; 9-10

Recommendation for matching DigComp 2.1 learners and MKKR (Hungarian Qualifications Framework) levels 1-4					
Competence area (5)	**Competence (21)**	**Expectations at basic and intermediate level – Competency level and MKKR level**			
		Basic level		Intermediate level	
		Basic level 1	Basic level 2	Intermediate level 1	Intermediate level 2
		grades 1-4	grades 5-8	grades 9-10	grades 11-12
		MKKR 1	MKKR 2	MKKR 3	MKKR 4
1 Information	**1. Browse, search and filter information**	xxxxxxx	xxxxxxxxxxxxx	xxxxxxxxx	xxxxxx
	2. Evaluation of information	xxxxxxx	xxxxxxxxxxx	xxxxxxxxx	xxxxxx
	3. Storing and retrieving information	xx	xxxxxxxxxxx	xxxxxxxxxxx	xxxx
2 Communication	**4. Interaction through technology**	xx	xxxxxxxxxxxxx	xxxxxxxx	xxxxxxx
	5 Sharing information and content		xxxxxxxxxxxx	xxxxxxxxxx	xxxxxx
	6. Exercise online citizenship		xxxxxx	xx	xx
	7. Cooperation through digital channels	xxx	xxxxxxx	xxxxxxx	xxxx
	8. Netiquette	x	xxx	xxx	x
	9. Digital identity management		xxxx	x	xxx
3 Digital content creation	**10. Content development**	x	xxxx	xxxxxxx	xxx
	11. Digital content integration and redevelopment	x	xxxxxxx	xxxxx	xxxx
	12. Copyright and licences		x	x	x
	13. Programming	x	xx	xxxx	
4 Safety	**14. Protecting digital devices**	x		x	
	15. Data and digital identity protection	xxx	xxxxx	xx	xxx
	16. Health protection	xx	xxxxx	xxxxx	
	17. Environmental protection	xxx	xxxx	xxxxx	
5 Problem solving	**18. Solving technical problems**				x
	19. Defining needs and choosing the right technology	x	xxxx	xxxx	x
	20. Creative use of innovation and technology	x	xxx	xxx	x
	21. Identifying digital literacy gaps			x	

DIGITAL COMPETENCES IN THE CURRICULA (EDUCATIONAL AUTHORITY)

MEASURING AND EVALUATING STUDENTS' DIGITAL COMPETENCE

The Hungarian Educational Authority formulated a framework aiming to determine and improve students' digital competence level.

Children from a very young age use digital devices but experience shows that besides daily used programmes and applications most students are hardly aware of the functions of their mobile phones or use these functions on purpose. An animated film, made by the Hungarian Educational Authority, showed how students can use their smart gadgets smartly when learning, entertainment, practical functions, being a citizen and last but not least communication are considered.[13] How students use their smart gadgets assumes open, creative, logical thinking, the continuous and wide-scale improvement of their digital competence during the time they spend in education.
In education it is desirable to build on a standard that sets target expectations and determines possibilities for developing further in every school grade.

One of the background factors in the development of 'The recommendation on a framework of digital competence expectations for learners' is that digital competence is one of the eight key competences for lifelong learning and it is essential for participation in an increasingly digital society (see the European Recommendation on Key Competences published in 2006.[14])

Digital literacy can be broadly described as the confident, critical and creative use of ICT (information and communication technologies) achieving goals in work, employment, learning, leisure, social inclusion and/or participation. Therefore, the second pillar of the description is the EU Recommendation DigComp 2.1.[15]
The DigComp 2.1 European framework summarises the four different domains of digital competence by listing 21 competences in terms of knowledge, skills and attitudes. Each of the 21 competences described in the framework is presented in the same format, which includes a definition of the competence, a description of the four levels (basic, intermediate, advanced and expert), examples of knowledge, skills and attitudes related to the competences, and examples of how the competence can be applied in the learning field.

The digital competence areas of citizens can be adapted to the digital competence areas of learners:

1. **Information:** Identify, locate, retrieve, store, organise and analyse digital information, assessing its relevance and purpose.
2. **Communication:** Communicate in the digital environment, share resources online, connect and collaborate with others through digital tools, participate in communities and networks.
3. **Digital content creation:** Create and edit new content (from word processing to images and videos), incorporate and revise previous knowledge and content, use creative expression methods, awareness of intellectual property rules, programming skills.
4. **Safety:** Personal privacy, data protection, digital identity protection, security measures, safe and sustainable use.
5. **Problem solving:** Identify digital needs and resources, make informed choices about tools appropriate to purpose and needs, solve conceptual problems digitally, creativity in using technology and problem solving, updating their own and others' competences.

The development of the 'Recommendation on a framework of digital competence expectations for learners' is a further prelude to the publication of the Hungarian Digital Education Strategy (DOS[16]) adopted by the Hungarian Government in 2016, focusing on the digital competence expectations to be acquired in public education.

The national framework recommended for the target group of pupils was developed based on the European framework of digital competence expectations for citizens DigComp 2.1, keeping its structure and the description of the individual competence areas, while keeping the expectations of the Hungarian National Curriculum on digital competence development in mind.

The main difference between the European and the Hungarian recommendations on the framework is that the latter focuses only on the competences to be acquired during the period of public education, and thus does not include the four levels of the framework of digital competence expectations for citizens. It is only developed for the two levels that can be identified in public education, the basic and the intermediate level.

The recommendations provide an overview of the digital competence expectations for learners, outlining and expanding all competences – as defined in DigComp 2.1 – in a way that they can be linked to the subject content defined by the Hungarian National Curriculum. Public education must play a dominant role in developing pupils' digital competences.

13 https://www.youtube.com/watch?v=gfZmLEO4D4s (5th April, 2021)
14 http://eur-lex.europa.eu/legal-content/HU/TXT/?uri=celex:32006H0962 (30th November, 2020)
15 https://ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/digcomp-21-digital-competence-framework-citizens-eight-proficiency-levels-and-examples-use (30th November, 2020)
16 https://digitalisjoletprogram.hu/files/55/8c/558c2bb47626ccb966050debb69f600e.pdf (30th November, 2020)

The Educational Authority is working on the development of a digital platform for the National Competency Tests, and later for the school-leaving exams, following the international student performance measurements. The new methods could open up new areas of understanding and measuring student competences. Digital measurement has many administrative and organisational advantages, allows pedagogical and professional innovation, and is more in tune with our times than paper-based measurement. The development of complex, modular, multifunctional measurement software is underway, and access to it will most likely be via the online TehetségKapu[17] (https://www.tehetsegkapu.hu/), which is already in use.

It also requires a higher level of digital confidence from students, as the new interface requires a different way of navigating than a page-turning notebook, more and more versatile visuals need to be explored, the ability to type confidently is a must, and the use of built-in digital aids is valid. All this can also allow the digital competences of learners to be assessed while solving the tasks set.

DIGITAL INTERFACES FOR CENTRAL LEARNING AND TEACHING

National Public Education Portal (Nemzeti Köznevelési Portál), Kréta e-diary (Kréta e-napló), Digital Collaboration Space (Digitális Kollaborációs Tér, sulinet (schoolnet portal)

The sudden introduction of a digital working method outside the classroom in Spring 2020 has led to a huge sense of unity among teachers. Self-organised groups of teachers shared their digital materials and experiences and compiled the best digital platforms from all over the country in editable Excel files.

The institutions that were able to get through this period easier were those that were able to choose a common platform quickly where students and teachers could keep in touch, organise online lessons, and implement some kind of digital classroom on a daily basis.

Many curriculum development websites have also made their databases available free of charge to make students' and teachers' work easier. An unprecedented collaboration has been achieved in this difficult situation, which has probably given a huge boost to the understanding of digital pedagogical methodology and its integration into everyday classroom practice.

This period also led to the Hungarian Educational Authority bringing forward the launch of the new, more modern and content-rich website of the National Public Education Portal (www.nkp.hu). The site previously offered mostly pdf content and had fewer interactive features. The new version offers teachers a much wider range of truly interactive tasks for almost all subjects, for grades 5-12. The smart textbooks for the new National Curriculum (NAT) have been uploaded, which also contain interactive elements themselves. The platform includes an educational media library, a taskbar for active and differentiated learning and a secure search interface. Registered teachers can personalise the interface dashboard, edit their own assignments and assignment flows, keep in touch with their registered colleagues and students, and learn about good practice from other teachers.

The e-Kréta[18] digital diary has been used by Hungarian teachers for years to keep track of weekly lessons, student absences and assessments, and messages to parents. From October 2020, the Digital Collaboration Space[19] has been added to the collaborative websites. The pandemic has also prompted the inclusion of this element. It is a complex digital platform that enables full online collaboration between learners and teachers within the e-Kréta system. The interface allows communication, online submission and return of assignments, homework administration and online lesson organisation. The platform can also handle group and project assignments, deadlines and can register assessments immediately in the e-Kréta system's student assessment recording interface, eliminating multiple administration for teachers.

Schools are not obliged to use the Digital Collaboration Space. Each institution could decide which digital platform to use for student collaboration. Many of them decided on the Digital Collaboration Space.

DIGITAL SCHOOL

The country's competitiveness largely depends on the quality of education, which is why creating and supporting high-quality public education is a priority. The general spread and application of digitalisation is necessary at all levels of society, and the existence, development and control of digital competences are equally important at the level of individuals and organisations. The Hungarian framework describing the digital competences of public education institutions[20] was developed alongside the Digital Wellbeing Programme[21], the Digital Education Strategy and the EU recommendation on the subject, DigCompOrg.

In order to start the digital transformation in an educational institution, a number of decisions have to be made, the conditions for the transition have to be created and the highest possible commitment to the topic has to be achieved among the members of the organisation. It is important not to expect rapid change, but rather to set a precise timetable for achieving the objectives, which should be as flexible as necessary.

[17] TehetségKapu https://www.tehetsegkapu.hu/ (25th March, 2021)

[18] E-Kréta diary https://tudasbazis.ekreta.hu/pages/viewpage.action?pageId=2424855 (5th Ferbruary, 2021)
[19] Digital Collaboration Space https://www.youtube.com/watch?v=v1xQjpOnYow (15th January, 2021
[20] Digital School https://www.oktatas.hu/kozneveles/projektek/efop3215 (19th May,2021)
[21] Digital Wellbeing Programme https://digitalisjoletprogram.hu/ (10th March, 2021)

The role of a supportive leader who can guide the planned and agreed processes is crucial. Every public education institution is unique, and it must be accepted that there are no ready-made strategies for transition, but it is worthwhile to look carefully at the possible principles, objectives and pitfalls.

The Recommendation describes the digital orientation of public education institutions in relation to technology and pedagogy. Importantly, the process is not about the technology itself, but about the pedagogical processes it positively catalyses. However, to reach the aim requires significant investment and a long learning process, which takes time, patience and attention, and may even encounter resistance from educators. This process is also described by the built-in SAMR model.[22]

It is also essential to take into account the elements that are holding back the digital transformation of institutions. For example, there is a problem if the institution lacks the necessary digital infrastructure, if the principal is not able to manage processes well, if teachers are resistant, if there is a lack of internal and external training, if new forms of learning are not pedagogically designed, or if there is a lack of balance between traditional and new pedagogical methods.

Recommendations can also be made for adapting digital pedagogies that are already being used successfully by educational institutions elsewhere. Examples include 'flipped classrooms' or 'bring your own device' (BYOD) solutions. We can use the opportunities of augmented reality (AR) or virtual reality (VR). We can easily implement differentiation in learning organisation, individual progression with chatbots, digital classrooms, or use gamification as parts of the curriculum.

It is worth determining standards for what a digitally well-equipped classroom looks like in a kindergarten, primary school or secondary school. It is advisable to summarise, in an inventory-like manner, the elements of digital infrastructure, network devices, software used, and the creation of secure operation. It is important to declare that successful operation in this area is also only possible with the cooperation of all those involved. The motivation and activity of pupils must be maintained at all times and the methodological knowledge of teachers must be constantly improved.

The 7 key elements of DigCompOrg, its 15 core elements and 74 descriptors, provide a clear framework for all organisations to succeed in their digital transformation. However, it is also essential that education governance provides the legal framework for these processes.

The digital transformation of public education institutions is facilitated by the availability of sophisticated institutional feedback and development tools that help to determine the level of digital maturity of the institution and to identify directions for further development. Today, in our country, two such self-assessment tools are available to institutions. One is SELFIE, developed by the EU, and the other is the national Digital Names Badge System (DNR).

DIGITAL COMPETENCES FOR TEACHERS AND SCHOOL LEADERS

The DigCompEdu framework describing teachers' digital competences was developed in 2017 based on the DigComp 2.1 framework for citizens' digital competences and the DigCompOrg framework for digital competences of educational institutions.

DigCompEdu was created to detail how information and communication technologies (ICT) can be used to improve and innovate education at all levels of teaching.

The DigCompEdu framework includes, according to the European Recommendation[23], six main areas of competence:

1. professional environment; 2. exploring, creating and sharing digital resources;
3. using and aligning digital tools with the teaching and learning process;
4. supporting the assessment process with digital tools and strategies;
5. engaging learners through digital tools;
6. developing learners' digital competences.

The more detailed competence descriptions assigned to the main competence areas – 22 competences in total – focus on the use of digital tools and the development of effective, inclusive and innovative learning strategies. The description of the digital competences that teachers are expected to develop in order to manage the learning and teaching process is provided in the framework's competences 2 to 5.

The recommendation for a national framework of expectations for teachers in digital competences is the same as the DigCompEdu framework in terms of the identification of core competence areas and the competences assigned to each area. The definition of more specific competence expectations within the core competence areas was guided partly by European trends and partly by the digital competence expectations of the national teacher certification system.

The description of the expectations of Hungarian teachers, in terms of digital competences, is in line with the DigCompEdu framework, in the same way as the European recommendations, and in the same way as the levels – A1-A2, B1-B2, C1-C2 – and the categories – Newcomer, Explorer, Enthusiast, Professional, Expert, Pioneer – are in line

[22] SAMR-modell https://blog.mimio.com/hs-fs/hubfs/Blog/samr_1024-1.png?width=706&height=386&name=samr_1024-1.png (8th February, 2021)

[23] https://ec.europa.eu/jrc/en/digcompedu (30th November, 20219)

with the categories used in the national teacher certification system. The pictograms, based on the means of transport, are used to illustrate the substantive differences between the levels.

NEWCOMER – EXPLORER – ENTHUSIAST – PROFESSIONAL – EXPERT – PIONEER

DIGITAL LITERACY LEVELS OF HUNGARIAN TEACHERS

Within each of the core competences, the areas assigned to each competence are further elaborated to describe the digital competences that are generally expected from teachers.
Progress at each level of digital competence does not directly correspond to levels of progress in the system of teacher certification. It is necessary to underline that the actual practical existence of digital competences can only be expected and qualified in a very differentiated way, depending on the status of the public education institution employing the teacher, the function of the institution and the nature of the actual pedagogical activity. A realistic assessment of the existence of digital competences and the adequacy of the level achieved can only be made depending on the current and future digital expectations required by the job tasks.

The expectations of Hungarian teachers in terms of digital competences were published in a chart by the Educational Authority in April 2020.[24]

In the Hungarian school system, the leaders of public education institutions are teachers as well. The tasks of the head of the institution are prescribed by law: they are responsible for, among other things, drawing up the rules of the institution, making proposals for the development of the pedagogical programme, organising and supporting pedagogical work, leading the teachers' staff, and creating healthy and safe conditions for everyday work. The recommendations on digital literacy requirements for the heads of institutions[25] concern this target group, as it is their competence and responsibility to develop organisational and personal digital literacy, to initiate and encourage educational innovation through digital technologies, and to provide the necessary personnel and material conditions. The definition of digital literacy expectations for deputy heads of institutions, heads of practical training and heads of professional working groups should be an internal institutional responsibility.

[24] https://www.oktatas.hu/pub_bin/dload/unios_projektek/efop3215/Javaslat_a_pedagogusok_digitaliskompetencia_szintjeinek_meghatarozasahoz_2020_04_30_MK.pdf (1st April, 2021)

[25] Digital competence expectations for the head of a public education institution based on the DigComp EU Recommendation https://www.oktatas.hu/pub_bin/dload/unios_projektek/efop3215/DigComp_intezmenyvezeto.pdf (1st April, 2021)

The digital competences framework was developed irrespective of the type of public education institution the head is in charge of (kindergarten, primary school, secondary school, college) and does not include separate promotion levels.

The digital expectations for heads of institutions are mainly based on the following four recommendations: the DigComp EU recommendations (DigCompEdu, DigComp 2.1,

DigCompOrg), the Hungarian Digital Education Strategy, the legislation on public education and the relevant elements of the Hungarian teachers' career development system. The work was complemented by additional background material. These included models that could be adapted from the competitive sector in the field of organisational and management theory, the descriptions of the areas of competence and competences of heads of institutions in the training of heads of public education at the Budapest University of Technology, the Central European Competence Framework[26] for school leaders, the incorporation of the self-evaluation of heads of institutions in Hungary, and the areas of the national pedagogical-professional audit relating to the supervision of school leaders. The digital competency expectations for heads of institutions were formulated by expanding the five main areas of leadership in terms of knowledge, skills and attitudes:

1. in the strategic leadership and operational management of development/learning and teaching
2. in strategic leadership and operational management of change
3. in the strategic and operational management and control of his/her own leadership and activities
4. in the strategic leadership and operational management of others
5. in the strategic leadership and operational management of the institution

In addition to the expectations, a digital competence framework proposal adapted to the EUROPASS framework has been published, which describes the characteristics of a master level user in five areas (Information Processing, Content Creation, Communication, Problem Solving, Security), which is the level expected from the heads of institutions.

MEASURING, ASSESSING AND DEVELOPING TEACHERS' DIGITAL COMPETENCES

The Hungarian teacher career system introduced in 2014 classifies all Hungarian teachers into 5 categories based on professional experience and quality of work: Trainee, Teacher I, Teacher II, Master and Researcher, where the first three levels are compulsory for all teachers.

[26] Central5: Central European Competence Framework for School Leaders http://oktataskepzes.tka.hu/content/documents/Central5_fuzet_2013_HU_web.pdf (2nd April, 2021)

These certification procedures are complemented by teacher self-evaluation and supervision, which takes place every few years and consists of a wide-ranging self-assessment and/or peer review of teacher competences. The professional work of Hungarian teachers, including at the level of certification, supervision and self-evaluation, is currently assessed on the basis of 66 indicators in 9 main areas of competence. It was questionable whether the digital competence will be included in the rating system as a new, 10th competence, or whether the indicators of the existing 9 competences will be modified and supplemented in such a way that the digital professional and methodological culture of individual teachers will become measurable and assessable.

After extensive professional consultation, it was finally decided that there will not be a separate digital competence area, but the indicators of existing teacher competences will be expanded. It is envisaged that 6 existing indicators will be modified and 4 new ones will be added at the mandatory qualification levels. In the teacher career development system, the existence and level of digital competences of individual teachers can be measured and assessed essentially on the basis of the digital professional and methodological elements of the teacher's professional practice. When evaluating digital methodological competence, it is necessary to take into account the technical equipment of the given public educational institution, and the age and level of development of the pupils/children. It is not specifically the use of digital tools that should be examined, but the transformation of mind-sets and attitudes in professional pedagogical work, preparation, self-development and communication.

The level of digital literacy will also become measurable and assessable in the supervision procedures for teachers, heads of institutions and institutions by integrating ICT expectations into the current assessment areas.

The MENTEP (Mentoring Technology-Enhanced Pedagogy) questionnaire, also available in Hungarian, helps teachers to self-assess their digital competences. The EU project ran between 2015 and 2018 and involved teachers from 11 countries. After the development and impact assessment, in 2018 Hungary joined the list of users of the self-evaluation questionnaire specifically designed for teachers. The purpose of the questionnaire is to monitor the areas, quality and potential of teachers' work supported by digital methodologies and to provide individual feedback to the online questionnaire respondent on their own level of preparedness, while comparing their results with the self-reported preparedness of their national and international colleagues. The self-assessment interface measures four broad themes, helping teachers to identify areas for their own development: Digital pedagogy, Digital content use and creation, Digital communication and collaboration, Digital citizenship.

Hungarian teachers could try the tool from 2019. Between 2019 and 2020, the Educational Authority carried out a survey with teachers to find out how Hungarian teachers are doing in the different areas.

The analysis sought to answer two questions:

1. What is the average digital competence of Hungarian teachers compared to the average of teachers in 11 countries?
2. What are the average digital competences of Hungarian teachers in each of the four subject areas compared to the average of teachers in the 11 countries?

Based on the results of those who voluntarily completed the questionnaire, it can be concluded that the distribution of Hungarian teachers' digital skills by level is similar to international trends, with no significant difference between international and Hungarian data.

The pandemic of 2020-2021 gave a big boost to the introduction process of the digital readiness survey, which accelerated the pace of the change of mind-set of teachers and heads of institutions, and catalysed the development of the technical and methodological background.

SUMMARY AND FURTHER GOALS

It is clear that Hungarian public education has taken several steps to prepare, accelerate and implement a progressive and digitally oriented methodology of public education and training. The goals, possibilities, methods and infrastructural conditions of the process have been formulated. Measuring and evaluation tools have been developed to ensure that all participants in education are aware of where they are in the digital switchover process, whether they are students, teachers, heads of institutions or the institution itself. The efforts of all those involved are equally needed now and in the future. The speed of progress has been helped by the unexpected event of the coronavirus pandemic, which created difficulties but also opportunities. It is necessary to summarise the results of the learning process resulting from this forced situation. It is necessary to discard the attempts that have not worked and to incorporate into the present teaching the methodological elements that have helped pupils to develop. There will be no return to the situation as it was before the pandemic.

There are still many tasks ahead. Once the objectives have been set and the situation assessed, intensive teacher training should begin. Teacher training should include a high level of digital methodology in every subject area. It is also necessary to plan and organise professional development for teachers in public education institutions, where they cannot only learn from external experts and consultants, but also learn from and try out good practices of their own experienced and successful colleagues in the field, with their continuous help and support. This will require the provision of diverse and differentiated task banks, accessible digital platforms, administrator support for learning and teaching in all subjects, and a reliable and maintainable infrastructure for all learners, teachers, classrooms and schools.

IRELAND

SUSAN NIC RÉAMOINN

Susan Nic Réamoinn has been the Irish language Education Officer with NCCA since 2018. Susan has worked across a number of projects at primary level in NCCA including the redevelopment of the Primary Language Curriculum and consultation on the new primary curriculum framework.

Susan has ten years teaching experience in both English and Irish-medium primary schools and has a particular interest in second language development and the use of technology in the early years.

Susan has a Master's in Business and Information Technology from Dublin City University and is currently pursuing a PhD at Trinity College Dublin, on how the use of robotics can aid language learning in the early years of primary education.

BEN MURRAY

Ben Murray is currently a Post-Primary Director with the NCCA. He has responsibility for curriculum and assessment design at junior cycle and senior cycle levels. He has 25 years teaching experience in both the primary and the post-primary sectors in Ireland; as a Music, a Classics and a digital media teacher. Over the course of those 25 years, Ben has coordinated a thriving music department, enjoyed a few years as a Deputy Principal, acted as mentor and adviser for initial teacher educator (ITE) students and has been involved in the design and deployment of teacher professional learning.

Ben is particularly interested in researching the embedding of key competencies in teaching, learning and assessment; in the role that technology plays in allowing collaborative cultures to thrive in classrooms and how these collaborative environments support the development and assessment of current and emerging key competencies.

SINÉAD TUOHY

Sinéad Tuohy joined NCCA in 2019 as an Education Officer with responsibility for post-primary developments.

Prior to assuming this role in NCCA, Sinéad previously worked as a post-primary teacher for eleven years teaching through both English and Irish before becoming involved in teacher professional learning. Over the course of eight years she has designed, developed and facilitated professional development programmes for teachers and school leaders to support the National Literacy and Numeracy Strategy, School Self-evaluation and the implementation of the Framework for Junior Cycle.

Sinéad has a particular interest in supporting young people to become active and responsible digital citizens and has been a researcher and manager of two Erasmus Plus projects (KA3), both with a focus on the development of digital literacy and the embedding of key skills into teaching learning and assessment.

TONY RILEY

Tony Riley joined the NCCA as an Education Officer in 2017 and is responsible for curriculum and assessment developments at primary level.

Having qualified in New Zealand, Tony has worked as a classroom teacher for over 30 years in both primary and post-primary school settings in New Zealand, United Kingdom, and Ireland. He currently works across a number of projects within the NCCA primary team. Tony is responsible for the research and development of the digital technologies competency and subject area as proposed in the draft primary school curriculum framework.

He is an active member of the executive committee for the Computers in Education Society of Ireland and is currently pursuing a Master's in Education in Dublin City University's Institute of Education.

Digital literacy in Irish curriculum – an expanding presence

NATIONAL COUNCIL FOR CURRICULUM AND ASSESSMENT (NCCA)

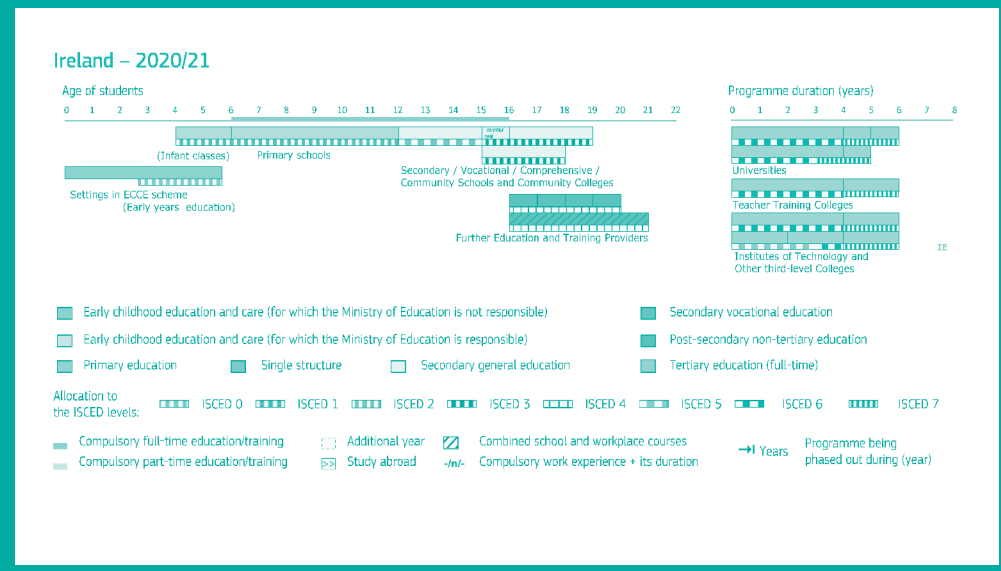
ABSTRACT

The National Council for Curriculum and Assessment (NCCA) is the statutory body in Ireland that advises the Minister for Education on matters in relation to curriculum and assessment for early childhood education, primary and post primary schools. In this paper, we outline how Ireland is fostering and supporting the use of digital technology and being a digital learner in the early childhood, primary and post-primary education.

Creating and sharing media in a digital environment has become an increasingly important feature of how young people communicate and engage with each other and with the wider world. The rapid growth and expansion of online platforms and applications coupled with the increasing access to information from a range of sources highlights the importance of understanding what it means to be a digital learner. Integrating digital technology into the curriculum supports broadening the imagination of children and young people while expanding their creative thinking and encouraging a positive and responsible attitude towards technology.

This paper will outline the work we are undertaking to support the development of children and young people as digital learners. It will explore how digital media literacy continues to be integrated into the curriculum in Ireland, with opportunities for children and young people to develop and grow as digital citizens and to apply these skills in a range of contexts, both within the classroom and in their daily lives.

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN IRELAND

INTRODUCTION

This chapter looks at a number of key initiatives in curriculum development, curriculum implementation, teacher education and improved learner outcomes in relation to digital technology and digital media literacy in both primary and post-primary education in Ireland. Over the last decade, Ireland's approach to educational policy development with regard to digital literacy has sought to embed and integrate digital technologies in teaching, learning and assessment, through a variety of national policies and initiatives.

Ireland's Digital Strategy for Schools 2015-2020; Enhancing Teaching, Learning and Assessment, provides a rationale and a government action plan for integrating ICT into teaching, learning and assessment practices in all schools. This Strategy builds on previous initiatives in the area of ICT integration and is the result of extensive consultation and research with education partners and stakeholders. Some of those previous initiatives include Project Maths (NCCA, 2008); the National Strategy to Improve Literacy and Numeracy among Children and Young People 2011-2020, (DES, 2011); the Framework for Junior Cycle (DES, 2015); The School Self-Evaluation Programme (DES Inspectorate, 2012) and the STEM Education Policy Statement and Implementation Plan (DES, 2017b; 2017c).

There are also a number of government policies outside the education sphere that have an impact on digital media literacy education. These include Ireland's Third ICT Skills Action Plan; the Action Plan for Online Safety and other national policies affecting data protection and online behaviours. As an agency that advises the Minister for Education on matters relating to teaching, learning and assessment, our advice is always looking to and cognisant of this broad policy landscape.

This chapter explores curriculum developments (both current and emerging) that detail how in Ireland, we are building a curriculum that provides for the development of digital literacy skills in all students, with a focus on primary and lower secondary education. In some cases, this takes the form of standalone subjects, in others, digital literacy is seen as a cross-cutting and cross-curricular aspect of teaching, learning and assessment. Firstly, before exploring specific curriculum developments in both the primary and post-primary sectors, it is worth looking at the Digital Strategy for Schools referenced above, as this is a cross-sectoral strategy that is compulsory for schools to implement.

POLICY TRENDS IN EDUCATION

Livingstone (2011) notes the potential of education to support the development of digital media literacy skills while Zhang et al (2020) highlight the 'benefits and significance' of digital media literacy education. O' Neill et al (2017) echo this and contend that the attainment of skills required by citizens to participate effectively in a digitally and globalised context is underpinned by the need for educational support. This educational support for effective digital citizenship 'is a matter of digital literacy, a form of literacy that encompasses the personal, technological and intellectual skills that are needed to live in a digital world' (p. 15).

To support the development of these digital literacy skills, the development of overarching national policy in the area of digital literacy is a significant and necessary support for curriculum development and provision. We will look in detail at one such policy, the Digital Strategy for Schools 2015-2020, Enhancing Teaching, Learning and Assessment.

DIGITAL STRATEGY FOR SCHOOLS 2015 – 2020; ENHANCING TEACHING, LEARNING AND ASSESSMENT

The Strategy and its accompanying Digital Learning Framework provides a rationale and an action plan for integrating ICT into teaching, learning and assessment practices in Irish primary and post-primary schools over the lifespan of the Strategy. The vision for ICT integration, as outlined in the Strategy is to "realise the potential of digital technologies to enhance teaching, learning and assessment so that Ireland's young people become engaged thinkers, active learners, knowledge constructors and global citizens to participate fully in society and the economy" (p. 5).

The Strategy encompasses all aspects of the education ecosystem and has been developed around four key themes:

- Teaching, Learning and Assessment Using ICT
- Teacher Professional Learning
- Leadership, Research and Policy
- ICT Infrastructure

The Strategy endeavours to ensure that on leaving post-primary education, students have acquired the key skills of higher-order thinking, creativity, independence, and collaboration, and a sound base of ICT competencies that will support their learning on transition to further or higher education (p. 12).

In considering the future of curriculum design, the Strategy provides that any new and/or revised curricula, syllabi and teacher guidelines will include clear statements regarding why and how digital technology should be used in teaching and learning, particularly in relation to components of the national literacy and numeracy strategy, and across all subjects and areas of learning (p. 22). This will mean that future curriculum specifications can drive effective application of ICT in learning, and support teachers in developing students' digital learning and digital literacy competencies (p. 23).

The Strategy also recognises that the existence of a pedagogical orientation that supports an active use of technology by teachers and students in schools increases the likelihood of ICT being used effectively in teaching and learning. Supports to develop this pedagogical orientation are created and disseminated through various support

services and agencies (as detailed later) and through the accompanying *Digital Learning Framework.*

This Digital Learning Framework (DLF) is a key objective of the Digital Strategy and has been adapted for the Irish context from the UNESCO ICT Competency Framework drawing also from other relevant European and international Digital Competency Frameworks. The localisation of these frameworks, through the development of the Digital Learning Framework, provides clarity for teachers in terms of how they can effectively embed digital technologies into their practice and guides school leaders and education providers in creating a shared vision for how technology can best meet the needs of all learners (p. 1).

The structure of the DLF is directly aligned to the domains and standards of the school self-evaluation process as detailed in Looking at our School 2016 – *A Quality Framework for Primary and Post Primary Schools* and as a result, articulates effective and highly effective practice for the use of digital technologies in the two key dimensions of **Teaching and Learning** and **Leadership and Management.** An important function of this framework is to assist schools in identifying the areas of their practice that are effective or highly effective, to identify and prioritise the areas where improvement is needed, and to help them chart an improvement journey (p. 2). Support for teachers and schools in implementing the Digital Learning Framework is provided by the Professional Development Service for Teachers (PDST). The https://www.pdsttechnologyineducation.ie/en/ provide a comprehensive programme of in-school supports, workshops for school leaders and online CPD and webinars to support schools with the overarching vision for the integration of technology as outlined in the Digital Strategy for Schools 2015-2020.

The Digital Strategy and its accompanying framework are part of a digital literary policy ecosystem that includes policies form both within and outside the education sector, as detailed in the introduction. We will now consider how the vision of this Strategy is realised within curriculum policy, as we explore curriculum developments with a focus on digital literacy in the primary and post-primary sectors.

PRIMARY CURRICULUM REVIEW AND REDEVELOPMENT

Since the publication of the Primary Curriculum 1999 there has been an acceleration in the volume of research on children's learning and development in the early childhood (birth-4 years) and primary school (4-12 years). Much of this research offers fresh insights into how children learn and develop across the areas of the curriculum. These research studies include Literacy and Numeracy for Learning and Life, Growing Up in Ireland, Children's Schools Lives. As well as the need to respond to curriculum challenges and to take account of new and emerging research findings, there have also been calls for the primary curriculum to do more. Schools and the curriculum, together, are often viewed as a critical site for responding to national priorities or needs and addressing societal problems. This is evident in calls for increased time to be allocated to existing curriculum areas such as Social, Personal and Health Education (SPHE) and to Physical Education (PE). Additionally, there are demands to include new aspects of learning in the curriculum such as Coding and Computational Thinking, Education about Religions and Beliefs (ERB) and Ethics, Modern Foreign Languages, and to place a greater general emphasis on Wellbeing. The NCCA's work on the primary curriculum review and redevelopment began with the development and implementation of a new Primary Language Curriculum followed by the development of a new primary Mathematics Curriculum and the publication of the Draft Primary Curriculum Framework.
The next four sections provide an overview of each of these areas and highlight how digital technology is supported across these areas.

PRIMARY LANGUAGE CURRICULUM

The first significant development in the ongoing process of redeveloping the primary curriculum has been the development and implementation of the Primary Language Curriculum/Curaclam Teanga na Bunscoile, in 2019. Language learning enables children to understand the world around them and to communicate effectively with others. Communication takes many forms, from the non-verbal and verbal to print-based and digital texts. As new technologies continue to emerge and as a result of living in a society and culture increasingly influenced by digital technologies, digital literacy is an important aspect of children's learning. The Primary Language Curriculum supports children's abilities to engage with technology to acquire, comprehend and communicate knowledge to and with a variety of audiences and in a variety of contexts. Essential to the development of digital literacy is the child's ability to locate, select and critically analyse relevant information in multiple modes to include text, visual and audio. It also includes the capacity to engage with digital technology in creative and imaginative ways. Appropriate use of digital technologies in the classroom can help children to demonstrate knowledge, skills and understanding in accordance with the learning outcomes for all three strands of the curriculum: oral language, reading and writing. By enabling them to engage with digital technologies from the start of primary school, teachers can support children to foster a positive attitude towards the use of digital technologies and to use technology responsibly and appropriately during language learning experiences and across other areas of the curriculum. As children become digitally literate, they can use a variety of digital technologies to develop understanding and to source, critique and manage information as engaged thinkers and active learners.

PRIMARY MATHEMATICS CURRICULUM

Ongoing work relating to a new primary mathematics curriculum are also taking account of developments in the digital technology space. Research commissioned to support the development of the new curriculum highlights the increasing role technology can play in expressing mathematics understanding and thinking and enhancing learning opportunities for children (Dunphy et al., 2014). Specifically, it points to the potential technology affords in bringing real-world applications to life in the classroom, helping to deepen mathematical understanding and connect mathematical learning to the real world (Dooley, 2019). Such findings will be reflected in the new curriculum, accompanying support materials and examples of children's learning. Furthermore, the approaches associated with computational thinking will be implicitly embedded in the curriculum, with strong synergy evident between them and the mathematical processes, which are integral components to the curriculum.

DRAFT PRIMARY CURRICULUM FRAMEWORK

Following the development of the Primary Language Curriculum and the Mathematics Curriculum NCCA is currently engaging in a consultation process on the recently published draft primary curriculum framework. This framework presents the vision, principles and key competencies of the primary curriculum including areas and subjects. This framework is currently under consultation with stakeholders including children, parents, teachers, and school leaders.

The framework outlines 'being a digital learner' as one of seven key competencies and includes technology as an integrated subject within the curriculum area of Science, Technology and Mathematics.

FIGURE 1 DRAFT PRIMARY CURRICULUM FRAMEWORK - KEY COMPETENCIES

DIGITAL TECHNOLOGY AND THE DRAFT PRIMARY CURRICULUM FRAMEWORK

As part of the Digital Strategy for Schools 2015-2020, NCCA was asked to consider approaches to integrating coding and computational thinking into the primary curriculum. Through this research, NCCA identified several common approaches used internationally to integrate coding into a primary school curriculum. These included locating coding within a broader curriculum area such as computing or computer science; applying some of the fundamental underpinnings of coding within subjects such as mathematics, science and the arts; and developing it across the curriculum as an overarching competence.
NCCA highlighted the value of working with teachers to identify current practice in relation to coding and computational thinking and established a schools-based initiative to explore with schools how, where and to what extent the two could be integrated into a redeveloped primary curriculum. The report highlighted the motivation teachers had for teaching computational thinking and coding in primary school. They stressed the importance and value attached to developing children's awareness of the technology:

We are living in a world that is dominated by technology,
as teachers it is our responsibility to try and prepare our students for their future.
This generation of students will experience a world even more online
and digital than the one we are living in today.
It's vital for children to function and blossom in a world where
digital technologies are the core of every functional device and
service they will encounter in learning and work.

Teachers commented that the essential skills associated with learning how to code should be taught explicitly. Once these had been mastered, the consolidation of the concepts of coding and computational thinking would be best achieved in a cross-curricular fashion. Children participating in the initiative clearly embraced the use of technology in their classrooms, using a project-based, child-centred, playful methodology with no fear of failure.

The impact of the Coding Report and other research findings led to the inclusion of 'being a digital learner' as one of seven key competencies proposed in the Draft Primary Curriculum Framework. As described, the competencies play a significant and central part in children's learning; they are embedded across all curriculum areas and subjects from junior infants to sixth class through the learning outcomes. In this way, the curriculum areas and subjects contribute to the development of the key competencies. This gives them relevance across the curriculum while providing continuity and connectivity in children's learning as they move through primary school. Like all learning, it is acknowledged that children's progress towards the key competencies will be influenced by their varying circumstances, experiences, and abilities.

The competency of being a digital learner seeks to support children to become curious, creative, confident, and critical users of digital technology. 'Being a digital learner' fosters children's ability to collaborate and thrive in a world increasingly immersed in technology. Children develop their knowledge, skills, concepts, attitudes, values, and dispositions through problem-solving, experimenting and creating. As children develop this competency, their confidence in using a range of digital technology to harness their imagination and expand their creative thinking and creative expression increases. The intention is also to empower children to be active digital citizens and to develop their responsible, safe and ethical use of technology. Therefore, enabling children to critically engage and contribute in a digitally connected and interdependent world. While the Draft Primary Curriculum Framework is still under public consultation until 2022, NCCA continues its research in the area of digital technology with a focus on;

- Communicating and collaborating with others through digital technology
- Accessing, analysing and managing content using digital technology
- Enabling content creation, problem-solving and creativity using digital technology
- Interacting ethically and responsibly with digital technology

For the next section we will turn our focus to curricular provision at junior cycle and explore how digital media literacy is fostered and developed in post-primary education

with a focus on lower secondary education, the Framework for Junior Cycle 2015, and in particular through opportunities presented in the Digital Media Literacy Short Course.

FRAMEWORK FOR JUNIOR CYCLE 2015

Junior cycle refers to the stage of education for 12-15-year-old students in Ireland. Within junior cycle, teaching, learning, assessment, and reporting is underpinned by the Framework for Junior Cycle 2015 which seeks to ensure a student learning experience 'appropriate to the needs of the 21st century' (2015 p.2). Figure 1 below provides an overview of the structure of the Framework for Junior Cycle 2015.

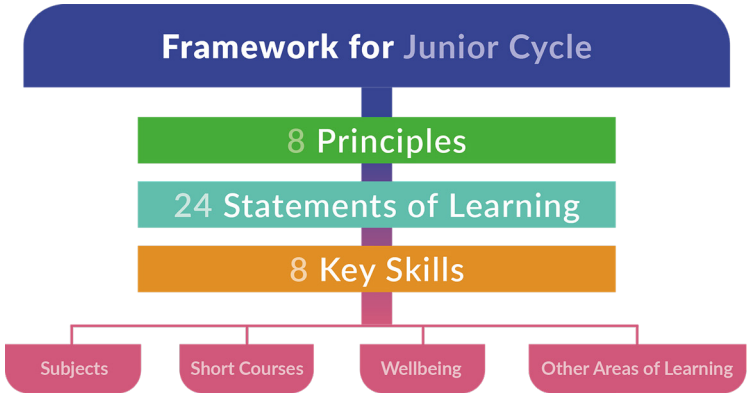


FIGURE 2 OVERVIEW OF THE FRAMEWORK FOR JUNIOR CYCLE

The Framework for Junior Cycle reflects the concept espoused by Halinen (2017) of a curriculum designed to support a changing and dynamic society while also building towards the future. Approached in this way, the Framework for Junior Cycle supports the cascading goals model outlined by the OECD (2020) with education embracing broader societal goals.

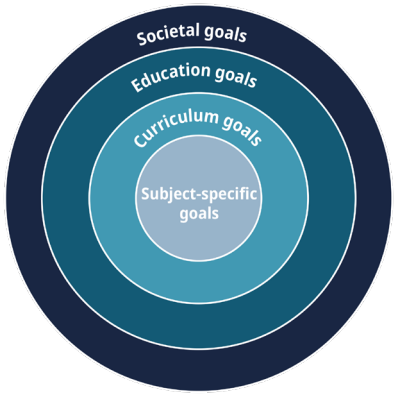


FIGURE 3 MODEL OF CASCADING GOALS (OECD, 2020 P. 73)

This model of curriculum lends itself well to the development of cross-curricular skills such as digital media literacy and digital citizenship as Frau-Meigs (2017) and O'Neill et al (2017) underline the transversal nature of digital citizenship and digital literacy. O'Neill et al (2017) propose that digital citizenship 'involves the values, skills, attitudes, knowledge and critical understanding' (2017 p.15) required in the digital world. The OECD further emphasise the importance of cross-curricular learning in supporting the development of digital media literacy, noting that 'cross-curricular themes are likely to be understood when concepts from different disciplines are learned in an authentic and meaningful way, such as environmental sustainability, global citizenship and media literacy (2020 p.63).

Reflecting this cross-curricular conceptualisation, the development of digital media literacy skills permeates the Framework for Junior Cycle 2015 and students have multiple opportunities across the curriculum to acquire and improve these skills during their three years of education through the Statements of Learning, Key Skills embedded into teaching and learning across the curriculum and in particular, through the Digital Media Literacy short course.

A set of twenty-four Statements of Learning are central to the student experience in junior cycle and schools must ensure that all statements of learning are offered to their junior cycle students. Within these twenty-four statements, two have a particular link to the development of digital media literacy, Statement 11 and Statement 24.

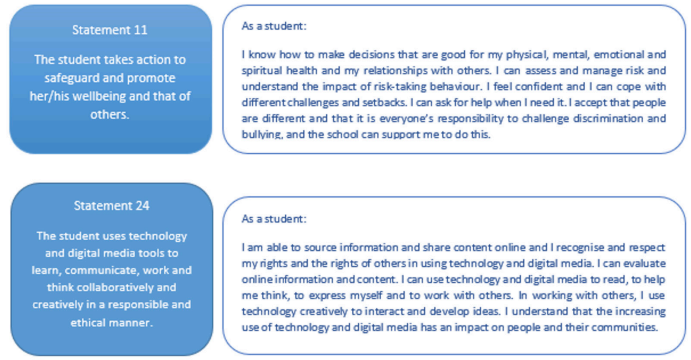


FIGURE 4 STATEMENTS OF LEARNING 11 AND 24 WITHIN THE FRAMEWORK FOR JUNIOR CYCLE

As indicated in Figure 2, the Framework for Junior Cycle 2015 also sets out eight key skills which support students learning across the curriculum and for learning beyond school similar to the key competencies within the primary curriculum. These key skills are embedded in the learning outcomes within each junior cycle subject and short course. Each key skill includes a number of elements, with the development of digital media literacy featuring in each key skill (Figure 6). The elements are set out in student-friendly language to ensure that students can access and understand the key skills and thereby take greater responsibility for their learning.

FIGURE 5 JUNIOR CYCLE KEY SKILLS

Managing Myself	Using digital technology to manage myself and my learning
Staying Well	Being responsible, safe and ethical in using digital technology
Managing Information and Thinking	Using digital technology to access, manage and share digital content
Being Numerate	Using digital technology to develop numeracy skills and understanding
Being Creative	Stimulating creativity using digital technology
Working with Others	Working with others through digital technology
Communicating	Using digital technology to communicate
Being Literate	Exploring and creating a variety of texts, including multi-modal texts

FIGURE 6 DIGITAL ELEMENTS OF THE JUNIOR CYCLE KEY SKILLS

In addition to these cross-curricular opportunities for the development of digital media literacy, schools in Ireland also have the opportunity to engage with a short course in digital media literacy designed to offer students opportunities to explore and discover the information and knowledge accessible online, enabling them to pursue their interests, to express themselves online and solve problems relevant to their lives.

DIGITAL MEDIA LITERACY SHORT COURSE

The Digital Media Literacy short course in junior cycle was introduced in 2016. As a 100-hour programme, it aims to support students to develop their ability 'to use digital technology, communication tools and the internet creatively, critically and safely in support of their development, learning and capacity to participate effectively in social and community life'. The development of the short course seeks to address the main findings from the EU Kids Online Report (2014) which found that:

- The more children use the internet, the more digital skills they gain, and the higher they climb the 'ladder of online opportunities' to gain the benefits
- Not all internet use results in benefits: the chance of a child gaining the benefits depends on their age, gender and socio-economic status, on how their parents support them, and on the positive content available to them
- Children's use, skills and opportunities are also linked to online risks; the more of these, the more risk of harm; thus, as internet use increases, ever greater efforts are needed to prevent risk also increasing
- Not all risk results in harm: the chance of a child being upset or harmed by online experiences depends partly on their age, gender and socio-economic status, and also on their resilience and resources to cope with what happens on the internet
- Also important is the role played by parents, school and peers, and by national provision for regulation, content provision, cultural values and the education system.
- Learning for students within the Digital Media Literacy short course is set out across four strands (see Figure 7) with learning outcomes set out within each strand which outline the knowledge, understanding, skills and values students should be able to demonstrate having completed the short course. In planning the course, teachers do not follow a linear approach, but develop units of learning based on the learning outcomes across the strands.

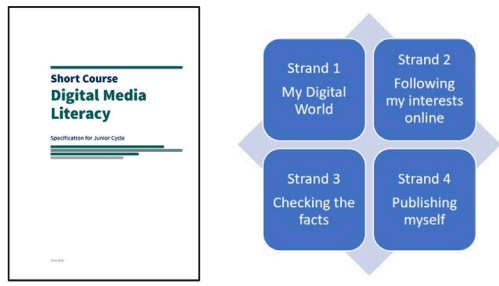


FIGURE 7 STRANDS WITHIN THE DIGITAL MEDIA LITERACY SHORT COURSE

Within **Strand 1: My Digital World**, students explore how and why to use digital technologies; investigate the ethical and legal issues around downloading media from the internet and develop an understanding of online safety for themselves and others. Through engagement with **Strand 2: Following my Interests Online**, students will explore how digital texts are published and their various purposes; they will compare

how similar information is presented in different formats and explore how to represent information using digital imagery. In their engagement with **Strand 3: Checking the Facts**, students will investigate how the choice of digital media influences and impacts on consumer patterns and explore the notion of bias and influence online. Finally, **Strand 4: Publishing Myself** provides opportunities for students to investigate online rights and risks, demonstrate good standards and protocols for online sharing of information and learn to cite and reference accurately when using online sources.
The Strands and Learning Outcomes within the Digital Media Literacy Short Course reflects the core concepts of empowerment and engagement and the four key areas set out within the Media Information Literacy epistemology proposed by Frau-Meigs (2017), with a focus on students being empowered to use digital technologies in a safe and ethical manner thereby becoming responsible digital citizens with a critical awareness of the information they encounter online.

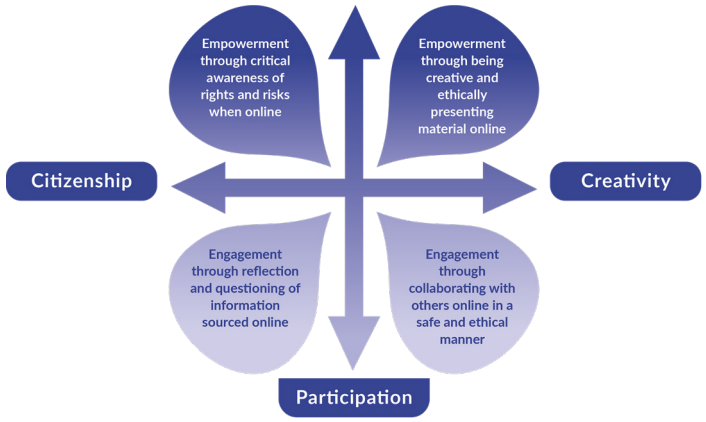


FIGURE 8 DIGITAL MEDIA LITERACY EPISTEMOLOGY WITHIN THE DIGITAL MEDIA LITERACY SHORT COURSE (ADAPTED FROM FRAU MEIGS, 2017)

Assessment in the Digital Media Literacy Short Course is based on ongoing assessment and the short course supports a wide variety of approaches to assessment as students engage in different learning activities such as discussing, explaining, researching, presenting, planning and taking action. In these contexts, students with their teachers and peers reflect upon and make judgements about their own and others' learning by looking at the quality of particular pieces of work (NCCA, 2017 p.15)

In their engagement with the Digital Media Literacy Short Course, students provide evidence of their learning in a variety of ways, including digital media, audio recordings and written pieces, all the time drawing on their learning about the safe and ethical use of information sourced online.

O'Neill et al (2017) note that assessment in digital media literacy programmes can be 'ambiguous in relation to formal assessment' (2017 p.36). However, students taking the Digital Media Literacy Short Course have an opportunity to complete a final project as their summative Classroom-Based Assessment. This is a significant piece of work that can be presented/published in an appropriate digital format and is generally completed towards the end of the course. It can be based on any topic related to the course and should demonstrate engagement with learning outcomes across all four strands. This project will be published. As part of the Classroom-Based Assessment, students should encompass an awareness of how to remain safe online, how to respond to potentially harmful situations, the benefits and risks of social networking, and how to be a respectful and responsible online citizen (NCCA, 2016 p. 15). This opportunity for independent research and publication provides students with an opportunity to demonstrate their learning, awareness and understanding of digital media literacy.

FURTHER SUPPORTS FOR DIGITAL MEDIA LITERACY IN IRISH SCHOOLS

To further support schools in fostering cross-curricular digital media literacy skills, a number of support materials have been produced. Webwise, the Irish Internet Safety Awareness Centre is co-funded by the Department of Education and is co-financed by the European Union's Connecting Europe Facility and produces a wide range of materials to support schools, students and parents. Materials produced by Webwise are regularly co-developed with their Youth Panel to ensure that young people can have a real say on the issues that affect them.

Primary support materials include All Aboard for Digitown, a digital citizenship programme designed for upper primary pupils (9-12 years old) supporting children in learning about their digital wellbeing, media and information literacy, being ethical and protecting their privacy. For younger children aged 7-10 years old HTML Heroes supports learning about online safety as part of the SPHE curriculum. The programme explores safe online searching, responsible online communication and managing your privacy online and allows teachers to assess the child's awareness and understanding and award certificates of achievement.

Recent Webwise publications for post-primary include Connected, designed to support the Digital Media Literacy Short Course with modules in online wellbeing; news, information and problems of false information; big data and the data economy; online rights. The resource aims to empower young people to be effective, autonomous and safe users of technology and online media. In addition to the Connected resource, Webwise have also produced a range of materials to support the cross-curricular development of digital media literacy skills include Be in Ctrl (addressing online sexual coercion and extortion), Lockers (focusing on non-consensual image sharing) and Think B4U Click (aiming to empower students to be effective, autonomous and safe users of new media).

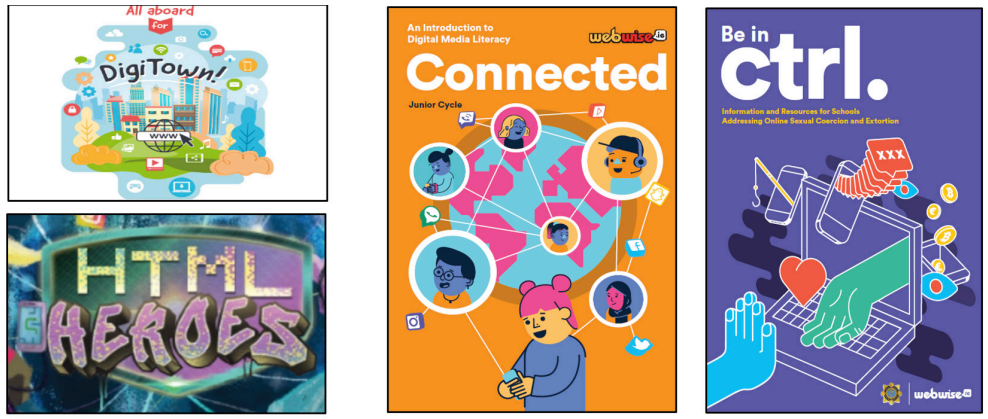


FIGURE 9 WEBWISE RESOURCES TO SUPPORT DIGITAL MEDIA LITERACY IN EDUCATION IN THE IRISH CURRICULUM

In addition, Junior Cycle for Teachers, the dedicated continuing professional development (CPD) support service produced Cloud Control a multi-media resource in association with RTÉ, the national broadcaster which support the Digital Media Literacy Short Course and the cross-curricular development of digital media literacy skills. The resource is based on an RTÉ documentary 'Cloud Control- Who Owns Your Data' which explores the topic of big data and how big data is being used for better or for worse in our day to day lives. The resource includes additional material developed with young Irish students who pose questions relevant to their lives as young digital citizens.

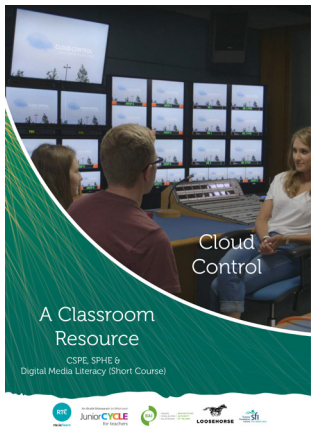


FIGURE 10 CLOUD CONTROL

Conclusion

In terms of supporting the increasing and ever-evolving digital media literacy skills required by children and young people, Livingstone et al (2020) found that the 'common call' from children and young people is for digital literacy education to be provided 'within the state curriculum' (2020 p. 14). As outlined throughout this chapter, the broader national education policy landscape and both the Primary Curriculum and the Framework for Junior Cycle 2015 provide children and young people with multiple opportunities to develop digital media literacy skills, both through standalone and cross-curricular approaches. In addition, at post-primary level, the Framework for Junior Cycle presents an opportunity for secondary schools to offer a short course in Digital Media Literacy as part of the timetabled school curriculum. This signals a clear policy intention to position and maintain the development of digital media literacy skills at the heart of the Irish curriculum.

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KOSOVO

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Digital literacy components addressed in the Curriculum Framework in Kosovo: implementation and challenges

ABSTRACT

The aim of this paper is to analyse the way digital literacy is addressed in the Education digitalization strategy and consequently in the Curriculum Framework (CF) and Core Curricula (CC) for grades 1 to 9 in Kosovo.

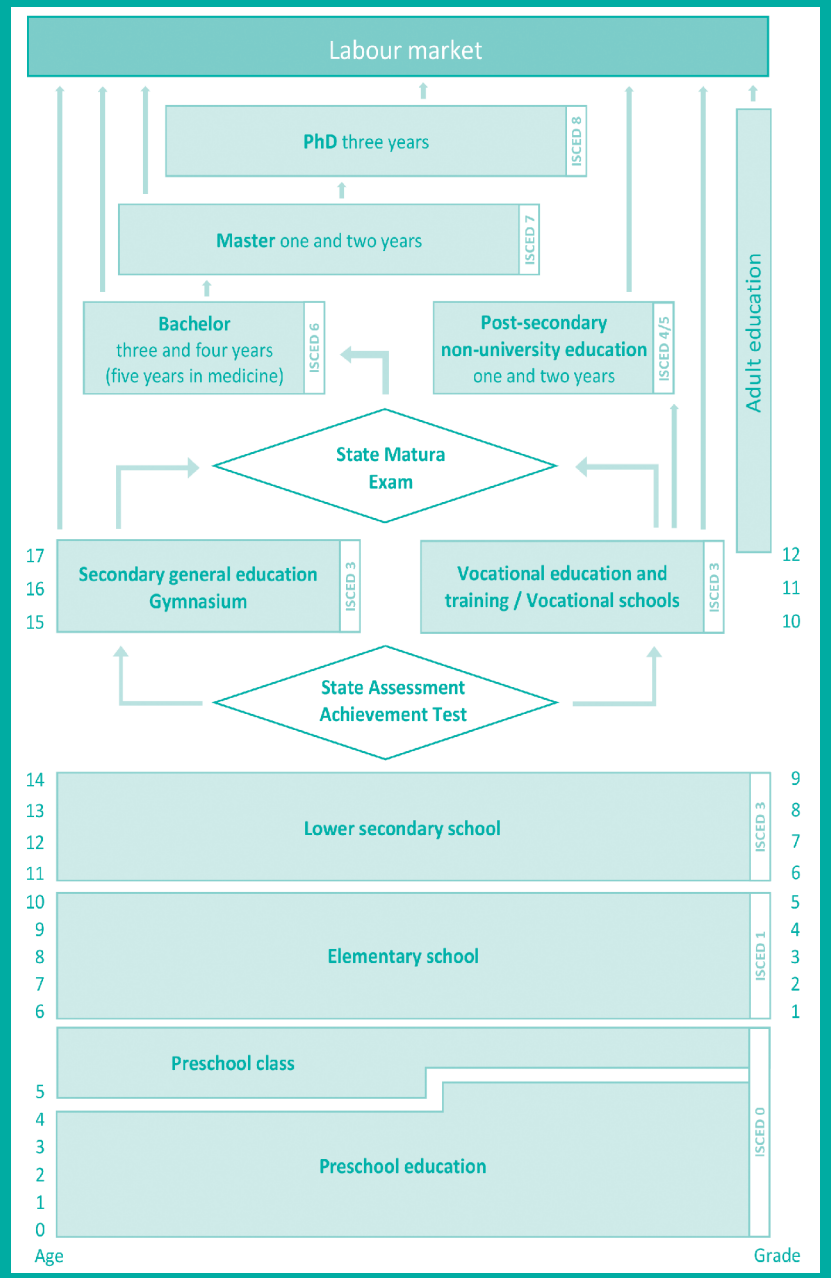
The purpose of this analysis is to identify the quantity and quality of digital literacy in the CF and CC and the challenges raised when implementing these contents in school practice in Kosovo. The new strategy for the digitization of education reflects the societal trends relevant to this issue in Kosovo. In Kosovo grades 1 to 9 are mandatory; therefore, the implementation of the new curriculum in terms of Learning Outcomes should lead to digital literacy.

Our analysis focused on the curriculum area 'Life and work', which is mainly focused on digital literacy. Based on the analysis, the inclusion of the digital component in the CF & CC is interdisciplinary, while the implementation challenges in other curricular areas are different from those in the area 'Life and work'. The implementation of digital literacy in classroom practice is found to be the most challenging because with respect to digital literacy students are often one step ahead of their teachers.

On the basis of the analysis of educational policies as represented by the CF & the Strategic Plan for institutions, we conclude with some recommendations for improving the teaching and learning of digital literacy.

Keywords: *digital literacy, curriculum, implementation, challenges, digital skills.*

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN KOSOVO

INTRODUCTION

Nowadays, an individual is considered technologically illiterate if he or she doesn't know how to use technology for communication and for work. Technology has not only become an integral part of our lives; keeping up with rapidly developing technology also presents an educational challenge. In addition, besides being a necessary means of communication between people, access to technology at the same time has become an important tool for researching resources for teaching and learning contents.

Technology as a tool for learning has continuously influenced the promotion of distance learning, the creation of new learning environments, the creation and expansion of learning collaboration networks, and the creation of attractive learning materials for students. The enormous spread of technology, in addition to providing the wide range of opportunities mentioned, has also presented challenges and surprises for a part of the educational community.

The main challenge for teachers is to keep up with the development and advancement of technology and digitization of materials and teaching resources. Specifically, the transition from using physical resources to digital equivalents is demanding for teachers. Many teachers are convinced that replacing a teacher is impossible, in which they are right, of course, as their full replacement cannot be achieved by ICT. This leads to resistance to any change whatsoever being expressed by a considerable number of teachers, especially regarding the use of digital teaching tools.

Seeing the importance, necessity, as well as the trends of technology development, the Ministry of Education reformed the curriculum to harmonize it with the current demands and needs of students. Unfortunately, teachers were not ready for the implementation of the competency-based curriculum, due to the lack of relevant pre-service and in-service training programs (Mehmeti et al., 2019).

THE KOSOVAR CONTEXT OF DIGITAL EDUCATION

Kosovo is a developing country, which has not yet bridged the gap between traditional teaching and a traditional mentality on the one hand and large-scale application of technology on the other. In this respect schooling, teaching, and learning in Kosovo are characterized by several important elements, such as:

i) Rapid expansion of Internet access for individuals and families.
ii) Penetration of the latest technology (equipment), either for communication or as a practical tool.
iii) Inclusion of digital literacy in educational policies, such as a curriculum framework and core curricula.
iv) Lack of digital competence among teachers, but also among parents, which limits the use of technology as an important tool in teaching and learning.

According to Eurostat data (2019) Kosovo has the highest rate of Internet access in Europe, with 93% of households having access to the Internet. This percentage is confirmed by the KAS survey (2020), stating that 96.4% of households had access to the Internet, while two years ago (2018) it was 93.2%. The age groups 16-24 (17.4% of the Kosovo population) and 35-44 (20.5%) had the highest access rates, while those aged over 65 (10%) had the lowest rates of Internet access (ASK, 2021). However, according to KESP 2017-2021 (MEST, 2016), it is estimated that about 76.6% of the population uses the Internet, but mainly for entertainment purposes (MEST, 2016, p.17). According to the data, there is no information on how much access to the Internet and the use of technology is utilized to access educational programs and materials. According to the same source, KESP, until 2016 about 57% of Kosovar teachers had attended the training program for ECDL (ibid., p.17). In addition, the student-computer ratio in Kosovo is 1:46, which is much lower than the EU average of 3-7 students per computer (ibid., p.19).

The issue of learning and technological skills has become a horizontal and vertical part[1], a crosscutting theme, of the Curriculum Framework (CF) and Core Curricula (CC). There is also a wider address in the Learning Outcomes for competencies, but also in the outcomes of the curricular areas. Recently, the Ministry of Education and the Government of Kosovo drafted a Strategy for the Digitalization of Education (2021-2026) including the general teaching process, from infrastructure to textbooks and teaching materials.

The need for access to digital resources for teaching and learning has led the country to orient its policies in the field of digitalization in line with current trends. In addition, specific aspects of the subject curricula should be reviewed in order to address the digitalization requirements. To address the issue of meeting the need for digitalization, in particular training of the new g eneration of students and teachers for the use of technology, the strategy has set two main objectives:

1. Strategic Objective 2: Development and use of digital teaching materials in order to increase the quality of teaching and learning.
2. Strategic Objective 4: Development of digital competence of all parties in order to successfully transform digital education, improve the quality of teaching and learning, and improve general social development (MES, 2020).

These objectives are broken down into detailed activities, a budget, and an implementation plan. Most of the planned activities aim to achieve the Learning Outcomes envisioned by the curricula. Meeting the digital demand, also as a cross-curricular competence, will help achieve the full realization of the competency-based curriculum philosophy. Analysis of the Learning Outcomes with respect to digital literacy will show how well the CF and the CC, qualitatively and quantitatively, facilitate students' acquisition of digital literacy.

[1] Note: this means extension to all levels of education (grades 1 to 9) as well as across all subjects.

THE DEFINITION OF DIGITAL LITERACY

The concept or expression of 'digital literacy' in the Albanian language, as well as in the curriculum, is used to refer to competence in using technology, as a digital competence as well as digital education. But in the CF dictionary it refers to learning with technology which is defined as: 'Learning based on the use of new information and communication technologies to advance access to information, as well as the effective and responsible use in the context of distance and networking activities' (MEST, CF, 2017).

In addition, in other official documents, strategies, and administrative instructions, the definition of digital education is based on EC/EU documents. The definition of digital competence is quoted from these documents and is used as such:

> Digital competence involves 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 cyber security), intellectual property related questions, problem solving and critical thinking (EU, 2018, p.9).

A study conducted by ICILS (2013) identified the forms and goals of technology use by teachers and students. The research included some of the EU countries, Australia, some Asian and Latin American countries. According to the data by the average of EU countries and individual countries, Norwegian students (91%) mostly use technology for listening to music, while South Korean students (63%) do so the least (Fraillon et al., 2013). Such research regarding the purpose of using technology has not been conducted in Kosovo.

The CF includes media education as an interdisciplinary opportunity, but also as an elective subject. The inclusion of content from this course is conceived as students learning and becoming aware about the use of media, including critical reading of news or other content. For this purpose, manuals and other materials for the implementation of media education have been prepared.

The Digitalization Strategy (MES, 2020) does not provide any definition of digital education, as it is considered more as an administrative document rather than a professional one. An important element of this strategy was the comprehensive aspect of the scope of digital literacy. Specifically, this is defined in Objective 1.3: Enabling all parties to contribute to digitalization in the field of education. It is therefore important to include the involvement of all parties in the process of making digitalization functional. Otherwise, without providing everyone with access to the Internet and technological equipment, the digital training of participants in the school and the learning process would not be possible.

In the same document (MES, 2020), the concept 'digitalization of education' means the supply of educational institutions with hardware equipment, software and computer networks; creating online services and digital content for the needs of the education system; as well as the development of digital competence among pupils, students, teachers, administrators and parents (MES, 2020, p.14). This is also the main goal of the government for the extension of digitalization at all levels and for all.

ADDRESSING DIGITAL LITERACY IN THE KOSOVO CURRICULUM

The issue of including student training in the use of technology was included as a crosscutting issue, and not as a separate aspect of involvement in the form of a course or module. Such an approach to digitalization has its advantages and disadvantages. Among the advantages was the obligation for digitalization to be an integral part of all subjects and levels of education. In this regard, every teacher was obliged to make digital training a priority of continuous training. Imposing this obligation increases the percentage of the population that is able to use technology and digital materials for teaching. While the disadvantage of this approach to the inclusion of technology, digital training, was considered to be the lack of addressing the technology in a particular subject, this would have ensured the sustainability and deeper inclusion of digital content. The course on Technology in compulsory schooling included not only digital learning topics but also other technology topics.

ADDRESSING DIGITAL LITERACY AS PART OF COMPETENCES

The educational point of departure of the CF is competence-based learning. The contents and the whole concept of the functioning of the compulsory education system (grades 1 to 9) were developed in this spirit. The naming and breakdown of competencies was done according to the European Competence Framework, modified according to the Kosovo context. Therefore, the CF includes six main competencies, with the digital competence extended and integrated in all other competencies. The Learning Outcomes (LO) of each competence address the ability of a student to a particular degree to 'what he or she is capable of doing', while subject Learning Outcomes address the content of 'what the learner will learn from... to fulfil the specific competency or set of competencies' (Mehmeti et al., 2019).

The basic competencies of the Kosovo Curriculum Framework (2016) include:

- Communication and express competence
- Thinking competence
- Learning competence
- Competence for life for work and for the environment
- Personal competence
- Civic competence (MEST, 2016)

To achieve these six competencies, 62 standard results were set, which students must achieve during regular schooling. Learning and teaching materials and methodologies

should be developed based on these competency outcomes. Out of 62 Learning Outcomes / Curriculum, about 6.5% addressed digital education. These results were part of effective communication skills and successful student. The results, standards, addressed the ability of what the student will be able to do using technology for learning or in everyday life, such as: 'Uses ICT and media effectively and responsibly as important tools of information, communication and interaction in the digital age' (CF, 2016, p.15). This and other outcomes were then broken down into LOs for ISCED Curriculum Levels, from elementary to the highest level of learning and application of digital knowledge and skills. In the subjects, the elements of digital literacy were included as teaching content.

Competencies for curricular areas were divided into four curriculum levels, according to the ISCED system. As for the number of Learning Outcomes for competencies according to the levels of the Curriculum were 199 LOs, while a total of 13 outcomes or about 6.53% of the total number of competency outcomes addressed digital competence. The curriculum was divided into curricular levels so that the learning contents and Learning Outcomes were adapted according to the developmental age of students. Also, as an integral part of this process was the measurement and evaluation of digital skills and knowledge. CF & CC were structured in seven curricular areas. Each curricular area contained one or more teaching/learning subjects with a certain number of teaching hours. LOs for curricular areas therefore addressed the basic concepts of those subjects.

INCLUSION OF DIGITAL EDUCATION IN THE CURRICULAR AREA 'LIFE AND WORK'

Within the structure of the Core Curriculum, there were seven curricular areas:

- Languages and communication
- Arts
- Mathematics
- Natural sciences
- Society and the environment
- Physical education, sports and health
- Life and work

The aim of the subject 'Life and work' was for students to 'develop knowledge, practice work, use of Technology and ICT, practice entrepreneurship development and achieve decision-making competencies related to professional orientation and sustainable development' (MEST, CC, 2016, p.80).

The curriculum area 'Life and work' included the subject of technology as well as career orientation, to which learning about technology was strongly related. According to the CF, each curricular area addresses the Learning Outcomes that must be met through the courses included in that area. Then each course, or course program, contains the Learning Outcomes of the course which derived from the LO/C competencies and the curricular area.

USING ICT TO ADVANCE LEARNING AND QUALITY OF DAILY LIFE	
GRADE 6-7	**GRADE 8-9**
1. Uses information from electronic sources to clarify knowledge in certain contexts.	1. Applies ICT knowledge for the presentation of certain processes.
2. Applies ICT in the content of various subjects towards digitalization in learning.	2. Uses computer programs for the practical implementation of teaching units and topics.

TABLE 1. DIGITAL LITERACY ADDRESSED THROUGH LEARNING OUTCOMES (LO) IN CURRICULA

In addition, through the Learning Outcomes of the course, the aim was to develop students' skills in using technology for communication, finding sources of information, knowledge, innovation and life and work. In the schools that had technology resources, students were also prepared for programming as well as various applications according to students' interests. However, this happened more often in private schools that focused on the development of technical and human competences. Finally, in Kosovo, there are many private companies, which provide training in programming and preparation of digital materials and various applications.

MEDIA EDUCATION PART OF CURRICULUM FRAMEWORK

The issue of media education included content related to traditional and digital media, television, radio, film, newspapers, magazines, Internet, photography, advertising and video games, media ethics, etc. (MEST, CF, p.100). Media education aimed to prepare students for the use of media, both print and electronic, as well as for the classification of information, but also for the avoidance of media abuse.

Media education was developed within the subjects, as an interdisciplinary topic, but also within the optional teaching subjects. According to the CF, when a subject, module, etc., is chosen as an optional subject by students then it becomes mandatory and is evaluated like other subjects (Mehmeti et al., 2019).

THE CHALLENGE OF IMPLEMENTING DIGITAL LITERACY IN TEACHING PRACTICE

Kosovo, with a young population where 50% are under the age of 24, and where one third of the population is up to 15 years old (MEST, 2021), continues to face many challenges in achieving digital competence. Although over 20 years have passed since the complete separation from the system of the former socialist countries, the complete reform and fulfilment of the criteria and requirements for a modern system according to contemporary trends has not yet taken place. There are still teachers trying to maintain the traditional approach for teaching dominated by teacher and ex-cathedra discourse (Potera & Shala, 2019). However, the education institutions have also not helped to equip all schools with technology and internet access.

With the reforms that were implemented and the construction of the new system where the teacher-centred approach was required to shift to a student-centred approach, not all obstacles were overcome. Even today, for most teachers, because of their traditional teaching experience, the main source of knowledge for students is considered the textbook for each subject. The new Curriculum offered wider autonomy of access to resources and didactic tools, but there was still hesitation and resistance to its full implementation at all levels of pre-university education (Mehmeti et al., 2019).

Digital education faces difficulties in its full implementation. There was an inequality between rural and urban schools in terms of internet access and technology in general. Both from the part of numerous donors and from institutions, investments in infrastructure were more focused in cities due to the larger number of students there. Due to the inequality in investment and the extension of opportunities for access to the Internet and technology, a number of teachers from rural schools have not attended training courses for the implementation of digital teaching in subjects. In addition, some teachers lacked interest (Potera & Shala, 2019).

With KESP 2017-2021 (MEST 2016) in Result 5.3., it was intended that 'All schools were equipped with ICT...', but this responsibility was left with municipalities and budget donors. If the Government aimed to achieve such an objective, then the relevant plan and budget should have been planned. In addition, with regard to the budget for the implementation of the Strategy for digitalization of education, where about €52 million is foreseen for the five-year period, it remains unclear as to how this will be provided.

A separate challenge in the implementation of digital education consists in the differences between the generations. Most students in Kosovo easily use digital technology and have access to digital resources on the Internet, while, on the other hand, many teachers do not. Therefore, a dilemma arises as to who should teach the new technology to whom: the teacher to the students or vice versa? Several teachers are reluctant to accept this change for fear of losing their authority and pride as teachers (Potera & Shala, 2019).

The issue of protecting students from the abuse of technology when they are given uncontrolled internet access is another challenge. As a result, we have frequent cases of bullying and violence among students after bullying on social networks. The best solution to overcome these challenges is to implement the national strategy for digitalization of education, which is on its initiative. With its full implementation, digital education at all levels of education at the country level will change radically.

Implementing policies to create cooperation between the private and public sector in digital education will also provide a good opportunity to prepare the next generations for the digital age. Today in Kosovo, there are dozens of private companies that deal with various aspects of technology, such as programming, training, and specialized courses for various technology applications. These companies are profitable businesses and large numbers of students and teachers do not have access to them.

DIGITAL EDUCATION IN LEARNING OUTCOMES BY SUBJECTS

Technology was a compulsory subject, from grade 6 onward, in which more aspects of learning and application of technology were included. However, CF also enabled the inclusion of Elective Learning, for which criteria were set for determining the school based on the needs and requirements of students and parents. Therefore, depending on the capacities of the school, elective teaching in the field of technology was organized.

Many schools also set up special technology laboratories, well equipped with computers and other necessary equipment. This is much more common in private schools, of which there are quite a few in Kosovo.

PERSPECTIVE OF DIGITAL LITERACY IN KOSOVO

Contemporary trends in education, teaching and learning are imposing the necessity of changing the approach to teaching, learning and forms of organization every day. A person who does not know how to use digital technology and how to access digital resources is considered illiterate according to today's standards. Human resources in the Kosovar population are very favourable for the absorption of demands for the implementation of digital technology. Now, the task and at the same time challenge for policymakers is to orient these opportunities towards the use of technology for effective teaching and learning. Therefore, the strategy for digitalization of education (MES, 2020) has addressed this issue in the specific objectives as follows:

- Specific Objective 2.2: Production of digital teaching materials in mother tongues for different levels and fields / subjects, in accordance with the law, Administrative Instruction, standards, curricula and teaching / subject programs. In Kosovo, according to the Constitution and the Law on Compulsory Education (LIE), students' education takes place in several languages (Albanian about 90%, Serbian, Turkish and Roma 10%). Therefore, teaching materials must be prepared for each mother tongue. This on the one hand is a legal obligation, but on the other hand increases the cost of preparing and implementing teaching materials.
- Specific Objective 2.4: Supply of students with technological equipment (with priority those with difficult economic situation and families with many children/students). Based on the LIE (2011) textbooks for compulsory education (1-9) are provided free of charge (refilled by the state). It must now be specified whether textbooks will be provided in the form of digital or physical devices. The strategy envisages supplying students with equipment, but not all, only those who have more students in the family or with poor social conditions.
- Specific Objective 2.5: To train teachers, students, and parents to use digital teaching materials. Many teachers have completed training for the ECDL[2], about 84%, but the implementation of technology in teaching remains a challenge for them. This is because a significant number of them do not have school equipment, personal equip-

ment or even internet access. Therefore, one of the challenges of digitalization remains equipping teachers and preparing them for the effective implementation of digitalized teaching.

Even more challenging is the promotion of digitalization of learning for parents, as they do not see it as their task to work with students at home. Did parents play an important role in organizing distance learning at the time of the COVID-19 epidemic? This has greatly influenced the awareness of parents about their role in working with students as part of teaching and helping to find resources, and completing homework assignments. According to this strategy (MEST, 2020), the focus for parents will be the issue of cyber security and protection against bullying and misuse of technology by students.

Regarding the preparation of students for the use of digital materials and access to them through the Internet, the focus is on the Learning Outcomes according to the CF and CC as well as the subject contents that will be in function of their preparation education (Mehmeti et al., 2019).
As for the perspective of the subject Technology, a radical change of the contents included in it so far is required. Especially at the higher levels of the school Curriculum, some content has already been identified as outdated and unnecessary for todays' generation of students. Additionally, several other objectives of the strategy (MES, 2020) address digitalization, such as:

- Specific Objective 4.1: Development of digital competence of in-service teachers. Educating teachers on the use of technology, especially digital competencies, are priority issues that are expected to be developed with future policies. The realization of this objective is based on the Strategic Framework (MEST, 2017), which addresses the need for professional development of teachers. Within area 3, Professional skills and practices (indicator 4.4), the teacher uses adequate technology in an adequate-safe, responsible and ethical way (MEST, 2016, p.23), predicts the levels of preparation of teachers for the use of technology in planning, teaching and in the overall leadership of the teaching process.
- Specific Objectives 4.2: Development of digital competence of future pre-university teachers, within the respective study programs. There are four faculties of education in Kosovo that deal with the preparation of new teachers. In the framework of study programs, special attention is paid to the preparation of teachers for the field of digital competence. In addition to special programs, all faculties are equipped with technology and functional cabinets. This has resulted in new teachers having no trouble using technology and computer equipment and software. A separate challenge for them is finding employment and the lack of technological equipment and laboratories in schools.

[2] ECDL- European Computer Driving License is a training program for teachers, implemented in Kosovo.

Based on the study of KPI[3] (2020) for e-learning and distance learning, a number of shortcomings have been identified in the preparation of teachers for the development of teaching through technology (KPI, 2020). Especially the preparation of digital teaching materials and the use of different platforms has been quite challenging even for young teachers of education faculties. Thus, there is an urgent need to give more space in the preparation of teachers to the application, practice, and technological knowledge rather than just to gaining knowledge of digital technology.

CONCLUSIONS AND RECOMMENDATIONS

Digital competence was addressed at a satisfactory level in educational documents. The inclusion of digital literacy at all levels of education was considered as necessity of time. This was in line with current trends in technology development as well as European and global policies to empower the new generation for the digital age.

As a developing country with a continuous goal for membership in the EU and other international mechanisms, and based on the demographic context, with the youngest population in the region, Kosovo continuously gave priority to digitization.

Curriculum change was effected to adapt to developmental trends. Adaptation of these trends required the development of supportive policies for the realization of education based on the achievement of competencies, as provided by the new Curriculum. Incorporation of digital literacy in the Curriculum had a vertical and horizontal dimension. Therefore, digital training was included in about 5% of LOs with the same level of inclusion in LOs for competencies. The curriculum was divided into six Curricular Areas. Each curricular area consisted of certain subjects. Digital literacy had a wider scope in the Curriculum Area 'Life and work', where the main subject was Information and Communication Technology (ICT). The contents of this course were not updated in line with trends and technological changes, and in many cases, they were outdated compared to the level of development of students' digital knowledge. Students' progress in learning technology was faster than changing the curricular content that addresses technological trends.

The government took some concrete steps to follow up with trends in technology development and requirements for implementation of digitization in all levels of education. In addition to changing and adapting curricula based on achieving competencies, the government developed strategies and action plans to meet these needs. The recently drafted strategy for digitalization of the education system in general represented the most serious and comprehensive step.

[3] Pedagogical Institute of Kosovo

Professional development of teachers on the use and implementation of technology in teaching should be updated according to their needs. They should be encouraged to follow-up on developments in digital technology but should also be equipped with devices and applications for effective teaching.

Internet access was another problem. During the data analysis it was found that not all schools, especially those in rural areas, have access to the Internet. Therefore, budget allocation policies for schools should be in line with development trends.

RECOMMENDATIONS

Learning Outcomes according to competencies, curricular areas and according to subjects should be transformed into necessary, mandatory standards for all students. They must accurately address the requirements and methodologies of teaching and learning, training students to use digital technology in teaching, learning and in researching secure sources of information.

ICT does not meet all the needs for the development of digital competence of students. In addition to technology, it also teaches other technology issues / topics so that important aspects of digitalization, innovation and application development remain unfulfilled. The contents of this subject should be updated in line with developments in information technology.

Syllabuses of faculties of education, which prepare teachers, should be constantly updated based on the needs and requirements of technology developments.

The issue of providing technological equipment as well as internet access should be the responsibility of the government, especially the provision of the budget, and not the municipalities or donors. In addition, the government should provide secure platforms and websites that prevent the misuse of technology.

In addition to providing access and equipment, the government should also develop awareness policies for effective implementation of the opportunities offered by digital technology without harming the health and welfare of students and school teaching staff.

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LUXEMBOURG

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Medienkompass -media- competent teaching and learning

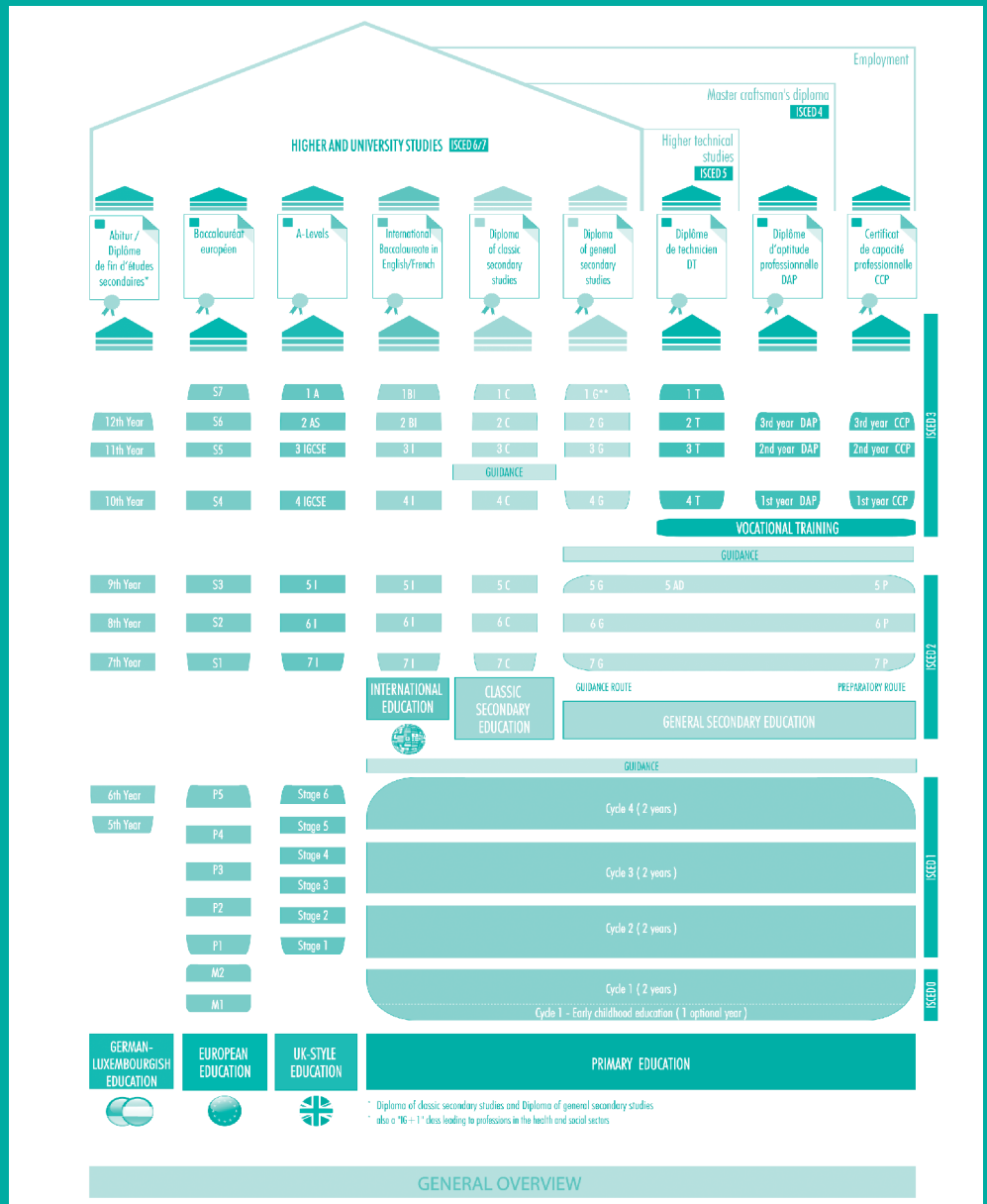
#holistic approach #digital and non-digital world #national framework #transversal competences #specific subjects #flexible implementation #challenges

ABSTRACT

This general overview of digital literacy curricula in Luxembourg illustrates the development and implementation of a transversal competence approach and the contribution of newly introduced digital media subjects in schools. A brief historical review highlights the necessity for a holistic approach in digital literacy education. To reflect the interconnectedness of digital and non-digital literacy education, this article stems from the idea of an inclusive education comprising both digital and non-digital media competences. This idea is developed in the national 'Medienkompass' framework, which defines digital media literacy as a transversal, cross-curricular competence. This approach is further developed by the introduction of specific subjects dedicated to ensure the basic understanding of underlying technological and ethical concepts.

As teaching digital media literacy represents an essential educational duty for all teachers, it cannot be done solely on the basis of a competency framework. Instead, it requires teacher training and flexible approaches for everyday use in class. In a broad overview, this article will illustrate the initiatives launched by the Ministry of Education, Childhood and Youth as well as the challenges that lie ahead to consolidate inspiring practices and make digital media literacy an integral part of all levels of education. 'Medienkompass – media-competent teaching and learning'

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN LUXEMBOURG

PREPARING THE FIELD… FOCUSSING ON MEDIA LITERACY

Luxembourg has a long tradition of grassroots initiatives led by individual teachers and schools to incorporate elements of media literacy into their lessons. In order to foster and bundle these initiatives, the first steps towards a comprehensive and systematic national approach in media education were taken.

In 2008, a first reference framework was commissioned by the Ministry of Education and developed by Gerhard Tulodziecki, Professor (Emeritus) of General Didactics and Media Education at the University of Paderborn, in cooperation with experts from Luxembourg. It aimed to describe the demands on education resulting from the rapid and profound changes in the media landscape. However, given the dynamics of technological and social developments, this reference framework was only a first step in a process requiring constant reflection and further development.

In 2010, media education was officially introduced into the Luxembourgish school system. Only one year later, media education was anchored as a transversal competence in the curriculum (Plan d'études) of elementary schools (Enseignement fondamental). It covers central aspects of media literacy, such as:

- diligent selection and use of media,
- creation and dissemination of media,
- analysis and evaluation of media conception,
- understanding and reflection on the influence of media, and
- discovering the conditions of production and dissemination of media.

Furthermore, a school development plan (Plan de développement de l'établissement scolaire) was introduced in the elementary school sector to support a school development responding to the local needs of the school population. Media literacy is listed among the possible fields of action. The school development plan was revised in 2016-2017 based on the experiences of the elementary schools and was made compulsory for all schools (elementary and secondary) in the country in 2017-2018. Since then, several schools have introduced media education into their curriculum as a subject, module, or extra-curricular activity.

A HOLISTIC APPROACH… TOWARDS DIGITAL LITERACY

A HOLISTIC DEFINITION OF DIGITAL LITERACY

The concept of media literacy applied in the Luxembourgish school system is based on the assumption of 'learning with and about media'. This means both sides of media are taken into consideration: on the one hand, the possibilities that media offer, especially in the field of content creation and social networking, and on the other, the risks associated with the increasing impact of media on everyday life. Given that technological advances are continuously growing in number, sophistication and complexity, the requirements for media literacy have changed. More recent concepts tend to use the term 'digital literacy', introduced by Ilomäki, Kantosalo and Lakkala (2011) in relation to digital, interactive media. In the term 'digital literacy', it becomes clear that the requirements for media competence have changed, and today, it can practically be equated with digital competence. A comprehensive definition of the term can be found in Ferrari (2012, p. 3ff.): 'Digital competence is the set of knowledge, skills, attitudes […] that are required when using ICT and digital media to perform tasks, solve problems, communicate, manage information, collaborate, create and share content, and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socialising, consuming and empowerment.'

In this sense, a basic understanding of how digital media and systems work (ICT basic skills) is just as much part of digital literacy as the skills to handle media responsibly (media literacy) and critically deal with the content they provide (information literacy). The same is true for the ability to identify, decompose and solve problems (computational thinking).

This broad definition of digital literacy comprising media literacy, information and data literacy, computational thinking and problem-solving as well as basic ICT skills aims to enable adolescents to use and engage with media and digital technologies in a safe, critical, responsible and creative way. They should be able to use them for their own educational processes and orient themselves in both media and non-media worlds. The goal of digital education is thus not essentially different from that of education in general: it should help people find their way as self-determined individuals in a constantly changing society. According to our definition, this ability to act is called digital literacy and it includes media and digital technologies.

A HOLISTIC STRATEGY: SIMPLY DIGITAL - FUTURE COMPETENCES FOR STRONG CHILDREN

einfach digital
Zukunftskompetenze
fir staark Kanner

SOURCE: MENJE, 2020

To promote the implementation of digital literacy at school, the Ministry of Education, Childhood and Youth established a measurable benchmark of students' actual skills by participating in the 'International Computer and Literacy Study 2018' (ICILS). The ICILS 2018 study specifically analysed the competences which Luxembourg intends to introduce into the curricula of elementary and secondary education in the coming years and which have so far not been explicitly taught in the Luxembourgish school system.
'Although we do not know exactly what the professions of tomorrow will be, it is nevertheless certain that the development of digital skills, and in particular coding and computational thinking, has become an unavoidable mission of a 21st century school that wants to effectively prepare young people for their professional and civic future,' concluded the Minister of Education, Childhood and Youth.

In this spirit, the Ministry adopted in the year 2020 a holistic strategy to digital literacy comprising elementary and secondary education: 'simply digital - future competences for strong children' ('einfach digital - Zukunftskompetenze fir staark Kanner'). Anticipating the increasing demand for digital skills in both professional and private life, the strategy aims to foster more than just computational skills. It is based on five uniquely human competences: critical thinking, creativity, communication, cooperation, and coding. The 'simply digital' initiative was developed around 3 key projects:

1 General framework for digital literacy: The national reference guide ('Medienkompass') proposes a transversal approach allowing teachers and educators to develop, promote and deepen digital literacy at all educational levels. This guide is based on the European Digital Competence Framework for Citizens, but deliberately comprises non-digital as well as digital media literacy aspects.
2 Coding and computational thinking in elementary education: Coding is introduced as part of mathematics in the last year of elementary education ('Cycle 4', i.e. 10-12 years), starting from the schoolyear of 2020/21. The following school year, the curricula of all grades in elementary education will be revised to anchor the core concepts transversally in all subjects taught. The objective is to teach children numerical reasoning in a pleasurable way at an early age.
3 Digital sciences in secondary education: A new subject will be gradually introduced in the lower classes as from the school year of 2021/22. The objective is to promote and develop creative approaches related to coding and a basic understanding of our digital world including big data, artificial intelligence, automation, etc.

With the four components of digital literacy, 'simply digital' strengthens the curriculum by combining a general transversal approach ('Medienkompass') with a more specific subject-oriented concept to ensure the basic understanding of underlying technological and ethical concepts.

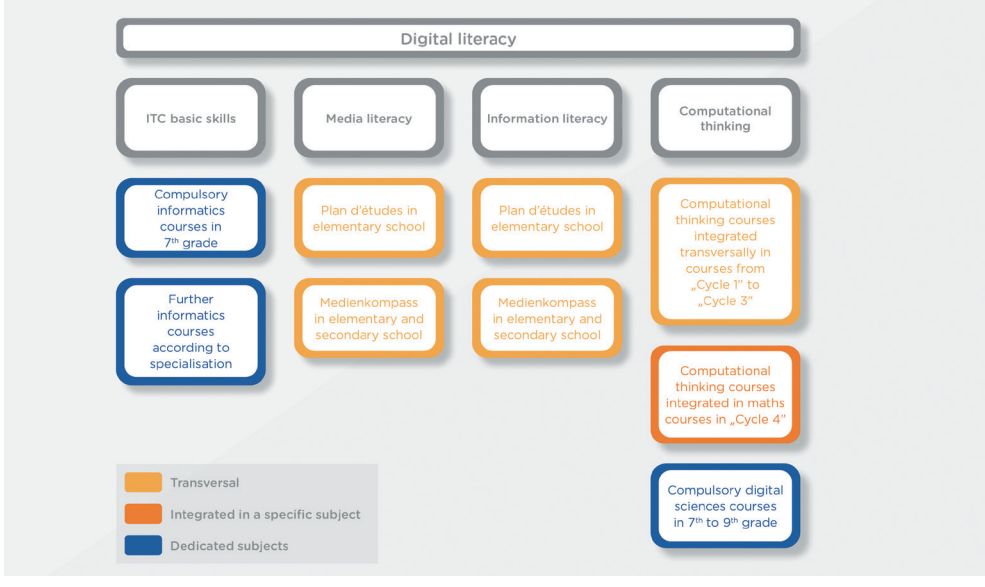


FIGURE 1: OVERVIEW OF THE STRATEGY 'SIMPLY DIGITAL - FUTURE COMPETENCES FOR STRONG CHILDREN' (SCRIPT, 2021)

TRANSVERSAL IMPLEMENTATION OF DIGITAL LITERACY

DEVELOPMENT OF A GENERAL FRAMEWORK

The 'Medienkompass – Medien kompetent lehren und lernen' (SCRIPT, 2020) was launched in 2020 as the national framework for digital literacy. It is based on the Digital Competence Framework for Citizens, DigComp 2.1 (Carretero, Vuorikari & Punie, 2017), but adapts it to the specific context of the Luxembourgish education system and deliberately includes digital and non-digital media competences.

In essence, the research and consultation process comprised two phases:

1 In the first stage, preliminary discussions were held with delegates from the Ministries of Education of France, Belgium and Germany in the 2017/18 school year.
2 In the second stage, the first draft of the national 'Medienkompass' was discussed with directorates, teachers and institutional representatives (school year of 2018/19).

The evaluation of these discussions led to the following adaptions:

- Critical reflection and evaluation of information are essential skills. Therefore, the competence framework is to be extended to include an area focusing on both responsible and creative engagement with media.
- Some competences seem to be pooled in the Luxembourgish education system and can therefore be summarised (e.g., 'interacting, sharing and collaborating through digital technologies').
- The term 'programming' is criticised because of its computer science bias and should be formulated more generally to include problem-solving thinking.

From June to September 2019, the English version of the DigComp 2.1 reference framework and its French translations done by the Belgian and French ministries were translated into German in a language-sensitive way, taking into account the insights gained in the consultation process.

This framework defines a set of 16 transversal competences enabling a step-by-step development and expansion of digital literacy along the education chain. The individual competences can be divided into five superordinate competence areas:

1. Information & data	2. Communication & collaboration	3. Content creation	4. Data protection & security	5. Digital world
1.1 Research data, information and digital content	2.1 Collaborate with others	3.1 Create text documents	4.1 Protect devices	5.1 Solve simple technical problems
1.2 Analyse and evaluate data, information and digital content	2.2 Share and publish data, information and digital content	3.2 Create multimedia documents	4.2 Protect personal data and privacy	5.2 Responsible and creative use of digital media
1.3 Store and manage data, information and digital content	2.3 Use appropriate forms of expression *(netiquette)*	3.3 Know and apply author rights	4.3 Protect health, well-being and the environment	
1.4 Process data, information and digital content		3.4 Modelling, structuring and coding		

FIGURE 2: COMPETENCE AREAS AND RELATED COMPETENCES DEFINED IN THE 'MEDIENKOMPASS' (SCRIPT, 2021)

Thus, the promotion of digital literacy is a core educational task for all teachers. Against this background, the 'Medienkompass' outlines how each subject can contribute to the development, promotion and deepening of digital literacy. This document provides theoretical and practical orientation for teachers, educators and students, thereby forming the central instrument for the upcoming processes of school and teaching development in Luxembourg.

IMPLEMENTATION OF THE FRAMEWORK

The promotion of digital literacy is a central educational task and can therefore not be performed solely on the basis of a competency framework. In order to enable the broad and efficient implementation of the framework, it requires a flexible transposition into everyday teaching situations as well as a common platform offering practical advice, inspiration and teacher training.
Given that the effectiveness of this tool depends strongly on the respective student target groups and the fields of application, an adapted, flexible 'translation' of the framework into the respective teaching situations is necessary. To make the implementation of the competency framework as flexible and workable as possible, the following concrete strategies or approaches are proposed:

1 **Access by competence**
Teachers select one or more competencies that they would like to work on in the lessons of a certain class or grade. The complexity, concrete tasks and contents used in the lessons are tailored to the targeted school types and age groups. For example, competence 1.1 'Researching data, information and digital content' in elementary schools can consist of extracting topic-related information from a given text; in secondary school, however, the focus can include formulating correct search queries or the use of filter functions in search engines.

2 **Access by topic**
This approach assumes that a certain topic is included in the subject, module or weekly plan. Within the framework of this selected topic, various elements of media education are then implemented, e.g. information research, critical handling of information or presentation. This is particularly useful and feasible in interdisciplinary work.

3 **Access by medium**
This implementation strategy is based on the assumption that a teacher wants to work specifically with a certain medium, e.g., the production of a short film. Depending on the topic, its complexity and the duration of the task, the production of a short film can include research, analysis, storage and processing of information competences, but also (digital) community processes or the responsible handling of personal data (e.g. film material).

4 **Access by grade and subject**
In this approach, the teacher selects items from the available teaching suggestions, taking into account their respective grades and subjects. In doing so, the stimulus can and should be adapted to the specific teaching situation, considering the materials and time available and the students' prior knowledge.

These four approaches offer teachers the possibility to choose how to promote their students' digital literacy.

Furthermore, a common platform acts as a central contact point for all teachers and educators in Luxembourg. The online platform www.edumedia.lu offers practical implementation aids and inspiration as well as an overview of current projects, events and training offers, including:

- Teaching ideas to encourage and enable teachers to deliver modern, multimedia-based lessons by offering them clearly structured teaching suggestions, best practices and examples.
- The 'Media Passport' serves to document the digital competences acquired by the students.
- eduMedia newsletter: Information on current (inter)national events and projects, teaching ideas, programmes and applications is provided in the form of a monthly newsletter which is sent to educators and teachers who are interested in digital topics.
- Further and in-service training: In cooperation with IFEN (Institut de formation de l'Éducation nationale), the national teacher training institute, numerous training formats are offered on digital literacy topics. The focus can be on programmes and applications (e.g. Office 365) or on teaching and learning methods (e.g. the flipped classroom approach).
- Extracurricular cooperation partners and places of learning: In Luxembourg, there are numerous players in the media sector ranging from state institutions to individual companies offering interesting information opportunities, e.g. in the context of lectures, excursions or workshops.

SUBJECT-ORIENTED IMPLEMENTATION OF DIGITAL LITERACY

INFORMATICS IN GENERAL SECONDARY EDUCATION

In the first year of general secondary school, informatics is a nationally standardised course covering four central concepts:

- Efficient and responsible use of the internet,
- Structured presentation of information,
- Analysis and processing of data, and
- Problem-solving and computational thinking.

The course combines information and project phases. Generally, students appreciate the hands-on training in internet research, presentation of information and the gamified approach to computational thinking using Scratch or GameMaker.

In addition to this national programme for the general stream of secondary schools, informatics is organised in a decentralised manner. Schools integrate computing and coding courses as well as informatics activities in their specific course offers.

Section I
In fact, IT courses are offered in Luxembourg at many different educational levels, be it in vocational training, in the general technical stream or at BTS level (a two-year higher education course), but until 2017 there was no equivalent offer for students of the classical stream. A new course, Informatics and Communication (section I – informatique et communication) was therefore created. It covers three years, after which students graduate with a high-school-leaving diploma granting access to universities in Luxembourg and abroad.

Course-specific subjects include programming classes, an introduction to modern technologies and a media communication class. In the two last years of the course, financial economics and data management complement the programme. Alongside these subjects, an interdisciplinary course aimed at developing entrepreneurial and project management skills represents a core subject for learners over the three years: project management.

COMPUTATIONAL THINKING IN ELEMENTARY EDUCATION

According to Jeanne Wing (2006), computational thinking (CT) is primarily a thought process leading to a representation of a problem and its solutions. This representation should enable a third party, whether a human or computer, to carry out this process effectively. This thought process involves several steps and competences. The following graph illustrates the eight basic CT competences that are promoted in Luxembourgish elementary schools.

FIGURE 3: BASIC COMPETENCES OF COMPUTATIONAL THINKING (REUTER, 2020)

COMPUTATIONAL THINKING IN 'CYCLE 4'

To emphasise the importance of the thought process, pupils of 'Cycle 4' (i.e. 10-12 years) start with unplugged activities. In a second phase, small robots are programmed using colour codes. Finally, the students learn the basics of the block-based programming language Scratch and are given the opportunity to code other devices.
Several resources were made available to schools at the launch of coding classes in September 2020:

- A starter kit with lesson plans and three different hardware components for classroom use,
- Numerous in-service training opportunities on computational thinking and coding offered at IFEN (Institut de formation de l'Éducation nationale),
- Recruitment of 15 specialised teachers known as ICNs (Instituteurs en compétences numériques). They operate in the schools of a regional directorate and offer teach-

ers valuable support in implementing the 'Medienkompass', promoting CT competences and setting up a media concept for the schools,
- A web platform (www.educoding.lu) with helpful information, reviews of hardware, software and tutorials,
- A web platform (www.kodeieren.lu) to network schools with experts in the field of coding.

Since the eight CT competences intersect with mathematical competences to a large extent, coding is integrated in maths lessons in 'Cycle 4'. From 2022, the national assessment tests at the end of this 'Cycle' will include items on computational thinking in mathematics.

Not only do the lesson plans offered in the starter kit refer to the national curriculum (Plan d'études), they also make connections with everyday life to ensure the transfer of knowledge. The introduction to computational thinking by means of unplugged activities resulted in very positive feedback from the teachers.

COMPUTATIONAL THINKING IN 'CYCLE 1' TO 'CYCLE 3'

From September 2021, computational thinking will be part of the curriculum for all grades in elementary schools. The focus will still be on the structured representation of thought processes. They can be represented differently depending on age groups, using language, pictures, symbols or programming blocks. CT will be embedded transversally in the first three grades of elementary education to ensure reference points in everyday life for the students.

DIGITAL SCIENCES IN SECONDARY EDUCATION

At the time of writing of this article, the final decisions were being taken concerning this new subject, which will be introduced in 2021/22. As the digital sciences course comprises three school years, from 7th to 9th grade, the first pilot schools will start in 2021/22, testing the programme in 7th grade. One year later, the curriculum – in an adapted form if applicable – will be introduced on a national level.

FIGURE 4: IMPLEMENTATION OF THE NEW SUBJECT DIGITAL SCIENCES (SCRIPT, 2021)

The course 'digital sciences' pursues a dual objective. On the one hand, it ensures a logical follow-up to the computational thinking courses in elementary education; on the other, it provides students with a broad understanding of the underpinning concepts and challenges of central digital themes. These topics are organised in six modules:

Modules	Topics
Is there such a thing as a machine that is as clever as me?	Artificial intelligence, creativity
Do you speak „Informatics"? My language, their language	Big data, internet of things
Me and the digital world	Algorithms, communication
The game... analogous or digital, individual or in a team, a whole programme	Programming, computational thinking, collaboration
The world wide web... me and the network	Cybersecurity, ethics, critical thinking
The robot... a partner for better or worse?	Robotics

FIGURE 5: MODULES AND TOPICS OF THE NEW SUBJECT DIGITAL SCIENCES (SCRIPT, 2021)

These modules are not meant to be dealt with one after the other, but rather in the form of a spiral curriculum. In fact, each module will be tackled in every grade, but with increasing complexity and goals.

The curriculum of this new subject comprises 36 hours per year, which corresponds to one hour a week. However, as the methodical approach is based on co-constructivism as well as activity and project-based work, the pilot schools are advised to look for ways to provide two-hour lessons or more in a row.

Evaluation will be conducted both on basis of products resulting from individual or group work (certificate assessment), and as process-oriented evaluation (formative assessment), in form of digital passports with badges (e-portfolio).

STRATEGIC COMPLEMENTS

one2one
classes mobiles et connectées

SOURCE: HTTP://WWW.ONE2ONE.LU

In order to give schools the means to pursue their objectives in the field of digital education and the promotion of 21st century skills, the Ministry of Education, Childhood and Youth has

launched several additional strategic initiatives and programmes. Each of these projects provides schools with the necessary support structure and tools, such as hardware, software, teaching resources, learning environments, etc.

In order to foster digital literacy from the start and guarantee equal opportunities for success, students are provided with individual tablet devices in a 'one2one' programme and, in the case of most specialisation courses, with laptops featuring the required software for all subjects. All participating schools requesting mobile devices must compile a comprehensive pedagogical file including a detailed description of the pedagogical project which must be supported by a motivated team of teachers. In terms of equipment, the national strategy for making devices available is based on an annual rental model. By 2020, over half the students in Luxembourg had received such equipment.

By acknowledging the omnipresence of digital tools in society and providing the same context in formal education, the importance of digital literacy, algorithms and informatics becomes clearer to students and teachers alike, providing a wide range of skills-related learning activities. In this respect, the use of these tablets and laptops is encouraged in every course and subject, though digital devices are not used exclusively in all learning activities. It is important to mention that the classes are not entirely paperless, as a digital option can at times be more time-consuming and/or complicated. Still, most tasks and additional hand-outs are no longer photocopied but shared via a learning management system. The same applies to homework and other assignments: students tend to upload their work rather than hand in printouts or handwritten productions. In addition, summative tests in more general subjects (languages, mathematics, etc.) are mostly still done on paper, whereas certain formative tests or progress checks may be done using an online learning platform or quiz website.

SOURCE: SNJ, 2021

BEE SECURE is a national initiative serving to promote the safest, most responsible and positive use of new information technologies among the general public. Its actions are focused on four priority areas:

- Awareness and information: It provides information and recommendations regarding the responsible use of the internet. For example, BEE SECURE systematically organises training sessions in elementary and secondary schools and is present at public events.
- Guidance and advice: The 'BEE SECURE Helpline' is a contact point for questions related to online safety and the responsible use of communication technologies. It is dedicated to the general public and in particular to children, young people, parents, teachers and educators, as well as senior citizens.
- Reporting of illegal content: Illegal online content can be reported anonymously via the 'BEE SECURE Stopline'. These reports can be assigned to the following three categories: child sexual abuse material (CSAM); discrimination; or racism, historical revisionism and terrorism.
- Monitoring: The regular exchange with children and young people in the context of the trainings, the evaluation of the questions asked via the 'BEE SECURE Helpline' and the cooperation with the discussion groups 'Youth and Kids Panels' enable BEE SECURE to closely follow new trends.

SOURCE: SNJ, 2021

BEE CREATIVE is an initiative in the field of non-formal and formal education with two final aims:

- Allow young people to acquire knowledge with the help of
- technical tools and new media ('digital literacy'), and
- Source: SNJ, 2021
- Promote the creativity, talent and entrepreneurial spirit of young people in the context of new information and communication technologies.

BEE CREATIVE promotes the creation and staffing of creative hubs ('makerspaces') in schools and campuses throughout the country. These hubs each have their own speciality or specialities, such as electro-technical engineering, 3D printing, television, programming or robotics and much more. Teachers, volunteers and administrative personnel share the task of staffing the spaces and guiding students in their own scientific and creative projects. Starting with six makerspaces in 2015/16, the maker network is ever-growing: besides 'Base 1', which is freely accessible to groups, classes and individuals of all ages, over twenty makerspaces have opened in secondary schools throughout the country. Three further makerspaces have been introduced in elementary schools and day-care-facilities.

SOURCE: SCRIPT/MENJE, 2021

MathemaTIC offers a personalised learning environment covering a variety of key mathematical topics including sense and numeration, measurement, spatial sense, as well as patterning and algebra.

Its main features include:

- Adaptiveness: Students work through mathematical items that are linked to the curriculum framework. They are provided with adaptive scaffolding to activate prior knowledge by using several learning strategies that lead to intuitive help-seeking.
- Multilinguism: The mathematical items have been carefully developed in four languages: German, French, Portuguese and English. This enables students to understand and work through problems in the language in which they feel most comfortable.
- Alignment with the curriculum: This alignment is represented on an interactive curriculum framework that provides teachers with the ability to monitor each student's progress through the learning resources, their strengths and weaknesses. It also provides students with a clear understanding of their knowledge based on educational objectives and standards.
- Intuitive dashboard: The MathemaTIC dashboards provide teachers with user-friendly, intuitive visualisations of the data gathered from students' activities using the mathematical items.

These features have proven to improve students' problem-solving skills.

Luxembourg Tech School

SOURCE: SCRIPT/MENJE, 2021

The Luxembourg Tech School is a non-profit organisation that hosts programming lessons that are integrated in the curricula of certain schools as after-school activities. Using the flipped classroom method, the IT experts involved create videos explaining concepts of managing group projects, prototyping and Python coding and guide their students through quarterly projects. These projects are closely linked to industries such as gaming, finance or banking. The respective trade chambers collaborate on the courses to provide students with opportunities to present their projects and gather experience in interacting with professionals from these fields. This initiative started at one campus and has already expanded to four campuses and thirteen schools.

Conclusion

Anticipating the increasing demand for digital skills in professional and private life, the strategy for digital education aims to foster more than just computational skills. It is based on five uniquely human competences: critical thinking, creativity, communication, cooperation, and coding.

The challenge of making digital literacy a part of everyday learning while maintaining equal opportunities for all students can only be achieved by taking a holistic approach to digital education. In this respect, the term 'holistic' has a fourfold meaning:

1 based on a broad definition of digital literacy,
2 covering all levels of education,
3 pursuing transversal and subject-oriented approaches, and
4 supported by additional material and non-material complements.

Given the interconnectedness of digital and non-digital literacy education, it seems inevitable that a broad definition of the terms including ICT basic skills, media and information literacy as well as computational thinking should be adopted.

To ensure a profound understanding of the underpinning concepts of our digital age, students need to be introduced to core themes at an early age while focussing on developing their attitudes, critical mindset and problem-solving skills. This idea needs to be taken up at several stages in secondary education to ensure digital literacy is developed.

In order to keep that common thread, the Luxembourgish school system has adopted a combined strategy of transversal and subject-oriented approaches. The transversal idea is developed in the national framework 'Medienkompass' defining digital literacy as a set of cross-curricular competences. This theoretical and practical guideline outlines how each subject can contribute to the development, promotion and deepening of digital literacy. This transversal implementation is backed up by subject-oriented approaches. These guarantee the examination, reflection and discussion of central digital literacy aspects. An informatics course in 5th grade in the general stream of secondary education provides basic knowledge of internet research, data processing, presentation and problem-solving. Computational thinking has been introduced as a subject matter included in the mathematics courses in 'Cycle 4' of elementary education. This topic will be further anchored transversally in the curriculum of all grades in elementary schools in the upcoming years. These basic concepts are taken up in secondary education with the digital sciences course focussing on a broad understanding of the underpinning concepts of digital themes such as artificial intelligence, big data, cybersecurity or ethics.

As the promotion of digital literacy is a core educational task of all teachers, it cannot be done solely on the basis of a competency framework or a written curriculum. In order to enable its broad and efficient implementation, it requires a flexible transposition into everyday teaching situations. This means that technical equipment must be available for students and teachers, as well as platforms and networks offering practical advice and inspiration, and teacher training on digital technology and methodology.
It is encouraging to see that many teachers are redefining their roles to include digital literacy as a 'natural' component of teaching into their everyday practices. This opens a whole landscape of learning opportunities – for both students and teachers.

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MONTENEGRO

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She is member in different international and national bodies for education and author of various publications such as Methodological guidance for the implementation of digital competence framework, Education for sustainable development, Entrepreneurial learning, Raising awareness on space planning – sustainable cities and rural settlements, Some aspects of modern curriculum, Teaching Science, Marzano's taxonomy, Implementation of the reforming curricula, etc.

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She is coordinator of a number of projects e.g., the EU-MNE funded project on the Integration of key competences for lifelong learning in Montenegrin education system, The 21st Century Schools educational program, Digital textbooks, Introducing the UN Sustainable Development Goals, Developing the entrepreneurial society in Western Balkans and Turkey, The knowledge exchange program for the Adriatic school system, Sharing experiences on the education reform processes in the SEE countries, and many other.

Trends and practices in developing curricula on Digital Literacy in Montenegro

ABSTRACT

As of 2004, digital competences are being developed in the Montenegrin educational system through compulsory and elective subjects in primary and secondary schools. With the aim to improve the quality of the learning process and students' achievements in this field, a National Framework for Digital Competences for all educational levels was developed and adopted by our National Council for Education in July 2020.

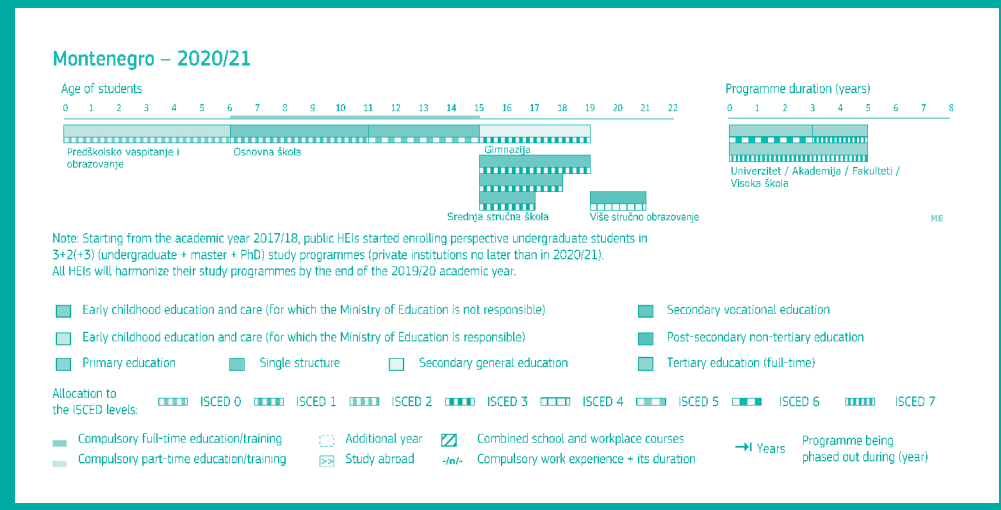
The implementation of the National framework for digital competence includes employing digital technologies in the teaching pedagogies and therefore it represents a strong support to innovation and the improvement of the competences such as critical thinking, problem solving, communication, creativity and enabling students an active participation in the society.

From this school year, all first-grade elementary school students learn from digital textbooks, which have certainly modernized the teaching and learning process.

In the situation of the COVID-19 pandemic, the great advantage of the application of digital technologies in teaching is reflected in the greater accessibility and overcoming of the spatial and temporal limitations, as well as in the significant improvement of teachers and students' digital literacy.

Training for the implementation of ICT in the teaching process and improvement of digital literacy is conducted as an integral part of the training offered to teachers and school management within the compulsory continuous professional development (CPD). More than 40% of all teachers and school administrators have already passed different kinds of related training, such as training for the implementation of key competences, training in Microsoft teams, digital textbooks, critical thinking, problem solving and coding on micro-bit, etc.

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN MONTENEGRO

INTRODUCTION

The use of digital technologies is in the focus of transformation of nowadays society as it has brought about radical changes in the field of our daily communication, life and work. Its importance is on the rise on everyday basis in various ways. The rapid development of digital technology and the growing need for its use is reflected in the changes in our attitude towards knowledge and skills which we must approach in an inclusive, balanced and ethical way. Although digitalization has been recognized as a major driver and contributor to the advancement of education, until the emergence of the COVID pandemic, the education sectors have lagged far behind in new development challenges.

Aware of the importance that digitalization has on the quality of education, Montenegro began in 2004 with modernization of its education system by creating adequate conditions for the implementation of digital education. The introduction of digital technologies and the development of digital competencies with students and teachers took place through a long and continuous process.

This article presents the development of digital education in Montenegrin educational system from 2004. After adopting new strategic and legislative framework the curriculm for primary and secondary schools was designed. The content of the compulsory subject Informatics with technical aspects, has been improved several times, while the last change in the curriculum implied the introduction of the subject in the 5th grade of primary school and the inclusion of programming in the content. This process was followed by creation of technical conditions in educational institutions (equipping schools with computer equipment and providing internet connection for each school) and the continuous professional development of teachers.

From the school year 2020/21, the National Framework - Digital Competence is being implemented in all educational institutions, which is obligatory for all levels of education. Furthermore, digital textbooks for the first grade of primary school have been introduced in the educational system, while a large number of projects are being implemented in primary and secondary schools, through which students are learning programing.

STRATEGIC AND LEGISLATIVE FRAMEWORK

The strategic framework implies the development of several important documents to enable the digitalization of education in a comprehensive and systematic way.

In the document The Book of Changes (2001)[1], which has determined the strategic directions of the development of education in Montenegro, the digitalization of education was recognized as one of the main priorities and innovations in relation to previous practices in education. Based on this book, the Ministry of Education and Science developed *the Strategy of introducing ICT into the education system of Montenegro* (up to university level)[2]. The main aims of this Strategy were that all students of primary and secondary school become fully involved in the information society by achieving computer and information literacy, while all teachers (in-service and pre-service) develop their skills and the use of ICT for teaching and learning. The Strategy implementation began in 2004 by the application of the Main Project on Education Information System of Montenegro (MEIS).The main goals of MEIS were to define necessary resources, concrete methods and technologies for the implementation of a modern Information system in education.
The digitalization of education took place in accordance with the Strategy for the information society development of Montenegro that outlines the strategic development tools in this development field, with a view to reaching the EU standards set out in the Digital Agenda 2020.

CURRICULUM DEVELOPMENT

In our curriculum, digital competence is being developed and integrated through different approaches such as individual subjects, integration into other subjects, cross-curricular topics and extra-curricular activities. Mastering basic computer knowledge and skills is mostly achieved through compulsory ICT programmes, while advanced knowledge and skills are developed through elective subjects, which is showed in the Table 1. Comparative overview of the study compulsory and elective ICT subjects/programmes at different levels of education in Montenegro. More cognitive and social functions (critical thinking, problem solving, cooperation, efficient communication, e-safety and alike) are developed through subject teaching as cross-curricular topics. In the document, Digital competence framework (2020)[4] digital competence is described as the ability to find, evaluate process, store, create and exchange information through digital technologies. At a higher level, it implies logical and critical thinking, information management and communication skills.

1 Željko R., Tatjana N., et al., (2001). The Book of Changes, Podgorica, Ministry of Education and Science
2 Strategy of introducing ICT into the education system of Montenegro (up to university level), (2003). Ministry of education and science of Montenegro, Podgorica
3 Glavnog projekta MEIS (Montenegrin Educational Information System) (2004) Ministry of education and science of Montenegro
4 Digital competence framework (2020), Ministry of Education

SEPARATE AND ELECTIVE SUBJECTS

In 5th, 6th, 7th and 8th grade of primary school and 1st or 2nd grade of secondary school there are compulsory and elective subjects that develop digital competences. In primary schools, the compulsory subject is called Informatics with technical aspects, which is being taught with one lesson per week. In secondary schools (gymnasiums and secondary vocational schools), the compulsory subject is called Informatics which is taught with two lessons per week. Compulsory informatics subjects' programmes in primary and secondary school are harmonized and written in such a way that secondary education programmes enable the upgrading of knowledge brought from primary education.

The subject Informatics with technique is based on the development practical skills of students in the ICT field. Through the learning process, students acquire basic computing literacy and affinity for the use of information and communication technologies and the advantages they bring. Students gain the ability to critically select sources of information and present them in an understandable and convincingly shaped way to basic information literacy and affinity for the use of information and communication technologies and developing interest in different occupations in the field of technology and a positive attitude towards entrepreneurship and self-employment in different areas.

Elective subjects are introduced in order for students to choose a certain number of subjects that will best stimulate their creativity and satisfy their learning needs. Students can choose elective subjects in the third cycle, i.e. 7th, 8th and 9th grade primary school and in all grades in the secondary schools. Marks from compulsory and elective subjects have an equal importance. Students have the opportunity to gain advanced and/or specialised digital skills choosing elective subjects and engaging in the extracurricular activities. In primary school, students are developing digital competence within the elective subjects such as Graphics with image processing and photography in 8th grade and Introduction to programming in 9th grade.

In gymnasium, elective subjects Algorithms and programming, Computer and web presentations, Media literacy, and Business informatics have been introduced in secondary vocational schools, there are different elective subjects.

COMPULSORY SUBJECTS	EDUCATIONAL LEVELS	AGE GROUPS	THE MAIN LEARNING GOALS
Informatics with technical aspects	Primary school	5th, 6th, 7th and 8th grade	Students should acquire basic information literacy and affinity for the use of information and communication technologies and the advantages they bring
Informatics	Secondary schools	1th or 2th grade	Students should acquire the necessary level of information literacy, necessary for living and working in the information society
ELECTIVE SUBJECTS	**EDUCATIONAL LEVELS**	**AGE GROUPS**	**THE MAIN LEARNING GOALS**
Graphics with image processing and photography	Primary school	8th grade	Students should acquire basic computer literacy and affinity for the use of graphic tools and programs in this area.
Introduction to programming	Primary school	9th grade	Students should acquire basic algorithmic literacy and affinity for the use of computers as tools for software development.
Algorithms and programming	Secondary schools	4th grade	Students should acquire master skills and technique of algorithmic approach, problem solving and basic principles of programming.
Computer and web presentations	Secondary schools	2th or 3th grade	Students should acquire master skills regarding presentation making on a computer, while including multimedia elements (images, sound, video) and becoming familiar with the basic elements of web presentations.
Media literacy	Secondary schools	2th or 3th grade	Students should develop one's own attitude towards the media and media texts and the ability of critical thinking, as well as developing the ability to produce media texts and include elements of media literacy in the complete curriculum
Business informatics	secondary Schools	3th or 4th grade	Students should acquire master skills for the use of computers in a business environment.

TABLE 1. COMPARATIVE OVERVIEW OF THE STUDY COMPULSORY AND ELECTIVE CT SUBJECTS/ PROGRAMMES AT DIFFERENT LEVELS OF EDUCATION IN MONTENEGRO

The teaching of compulsory and elective subjects in primary and secondary schools is carried out by teachers of informatics, mathematics or electrical engineering who have acquired the competencies for teaching these subjects during their initial education.

With the aim to improve the quality of the learning process and students' achievements in primary schools, this year we teach an improved[5] curriculum for Informatics with technical aspects. Learning outcomes are improved in the area critical thinking and problem solving trough programming and coding as our students will be able to using a computer in everyday life and work.

INTEGRATION OF KEY COMPETENCES INTO EDUCATION SYSTEM OF MONTENEGRO

The modernization of the Montenegrin education system to meet the needs of lifelong learning, i.e. the acquisition of professional knowledge and transferable skills necessary for the labour market, has led to the need of introduction of a general, integrative approach which would connect existing fragmented efforts focusing on the development of key competencies. Previous reforms of the education system have significantly developed a system for the implementation of key competencies but have not ensured synchronization of all key competencies in the same way, as well as for all levels of education as parts of a whole. However, these activities have contributed to creating the conditions for vertical and horizontal coherence and cohesion of the education system.

Within the framework of the implementation of the IPA project Integration of key competencies in the education system of Montenegro, the Montenegrin key competences framework programme was developed to functionally connect and integrate key competencies already existing in the education system. The Framework programme of key competences is a development strategic document, representing the basic starting point for a unique approach to the development of key competencies for lifelong learning in preschool, primary, secondary and university education in Montenegro. It provides clear recommendations for action, while leaving enough space for different specific solutions for each of the key competencies and for each level of education.

The framework programme is based on fundamental reccommendations of European policies and current education practice in Montenegro. It has been harmonized to a great extent with the European Reference Key Competence Framework for Lifelong Learning[6], except that they are adapted to the specifics of the Montenegrin education system.

The national framework programme contains the definitions and descriptions of the eight key lifelong learning competences and student learning outcomes by ISCED levels. The framework programme is the starting point for further development of teacher training and educational concepts, and at the same time the assumption of the structured integration of key competences into all levels of education in Montenegro.

[5] Informatics with technique for 5th, 6th 7th and 8th grades of primary school. https://zzs.gov.me/ResourceManager/FileDownload.aspx?rId=414561&rType=2

[6] Council Recommendation of 22 May 2018 on key competences for lifelong learning, OJ 2018/C 189/01.

Digital competence was in a systematic way introduced through the Montenegrin key competence framework. In the Framework, digital competence is said to include safe, critical and responsible use of digital technologies and handing them for learning, in work and for the participation in the society. The framework also states that digital competence includes information literacy, communication and collaboration, media literacy, digital content creation (including programming), security (including digital well-being and competences related to cyber security), intellectual property issues, problem solving and critical thinking.

NATIONAL FRAMEWORK – DIGITAL COMPETENCE

In order to more strongly support the personal and social development of students and underline the importance of developing digital literacy, digital competence is more specifically defined and described in the interdisciplinary curriculum Digital Competence Framework[7], which implementation began as of the school 2020/2021.

The framework provides an opportunity to influence the stronger development of digital literacy and skills in the teaching and learning processes, through the implementation of the complete curriculum, both for students and teachers. In order to monitor the requirements for harmonization of standards in education with the European Union (EU), we have based the principles and objectives of our Framework on two digital competence frameworks, recently adopted by the European Commission, DigComp 2.0: (The Digital Competence Framework for Citizens. Update Phase 1)[8] i DigComp 2.1: (Digital Competence Framework for Citizens)[9].

Through the Montenegrin Digital Competences Framework, Montenegro, like most European countries, has explicitly included in its education system the goals related to five areas and 21 competencies. Areas of digital competence are: 1) information and data literacy, 2) communication and collaboration, 3) digital content creation, 4) Safety and 5) Problem solving. The areas are interconnected and are built on top of each other in order to provide students with the systematic development of general digital literacy. Competences can very easily be connected with the teaching contents of various subjects in the general education part of the curriculum, as well as with the modules in secondary vocational schools. Areas overlap in some parts, but each area of digital competence has its own specifics impacting the development of specific knowledge, skills and attitudes. Educational outcomes of digital competencies were developed for three levels of education (preschool education, primary and secondary education). The areas of digital competence are shown graphically in Figure 1.

[7] Framework – digital competence https://zzs.gov.me/ResourceManager/FileDownload.aspx?rId=414555&rType=2

[8] DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1, The Conceptual Reference Model, Joint Research Centre, European Commission

[9] DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use, Joint Research Centre European Commission

FIGURE 1. THE AREAS OF DIGITAL COMPTENCES ACCORDING TO DIGCOMP 2.1[10]

Framework - Digital Competence is designed so to be fully compliant with the methodological requirements of the development of compulsory subject programmes. For each area and for each level of education, educational outcomes, learning outcomes and didactic recommendations for the attainment of the educational outcome, i.e. concepts and contents and proposed learning activities are given, so that teachers can more easily implement the goals of the interdisciplinary topic through the subject they teach. At the end, a proposal for assessing student achievements and conditions for implementation are given.

Table 2. Areas 2 Information and digital literacy shows an example how Areas 1 Information and data literacy for ISCED level 2 are elaborated in the Montenegrin Digital Competence Framework.

EDUCATIONAL OUTCOME 1.1. At the end of learning the student will be able to view, search and filter data, information and digital content.
LEARNING OUTCOMES Upon completion of learning, the student will be able to: − explain the need for information and content in the digital environment, − apply search to obtain data, information and content in the digital environment, − customize your search strategy to find the most relevant data, information and content in the digital environment.
Didactic reccommendations for the execution of the educational outcomes
Content/terms: Terms: information, digital content, digital environment, browser
Learning activities
Students use well-defined keywords to find portals with specific information and digital content. They explain why they use certain keywords to find certain material.
Educational outcome 1.2 At the end of the learning, the student will be able to evaluate data, information and digital content.
Learning outcomes Upon the completion of learning, student will be able to: − explain the importance of credible and reliable data, − differ credible and reliable sources of data, information and content in relation to the unreliable, − conduct anlysis, comparison and assessment of credibility and reliability of clearly defined sources of data, information and digital content.
Didactic reccommendations for the execution of the educational outcomes **Content/terms:** data, information, **Learning activities** The student **examines** and compares specific sources of data, information and content and selects credible and reliable ones. The student processes data, information of digital content from sources on web pages and compares them with data, information or content from other similar sources (books, manuals, magazines). The student uses various search mechanisms as a source for finding information, analyzes their impact on the evaluation of data, information and content.
Educational outcome 1.3 At the end of learning, student will be able to handle data, information and digital content.
Learning outcomes Upon completion of learning, the student will be able to: − specify simple formats for storing data, information and content, − save data in the appropriate format and save them in different locations, e.g. the local computer of other users − determine how to easily organize, store and use data, information and content in the digital environment, − organize the storage of information, data and content in a network environment (e.g. Cloud) in order to facilitate their organization, storage, sharing and sharing.
Didactic reccommendations for the execution of the educational outcomes **Content/terms**: data, information, sharing, Cloud, disk, external disk **Learning activity** The student considers and locates places of local storage, e.g. disk, an external disk, and schematically shows the organization of the data. The student independently prepares and organizes data, information and content so that they are available over a longer period of time, as well as to other users for future work. The student organizes the storage and availability of data, information and content through a network environment (e.g. Cloud), so that the data is suitable for sharing and working together.

Execution of the Framework - Digital Competence in the educational programme at all levels of education develops key competencies of students, contributes to an integrative approach, allows the general education curriculum to include goals and contents of education that are not part of formal disciplines or individual subjects, or are interdisciplinary and more connects the contents of different disciplines or areas. A holistic approach supports the personal and social development of students, multidisciplinary problem solving or a research issue and promotes the application of what is learned in new situations and in different ways. By introducing the key competences, digital literacy through all subject programmes enables students to safely, critically and responsibly use digital technologies in all segments (learning, work, social interactions ...) and raise IT and digital literacy to a higher level.

[10] DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use, Joint Research Centre European Commission

Implementation of the Framework - Digital competence requires shifting from classical knowledge transfer towards problem solving and determining possible solutions. Education keeps its focus on the specific subjects/modules, while opening doors to multidisciplinary and interdisciplinary research of a real life situation.

The learning outcomes that are built in this component show that education is not just simple acquisition of knowledge and skills, but an integral approach which offers motivation and commitment for the activities leading to the improvements in the inclusion into the economic and social society spheres, as well as the improvement of the acquired competences after the completion od pre-university schooling in the lifelong learning process.

Achieving the goals of digital competence enables the strengthening of basic competencies in a way to be interesting to students because it takes place in a digital environment close to them.

Learning outcomes from the Framework - Digital Competence at the school level are planned through the annual work plan of the school, through the annual work plans of teachers and preparations for teaching for all subjects, through mandatory electives, through continuous professional development of teachers and extracurricular activities.

Successful implementation of digital competence implies evaluation of its contents by teachers. Digital competence is an integral part of the education programme, so the assessment/assessment of student achievements is mandatory as in other school activities.

Assessment and evaluation of multidisciplinary competencies of students is more complex than the assessment of competencies related to one discipline. It is important that it takes place from several aspects, with criteria ranging from the acquisition of knowledge, development of skills and respect for different points of view, to an advanced level of mastering digital competence. Such monitoring, evaluation and evaluation is complex.

As already mentioned, digital competence is developed through five areas that influence the development of specific knowledge, skills and attitudes related to information and digital literacy, communication and cooperation, digital content creation, security and problem solving. Each of these areas should be reflected in the evaluation criteria. Assessment strategies include the complexity of the knowledge and skills and attitudes acquired through a multidisciplinary approach.

In the Digital Competences Framework, the examples of evaluating educational outcomes for primary school in relation to 4 levels of primary (memory), secondary (understanding), advanced (application and evaluation) and outstanding achievements (creation) are presented.

Implementation modalities of the *Framework - Digital Competence for all levels of education are elaborated in detail and explained in the Methodological Guide for the implementation of the Digital Competence Framework.*

EXTRA-CURRICULAR ACTIVITIES

Students to a significant degree develop digital competencies through Extra-curricular activities. A large number of projects are being implemented in schools, student sections have been formed in the way that students deal with programming, programming competitions are organized as well. Almost all schools in Montenegro have entrepreneurial clubs, while in addition to entrepreneurial clubs, micro: bit clubs have been formed in all primary schools, where students from 6th to 9th grades additionally develop basic skills and gain self-confidence in the fields of computer literacy and coding.

Micro: bit clubs were formed in cooperation with the British Council, which launched a project Schools for the 21st century. All primary schools in Montenegro received micro: bit devices through this project. It is intended for students aged 10 to 14 who use it in the process of regular classes and in various extracurricular activities. Micro: bit devices (pocket computers) help children master new digital and programming skills in a fun, innovative and interactive way. Programming develops logic in children, teaches them to make decisions and look at problems from multiple perspectives. Possessing, and more importantly applying, new skills has the effect of increasing self-confidence and openness to new ideas. The Extra-curricular activities strongly encourage regular curriculum in our schools.

The vision of programming clubs is to inspire future generations and increase their interest in computing and digital content creation. The projects are gradually introducing programming concepts that allow children to gradually improve their knowledge. As part of the School's programme for the 21st century, a Guide for the work of micro:bit clubs has been developed, with the aim of providing support to all primary schools participating in this programme in establishing and running a school coding club.

Students are very interested in this form of teaching. It is important to emphasize that in these learning activities like to participate with all their capacity also those students who do not show significant interest in the usual teaching activities. The great advantage of establishing micro:bit clubs in schools is reflected in the fact that it encourages girls to get involved in the programming process, which increases their motivation for additional engagement in learning and research.

Students involved in the work of micro:bit clubs participate in national and regional coding competitions with projects they have developed during one school year. The purpose of the competition is to involve children from all over the country and to inspire young people to solve everyday problems in their schools and communities through coding physical devices.

Teachers in schools have already gone through a three-day training programme. The British Council, as part of the "Schools for the 21st Century" programme, has also developed the "Examples of Teaching Practice" Guide with the aim of supporting the professional development of teachers through the best examples of teaching key skills. The Guide contains a large number of lesson preparations for teaching as examples of good practice, thus providing additional support to teachers in the process of integrating critical thinking skills, problem solving and coding into the everyday teaching process.

DISTANCE LEARNING AS A RESPONSE TO THE COVID-19 PANDEMIC

The COVID -19 pandemic has significantly affected people's awareness of the digitalization of society. The concept of the "Digital Age", on which the strategic directions of the development of the society of the 21st century are based, was quickly transferred from the theoretical aspect to the practical one.

The outbreak of the COVID-19 pandemic and rapid transition from face-to-face to distance learning have further underlined the important role of teachers in providing all students with equal access to quality learning in which no one is left behind. The transition to a distance learning approach to instruction in primary and secondary schools due to the pandemic outburst in Montenegro imposed new and urgent challenges to the education system. It resulted in the development of online platforms and applications to support teaching and learning[11], recording video materials and lessons broadcasted on national TV and internet channels.

The readiness and flexibility in addressing these issues and challenges are rather satisfactory in terms of the inclusiveness of the approach and provision of support, especially when marginalised groups concerned.

Within distance learning lectures from all subjects in primary and secondary schools were recorded and broadcasted on three national frequency channels, in order to achieve presence in every household. The #LearnAtHome content was also broadcasted in Albanian.

DIGITALIZED TEXTBOOKS

In order to improve and support the development of digital competencies, increase the quality of teaching and learning and raise the level of student achievement, digital textbooks for the first grade of primary school have been produced that will repeatedly modernize the teaching and learning process. In accordance with application of digital technologies, students can upgrade their knowledge from open and free sources, which makes it easier for them to learn through interactive and more interesting content, learning becomes personalized and adapted to the student.

Moreover, students develop digital competencies from the earliest age, understand the importance that digital technologies have and how great the diversity of its use is.

Working with digital textbooks is an interactive process in which each student chooses their own, different paths of finding relevant facts. Learning with digital textbooks requires a thoughtful and critical approach to problem solving. This means that, during the teaching and learning process, the student should understand how communication, creativity and innovation are supported in the digital environment, but should also be aware of their advantages, limitations, effects, challenges and risks.

Digitalized textbooks prepared by the Institute for Textbooks and Teaching Aids in Podgorica, for all first grade primary school subjects[12], were enriched with numerous multimedia and interactive contents of top quality that meet the quality standards of National Geographic in the Montenegrin language in accordance with the valid subject programmes. This will enable students to efficiently acquire new knowledge, and make it easier for teachers to teach, by combining content from printed and digital textbooks. Digital content will arouse curiosity and motivation for learning in each classroom, but also improve distance learning in case of need. This year, the programme will be implemented in all first grades of primary school so that children from an early age can understand the importance of digital technologies and the diversity of its use.

All teachers who teach in the first grade have been trained in the use of digital textbooks in teaching, and they have been provided with a manual with instructions for using didactic textbooks."

As part of a comprehensive response to the crisis, but also as a plan for long-term cooperation, the Ministry of Education, Science, Culture and Sports and UNICEF in Montenegro will in the coming period create a platform for online learning, digital materials and training of teachers to use digital teaching aids. Online learning, digital materials for the students in the second grade in the primary school will be ready for the 2021/22 school year. The platform will be based on a prototype under the global title Learning Passport, which was created as a result of a partnership between UNICEF, Microsoft, and the University of Cambridge, and is supported by the Boston Consulting Group.

This platform aims to improve the continuous involvement of families and parents in the learning process, providing practical resources and materials for the development and education of children. Also, its goal is to strengthen opportunities for professional development and facilitate cooperation between professionals in the education sector.

[11] Distance learning platform #LearnAtHome: www.ucidoma.me ; Teacher's portal: www.skolskiportal.edu.me; Digital School platform:http://www.digitalnaskola.edu.me/;Online school register: www.dnevnik.edu.me; Protal for eEnrollment: www.upisi.edu.me;

[12] Digital textbooks for 1st graders: www.uci.me

In Montenegro, the platform will contribute to the creation of quality and inclusive content for children, adolescents, their parents and all other professionals in the education sector through locally contextualized content and an individualized approach.

TEACHER TRAINING

Teachers play the most important role and provide a crucial driving force for the learning process of students in the education system. Teachers are to equip young people

with the necessary skills, knowledge and attitudes to develop their full potential and to become responsible and active citizens in our fast changing and technology-driven societies. By introducing up-to-date learning strategies and better acess to quality digital educational content for students, the acquisition of digital competence needed for life and work in the 21st century, is enabled.

It is often noticed in practice that students do not sufficiently apply knowledge from one area to the other, i.e. they have no functional knowledge. In order to be able to do so, they need to become aware of the existence of possible inter-connectedness, and the role of teachers is to create teaching situations which would require it.

The use of digital technologies in the teaching process provides an innovative and stimulating learning environment, increases students' motivation and bears important potential for the adaptation of the learning process to individual needs of students. Also, it includes the empowerment of students with critical and safe and thus professional use of digital techologies.

In order to develop digital literacy, our teachers have passed a number of seminars on the development of general digital competence and competences for use of digital technologies in the educational process.

In Montenegrin educational sistem teachers are engaged in continuing professional development (CPD) for good quality teaching and learning and CPD is mandatory for all teachers at all educational levels from preprimary to the university level.

The Bureau for Education Services and VET Centre are the educational institutions in charge of teachers' CPD, and thus for training in the field of digital competences. Teachers of mandatory subject have adopted digital competences during their initial education, whereas other teachers choose some of the accredited programmes that can be found in the Catalogue for Professional Development of Teachers. The Catalogue of programmes for teacher professional development includes over 30 training accredited programmes for using IT in the teaching process.

Measures refer to the improvement of conditions for increasing the level of ICT used in teaching process, providing conditions for online collaboration of teachers, improving conditions for using information system of education at branch institutions as well as promotion and workshops for using the teachers' portal. In terms of the basic level of computer literacy, a number of trainings have been carried out for the teaching staff to acquire the basic knowledge in this field.

Within the scope of the 21 Century Schools project, the British Council trained more then 25 percent of the primary school teachers on critical thinking, problem solving and coding with micro:bit devices.

In order to provide support to teachers in implementing key competences, due to situation with pandemic COVID-19, the concept of online training programme for teachers was developed and adapted in line with the training programme "Education of teachers for key competences in primary and secondary education". Related training thus far held for 1500 trainees, including both classroom teachers and STEM subject teachers of primary and secondary education (planned for total 1 860 teachers).

An internet platform to support participants has been developed. The platform is set up and fully functional, available at www.ikces.me. The platform delivers complete training material for teachers, 130 school annual action plans for the implementation of key competencies throughout the school curriculum, as well as more than 120 lesson plans written by teachers after the completion of the training programme.

Every school in Montenegro has school an ICT coordinator in charge of the overall ICT management at school (system maintenance, reporting failures, monitoring antivirus protection, encouraging and assisting staff with the application of ICT in teaching, training staff to use ICT, assisting staff with the use of electronic didactic materials, etc.), These training programmes are offered to teachers; they apply for seminars based on their own training needs.

Conclusion

To improve the quality of education and its adaptation to digital transformation in the coming period we will continue to implement activities related to improving infrastructure, digital competencies of teachers, and digital content that will enable digital education to be relevant, accessible, and inclusive.

Successful implementation of the National framework – Digital competence in all education levels provides an opportunity to influence the stronger, development of digital literacy and skills in the teaching and learning processes, through the implementation of the complete curriculum, both for students and teachers in a systematic way. Achieving the goals from this framework enables our students to develop competencies for information and data literacy, communication and cooperation, creation of digital content, safe and secure use of digital technologies, and problem-solving.

In using digital technologies, teachers acquire new skills for developing innovative teaching practices characterized by the variety of teaching styles, enabling thus higher personalization of learning and improved cooperation between teachers and students, as well as meeting the individual student needs. The majority of teachers in Montenegro have been trained to use internet platforms for teaching and create new models of more open and flexible learning. By implementing training for teachers related to the inclusion in the teaching process of existing platforms and digital educational content through the adaptation of pedagogical methods will influence the strengthening of their digital competencies.

Although Montenegro has in place a high quality strategic and legislative framework for implementing digital education, the COVID pandemics has indicated the need for improvements in implementation. During the previous year, a lot has been accomplished with respect to the equipment of schools with digital devices as well as by ensuring an adequate internet connection for each institution, in order to make available the same quality of education for every individual. No matter the great support by the system, concerning the development of the didactic materials, teacher training and school furbishment, this pandemic period presented and still presents a challenge for teachers, as well as students.

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NETHERLANDS

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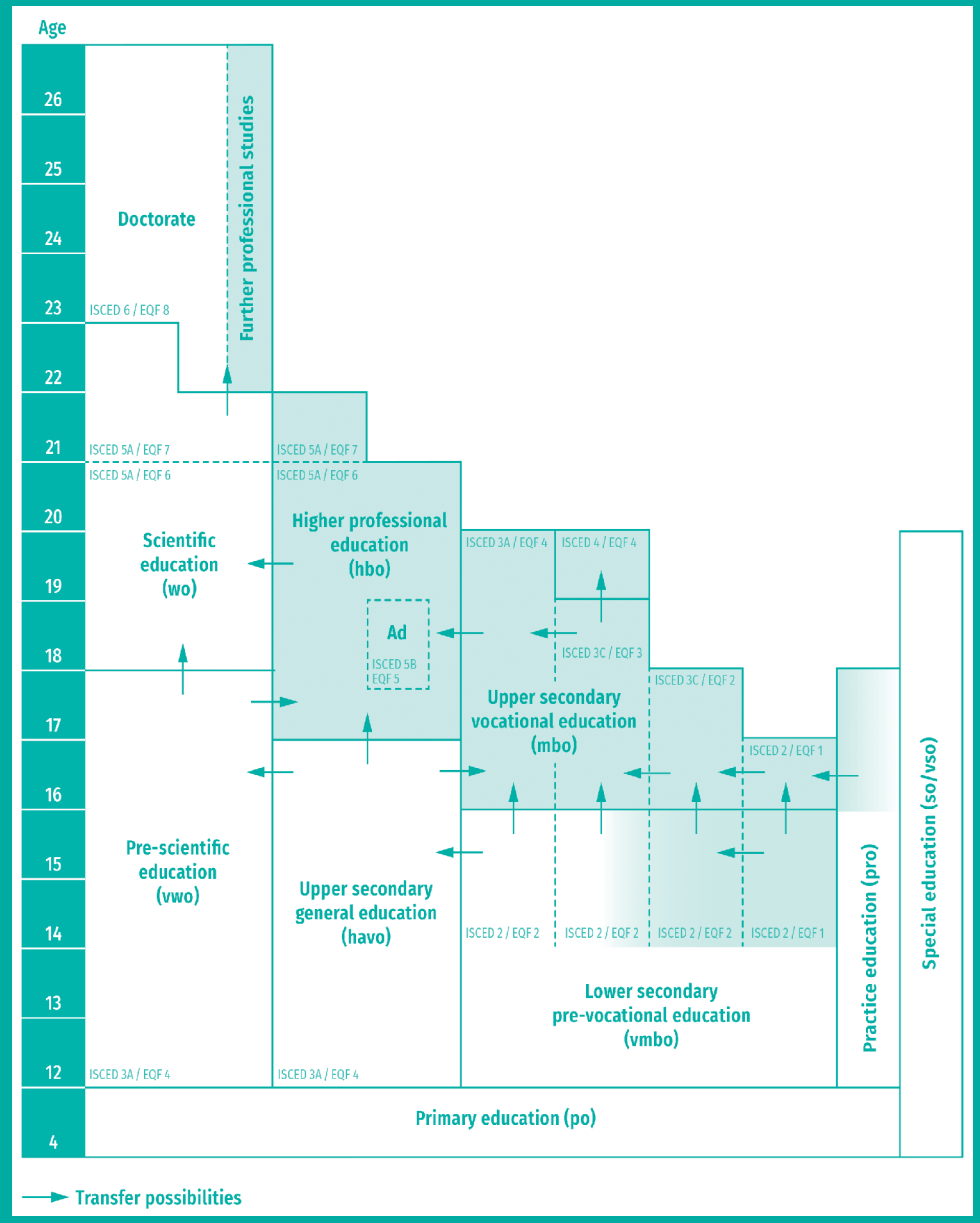
Digital literacy in the national curriculum of the Netherlands

ABSTRACT

Digital Literacy will be included in the revision of the Dutch curriculum for primary and secondary education. This is necessary because there is little or no attention given to Digital Literacy in the current curriculum, while the need to include it in the curriculum is evident.
In recent years, more and more schools are educating their students in Digital Literacy, although they shouldn't have to, because Digital Literacy does not have national core objectives or attainment targets. Research shows that much remains to be done to address all aspects of Digital Literacy in continuous learning tracks and careful monitoring of student progress.

The TDT, which has made proposals for the new national curriculum with regard to Digital literacy, emphasizes the importance of conceptual knowledge, of critical thinking about the role of digital technology for people and society and of the use of digital technology for creative processes. The proposals of the TDT described almost all competencies from the Digcomp 2.1 framework and added some elements to it.
The political decision-making process about the continuation of the revision of the Dutch curriculum has not yet been completed. When it comes to the introduction of Digital Literacy, it is important to learn from the experiences with Information Science in the 1990s. This means that a lot of attention will have to be paid to the implementation of the curriculum of Digital Literacy and to the training of teachers. It is also important that Digital Literacy is properly embedded in the curriculum, especially if the choice is made to integrate it into other subjects as much as possible.



OVERVIEW OF THE EDUCATIONAL SYSTEM IN THE NETHERLANDS

INTRODUCTION

The actual influence of digital technology on today's society is huge. The areas it impacts vary from daily life and work and science and the economy, to the functioning of our democracy , and even international relations. Every day we see the opportunities digital technology offers: our political leaders meet remotely, as do we ourselves, education is becoming more hybridized, bottlenecks in the traffic system are identified with the help of telephone providers, houses are built with 3D print technology, a passport can be applied for online, everyone can be a producer of news, the chain between producer and consumer is becoming shorter, changing their relationship. Each of us lives in a world that is heavily influenced by digital technology. This development is set to continue for the foreseeable future.

What do we mean by digital literacy in the Netherlands?

Internationally, there is no total agreement about what digital literacy actually means. Scientific studies show that each course of study and each frame of reference uses its own terminology to name and describe the learning area. What all of these descriptions share in common, is that digital literacy is a complex competency with a layered structure (Voogt et al. (2019)). Given the divergent descriptions used for the digital literacy learning area, we now describe the definition of Digital Literacy we apply in the Netherlands as follows:

Digital literacy is "being able to handle ICT, digital media and other technologies needed to access information and being able to participate actively in today's (knowledge) society. There are different skills needed: instrumental skills (being able to deal with ICT and ICT applications), structural skills (the competence to search and select information) and strategic skills (processing, integrating and producing information)" (Thijs et al. 2014).

Digital Literacy as defined above has four components:

1. Basic ICT skills consist of the knowledge of basic concepts and functions of computers, the ability to identify, connect and operate hardware, the ability to deal with standard office applications (e.g. word processors, spreadsheets and presentation software), the ability to use software programs on mobile devices, and the ability to use the internet (browsers, email).
2. Computational thinking consists of thought processes that involve the identification, decomposition and solving of problems, as well as the ability to organize, represent and analyze data that is used for finding solutions for problems while using ICT techniques and tools. Computational thinking also focuses on raising awareness as to the opportunities presented by information technology for solving problems, even in situations where information technology does not (yet) play a role.
3. Media literacy consists of the knowledge, skills and attitudes necessary for consciously, critically and actively working with media. In addition to the ability to understand how media work and how they influence what we see, it is about the ability to create content, participate in social networks, and to reflect on your own media use.
4. Information literacy is the ability to identify and analyze the need for information and, on that basis, the ability to search, select, process, use, and present relevant information.

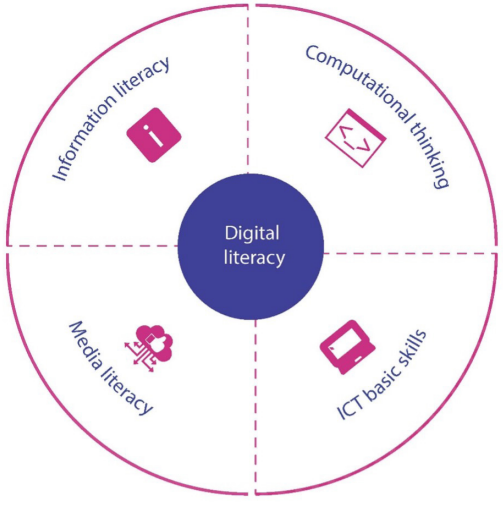


FIGURE 1: FOUR DOMAINS OF DIGITAL LITERACY

DIGITAL LITERACY IN THE CURRENT CURRICULUM

In the current national curriculum framework, consisting of core objectives and attainment targets, little or no attention is given to Digital Literacy (Thijs et al (2014a)). The core objectives for primary education and for lower secondary education offer some points of reference for (aspects of) digital literacy, but the descriptions of these are so global, they do not provide enough guidance for concrete elaboration in practice. The attainment targets for upper secondary education focus on aspects of digital literacy to varying degrees. In Dutch and modern foreign languages, minimal attention is paid to digital communication and writing and reading digital texts. Dealing with large data files is focused on in mathematics.

In primary education and lower and upper secondary education, it is unclear what exactly is required of schools and the four domains of digital literacy are not fully covered in core objectives and attainment targets. The influence of digital technology on the content of subjects and on the economy and society is hardly discussed in the core objectives and attainment targets. In lower pre-vocational secondary education, the vocational programs were adjusted some time ago. At an orientation level, technological applications in the professional world are given some attention. The question, however, is whether the knowledge and skills required for this type of application are sufficiently described and embedded (De Vries and Strijker 2017). All in all, it can be concluded that there is little or no attention for Digital Literacy in the national curriculum frameworks and when there is, it is focused on specific aspects of Digital Literacy, not on the full range of Digital Literacy topics as defined above.

RECENT DEVELOPMENTS: SCHOOLS GETTING STARTED WITH DIGITAL LITERACY

Although the national core objectives and attainment targets provide little guidance for addressing Digital Literacy in educational practice, more and more schools in the Netherlands are taking steps to introduce (aspects of) digital literacy in the school curriculum. This applies especially, but not exclusively, to primary education. Schools in the Netherlands have the freedom to do this, because the Netherlands attaches great importance to the freedom of education. The core objectives and attainment targets describe in broad terms what is expected of schools. Schools can implement this in their own way according to their own pedagogical vision. In addition, schools have the opportunity to supplement the curriculum with subjects, projects or themes that they find important. This offers schools the opportunity to supplement the national curriculum with (aspects of) Digital Literacy. They do this because they believe that they should prepare their students for the digital society or because they believe that students should be more aware of how they use digital technology and should be more critical of the digital technology they are already using. Finally, this offers schools the opportunity to show that they keep their education up to date and relevant by also paying attention to Digital Literacy.

Interest in Digital Literacy arose and grew in conjunction with the focus on skills for the 21st century.
The urgency to pay attention to Digital Literacy in education was emphasized by the Royal Academy of Sciences (KNAW 2012), which published an advisory report on this subject. Although the KNAW limited its advice to secondary education (HAVO and VWO), it states that it is important to make Digital Literacy a structural part of pre-vocational secondary education and primary education, as well.
Because of the growing interest in Digital Literacy and the growing sense of urgency, SLO, the national institute for curriculum development in the Netherlands, has been working on exemplary learning pathways for all four domains of Digital Literacy since 2014 . SLO collaborated with schools that want to give Digital Literacy a place in their lessons. In this way, an informal curriculum for digital literacy has been created, the extent of which is not clear and the benefits of which have not been properly analyzed.

SITUATION

Relatively little data is available on the Digital Literacy of students in the Netherlands. This is not surprising given the position of Digital Literacy in the formal national curriculum in the Netherlands. Based on the available data, the following impression emerges. The Netherlands did not participate in the latest ICILS study (Fraillon et al. 2019), but it is likely that the results of this study largely apply to the Dutch situation. The ICILS research concerns the skills of 14-year-old students in acquiring and producing information using ICT and digital communication. In addition, this study focused on computational thinking.

The results of the research showed that growing up in a digital world does not automatically make students digitally literate. The achievements of students in the context of this study were classified into four levels, with the level of mastery increasing per level. 18% of the students scored below level 1, the basic proficiency level, 25% of the students were classified at level 1 (the level at which students demonstrate functional knowledge of the use of computers), 36% at level 2 (the level at which students can search, process and provide information with guidance), 19% at level 3 (the level at which they could independently go through the process of information acquisition and provision) and 2% at level 4 (the level of complete mastery at which the ability to evaluate is apparent).

Students' scores on the computer and information literacy (CIL) scale. In most countries, the majority of students scored in level 2. On average, across all countries, the proportion of students above level 2 is lower than the proportion below level 2.

FIGURE 2: INFOGRAPHIC ICILS 2018

This research demonstrates the need to teach students how to use digital technology to process and present information. The study also showed that the socio-economic background of students influences their score: students from a higher socio-economic background scored significantly higher than other students. Furthermore, boys received higher scores for computational thinking and girls for information acquisition and presentation.

The Leerlingmonitor Digitale geletterdheid (Student Monitor Digital Literacy) (Kennisnet 2020), conducted by the University of Twente, provides insight into the Digital Literacy of Dutch students from the last two years of primary education and the first two years of secondary education. In the context of this research, students demonstrated in an authentic assessment how they deal with different aspects of Digital Literacy: information acquisition and publication, computational thinking, privacy and security and the handling of equipment and applications. The context used for the test was social media.

The research showed that

- Students from primary education who are likely to progress to secondary education (HAVO and VWO) and students from the first two classes of HAVO and VWO scored significantly higher than students from pre-vocational secondary education (VMBO), or students from primary education who are continuing on to VMBO. The scores obtained by students within one and the same group varied greatly.
- Students with a lower socio-economic status may be less digitally literate;
- There was considerable variation in the level of skill among students at the same education level in secondary education. Although the average score of HAVO and VWO students differs, some VMBO students received high scores and some HAVO and VWO students received low scores.
- Only the highest-scoring students performed well in assessing the reliability of information and in dealing with safety and in acting ethically.
- Improvement in digital literacy is possible. This was especially evident among HAVO and VWO students, less so among VMBO students.
- The students' school has a significant influence on the degree of Digital Literacy.

The ICILS research and the Kennisnet research showed that many students have limited digital literacy, that many students have difficulty dealing with digital technology critically, consciously and independently. The studies also revealed large differences within groups of students and between boys and girls and that the socio-economic status of students influences the degree of Digital Literacy. In addition, Kennisnet's research showed that the school that students attend has a significant influence on the degree of digital literacy.

Following on from the last point, it is interesting to see how schools in the Netherlands currently deal with Digital Literacy. The Monitor Digitale Geletterdheid in het po 2018-2019 (Monitor Digital Literacy in primary education 2018-2019 (Groothengel, A., Woud, L. van der. (2019)) provides insight into the state of affairs in primary education.
This research shows that primary school teachers assign a score of 4.9 to their students' digital literacy on a scale from 0 to 10. That score is the average of the scores for media literacy (4.7), information literacy (4.7), computational thinking (4.5) and basic ICT skills (5.7).

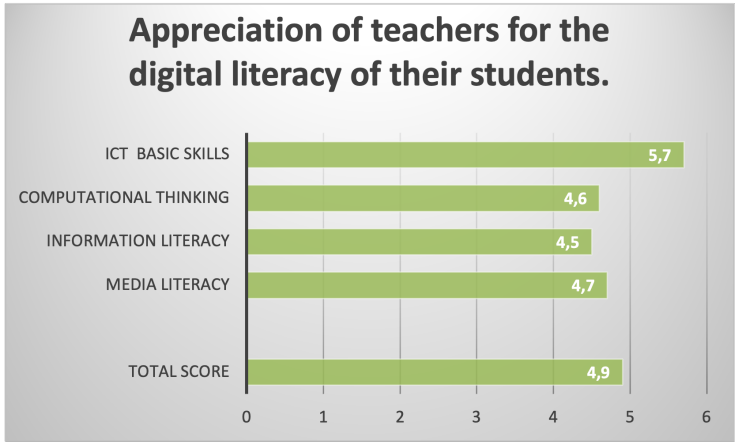


FIGURE 3: AVERAGE SCORE OF DIGITAL LITERACY OF STUDENTS IN PRIMARY EDUCATION.

63% of teachers felt a great to very great need to work on increasing the Digital Literacy of their students. 72% of the teachers made Digital Literacy a fundamental part of their lessons (in one or more subjects or in projects), 13% included it occasionally, for example in project form, and 15% of the teachers did not include it at all.
Almost three quarters (73%) of the administrators indicated that the school board is working systematically on the development of Digital Literacy of students. 65% also indicated that there are one or more working groups for Digital Literacy for several schools in their schoolboard. When working on digital literacy, 59% of teachers said they did not use a learning pathway or learning objectives.

Teachers who made Digital Literacy a fundamental part of their lessons, said they emphasized basic ICT skills. The domain of computational thinking was the least frequently taught. About 40% of teachers felt that they devoted insufficient attention to the four domains of Digital Literacy. It is striking that the teachers who worked with disadvantaged students paid little or no attention to information skills. A final noteworthy point from this survey is that only 4% of schools measured and tracked student progress.

All in all, it appears from the foregoing that there is a need to pay attention to Digital Literacy in schools in order to prevent the digital divide from increasing and to equip all students, regardless of their background, to participate in the digital society. We have seen that three quarters of primary schools make Digital Literacy a fundamental part of their lessons, but that there is still room for improvement, for example by working according to a certain learning track and monitoring the progress of students. Although we have no figures for digital literacy education in secondary education, based on anecdotal evidence, there is no reason to assume that the state of affairs in secondary education differs significantly from that in primary education.

Despite the fact that there is little or no emphasis on Digital Literacy in the official national curriculum, it appears to have been given a place in education, especially in primary education. Against this background, the national curriculum is undergoing revision, with the goal of ultimately achieving the following: new core objectives and attainment targets for primary education, lower and upper secondary education applicable to all pupils.

REVIEW OF THE NATIONAL CURRICULUM IN THE NETHERLANDS

After a national discussion about what students should learn in order to participate in the future society, the development process for a new national curriculum for nine learning areas started in late 2017: Dutch, English and modern foreign languages, Arithmetic and Mathematics, Human and Society, Human and Nature, Art and Culture, Sport and Exercise, Citizenship and Digital Literacy. The process was supervised by a steering committee, in which various educational stakeholders participated: teachers, parents, students and school administrators of both primary and secondary education. A scientific advisory board supported the steering committee to improve the quality of the outcome. The aim of the curriculum review was to describe what each student should know and be able to do to participate in contemporary and future society. The aim was to enhance the continuous learning path between primary and secondary education, between lower and upper secondary education and to create more cohesion within and between the subjects. The new curriculum should leave sufficient room for schools to add subjects or themes to the national curriculum based on their own vision and/or in line with the specific circumstances at a school. It should be possible to teach the new curriculum in approximately 70% of the available teaching time. The percentage mentioned was not an absolute standard, but more an indication of the intended scope of the new curriculum. It is the first time that the revision of the curriculum has been tackled in this way in the Netherlands: integrally, for primary and secondary education and for all subjects.

Within the new curriculum, two subjects should be given a place that are not part of the current curriculum: Citizenship and Digital Literacy.
A teacher design team (TDT) was set up for each subject, consisting of an average of 14 teachers, from both primary and secondary education, and two school leaders. Eight development schools were linked to each TDT, who assessed the proposals of the TDTs for their practicality and relevance and provided feedback on the work of the TDT based on their vision and practical experience. Each TDT also had an advisory group of about 4 scientists, domain experts, who tested the work of the development team on a scientific basis. The TDT was instructed to provide 'building blocks' for new national core objectives and attainment targets. These building blocks would be used in the next phase of the reform process to actually formulate those objectives and targets. The TDTs carried out a process in which they first prepared a vision for their subject, then they formulated 'big ideas' (important themes and concepts) and finally, they described what students should know and be able to do by the end of primary education and the end of lower secondary education (the building blocks). Initially the intention was also to formulate

building blocks for the end of the upper secondary education, but the TDTs ended up lacking time for realizing this intention, amongst others because the structure of separated subjects of upper secondary education proved too complex. For upper secondary education, the development teams formulated recommendations that were less elaborate than the building blocks for primary and lower secondary education.

In the period from December 2017 to September 2019, the TDTs met eight times in multi-day meetings. The time between meetings was used to solicit feedback on the intermediate products the TDTs had created. Stakeholders and other interested parties were given the opportunity to ask their questions, express their views and make proposals for adjustments. The TDTs discussed the feedback during a subsequent development session and accounted for the choices they made as to whether or not to process the feedback received.
This is how the TDTs came up with their proposals for the new curriculum, which they presented to the Minister of Education in October 2019. Since that time, political consultation has taken place about the continuation of the process and the phase in which the core objectives and attainment targets should be formulated on the basis of the proposals of the development teams, but that consultation has so far (May 2021) not resulted in any decisions being made. However, at the request of Parliament, the Minister has set up a Curriculum Committee to investigate whether the scientific basis for the proposals of the TDTs is strong enough to serve as input for new core objectives and attainment targets.

PROPOSALS FOR THE LEARNING AREA DIGITAL LITERACY IN THE NEW CURRICULUM

This section discusses the proposals made by the TDT with regard to Digital Literacy .
In developing the vision on Digital Literacy, the TDT started from the description of Digital Literacy given earlier in the article. This description, which came about after extensive analysis of the literature and consultation between domain and practice experts, is generally accepted in the Netherlands.

The development team chose four angles from which to approach the four components of Digital Literacy:
- Students acquire knowledge of digital technology;
- Students acquire skills for dealing with digital technology;
- Students learn to think critically about digital technology;
- Students learn to create with digital technology.

By choosing these angles, the development team wanted to make clear that
- Digital literacy also has an important knowledge component in addition to a skills component. In order to understand the functioning of digital technology and to deal with it consciously and responsibly, it is necessary that students acquire domain-specific knowledge.
- It is important to teach students to think critically about the tremendous influence of digital technology, about the relationship between humans and technology, about the personal relationship with technology, about social, economic and moral/ethical issues associated with the use of digital technology.
- Digital technology can be a powerful tool for making things and expressing
- one's creativity.

After formulating the vision, the TDT identified six important topics and big ideas that the new curriculum should cover:
Data and Information, Security and Privacy, The Functioning and Creative Use of Digital Technology, Digital Communication and Collaboration, Digital Citizenship and the Digital Economy.

Initially, the TDT had also chosen 'Sustainability and Digital Technology' as a 'big idea', but this was ultimately not included in the proposals for Digital Literacy, because this 'big idea' had been given a place in the learning area Human and Nature.

FIGURE 4: BIG IDEAS FOR DIGITAL LITERACY

For each topic/big idea, the TDT created one or more sets of building blocks. The building blocks are input for learning lines and descriptions of what every student should know and be able to do.

The chosen six topics/big ideas and matching building blocks connect the previously described four components of Digital Literacy. In this way, they provide insight into the relationship between these components.
The following table shows the relationship between topics/big ideas and the four domains.

BIG IDEAS	BUILDING BLOCKS	DIGITAL LITERACY COMPONENTS
1. Data and information	• From data to information • Digital data	- Media Literacy - Information Literacy - Computational thinking
2. Safety and privacy	• Safety • Privacy	- Basic ICT skills - Media Literacy - Computational thinking
3. Application and (creative) use of digital technology	• Interaction and creation with digital technology • Controlling digital technology	- Basic ICT skills - Media Literacy - Computational thinking
4. Communication and collaboration	• Networks • Communication • Collaboration	- ICT basic skills - Media Literacy - Information Literacy - Computational thinking
5. Digital Citizenship	• The digital citizen • Digital identity	- Basic ICT skills - Media Literacy - Information Literacy
6. Digital Economy	• Participating in the platform economy • Digital marketing	- Basic ICT skills - Media Literacy - Information skills

TABLE 1: RELATION BETWEEN 'BIG IDEAS', BUILDING BLOCKS AND DOMAINS OF DIGITAL LITERACY

An example of the content of the building blocks is the description of the learning track 'Interaction and creation with digital technology', which is part of the big idea 'Application and (creative) use of digital technology'. In this description, the TDT set out what knowledge and skills students should have at the end of primary education and at the end of lower secondary education.

PRIMARY EDUCATION

Knowledge and skills

Students learn:

- about the functions and parts of a number of standard applications by using them (e.g. word processors, presentation programs, image editing software)
- to use their understanding of how applications work to select and apply the most effective application from multiple applications.
- to interact with digital technology for the purpose of learning, socializing and entertainment.
- to creatively apply digital technology in a production or design process, using methods associated with digital technology.
- that technology is always evolving and that they themselves can devise and experience new applications.
- reflect on the significance of digital technology for themselves, their living environment, the school and the world around them.
- to think about the physical and mental health aspects involved in using digital technology and learn to take them into account in their personal lives and those of others.

LOWER SECONDARY EDUCATION

Knowledge and skills:

Students learn:

- to recognize underlying concepts in standard applications of digital technology and use them in new applications and contexts.
- that digital technology and applications can be used for purposes other than those for which they were designed. Students become acquainted with examples of how technology can be used differently and thus acquire more or different functions, come up with new possibilities and create various applications.
- to apply digital technology individually or together with others in various ways efficiently, creatively and flexibly in a creative design or production process, using methods that are typical for digital technology.
- that digital technology has a fundamental place in society and that, as a result, society is constantly and radically innovating and changing.
- to think about the relationship between human and digital technology: they become aware of how people and technology relate to each other and think about the personal, social and economic values that can play a role in this and the trade-offs that can be or should be made.
- how digital technology is applied in different fields of study and within different professions, giving them insight into the possibilities that digital technology offers for their choice of profession or further education.

UPPER SECONDARY EDUCATION

The TDT formulated the following recommendations for upper secondary education:

1. Pay attention to the challenge for students to use digital technology in new ways within different contexts;
2. Pay attention to the possibilities that exist for keeping up with the ever-changing technological developments, so that students are aware of the consequences this has for their own choice of further education and profession and their position in society.
3. Continue paying attention to learning to reflect on the consequences of the current and future applications of digital technology. Students form an opinion about its ethical, social, scientific and economic aspects.
4. Pay attention to the fact that students continuously think about the relationship between human and digital technology: they are aware of how people and technology relate to each other and think about the ethical, social and economic aspects that can play a role in this and about the possibilities that digital technology offers for enriching human existence.
5. Pay attention to the possibilities offered by digital technology when solving complex problems or when designing and developing your own (artistic) ideas.
6. Pay attention to cross-curricular work and the creation and design process, with respect to courses of study and professions.
7. Pre-vocational secondary education: Broaden the knowledge and skills that are acquired in lower secondary education so that the students have a better connection with courses of study and professions.

The proposals of the development team have been well received by stakeholders from science, business and media. The proposals also received support from education. The development schools associated with the development team recognized the relevance of the proposals and considered them ambitious but feasible if attention is paid to the careful implementation of digital literacy in all school types and at all levels.

The Review Digitale geletterdheid (Digital Literacy Review (Voogt et al. (2019)) asks which knowledge and skills fall under the concept of Digital Literacy in different frameworks and curricula. One of the curricula involved in answering this question was the proposal of the TDT for Digital Literacy intended for primary education. The DigComp 2.1 framework (Carretero, S., Vuarikari, R. and Punie, Y. (2017)), developed by the European Union, which was used in the review as an overarching framework to carry out this analysis. The analysis shows that the proposals of the TDT address almost all competencies described by DigComp 2.1. In two cases, this was not the case:

1. Solving technical problems (5.1 in the DigComp framework)
2. Identifying digital competence gaps (5.2 in the DigComp framework)

Like the curricula of a number of other countries, the TDT's proposals also describe goals that were not easy to link to the DigComp framework. In the review, these goals are divided into four categories:

- Control and choose applications
- The technical operation of technology
- Reflection on the consequences of technology for themselves and society
- Use of technology for learning.

The TDT has formulated goals that can be assigned to the first three categories.

POSITION OF DIGITAL LITERACY IN THE CURRICULUM

Assuming that the proposals of the TDT for Digital Literacy would actually lead to new core objectives and attainment targets for Digital Literacy, intended for all pupils in primary and secondary education, the question is what the position of Digital Literacy will be in the curriculum.
The TDT argued in favor of integrating digital literacy into other subjects as much as possible. According to the TDT, the other subjects and learning areas provide a relevant context in which students work on their Digital Literacy. However, the TDT also advocates for giving Digital Literacy a unique place in the curriculum , because this subject involves specific knowledge, methods and skills that will not automatically be covered in other subjects. Specialized teachers are needed to provide education in the domain-specific aspects of Digital Literacy.
While there is much to be said for the TDT's view, caution is warranted.

Voogt and Ten Brummelhuis (2014) describe how a similar approach failed in the Netherlands in the 1990s. In the early 1990s, a new Information Science subject was introduced. That was a small subject, intended to teach the basic knowledge and skills that would then be applied in other subjects. Things went wrong during the implementation: the elaboration of the goals in the teaching materials was limited (practical operational skills (learn which buttons to press) and programming) and the integration into other subjects did not go well because the teachers of the other subjects were insufficiently equipped to shape Information Science within their subject. The students' results were disappointing and at the beginning of the new century, after the curriculum had been revised, Information Science had disappeared as a subject and as part of other subjects. The result is the situation described earlier in the article.
If a similar approach is chosen in the revision of the curriculum of the Netherlands as in the 1990s, it is important to pay considerable attention to the implementation of the new subject Digital Literacy. It is important that good teaching materials and assessment instruments are developed in line with the goals, that there is sufficient space within the curriculum of other subjects to include the aspects of Digital Literacy relevant to the subject or field of study. But above all, it is important to pay attention to the training of teachers, both specialists and teachers of other subjects.

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NORWAY

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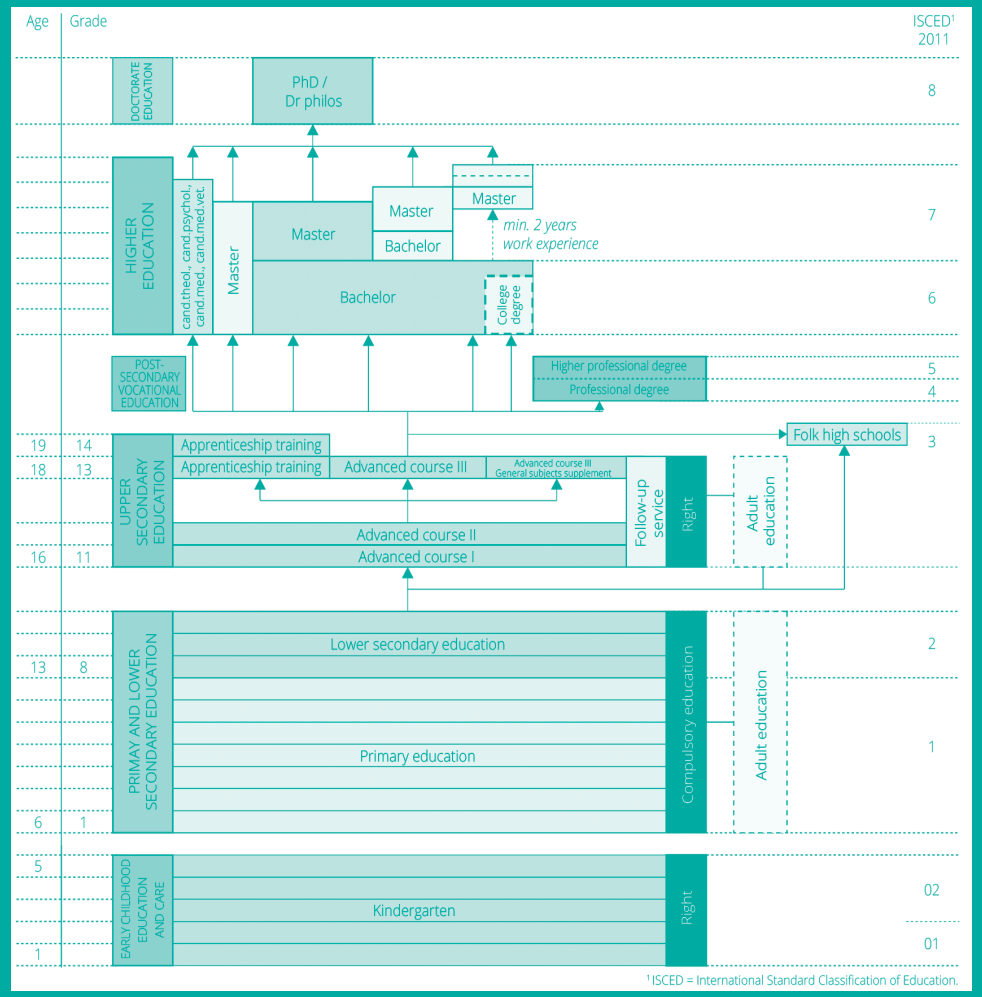
Digital Literacy: from Punching Punch Cards to Behaving in Cyberspace

ABSTRACT

In the Norwegian national curriculum reform “Subject Renewal (2020)”, the main objective has been to strengthen in depth-learning, understanding, critical thinking and reflection. Developing subject curricula with more relevant content and reducing curriculum overload by prioritising in the subjects serves as the overriding objective in order to provide a curriculum that prepares pupils for the future. To this aim, the reform has significantly strengthened the focus on digital competence. There are many sides to digital competencies in the subject curricula, including digital literacy, the competence to develop digital technology (programming/coding) and problem-solving methods in terms of computational thinking. The article discusses this diversity and its complexity. Some consequences for implementation are also addressed.

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN NORWAY

INTRODUCTION: DIGITAL COMPETENCE IN THE 2020 NATIONAL CURRICULUM REFORM

The article begins by explaining the background of the 2020 national curriculum reform and how digital competence has been conceptualised in the new curriculum. Digital competence in the curriculum can be split up in four parts and these parts are used to structure the article. In section two, the function of digital skills as a generic competence is addressed. Section three examines digital technology, programming and computational thinking in the curricula. Section four compares digital literacy and digital competence to the definition of digital literacy in the CIDREE Yearbook, and both similarities and differences are found. Sections 5-7 discuss the complexity of the many aspects of digital competencies in the national curriculum and look at the consequences for implementation. The article concludes by raising interesting questions to pursue in the evaluation of the curriculum reform.

In the autumn of 2020, primary and lower secondary school in Norway, years one to ten, introduced new subject curricula. The overall objective has been to provide a curriculum that prepares pupils for their unpredictable futures. What can be predicted, on the other hand, is that our social environments will become increasingly technologically dense. Consequently, the requirements for technological competence will increase, both in terms of participation in society and the competences required in higher education and working life. Therefore, new content has been incorporated in the curricula, including programming and computational thinking. Digital literacy has been included in all subject curricula since 2006. However, such aspects as digital judgment, digital security and critical thinking have been strengthened. Furthermore, digital creativity has been given more room in the core curriculum.

Thus, there are many sides to digital competencies in the subject curricula. This article discusses this diversity and its complexity and investigates some of the consequences for implementation.

As mentioned above, digital competence in the national curriculum can be divided into four parts:

- Digital literacy
- Digital technology
- Programming
- Computational thinking

The CIDREE Yearbook is based on a definition of digital literacy that includes basic ICT skills, computational thinking, media literacy and information literacy. Section four below addresses the relationship between this conceptualisation of digital literacy and how digital competence and digital literacy are conceptualised in the Norwegian subject curricula.

One aspect that must be pointed out first, however, is that digital literacy, as the term is used in the Norwegian curriculum, does not include all aspects of digital competence, as digital literacy seems to do in the CIDREE Yearbook's understanding of the term. This will be discussed later in the article.

DIGITAL LITERACY AS GENERIC COMPETENCE

One of the key features of the compulsory and secondary education reform of 2006, the Knowledge Promotion Curriculum Reform, was the integration of basic skills, understood as literacies, in the subject curricula.

The evaluation of this reform showed tha t the quality of the work on basic skills in everyday school life varies very much from school to school. The evaluation also showed that there are differences in how the basic skills are understood. One widespread misconception has been that they have been regarded as elementary skills that are most important for pupils in the early part of their education, and not as skills that are developed continuously as part of the subject competence throughout their compulsory education path (years 1-13). The need to address these challenges that arose with the 2006 reform was one of the reasons for the curriculum reform of 2020.

In the 2006 reform, five skills were defined as basic to learning in school and working and societal life. These skills are basic in the sense that they are fundamental to learning in all subjects and are a prerequisite for pupils being able to show their competence and qualifications.

From the 2006 reform, all subject curricula describe how the five basic skills, namely orals, reading, writing, numeracy and digital skills, contribute to developing the pupil's competence and qualifications and how these skills are integrated into the subject. Each subject curriculum integrates competence aims, basic skills and subject content. The skills are consequently expressed in different ways and to varying degrees in each of the subject curricula, depending on the relevance the five skills have for the subject in question. In the Subject Renewal Reform of 2020, this concept is continued. Underlying this basic skills approach is a specific understanding of being literate that can be linked to an extended understanding of literacy. A broad definition of literacy embraces the competence to read and write in various contexts, and the concept includes a set of language skills that enable pupils to understand, create, communicate, orient themselves and participate in society and working life (Barton, 2006). The extended definition of literacy includes such competencies as identifying, understanding, interpreting and communicating. Thus, literacy is about being able to read and write in various contexts.

In the new reform, as well as in the curriculum reform of 2006, the school subjects are the contexts for learning and developing literacy according to each subject's premises. Digital skills constitute one of the five basic skills, meaning that these skills are part of the competence and are tools for learning in each subject.

In terms of digital literacy, digital skills refer to complex competence in both technical and verbal-language skills that include the ability to read and create multimodal texts. Furthermore, being literate in technology-rich environments refers to the ability to critically assess the sources the pupil reads and uses (Skovholt, 2014). Digital skills are defined as: the ability to use digital tools, media and resources efficiently and responsibly; the ability to find and process material, which means acquiring, processing and interpreting information from digital sources; the ability to produce and process texts, which means being creative with the use of digital resources; the ability to use digital resources for communication and interaction; and the ability to exercise digital judgment (Norwegian Ministry of Education and Research, 2012).

Moreover, digital skills are a prerequisite for further learning and for active participation in working life in a constantly changing society. The development in digital technology has changed many of the conditions for reading, writing and verbal expression. Consequently, using digital skills is a natural part of learning both in and across subjects, and they can be used to acquire and apply new learning strategies. At the same time, they require a new and improved ability to critically judge sources.

As a generic competence, digital skills are integrated in all the subject curricula. Below are examples of how different aspects of digital literacy are addressed in the various subjects. Arts and crafts, mathematics, music, science and social studies have been chosen because these are the subjects that also address other aspects of digital competence.

SUBJECT	DIGITAL SKILLS
Mathematics	Being able to use graphing tools, spreadsheets, CAS, dynamic geometry software and programming to explore and solve mathematical problems. Furthermore, this involves finding, analysing, processing and presenting information using digital tools.
Science	Being able to use digital tools to explore, register, calculate, visualise, program, model, document and publish data from experiments and fieldwork. Digital skills also include using search engines, mastering search strategies, critically assessing sources and selecting relevant information on scientific topics.
Music	Being able to use music technology to practise, create and experience music. This involves using digital tools creatively to record, process and manipulate sound and use programming to be creative and work in creative processes.
Arts and crafts	Being able to use digital tools and digital media as a source of inspiration, testing, documentation and presentation. This also includes using digital tools and programming in creative processes.
Social studies	Being able to use digital tools to find, process and navigate through digital sources, critically assess digital sources and select relevant information. It also means being able to communicate, collaborate and create digital products and follow rules and norms for online communication, as well as privacy and copyright protection. The social studies subject has a special responsibility for developing pupils' digital citizenship

What the above extracts from the curricula show is that digital skills are expressed in different ways, depending on how the skills are understood in the subject in question and what function they have in this subject. Therefore, in the process of developing a national subject curriculum, one of the tasks is to decide which digital skills are involved in the subject in terms of how they are to contribute to the development of the pupils' competence in the subject, and how digital skills themselves are a part of this competence.

DIGITAL TECHNOLOGY, PROGRAMMING AND COMPUTATIONAL THINKING

Prior to the curriculum development, technology experts consulted by the Ministry of Education proposed that a new compulsory school subject in digital technology should be introduced in primary and lower secondary school. According to the proposal, the subject should be practical and should give pupils the opportunity to acquire basic technological competence.

When planning for the curriculum development, the Ministry chose not to create new school subjects. Instead, to respond to the need to improve technological competence, technology has been incorporated into the existing subjects on each of these subjects' premises.[1]

The Digitalisation Strategy for Basic Education 2017–2021 points out how technology and programming are to be addressed in the new reform: "In the Subject Renewal Reform, consideration must be given to how technology, programming and computational thinking can be incorporated in specific subject curricula, especially in mathematics and science" (Norwegian Ministry of Education and Research 2017, p. 18).

However, two new subjects have been created, i.e., a programming elective in upper secondary school and programming and modelling, also in upper secondary school.

The following describes how digital technology, programming and computational thinking have been incorporated into the following subject curricula: arts and crafts, mathematics, music science and social studies.

DIGITAL TECHNOLOGY

In **science**, several of the competence aims refer to using, understanding, creating, and evaluating technology. Technology, however, is more than just digital technology. Thus, when developing the curriculum, the ambition has been to give teachers the option of including more technology than just the digital aspect. Several of the competence aims open for digital technology, even if only implicitly expressed.

In **music**, music technology can be used to practise, create and experience music. Music technology is particularly relevant in the competence aims where the pupils are to

[1] Cf. Norwegian Ministry of Education and Research, 2016.

create music, for example in this competence aim after year seven: "use technology and digital tools to create and process music". Digital technology is implicit in all the competence aims that refer to practising, making and experiencing music.

In **social studies**, (digital) technology is explicitly considered in the competence aims as a factor for making changes in nature and society, seen from historical, contemporary and future perspectives. Additionally, pupils are to link technology to other competence aims, for instance in connection with questions about power and how society has an impact on nature.

In **arts and crafts**, digital technology is most evident in these two competence aims after year ten: "use different tools and handicraft techniques and suitable technology in the processing and joining together plastic and soft materials", and "explore how digital tools and new technology can provide opportunities for forms of communication and experiences in creative processes and products".

PROGRAMMING

Through the curriculum development process mathematics has been given sole responsibility for the initial learning of programming. The progression in programming is explicitly evident at all stages. Up to and including year four, programming is non-digital.

The progression in the competence aims is listed below:

The pupil is expected to be able to

- After year 2: create and follow rules and step-by-step instructions during play and games
- After year 3: create and follow rules and step-by-step instructions in play and games related to the coordinate system
- After year 4: create algorithms and express them using variables, conditions and loops
- After year 5: create and program algorithms with the use of variables, conditions and loops
- After year 6: use variables, loops, conditions and functions in programming to explore geometric figures and patterns
- After year 7: use programming to explore data in tables and datasets
- After year 8: explore how algorithms can be created, tested and improved by means of programming
- After year 9: simulate outcomes in random trials and calculate the probability that something will happen by using programming
- After year 10: explore mathematical properties and relationships by means of programming

Programming in the **music** subject is visible in connection with digital skills. It means using digital tools creatively to record, process and manipulate sound and using programming to be creative and to work in creative processes. It can be used in all competence aims that deal with creating music, and is explicitly formulated in the competence aims in lower secondary school:

The pupil is expected to be able to

- After year 10: create and program musical sequences by experimenting with sound from different sources

In **arts and crafts,** programming can be used to achieve several of the goals in the plan. For instance, it is explicitly stated after year seven: "use different programming languages to create interactivity and visual expressions".

Programming is mentioned explicitly in some parts of the science curriculum and plots out a clear learning progression.

COMPUTATIONAL THINKING

In mathematics, computational thinking is connected to "exploration and problem solving" in the subject. Computational thinking is important in the process of developing strategies and procedures to solve problems, and it means breaking a problem down into sub-problems that can be systematically solved. This also includes assessing whether the sub-problems would be best solved with or without digital tools.

Computational thinking largely coincides with mathematical thinking. The incorporation of computational thinking represents a strong shift towards promoting the active and exploratory pupil. There is also a focus on having the pupils reflect on and argue for the methods they choose when trying to solve problems. In this way, it can be argued that computational thinking permeates the entire mathematics curriculum.

In social Studies, it is expected that pupils should be able to reflect on how algorithms can affect our understanding, and this is explicitly formulated as a competence aim in year ten:

- After year ten: assess the way in which different sources provide information on a social-studies topic, and reflect on how algorithms, unilateral sources or the lack of sources can affect our understanding.

Music: Computational thinking is not a prerequisite for achieving the competence aims in the music subject but can still be used in creating music.

Arts and design processes constitute computational thinking in the arts and crafts subject. Here pupils follow a given system to find a solution to a problem. All competence aims dealing with art and design processes require the pupils to use computational thinking. For example, after year four: "carry out art and design processes by seeking inspiration, exploring possibilities, making choices and making one's own products."

In **science**, scientific practices and ways of thinking are key elements. Exploratory work methods in science, such as having a sense of wonder, asking questions and formulating explanations based on evidence overlap with computational thinking. The content

of computational thinking is therefore incorporated in the curriculum, even if the term "computational thinking" is not mentioned explicitly.

To this point the diversity of digital competence in Norway's current curriculum reform has been explained. Below, some aspects of the complexity involved will be discussed, and some consequences for implementation will also be looked into.

But first, in section 4, the article will compare how digital literacy is understood in the CIDREE Yearbook and in the Norwegian curriculum.

COMPARISON OF HOW CIDREE AND THE NORWEGIAN EDUCATION AUTHORITIES UNDERSTAND DIGITAL LITERACY

The CIDREE Yearbook defines digital literacy as encompassing skills that relate to using ICT effectively, efficiently and responsibly, combining basic ICT skills, computational thinking, media literacy and information literacy. Below, the article will elaborate on how Norway's interpretation of digital literacy relates to these four aspects.

First, in the Norwegian curriculum, digital literacy is one of the five basic skills: reading, writing, numeracy, oral skills and digital skills. These skills are part of the competence in all subjects and are necessary tools for learning and understanding. They are also important for each pupil's development of identity and social relations, and for the ability to participate in education, work and societal life. Thus, the five basic skills are to be understood as literacies.

This means that the Norwegian curriculum's digital skills do not, or at least to a very small extent, include basic ICT skills as in the CIDREE definition. Nevertheless, digital skills are integrated into the competence aims in the relevant subject curricula, such as this in the Norwegian subject:

The pupil is expected to be able to
- After year 2: write texts by hand and using a keyboard

Second, computational thinking in the CIDREE Yearbook definition refers to using thought processes that involve the identification, deconstruction and solving of problems. As shown in section three, the Norwegian subject curricula understand this in an almost identical way.

Third, the CIDREE Yearbook states that media literacy is about the knowledge, skills and attitudes necessary to undertake conscious, critical and active work with media. In addition to the ability to understand how media work and how they influence what we see, this is about the ability to create content, participate in social networks and reflect on one's own media use.

In the Norwegian curriculum, these dimensions are present to a degree in what we call the digital skills. However, some of the dimensions are also included in the definition of competence that all the competence aims in all subjects are based on – and thus a part of the competence in all subjects:
- Competence is the ability to acquire and apply knowledge and skills to master challenges and solve tasks in familiar and unfamiliar contexts and situations. Competence includes understanding and the ability to reflect and think critically.

Fourth, the CIDREE Yearbook states that information literacy is the ability to identify and analyse a need for information and based on this to be able to search, select, process, use and present relevant information. This aspect of digital literacy is also included under both digital skills and the definition of competence.

SUBJECT CONCENTRATION VERSUS SUBJECT INTEGRATION

A characteristic feature of the Subject Renewal Reform is that, on the one hand, it sharpens the focus on the importance of each school subject, with subject concentration as a stated objective. On the other hand, a subject-integration approach is also emphasised. In part, this is about digital literacy as a generic competence, and in part about certain aspects of digital technology being emphasised across disciplines.

The research-based evaluation of the 2006 reform found that when it came to the basic skills, it proved to be demanding to implement the reform as intended (Møller, Prøitz & Aasen, 2009; Aasen, Møller, Rye, Ottesen, Prøitz & Hertzberg, 2012; Vibe & Lødding, 2014). Some teachers, heads of school and municipal education authorities understood the basic skills in a narrower way than was the intention, i.e., more as elementary skills. Some educators, especially upper secondary school teachers, perceived the basic skills as being in addition to academic knowledge, and thus something that displaced important academic content. This understanding clashes to a degree with the extended definition of literacy, i.e., the intention of embedding language, communication and digital skills within the subject competence.

However, since the introduction of the 2006 reform, both in primary and secondary school, support for and awareness of the basic skills has gradually increased. Nevertheless, to support understanding and help promote even better implementation, the 2020 Subject Renewal Reform places stronger emphasis on how the subjects have different roles to play in the pupils' development of the five skills. Thus, the different responsibilities of each subject are clarified in the subject curricula.

The decision to not create a separate subject in digital competence, but rather to integrate digital competence in several subjects (cf. section three) makes sense when bearing in mind the premise that digital competence is an integral part of the competence in all subjects. At the same time, this may challenge teachers' competence more than if,

for example, programming had been a separate subject. See below for more on teacher competence.

In this context, there is a debate on whether integrating programming into subjects can lead to it replacing other important subject content, for example traditional academic content in mathematics.

TEACHERS' PROFESSIONAL OPTIONS

One challenge in the curriculum has been to find a good balance between the explicit and implicit expression of different aspects of digital technology and digital competence. The ambition has basically been to ensure that the technological aspect is so explicit that schools will not be able to disregard content that refers to this.

However, making digital technology explicit in the curricula can also present some challenges. On the one hand, teachers' professional options might be limited. It is demanding to find on the one hand, a good balance between open competence aims that provide scope for professional action, academically and didactically, and, on the other hand, more detailed learning outcomes that can be good support for teachers, but which at the same time also might limit academic and didactic options.

Consequently, it has been necessary to balance the need to support teachers, and the need to state a level of competence in programming after each year, and simultaneously maintain the teachers' professional options. To express learning outcomes in ways that do not limit these possibilities, the number of competence aims in the subject curricula has been kept to a minimum, nor are there very detailed knowledge- or skill-oriented competence aims. The most important consideration has been to not limit the teachers' options when setting priorities and making professional choices when they adapt the teaching to different pupils and groups of pupils on the local level.

To support teachers and schools in introducing the new curriculum starting from 2020, the national education authorities have prepared national measures to improve the understanding of digital competence and contribute to good digital practice. Digital support resources have been developed, including websites and digital school-based competence packages in technology, programming and computational thinking. Resources like this have been developed both before and after the Subject Renewal Reform to help raise digital maturity in the school sector.

It is also important to mention that the government has allocated a larger amount of money over a five-year period to the national initiative "The Technological Schoolbag". This will provide pupils with knowledge and understanding of technology, computational thinking and programming. The initiative has been funded through grant schemes and other measures aimed at the local authorities, school leaders and teachers. The education authorities have pointed out that the online support resources must support key intentions of the Subject Renewal Reform, and it should contribute to didactic reflection in the professional communities at schools rather than provide ready-made solutions or intervene too much when it comes to the teachers' local options.

The national education authorities are monitoring the use of such support to assess whether it is working as intended, especially when it comes to the balance between providing adequate support and guidance and possibly limiting local and professional options. The first sub-report in the evaluation of the reform points out that although the use of support resources is voluntary, in practice their influence can set limits on what teachers feel they can do and the options they have in the exercise of their profession (Karseth, Kvamme & Ottesen, 2020).

This issue will receive attention in later evaluation reports. Even though the national education authorities communicate that there is a difference between what the regulations are (the national curriculum) and what recommendations are (the support resources), in practice the supporting resources may seem more controlling than what was intended.

SOME CONSEQUENCES FOR IMPLEMENTATION OF THE REFORM

In the current curriculum reform, computational thinking and programming have been included as new aspects, especially in mathematics. Many mathematics teachers lack skills in programming, and this can detrimentally affect the implementation of the reform. Furthermore, the subject curriculum in mathematics states that pupils must work with mathematical content using programming. To realise this ambition, a new pedagogical didactic competence is required of mathematics teachers. There is also a need to develop a new mathematics pedagogical content knowledge that utilises programming as an integrated part of mathematics. Currently, little work has been done in this field.

Undoubtedly, programming and computational thinking are new and unknown fields to many teachers. Nor is there any doubt that this places new demands on many of them. Moreover, it must be recognised that there is a difference between learning programming as a subject/skill on its own and learning programming as an integrated part of another subject. The latter refers to programming as a tool for solving problems and increasing one's competence in the specific subject.

At present, there appear to be limited educational programs offering teachers courses in subject didactics that include programming as a tool that is embedded in the subject. There are, on the other hand, many subject didactics courses related to programming as a subject. While the difference between these two may not seem that large, there is still a significant difference in the field of subject didactics.

In Norway, the local authorities are the school owners for primary and lower secondary school and therefore responsible for ensuring that teachers at these levels have the competence they need. This also includes new requirements for competence that arise due to new content in the curriculum.

When it comes to digital competence for teachers, several universities and university colleges offer teachers further education in, for example, programming. However, it is a problem that many of these courses are solely programming courses, and not courses in mathematics didactics in which programming is integrated in the subject. We also know that not every teacher who wants to take a further education course is admitted due to the limited number of study places. Furthermore, for practical reasons, some teachers may find it difficult to take further education courses. Challenges in finding competent substitutes for teachers on a temporary basis while they attend courses is another issue that has to be addressed.

Bearing these circumstances in mind, in collaboration with various universities and university colleges, the Directorate for Education and Training has developed a digital competence package that is free and available to all. This online competence development package is available to everyone who wants to receive support to plan and carry out teaching in programming at their school.

Everyone involved in education knows that it takes time to introduce a new national curriculum. In a school year marked by major upheavals with the introduction of new curricula, in addition to extraordinary measures because of the corona pandemic, it has been more demanding than it otherwise would have been to find enough time for competence development and development work.

Nonetheless, the national education authorities have signalled that the local education authorities are expected to give priority to facilitating continuing and further education for teachers who want and need it, even if this is demanding. The argument has been that it is positive to get started on building competence in this field, and to share experiences in this area, even when these are challenging times.

Conclusion

The political decision to include programming and computational thinking in the curriculum has gained much support throughout the development of the Subject Renewal Reform. The Government's Digitalisation Strategy states that programming and computational thinking should be integrated in all relevant subjects (Norwegian Ministry of Education and Research, 2017). A key consideration has been that pupils' work with programming in subjects can be a powerful tool that will increase their understanding of the subject matter, and, on a more general level, will also help their understanding of how digital technology works and what role technology plays in society. The assumption is that when, as intended, pupils encounter this topic in several subjects, their digital competence will be expanded. This does not only refer to programming, but also to digital judgment and other aspects of digital literacy.

It must also be pointed out that the new curriculum places new demands on teachers, especially on mathematics teachers.

The evaluation of the Subject Renewal Reform (2019–2025) examines various aspects of the reform's intentions.[2] It provides insight into how the reform has been implemented, how it is changing practices in schools, such as teaching methods and ways of learning, and how far the learning outcomes match the intentions.

In the continuing evaluation research, it will be important to investigate such issues as how teachers understand the concept of "computational thinking", how computational thinking is implemented in the teaching, how the interaction between the work with programming and the traditional academic goals will be supported and how the challenges are associated with this will be addressed.

[2] See: https://www.udir.no/laring-og-trivsel/lareplanverket/fagfornyelsen/evaluering-av-fagfornyelsen/ and https://www.uv.uio.no/forskning/prosjekter/fagfornyelsen-evaluering/publikasjoner/

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SCOTLAND

GEORGE MILLIKEN

George Milliken is a Development Officer at Education Scotland. He is currently working to develop digital approaches to support practitioners increase their confidence, skills and knowledge of digital learning and teaching.
Before working in education, George was involved in developing grassroots football before training as a primary school teacher, and then working nationally at Education Scotland. He has planned learning at all levels of the primary curriculum and discovered that digital literacy and digital skills could be used to improve educational outcomes for learner through engaging, exciting and meaningful learning. Now working at a national level, George is responsible for leading professional learning for educators and connecting with networks across the country.

In this role at Education Scotland, he works collaboratively with Scotland's local authorities, national, regional and industry partners to develop and deliver professional learning that demonstrates the positive impact digital technology can have on educational outcomes.

LOUISE FOREMAN

Louise Foreman is an Education Officer at Education Scotland. She is currently working with practitioners in a wide range of educational settings and partners to explore and implement digital curriculum design and pedagogies. Louise's career spans over 20 years in education working across primary schools, local authority and now nationally.

She has planned learning at all levels of the primary curriculum where she quickly identified the significant positive impact embedding digital literacy across the curriculum had on the engagement, attainment and achievement of learners. Her career progressed to coaching and mentoring teachers and managing and coordinating digital skills professional learning across a local authority, where she also built strong networks and partnerships between schools and digital industry.

In her current role at Education Scotland she works collaboratively with Scotland's local authorities, national, regional and industry partners to design and promote high-quality digital professional learning and leadership.

Digital technologies form a central part of Scotland's heritage, identity and future

ABSTRACT

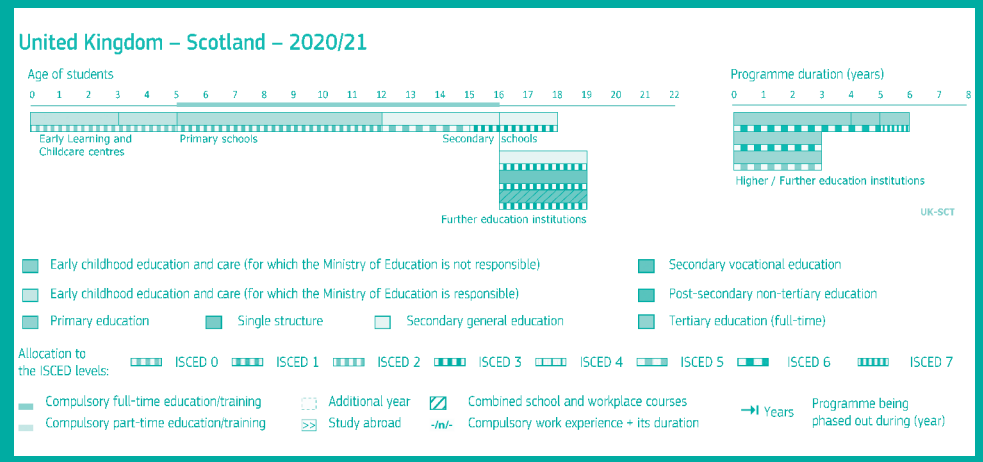
They are vital to the educational experiences of our children young people so they can flourish in learning, life and work, and essential to our economic growth . Drawing upon the Scottish Government's 'Digital learning and teaching strategy for Scotland' (2016) and a comprehensive review and refresh of Scotland's Technologies curriculum in (2017), this article will illustrate and detail the innovations, partnerships and milestones that have led to implementing digital literacy and computing science across an education system.

Digital literacy is placed at the heart of the Scottish curriculum, offering real time, real world experiences full of creativity, problem solving and critical thinking. It is embedded within 'How Good is Our School', the national framework to support self-evaluation and reflection; Initial Teacher Education; and the Professional Standards set by the General Teaching Council for Scotland. This article will illustrate how digital literacy has been embraced by education practitioners and learners across Early Learning and Childcare, primary and secondary schools (ages 3-18). It will detail models of professional learning nationally, regionally, locally and at school level. Adapting and diversifying modes of professional learning are critical in providing practitioners with relevant, motivating and skills-building opportunities to improve their own digital learning so they can provide better learning for young people. This has led to the development of knowledge, skills and application in the use of digital tools and on pedagogical practice.

This article will detail how partnerships with industry has enabled the creation of a self-evaluation digital accreditation programme, Digital Schools Award for Scotland, which has been adopted in increasing numbers of schools across local authorities the whole of Scotland. It promotes a culture of leadership and recognises and encourages excellence in the holistic approach to embedding digital literacy throughout the life and community of a school.

This paper will also provide a unique overview of the digital learning and leadership response to the global pandemic, building

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN SCOTLAND

upon and leveraging a Scotland-wide secure online learning platform for practitioners and learners. It will illustrate how Scottish educators and learners utilised technology to provide continuity of education during school closures, building bridges of communication and collaboration across practitioners and learners, and breaking down geographical boundaries across a nation.
Finally this paper will detail the advice and support provided for remote and blended learning across Scotland. It will reveal how partnerships between national agencies has resulted in the creation of a National e-Learning offer.

INTRODUCTION: IMPLEMENTING DIGITAL LITERACY ACROSS THE SCOTTISH EDUCATION SYSTEM

Scotland has a reputation as a nation of innovators and is famously the home of many life changing inventions, from penicillin and chloroform to television and the telephone. With a population of 5.4 million, the country continues to build upon this rich legacy as a leading innovator in many areas of the technologies such as renewable energy, life sciences and games design. Technologies are a central part of Scotland's heritage, identity, and future and as the digital sector continues to expand rapidly, it is a key contributor to economic growth and global competitiveness.

Digital technologies have been included in key Scottish Government policies, within and beyond education in aspects such as sustainable economic growth, a feature which runs through Scottish education and our national curriculum - 'Curriculum for Excellence (CfE)'. To ensure our children and young people are ready for an ever-changing world, CfE ensures that all learners are taught digital skills, digital literacies, and computing science. Not only is digital literacy taught in the Technologies curriculum but is a theme that runs throughout other areas, including Literacy, Numeracy and Health and Wellbeing.

Alongside the curriculum, Scotland also has a Digital Learning and Teaching strategy to develop educators' skills, learners' access to technology, empower leaders and enhance curriculum and assessment delivery. This is designed to ensure that everyone – educators and learners – can develop their digital literacy skills and access our innovative and creative curriculum in meaningful ways.

This article draws upon the Digital Learning and Teaching strategy for Scotland and a comprehensive review, and refresh of Scotland's Technologies curriculum. It illustrates and details the innovations, partnerships and milestones that have led to implementing digital literacy and computing science across an education system.
Scotland's digital future ambitions for education is mirrored by the European Commission, Digital Education Action Plan (2021-2027) and the vision for high-quality, inclusive and accessible digital education across Europe. The two strategic priorities:

- Fostering the development of a high-performing digital education ecosystem
- Enhancing digital skills and competences for digital transformation

This article aims to continue to contribute to the wider discourse about digital education and skills within the European and global context.

SCOTLAND'S TECHNOLOGY CURRICULUM FOR EXCELLENCE – A COMPREHENSIVE REVIEW

Scotland's curriculum – Curriculum for Excellence (CfE) – helps our children and young people gain the knowledge, skills and attributes needed for life in the 21st century.

Curriculum for Excellence places learners at the heart of education. At its centre are four fundamental capacities. These capacities reflect and recognise the lifelong nature of education and learning. The four capacities are aimed at helping children and young people to become:

- Successful learners
- Confident individuals
- Responsible citizens
- Effective contributors
-

THERE ARE EIGHT CURRICULUM AREAS:

- Expressive arts
- Health and wellbeing
- Languages (including English, Gàidhlig, Gaelic learners, modern languages and classical languages)
- Mathematics
- Religious and moral education (including Religious and moral education and Religious education in Roman Catholic schools)
- Sciences
- Social studies
- Technologies.

Literacy, numeracy and health and wellbeing are recognised as being particularly important – these areas are seen as being the 'responsibility of all' staff.

In 2014 there was a review of the technologies curriculum, Building Society, Young people's experiences and outcomes in the technologies, which reinforced the values underpinned by the Scottish concept of the technologies – as inspiring, enabling, supporting and equipping our children and young people to take their learning and use it to make people's lives better. The review recognised the impact technologies have on children's and young people's learning, achievements and readiness for the world in which they will live and work. It celebrated the successes already established across our education landscape and equally set out much that can be done to improve outcomes for our children and young people, and our communities. The report recommended that learning through technology must be of 'real quality, real-world and real-time' in order to compete, thrive and provide leadership in challenging circumstances. However, this requires educators who are confident in the application of digital skills and digital pedagogy.
The Building Society review identified three clear themes to bring about improvements in young people's experiences and achievements in the technologies.

- Young people's learning needs to promote innovation, and make much more direct use of the exciting, dynamic technologies environment in which children and young people will live and grow
- Staff working with children 3-15 need a stronger lead and clearer guidance to support better learning in the technologies
- Digital technologies need to become much more central to children's learning in all areas of the curriculum.

The review made it clear that better Technologies learning would need all partners – learners, practitioners, parents, businesses and the wider communities to work together, in new and more productive ways. Education Scotland would provide the lead, engaging partners closely in delivering Building Society's promise and potential.
Based on the three themes, an agenda for action was established:

CREATIVITY AND PROBLEM-SOLVING, REAL-WORLD, REAL-TIME

- Define criteria and audit tools for creativity and problem-solving, real-world, real-time, by which children's and young people's technologies experiences can be evaluated; develop resources to create, promote and support progressive technologies programmes, for children and young people 3-18, which deliver creativity and problem-solving, real-world, real time; and engage with children and young people, parents and communities, businesses and employers, to create the new resources.

DIGITAL TECHNOLOGIES AT THE HEART OF LEARNING

- Conduct research into learning which exploits digital technologies fully; and develop initial teacher education and continuing professional learning models, resources and processes which locate digital technologies at the heart of learning.

BUILDING THE TECHNOLOGIES BRAND

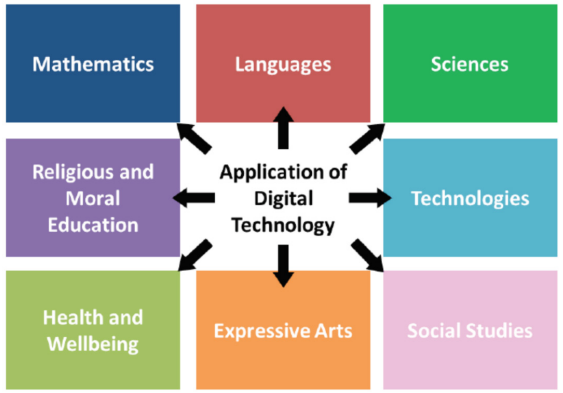
- Convene short-life development action groups including early years, primary and secondary specialists; and develop a coordinated/integrated technologies curriculum for the broad general education 3-15, to deliver the entitlement by end of S3 and support appropriate transition into specialist senior phase pathways.

This review coincided with an OECD report in 2015, *Improving Schools in Scotland: An OECD Perspective.* In line with the recommendations from 'Building Society' and the OECD, that the curriculum be kept up to date and practitioners engaged in the process, it was agreed to refresh the Scottish Technologies curriculum, Experiences and Outcomes. It was also agreed that there would be a particular focus on Computing Science and Digital Literacy. This was based on growing evidence that the existing Experiences and Outcomes were outdated, no longer included the appropriate content or offered experiences to develop the skills required for our learners to be innovators and leaders in the digital technologies sector. This was a source of frustration to practitioners, employers and learners and the refresh was welcomed by the education community and industry.

The Technologies Curriculum
The Technologies curriculum includes the study of digital literacy; computing science; food and textile technology; technological developments in society and business; craft, design, engineering and graphics. The Technologies curriculum is the application of knowledge and skills to extend human capabilities and to help satisfy human needs and wants, and it has had profound effects on modern society. Learning in the technologies enables children and young people to be informed, skilled, thoughtful, adaptable and enterprising citizens.

Digital literacy plays an essential role in Scotland's *Curriculum for Excellence (CfE).* It is positioned within the Technologies curriculum area, underpinned by a core set of digital literacy related Experiences and Outcomes and Benchmarks that every learner in Scotland is entitled to as part of a *Broad General Education (BGE)*. The digital literacy Experiences and Outcomes within the Technologies curricular area include, in line with the CIDREE definitions, ICT basic skills, computational thinking, media literacy and information literacy.

Cyber Resilience and Internet Safety (CRIS) is recognised as a key element of online life by the Scottish Government, and this is reflected in its inclusion in the curriculum and the strategy launched 2015, Safe, secure and prosperous: a cyber resilience strategy for Scotland - gov.scot (www.gov.scot). CRIS encompasses media literacy and information literacy combined with the Literacy and English Experiences and Outcomes, ensuring cross-curricular learning by design.
Computational thinking sits within the Technologies - Computing Science Experiences and Outcomes, ensuring these skills are an essential part of the broad general education for all learners.



REFRESH OF THE TECHNOLOGIES EXPERIENCES AND OUTCOMES

There was extensive engagement with academia, industry and practitioners during the review and refresh process of the Technology Experience and Outcomes. The review was led by a team of writers made up of practitioners (early learning and childcare, primary and secondary), academics, business and industry leads, local authority representatives and the Scottish Qualification Authority, supported by Education Scotland. Consultation opportunities, such as face to face events, live question and answer sessions through online forums provided opportunities for a wide range of stakeholders to input. There was widespread agreement and a clear expectation that the Digital Literacy Experiences and Outcomes would apply across the entirety of the Scottish curriculum and not be confined to Technologies learning and teaching.

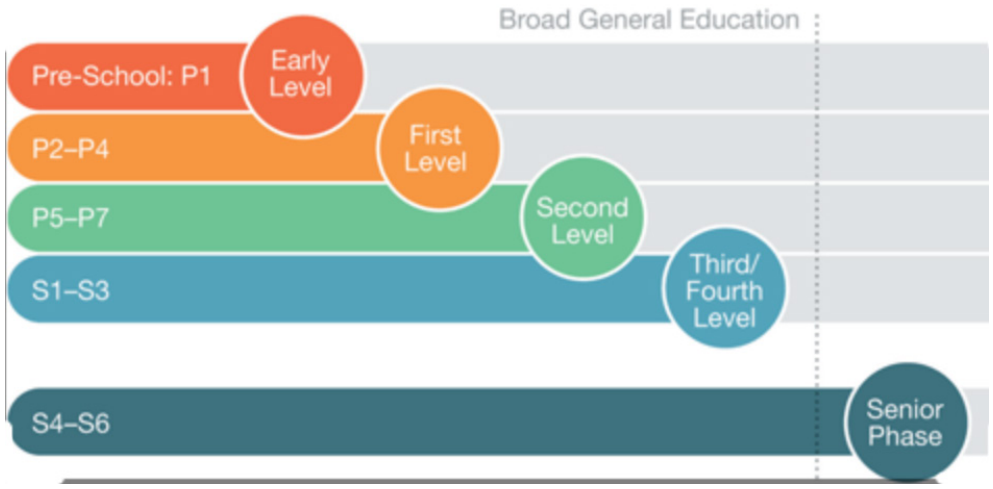
What sets Scotland's Curriculum for Excellence apart from many other nations' is the inclusion of Computing Science from age 3. Computational Thinking is a significant strand within our Computing Science curriculum, recognised as a vital skill for learners, embracing creativity and problem solving. The importance of Computational Thinking within the curriculum is also mirrored in the OECD, Education and Skills Today, A Global Perspective article (OECD, 2019). Children respond well to opportunities to personalise their learning in the Technologies and appreciate the chance to solve problems in their own ways: matching their ideas with those of others, justifying decisions and raising their awareness of the potential for teamwork to generate fresh solutions.

Digital Literacy

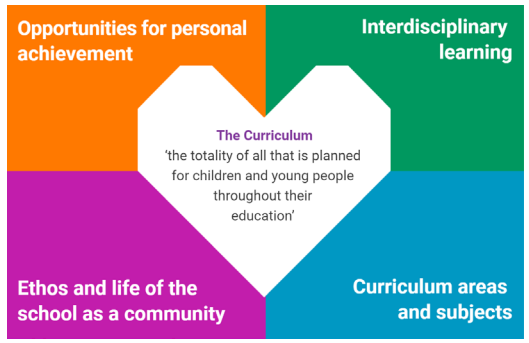
Organiser	Early	First	Second	Third	Fourth
Using digital products and services in a variety of contexts to achieve a purposeful outcome	I can explore digital technologies and use what I learn to solve problems and share ideas and thoughts. TCH 0-01a	I can explore and experiment with digital technologies and can use what I learn to support and enhance my learning in different contexts. TCH 1-01a	I can extend and enhance my knowledge of digital technologies to collect, analyse ideas, relevant information and organise these in an appropriate way. TCH 2-01a	I can explore and use the features of a range of digital technologies, integrated software and online resources to determine the most appropriate to solve problems. TCH 3-01a	I can select and use digital technologies to access, select relevant information and solve real world problems. TCH 4-01a
Searching, processing and managing information responsibly	I can use digital technologies to explore how to search and find information. TCH 0-02a	Using digital technologies responsibly I can access, retrieve and use information to support, enrich or extend learning in different contexts. TCH 1-02a	I can use digital technologies to search, access and retrieve information and am aware that not all of this information will be credible. TCH 02-02a	Having used digital technologies to search, access and retrieve information I can justify my selection in terms of validity, reliability and have an awareness of plagiarism. TCH 3-02a	I can use digital technologies to process and manage information responsibly and can reference sources accordingly. TCH 4-02a
Cyber resilience and internet safety	I can explore, play and communicate using digital technologies safely and securely. TCH 0-03a	I can extend my knowledge of how to use digital technology to communicate with others and I am aware of ways to keep safe and secure. TCH 1-03a	I can explore online communities demonstrating an understanding of responsible digital behaviour and I'm aware of how to keep myself safe and secure. TCH 2-03a	I can keep myself safe and secure in online environments and I am aware of the importance and consequences of doing this for myself and others. TCH 3-03a	I can explore the impact of cyber-crime for business and industry and the consequences this can have on me. TCH 4-03a

Computing Science

Organiser	Early	First	Second	Third	Fourth
Understanding the world through computational thinking	I can explore computational thinking processes involved in a variety of everyday tasks and can identify patterns in objects or information. TCH 0-13a	I can explore and comment on processes in the world around me making use of core computational thinking concepts and can organise information in a logical way. TCH 1-13a	I understand the operation of a process and its outcome. I can structure related items of information. TCH 2-13a	I can describe different fundamental information processes and how they communicate and can identify their use in solving different problems. TCH 3-13a I am developing my understanding of information and can use an information model to describe particular aspects of a real world system. TCH 3-13b	I can describe in detail the processes used in real world solutions, compare these processes against alternative solutions and justify which is the most appropriate. TCH 4-13a I can informally compare algorithms for correctness and efficiency. TCH 4-13b
Understanding and analysing computing technology	I understand that sequences of instructions are used to control computing technology. TCH 0-14a I can experiment with and identify uses of a range of computing technology in the world around me. TCH 0-14b	I understand the instructions of a visual programming language and can predict the outcome of a program written using the language. TCH 1-14a I understand how computers process information. TCH 1-14b	I can explain core programming language concepts in appropriate technical language. TCH 2-14a I understand how information is stored and how key components of computing technology connect and interact through networks. TCH 2-14b	I understand language constructs for representing structured information TCH 3-14a I can describe the structure and operation of computing systems which have multiple software and hardware levels that interact with each other. TCH 3-14b	I understand constructs and data structures in a textual programming language TCH 4-14a I can explain the overall operation and architecture of a digitally created solution TCH 4-14b I understand the relationship between high level language and the operation of computer TCH 4-14c
Designing, building and testing computing solutions	I can develop a sequence of instructions and run them using programmable devices or equivalent. TCH 0-15a	I can demonstrate a range of basic problem solving skills by building simple programs to carry out a given task, using an appropriate language. TCH 1-15a	I can create, develop and evaluate computing solutions in response to a design challenge. TCH 2-15a	I can select appropriate development tools to design, build, evaluate and refine computing solutions based on requirements. TCH 3-15a	I can select appropriate development tools to design, build, evaluate and refine computing solutions to process and present information whilst making reasoned arguments to justify my decisions. TCH 4-15a



Scotland's *Curriculum for Excellence* helps children and young people gain the knowledge, skills and attributes needed for life in the 21st century. A refreshed narrative on Scotland's curriculum, which sets Curriculum for Excellence within the current context, was published in September 2019. As part of their learner journey, all children and young people in Scotland are entitled to experience a coherent curriculum from 3 to 18, in order that they have opportunities to develop the knowledge, skills and attributes they need to adapt, think critically and flourish in today's world. *Experiences and Outcomes* are a set of clear and concise statements about children's learning and progression in each curriculum area. They are used to help plan learning and to assess progress.

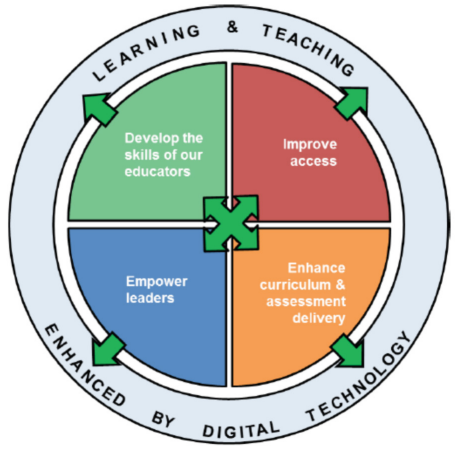


Benchmarks have been developed to provide clarity on the national standards expected within each curriculum area at each level. They set out clear lines of progression across all curriculum areas from Early to Fourth Levels. Their purpose is to make clear what learners need to know and be able to do to progress through the levels, and to support consistency in teachers' and other practitioners' professional judgements.

DIGITAL LEARNING AND TEACHING- A STRATEGY FOR SCOTLAND

Scotland's Digital Learning and Teaching strategy, *Enhancing learning and teaching through the use of digital technology was launched,* 21st September, 2016. It sets out an ambitious plan for all learners and educators to benefit from digital technology to enhance learning and teaching, equip children and young people with vital digital skills and crucially to lead to improved educational outcomes. It promotes the development of digital skills, including Computing Science, which are vital for life, learning and work in today's increasingly digitised world.

Launching the Digital Learning and Teaching strategy in 2016, John Swinney, Deputy First Minister and Cabinet Secretary for Education and Skills, said:
"Digital technology can make a significant contribution. Where our educators are supported through professional development, resources and leadership, digital technology can enrich learning and teaching, help to raise levels of attainment, and close the attainment gap. The skilful deployment of digital technology in our schools and early learning settings will also ensure our learners develop a level of general and specialist digital skills that are so vital for learning, life and work in an increasingly digitised world. I want to unlock this potential - to the benefit of the individuals, Scottish economy and society as a whole.
The positive impact of digital technology is already felt within schools across Scotland. There are fantastic examples of innovative practice across all areas of Curriculum for Excellence. However, there is more to do to ensure that all our children and young people can benefit in this way."



Aims of the strategy:

- Develop the skills and confidence of educators in the appropriate and effective use of digital technology to support learning and teaching
- Improve access to digital technology for all learners
- Ensure that digital technology is a central consideration in all areas of curriculum and assessment delivery
- Empower leaders of change to drive innovation and investment in digital technology for learning and teaching

Digital skills and the use of digital technologies offers opportunities to enrich learning and support teaching across Scottish education in a variety of ways:

- Develop digital literacy and computing science specific skills across the curriculum
- Promote learner participation and collaboration
- Extend access to learning opportunities – anywhere, anytime
- Personalise learning to meet different learning styles, paces and needs better
- Enable teachers across Scotland to share resources and practice
- Reduce bureaucracy for teachers through innovative planning and assessment methodology
- Strengthen parental engagement in all aspects of learning and teaching.

To support educators with the development of digital skills, the Scottish Government provided a national digital learning platform. *Glow* was established in 2009 and was the world's first country-wide educational intranet. It connects all 32 Scottish local authorities, learners and educators, together under one safe, secure, digital learning and teaching platform. Glow was refreshed in 2017 to further support the digital learning and teaching strategy. It provides learners and educators access to a number of different online services and tools. These are provided to support educators enrich and enhance learning across the curriculum. They allow educators and learners to work in collaborative and innovative ways, anytime, anywhere, and on any device.

Education Scotland's national digital team supports Scotland's 32 local authorities and teachers to implement the changes to the experiences and outcomes through the National Technologies Network and Computing Science leadership group.

A national *Digital Learning and Teaching programme*, acting as a driver for change, has ensured that Scotland is a leader in the field of digital literacy, computing science and digital technology in education. Working with partners to identify, implement and promote ways of using digital technology across Scottish schools and educational establishments in order to raise attainment, ambition and opportunities for all. The national Digital Learning and Teaching Strategy (2016) has been central to the delivery of the programme and has provided a focus for the remit of Education Scotland.

IMPLEMENTING DIGITAL LITERACY AND COMPUTING SCIENCE ACROSS A CURRICULUM THROUGH NATIONAL STRATEGY AND POLICY

Scotland has a system of national inspection for education and teaching standards that sets a standard for high quality, effective learning and teaching. This ensures that educators are implementing national strategies in the classroom. Educators are expected to ensure that learning is meaningful and relevant by linking to the world of work. The digital learning and teaching team at Education Scotland created a series of 'vision diagrams' to support educators with this. Education Scotland also developed a Digital Schools Award to recognise the digital work in schools and nurseries.

The interconnected nature of digital literacy and computing science means it cuts across numerous areas relating to education and the curriculum. It is intricately weaved together with numerous policies, strategies and across the work of Education Scotland and partner agencies.

Below we present the most important of these and we illustrate how they were deployed for the implementation of digital literacy and computing science across the curriculum.

Since 1996, *How good is our school? (HGIOS)* has been the nationally recognised Scottish framework which underpins effective self-evaluation as the starting point for school improvement. Inspections of educational provision by Her Majesty's Inspectors (HMI) and self-evaluation guidance are central to the process of educational improvement. The use of digital technologies and the application of digital skills development continues to be prominent in both inspections and self-assessment guidance. The framework is designed to be used to support self-evaluation and reflection by practitioners at all levels.

How Good Is Our School? aims to:

- ensure educational outcomes for all learners are improving
- address the impact of inequity on wellbeing, learning and achievement
- consistently deliver high-quality learning experiences
- embed progression in skills for learning, life and work from 3-18
- improve the quality and impact of career-long professional learning

The integration of digital is incorporated throughout the self-reflection framework, providing examples of highly effective practice and challenge questions relating to digital literacy and computing science.

- We regularly interrogate data, making use of digital technology to support this where relevant and appropriate
- We make the best use of available resources, including digital technologies, to create, sustain and enhance a motivating environment for effective learning
- All staff take responsibility for developing digital literacy across the curriculum
- Assess - Learners exercise choice, including the appropriate use of digital technology, and take increasing responsibility as they become more independent in their learning
- Learning is enriched and supported by our effective use of digital technologies
- Is the development of digital skills underpinned by computing science, enabling children to be skilled users and creators?
- All children and young people have the opportunity to develop and apply more sophisticated computational thinking skills.

The General Teaching Council for Scotland, established in 1965, is Scotland's independent, self-regulating body for teaching and maintains the suite of *Professional Standards*. The *Standard for Career-Long Professional Learning* describes the advanced professional knowledge and pedagogical expertise that registered teachers will develop and maintain as they continue to progress in teaching and the education profession - including for digital literacy and skills within the curriculum but also digital learning and teaching strategies.

Registered teachers in Scotland are required to demonstrate a depth of knowledge and understanding of:

- pedagogical theories and professional practice in digital technologies to support learning
- curriculum Design - the value of learning beyond curricular areas/subject boundaries and of cross curricular subjects, e.g. digital literacy
- the skills and competencies that comprise teacher digital literacy and know how to embed digital technologies to enhance teaching and learning
- plan effectively to meet learners' needs - communicate appropriately with every learner, modelling and promoting competence and confidence in literacy, numeracy, health and wellbeing and digital literacy
- effectively utilise pedagogical approaches and resources - employ appropriate teaching strategies and resources, including digital approaches, to meet the needs and abilities of every learner
- a wide variety of questioning techniques and a wide range of digital and traditional approaches to enhance learning and teaching
- effectively organising and managing learning - enable every learner to make full use of well-chosen resources, including digital technologies, to enhance learning, teaching and assessment as appropriate.
- Scotland's STEM Education and Training Strategy, launched in 2017 coincided with the launch of the Technologies Experiences and Outcomes. It set out an ambitious plan of action to facilitate transformation through STEM education in the following ways -
- our population will be able to thrive in an increasingly scientific and technological world and will benefit from enhancements in health, environment and quality of life that STEM innovation brings
- our industries will have the highly-qualified, skilled and motivated workforce they need to continue to grow and to support our economy
- our country will be able to tackle child poverty, social inequity and the generational unemployment that has blighted many of our communities.

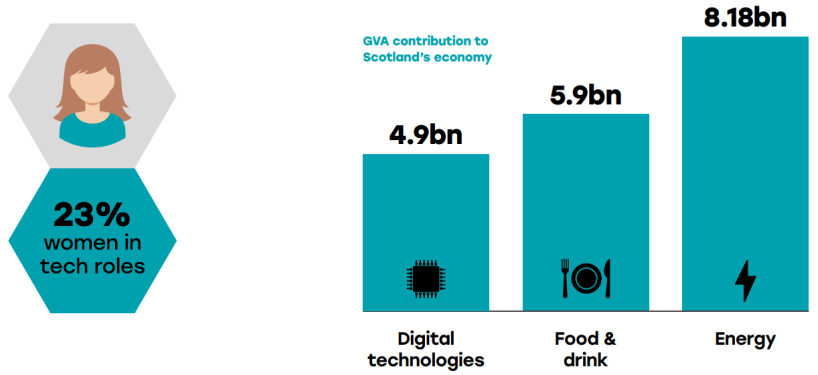
The *Developing our Young Workforce (DYW)* programme, established in 2014, aims to reduce by 40% the number of young people aged 16-24 who are unemployed. DYW Regional Groups, led by industry, have been established to promote partnership working between industry and schools. This includes improving the range and quality of work placements for learners, helping to develop the local curriculum offer, including development of skills to meet industry needs, and supporting an increasing range of pathways into the world of work for learners. Standards and guidance have been published to support this work and ensure employability and career management skills are embedded within the curriculum for learners aged 3 to 18 years.

Enhancing learning and teaching through the use of digital technology The National Strategy, in alignment with the wider policy context in Scotland, has a strong focus on tackling inequity and in building a more equal and socially just society in Scotland.

Tackling the Technologies Gender Gap Together report published by Skills Development Scotland, 2017, aims to better understand the gender imbalance across technology and in the technology sector. The research found that the gender imbalance begins early with young girls in school and continues throughout the technology education and employment pipeline, but that females are interested in working in technology and with appropriate targeted intervention there is an excellent opportunity to support greater female participation. Partnership projects delivered with Education Scotland included -

- Working with Girl Guiding Scotland to develop the Digital Scotland Challenge Badge to reach young girls in an alternative environment
- Developing teaching resources and lesson plans to support teachers to extend the reach of computing science into subjects popular with young girls like Art, Languages, English and Music.

There has been some progress in female representation from 2016. When the research was published women in technology roles was 18%, but this had increased to 23.4% in 2018.



Scotland's Digital Technologies: Summary Report 2019 presents a picture of Digital Technologies in Scotland, the skills supply pipeline and employer demand for digital technology skills.

The technologies sector contributed £4.9bn Gross Value Added (GVA) to Scotland's economy in 2019, accounting for 3.5% of total GVA. GVA per head for the tech sector is 40% higher than for the economy, making it a considerable contributor to Scotland's economy. The contribution made by the tech sector to GVA is fast approaching that of established key sectors including food & drink (£5.9bn GVA) and energy (£8.18bn GVA). The number of technology businesses has grown by 60% since 2010 – almost three times as fast as businesses across Scotland (21%). Sub-sectors such as computer consultancy (82%) and computer programming (159%) have grown exponentially, illustrat-

ing the demand for these activities. Demand for technology recruits continues to grow rapidly. It is estimated that Scotland needs around 13,000 new people to work in technology every year. A significant proportion of these jobs will be due to replacement demand and people leaving the workforce.

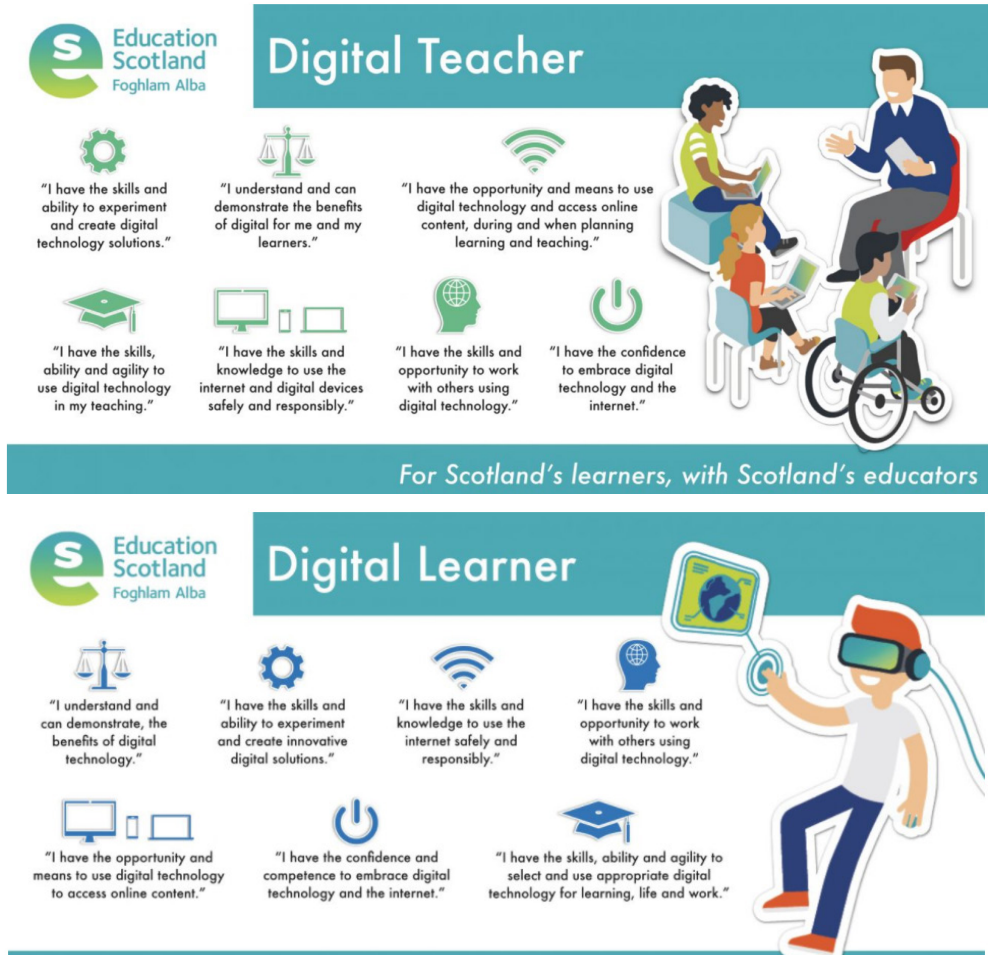
Employer demand for technology skills is high and expected to rise, particularly in key areas such as development and implementation, delivery and operation, and relationships and engagement. Emerging technologies like artificial intelligence and data are further driving demand for more specialist technology skills.

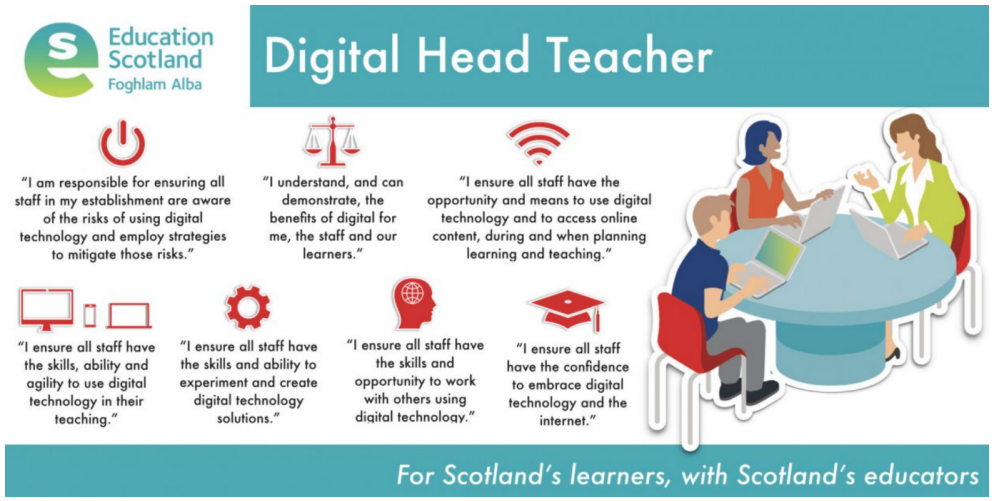
Scotland's strategy, 'Enhancing learning and teaching through the use of digital technology' outlined the 4 strategic objectives required to embed digital learning across the curriculum and a wide range of actions were developed to help deliver transformational change. These actions are now detailed.

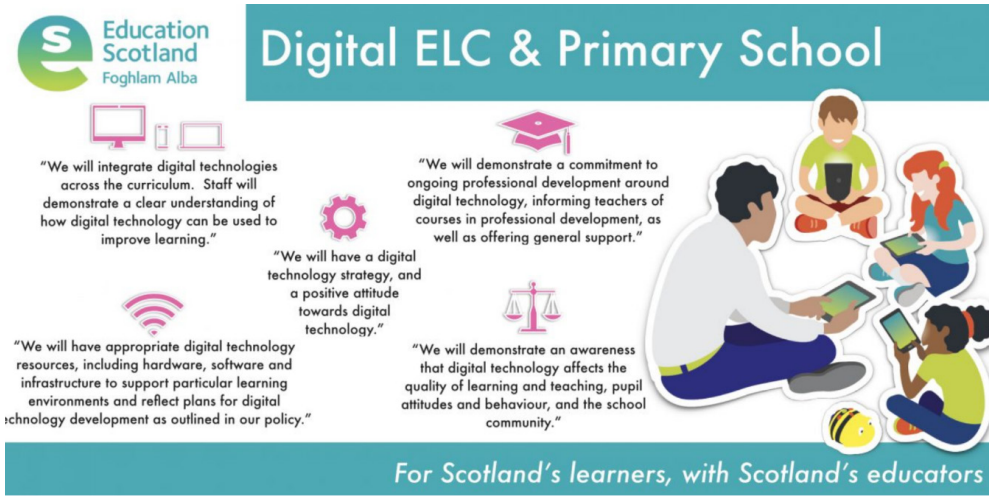
Six Regional Improvement Collaboratives (RIC) were established in 2017 bringing together 32 local authorities (local government) and Education Scotland to develop a coherent way of working, building capacity across regions and adding value through collective efforts. In response to this the Digital Skills and Digital Literacy team at Education Scotland was resourced in order to provide each RIC with a dedicated Digital Officer supporting Digital Literacy, Digital Skills and Computing Science.

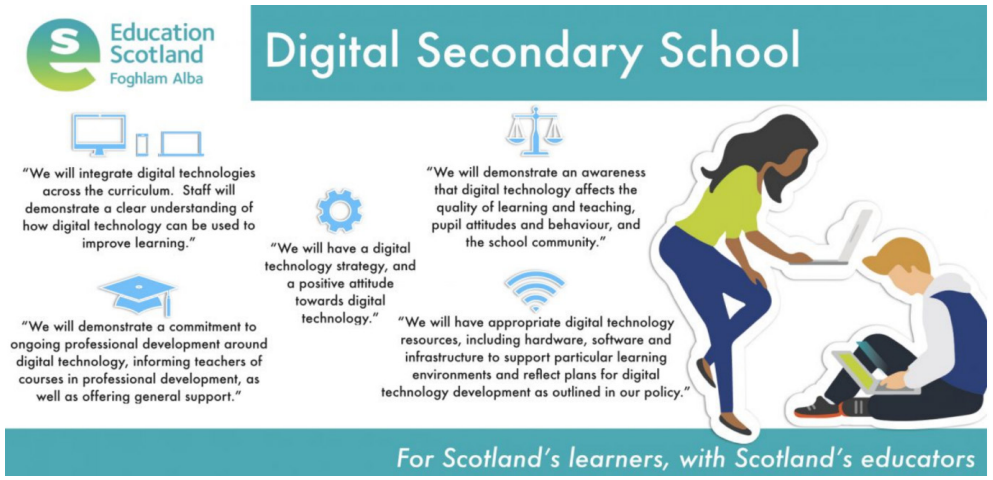
Education Scotland's national digital team provides professional learning opportunities which are available to educators at all stages to equip them with the skills and confidence to utilise technology appropriately and effectively, in line with the GTCS Standards. Career Long Professional Learning (CLPL), research, guidance and advice to support professional development is available to all Scottish educators via Glow, Scotland's national online digital platform and the National Improvement Hub which informs practice and highlights the benefits of using digital technology to support education.

Education Scotland developed a set of *digital vision diagrams* exploring what digital means for Teachers, Learners, Head Teachers, Schools and Local Authorities.









An annual National Digital Learning Week has been established and promotes the benefits of using digital technology in education. It has provided education establishments and educators with a valuable opportunity to share ideas and approaches relating to the use of digital technology to support education, digital skills and computing science development.

Education Scotland established a Technology national network and Computing Science leader network, including representation from all of Scotland's 32 local authorities. Strategies, plans and practice relating to the provision and use of digital technology and computing science in education is shared across all local authority boundaries. These national networks provide a valuable forum for the sharing of practice and experiences and Glow provides an online collaborative environment.

Education Scotland promotes the use of Glow to facilitate learning and teaching, professional sharing and dialogue and with the range of tools offered by Glow it allows educators to engage in professional learning and the sharing of good practice. Education Scotland is committed to maintaining the opportunities for digital learning and teaching afforded through Glow to allow educators to develop their knowledge around the use of digital tools for pedagogy.

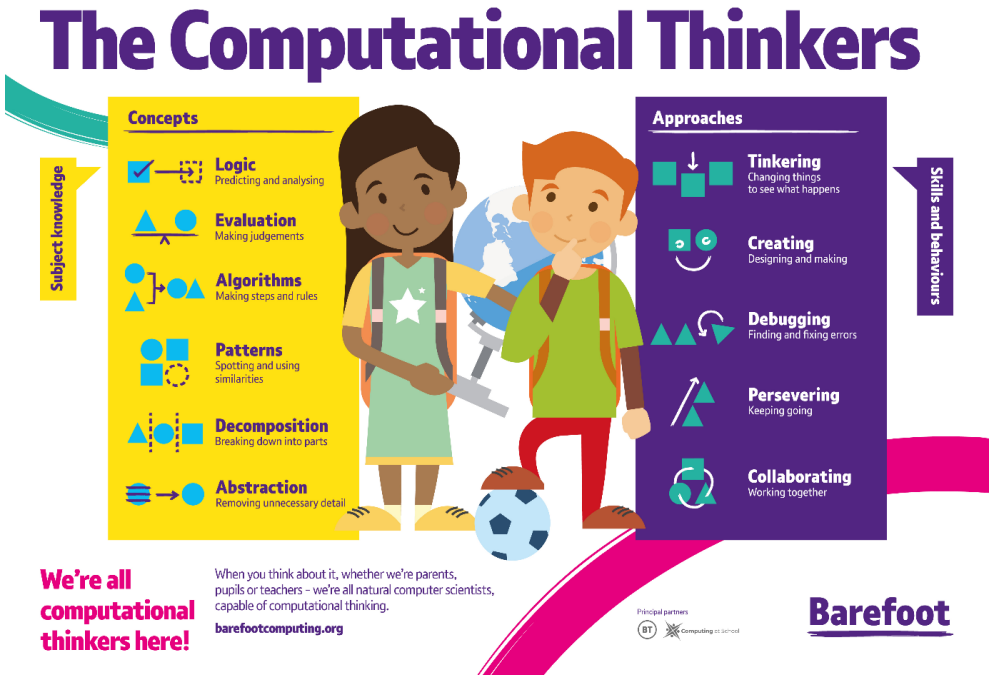
DIGITAL SCHOOLS AWARDS SCOTLAND

Partnership working between Education Scotland and industry partners HP (Hewlett Packard) resulted in the creation and delivery of the *Digital Schools Award for Scotland* programme, aligned to the Digital Learning and Teaching strategy. This gives all nurseries and schools in Scotland the chance to work towards an accredited digital school award. It recognises and encourages excellence in the use of digital technology across all our education settings and provides access to a framework detailing how schools can make the best use of digital technology in their local context. 60% of nursery, primary and secondary schools have registered, and over 250 awards have been achieved across Scottish education.

Scotland is taking part in piloting the European Erasmus+ project, 'SELFIE - Digital Schools Awards Programme'. This project builds on an existing programme, the Digital School Awards, developed in conjunction with HP and their partners and already established across Scottish education. The project will run over two years and will pilot in five countries: Slovenia, Serbia, Lithuania, Scotland and Ireland. Over two years, the project's aim is to help schools to successfully develop their digital education practices by combining SELFIE and the existing Digital Schools Awards scheme.
SELFIE involves students, teachers and school leaders in a collective reflection on technology use. Its results can highlight issues including:

- in what areas is technology used effectively and where can the school improve?
- does the school have a vision for how it wants to use technology and, if so, do staff and students know what it is?
- what kind of training do teachers find most beneficial?
- where should funding be allocated?

Education Scotland collaborates with a wide range of partners, Code Club, RaspberryPi, MicroBit Foundation, Apps for Good, to promote the use of computing science across all levels of the curriculum with all learners and practitioners. 'Barefoot' Computing Science resources were launched in Scotland, 2016. This was as a result of partnership working between BT (British Telecom), Computing at School and in collaboration with Education Scotland to map resources to Curriculum for Excellence. Over the last four years 83% of primary schools in Scotland have benefited from the programme via over 10,000 teachers and over 600 workshops. The resources are developed by teachers and backed by research, empowering early learning and primary school practitioners across Scotland to deliver and embed Computing Science across Curriculum for Excellence.



Working together in partnership has helped to boost teachers' subject knowledge, save time and bring computing science to life in an accessible way.

RESPONDING TO THE C-19 PANDEMIC AND SCHOOL CLOSURES

Professional learning for educators was vital in the immediate response to support the transition to online learning and teaching models. Adapting and diversifying modes of national online professional learning was critical in providing practitioners with digital learning opportunities, both to upskill knowledge in the use of digital tools and on pedagogical practice.

The Education Scotland national digital learning team supported practitioners to make better use of online, hybrid and blended learning models to support their students to continue learning. DigiLearnScot, the online learning community was developed, providing access to 'on demand' professional learning in the form of live webinars, a 'Watch Again' facility, bitesize professional learning videos, professional learning pathways and the sharing of practice from across Scottish education. The national digital skills team delivered over 240 live webinars to almost 13,000 practitioners during the period of lockdown. Digital Skills are offered in the form of bitesize videos and professional learning pathways with most of the national support focused on the pedagogies of digital learning and embedding this across the curriculum. As learners and educators return to their physical settings there is emerging evidence to state that digital skills and digital pedagogy continues to be a priority.

Glow provided continuity of education during school closures, building bridges of communication and collaboration, breaking down geographical boundaries across a nation. It provided educators and learners with the tools to engage in synchronous and asynchronous learning, to set assignments, track, monitor and assess progress, achievement and engagement. 700, 000 learners (between the ages of 8 to 18) and 54,000 educators have access to Glow. During the first lockdown there was a very substantial increase in the use of Glow to facilitate learning and teaching, nearly 11.5 million sessions in May 2020. This increase was somewhat expected given that digital was the primary means by which pupils were able to stay in touch with the schools, teachers and learning during this time. What the data does tell us is the level to which that increased usage has been maintained as schools begin to reopen. Almost 430,000 unique users logged in 7.3million times in September 2020 when schools had returned to in school building learning and teaching; this is a significant increase on the same period in 2019, both in terms of users and of their usage. 500,000 unique users logged into Glow, 27 million times in January and February 2021. This indicates a positive shift in the use of technology to support and enhance learning across the curriculum.
The pandemic highlighted the digital divide that exists in Scotland, with significant

numbers of young people isolated by a lack of access to devices. The Scottish Government & Education Scotland responded immediately to this by supporting all 32 local authorities to purchase and distribute devices. In the first lockdown Scottish Government invested £25 million to support digital inclusion amongst disadvantaged children and young people with a further £45 million provided to Local authorities for remote learning. 70,000 devices and 14,000 MiFi and data packages have now been distributed to learners across Scotland.

Partnership working between, Education Scotland, e-Sgoil (Scotland's remote teaching facility), the Association of Directors of Education in Scotland (ADES), the Scottish Government and Regional Improvement Collaboratives (RICs) has resulted in the creation of a National e-Learning offer as a response to the pandemic. It provides a range of live, recorded and supported learning resources to support practitioners in delivering remote learning. The National e-Learning offer is being further developed increasing curriculum access and choice for all learners, providing flexible options for practitioners and learners.

SCOTLAND'S DIGITAL FUTURE - RESPONDING TO THE PANDEMIC

During the pandemic many practitioners came to appreciate the benefit of digital and on-line learning and evidence shows that confidence in the use of digital technology has improved during the pandemic. That said, there are still two areas to address. Firstly, the equitable access to digital technology and the digital infrastructure to support this. This includes consideration of devices, appropriate software and good internet connectivity at home, in schools and settings and in the community. Secondly, there are discrepancies in the use of digital technology. Evidence shows that the knowledge, skills and experience of providing high-quality learning and teaching using digital technology is variable across Scotland. Further professional learning is required to model how digital technology can be used to enhance evidence based practice for all aspects of learning, teaching and assessment in a fully integrated way.

Models for online professional learning developed by the national digital skills team, Digilearn.scot provided a significant but flexible level of support nationally at the point of need during Covid-19. This support often complemented or was co-produced with local level offers for practitioners and this model should continue to be developed post-pandemic.

The Covid-19 pandemic has also created an accelerated need for exemplification for new approaches to practice such as remote, on-line and blended learning and a hybrid model of these. Moving forward we need to be clear what we mean by each of these terms within the Scottish context and how these approaches sit alongside and complement other pedagogical approaches such as outdoor learning and play. There is a national role to support practitioners understand what effective learning and teaching looks like with digital technology both within physical settings and when learning remotely.

As Scotland moves towards a 1:1 model (one internet enabled device per learner) it must fully understand the enabling factors that need to be in place in order to maximise the benefits of such an offer. This includes the aforementioned infrastructure and professional learning, otherwise there is a danger of providing equity in terms of equipment but inequity in terms of experience. Should Scotland decide to revisit its examination system, it should do this with the expectation that one device will be available per learner from the outset as this will open up more opportunities for creative approaches to formal assessment, such as digital portfolios and opportunities to explore on-going secure digital assessment.

A changing nation: how Scotland will thrive in a digital world - gov.scot (www.gov.scot) strategy was launched in March 2021, in response to the pandemic and it commits to do more to help our children and young people to raise awareness of digital technologies and realise the value of digital skills. A commitment of the new strategy is to ensure that every part of Scotland and every community within it can have access to good quality connectivity now and in the future.

It sets out the measures which will ensure that Scotland will fulfil its potential in a constantly evolving digital world. A vision of a modern, digital and collaborative government, designed around people. This strategy commits to ensuring our children and young people are prepared for the workplace of the future.

Conclusion and Reflections

This article has outlined Scotland's long tradition of innovation, creativity and development of technology and how this has shaped our current education system and curriculum. It has identified the principles of digital learning and teaching in Scotland and the role of Education Scotland and its partners in achieving these.

It is clear from our experiences during the pandemic that digital technology plays a vital role in the delivery of education in a modern education system. Most of the learning provided during school closures was online and this has accelerated the need and enthusiasm for practitioners and students to develop their own digital skills across the curriculum.

The challenge of embedding Digital Literacy across our curriculum meaningfully and effectively and improving the performance of digital competencies can be achieved by taking a holistic approach. Students need to be introduced to digital learning, which is contextualised at an early age, focussing on developing skills, knowledge, attitudes and ambitions. It is essential to nurture and build upon this learning throughout a student's career to ensure digital fluency can be an intrinsic part of Scotland's education system, society and culture.

Based on our experiences we offer the following reflections:

- We must capitalise on the progress of digital skills, knowledge and application our educators and learners have made during the pandemic. We will continue to work with practitioners to develop their knowledge and skills in how digital can support and improve learning, teaching and assessment.
- Digital inclusion will continue to play a vital role in our work going forward. We must get more effective connectivity solutions and devices into all education establishments, within the wider community and to make full use of the technology available.

While the experiences and observations presented here are drawn from the Scottish context, it is hoped that there will be resonances and potential implications for other systems across Europe.

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SERBIA

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Development of the Digital Competences of Students in the Republic of Serbia

DIGITAL LITERACY IN PREUNIVERSITY EDUCATION

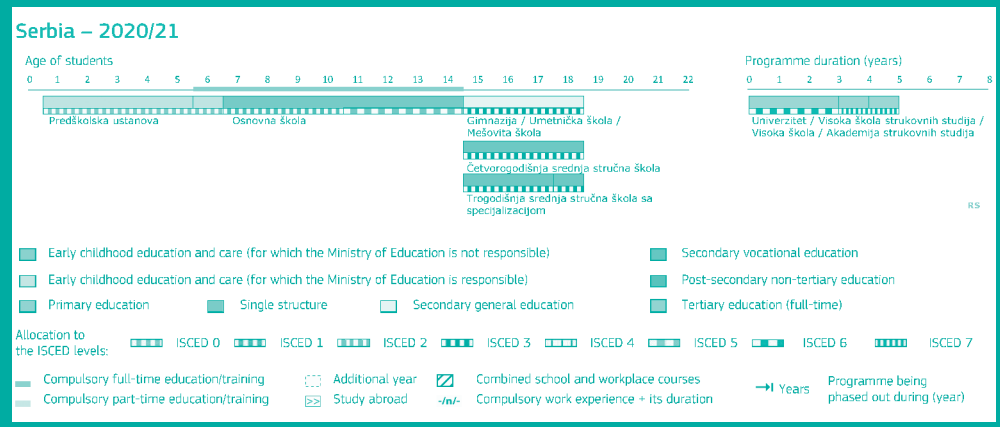
ABSTRACT

The Serbian Education Development Strategy 2020 (Ministry of Education Science and Technological Development, 2012) has set the basis for the promotion of the electronic and distance learning in all levels of education, from preschool, across higher, up until lifelong learning. The first Soft Policy Paper Guidelines for Advancing the Integration of Information-Communication Technologies in Education, adopted by the National Education Council of the Republic of Serbia 2013, broadly discussed digital education based on the result of a yearlong comprehensive research and discussion. The document has presented an abundance of quantitative and qualitative data that reflect the current level of development and the application of ICT within the system of elementary and secondary education in Serbia. Major impact of all the ICT-related policies flourished in 2017 when the course of Informatics and Programming was introduced in primary education at the fifth grade (students age 11) as a mandatory school subject. This initiative presents one of the main pillars for the development of digital competences of students within the Serbian educational system. Since then, 250 thousand students have been introduced to Digital Literacy and Coding.

Educational system

INTRODUCTION

The educational system in the Republic of Serbia includes: preschool, primary and secondary school and higher education. Primary education is compulsory, takes eight years and is carried out in two educational cycles. The first cycle covers four grades. At this stage the class teacher teaches all subjects, with some exceptions (e.g. arts and foreign languages, which may be taught by the subject teachers who also teach in the second cycle). The second cycle covers four grades (starting from fifth to eighth) and each subject is taught by subject teachers. Secondary education is not compulsory and lasts three or four years, covering a population of students aged 15 to 19 years. There are three types of secondary education: general secondary education (grammar schools lasting four years); vocational secondary education (lasting three or four years); artistic secondary education (lasting four years).



OVERVIEW OF THE EDUCATIONAL SYSTEM IN SERBIA

Serbia – Country-specific developments

In this part we will discuss country-specific developments in relation to implementing a curriculum that includes digital literacy. The goal of the education system in the Republic of Serbia is to support future economic development of the country through fostering and creating an educational environment which enables students to become cognitively agile individuals, familiar with technology and capable of using its potential in their social life and future jobs.

The education system in the Republic of Serbia is focused on creating conditions which will enable students to develop key competences for life-long learning and cross-curricular competences as defined by the law. The curriculum in pre-university education has been innovated and is based on learning outcomes. The emphasis is on obtaining generic and transversal knowledge and skills, with more opportunities for cross-curricular learning and development of 21st-century skills (creativity, critical thinking, teamwork, problem solving).

A new curriculum for preschool education has been adopted aimed at overall development and wellbeing of children through an integrated approach to learning. Digital competences, as well as other 21st-century skills, are part of the new curriculum. Support to institutions is provided through in-service teacher training and publicly available manuals and guides, as well as through support mechanisms for horizontal exchange and mentoring available to the institutions.

In the Republic of Serbia, Computer Science is a mandatory school subject in the second cycle of primary education. Students learn coding in visual and textual programming language, learn about internet safety and how to approach building their own digital identity. As a result, students obtain competences needed for a successful and productive life in digital society. The curriculum of all subjects envisages project-based teaching where students apply their knowledge, use robots and micro:bit devices. Within the framework of the '21st Century Schools' programme, micro:bit devices were distributed to all primary schools in the Republic of Serbia in January 2020.

As a response to the needs of the economy, the Serbian education system has formed more than 100 classes for high school students exceptionally talented in IT. Grammar school students have opportunities to use the knowledge gained and further develop digital competences within one out of six elective multidisciplinary subjects. In vocational education, numerous dual educational profiles have been created. These profiles are becoming more popular among students, since they boost prospects for getting jobs after graduating.

As part of higher education, the Republic of Serbia has ICT programmes in 51 institutions in 23 towns. The number of graduate students in ICT programmes increases by 1,000 every year. An innovative Master 4.0 study programme has been developed with a focus on transdisciplinary knowledge. This programme includes 10 faculties and 2 universities, more than 300 lecturers and 75 companies, and over 130 subjects have been introduced (machine learning, virtual reality, block chain…)

Digitalization in education is one of the strategic goals of the Republic of Serbia. It is implemented through three basic activities:

- Human capacity development
- Development of ICT structure
- Design and establishing of electronic services (Unified Education Information System, electronic gradebook, digital textbooks…)

Considering the average age of employees in education and fast technological developments, continuous support to teachers in the modern pedagogical use of technology is provided. A new *Digital competences framework – a teacher for digital age 2019* has been published. Based on this education policy instrument, training for teachers has been designed. The goal for all teachers is to achieve the basic level of digital competences in order to enable them to implement the innovative curriculum.
All pre-university schools have electronic gradebooks, and the majority of schools actively use them. Serbia is among the leading countries in Europe in the successful use of SELFIE – an instrument for Self-reflection on Effective Learning by Fostering the use of Innovative Educational Technologies – but there are additional investments required in order to use the full potential of digital technologies for improved quality of teaching and learning. We are also currently implementing a 'Digital classroom' project as part of which teachers of different subjects and their students are provided with electronic textbooks, ICT equipment (laptop, video beam projector and stand) and relevant training. By the end of 2021, all undergraduate teachers will be provided with digital textbooks. After realization of this project, 30,000 classrooms will be equipped with laptops and 23,000 video beam projectors.

CURRICULUM AND DIGITAL LITERACY IN SERBIA

The formal expectations regarding the development of Digital Literacy[1] for students are formulated in the Law on Foundations of the Education System (Official Gazette, No. 88/2017, 27/2018 – other laws, 10/2019, 27/2018 – other laws and 6/2020). The law intends to ensure a comprehensive approach to the development of complex and multilayered concepts such as media, information and digital competences. It presents the regulatory framework aiming at continuous development of key or transversal and general cross-curricular competences within the Serbian pre-university education system.

[1] In the Republic of Serbia the term Digital Competency is used.

Digital Literacy and Digital Competency are listed among the key and general interdisciplinary competences. General interdisciplinary competences are based on key competences. They are supposed to be developed through teaching and learning processes within all subjects. The approach towards general interdisciplinary competences and key competences is selected as it assures a more dynamic and engaged combination of knowledge, skills and attitudes relevant to different realities and life contexts. The focus seems to involve an inevitable reduction in declarative knowledge and the need to develop knowledge, practical skills and new attitudes which allow people to act accordingly in complex social situations. It emphasizes the intentionality of the regulator to assure higher transferability of knowledge in different fields including better conversion of acquired competences into the capacity for action, personal achievements, and lifelong learning.

In a broader sense, the outcome of the learning process should be turned into practical skills and a new attitude which allows students to act accordingly in complex social situations. (Basic) ICT skills, computational thinking and information literacy in pre-university education are developed through two school subjects: Digital World and Computer Science. Also, project-based learning involving (basic) ICT skills, computational thinking and Information literacy development is promoted through methodological instructions for teachers, which are an integral part of each school subject curriculum.

DIGITAL WORLD

Digital World is a mandatory school subject within the first cycle of primary education, involving pupils aged 7-10. Implementation started from the school year 2020/21. As stated in the curriculum, the overall goal of teaching and learning in Digital World is to develop students' digital competences in order to enable them to safely and correctly use digital devices for learning, communication, cooperation and the development of algorithmic thinking.

At this point, nearly 60,000 first-grade primary pupils are involved in learning topics within the Digital World subject. In parallel, Digital World curricula for second, third and fourth grade are being developed. At the national level a working group consisting of various experts in the area of computer science, education psychology, curricula development and pedagogy has been established to discuss, design and propose the new curricula. The subject has 36 school hours per year and is structured around three teaching areas: digital society, safe use of digital devices and computational thinking. Examples of the learning outcomes:

Digital society	Safe use of digital devices	Computational thinking
The student will be able to describe some of the life situations in which digital devices make it easier to do the work.	The student will be able to explain why the revealing of personal data is a risky behavior when communicating with digital devices.	The student will be able to analyze a simple, previously known procedure/activity and to suggests steps for its implementation.
The student will be able to compare traditional forms of communication with communication through digital devices.	The student will be able to appoint persons or institutions to be contacted for help in case of contact with inappropriate digital content, unknown, malicious persons or persons who communicate in an unacceptable manner.	The student will be able to relate the algorithm with the behavior of the digital device.

COMPUTER SCIENCE IN PRIMARY EDUCATION

Computer Science is a mandatory school subject within the second cycle of primary education, involving students aged 11-14. Implementation started from the school year 2017/18. At this point, nearly 250,000 students are involved in learning topics within the Computer Science subject.

As stated in the curriculum, the overall aim of the subject is to enable students to manage information, be secure while communicating in the digital environment, and create digital content and computer programs to solve various problems in a society that is changing rapidly with the development of digital technologies.

In all four grades, the subject is structured around three teaching areas: (basic) ICT skills, information literacy and computational thinking. Within the field of computer science, the most important novelty is learning programming – in the fifth grade students learn visual programming languages (most often Scratch, which is localized in the Serbian language and Cyrillic alphabet), while from the sixth grade students learn textual programming languages (e.g. Python). The number of teaching hours is one per week.

In Serbia, a decade and a half ago, educational standards for the end of compulsory education (primary education) were defined for 10 subjects. However, digital literacy wasn't among them. Work is currently underway to adopt and promote recently defined digital literacy general subject competence and quality standards for the end of primary education.

Examples of the learning outcomes:

(Basic) ICT skills	Information literacy	Computational thinking
The student will be able to create, edit and structure digital content that contains tables in the program for working with text and the program for working with multimedia presentations. The student will be able to store and organize data locally and in the data cloud.	The student will be able to access the Internet, independently search, find and evaluate information and download it to a digital device respecting copyright. The student will be able to explain the process of protecting a digital product / content with an appropriate CC license.	The student will be able to create a simple computational program in a text programming language. The student will be able to explain and apply the appropriate program structure (value assignment, branching, loops).

The methodological instructions for teachers (which are an integral part of the subject curriculum) state that 'defined outcomes can be achieved with a certain degree of freedom in the choice of work methods, software tools and technologies (computer, digital device ...), as well as in the order and dynamics of the implementation of elements of different thematic areas.'

COMPUTER SCIENCE IN SECONDARY EDUCATION

Computer Science is a mandatory subject in secondary education, with students age 15-19, with a variety of approaches regarding the number of years (1-4) and teaching hours per week (1-3) in accordance with the area of education – general or vocational secondary education. Basically, the curriculum is created with the aim to deepen the knowledge developed in primary education.

Grammar school - example

In the curriculum for grammar schools it is stated that the overall aim of the subject is to acquire knowledge, master skills and form value attitudes that contribute to the development of digital literacy necessary for further education, life and work in modern society. By adopting concepts from computational thinking, the student develops the ability to think abstractly and critically about the automation of work with the help of information and communication technologies and develops the ability to effectively use technology in a rational, ethical and safe way.

General subject competence is defined as: 'By learning the subject of Computer Science, the students are able to apply the acquired knowledge and skills in the field of information and communication technologies in order to fulfill the set goals and tasks in everyday life, further education and future work. Students developed the ability of abstract and critical thinking with the help of information and communication technologies. Students developed digital literacy and positive attitudes towards computer science.'
Specific subject competences are a description of the specific abilities of a student that enable him/her to develop a general subject competence. They imply the ability to use information and communication technologies responsibly while recognizing potential risks and dangers; ability to write event-driven computer programs and understanding the principles of creating modular and well-structured computer programs. Specific competences include the ability to quickly, efficiently and rationally find information using computers, as well as their critical analysis, storage and transmission and presentation in graphical form.

The number of teaching hours is two per week.

Media literacy is not taught as a separate subject. The approach to media literacy is comprehensive and it can be referred as part of key competences that are developed through the entire educational process, particularly in relation to the following competences: communication in the mother tongue, communication in a foreign language, social and civic competences, cultural awareness and citizenship and digital competence.

Media literacy is thus developed through all subjects, and especially through Serbian Language and Literature, Civic Education, as well as Computer Science. In this process, a contribution is also expected from school librarians, pedagogues and psychologists. Since 2005, the curricula of Civic Education and Serbian Language and Literature in primary schools have included topics that strengthen the capacities of students in the field of media literacy. Since 2018, with the introduction of the elective subject Language, Media and Culture in secondary schools, education in this area has been additionally emphasized. Teacher Training Faculties have introduced compulsory courses focusing on mass communication, as well as elective courses in the field of film and television culture since academic year 1994/95. At the moment, 130 study programs at various faculties include subjects in the field of media literacy or media education. This forms the basis for a better understanding of the media environment and content. However, the process of developing media literacy is complex. Acquiring new media literacy knowledge in the digital era requires more opportunities and different types of approach.

DEVELOPMENT OF TEACHER-SPECIFIC DIGITAL COMPETENCES WHILST IN SERVICE

The development of the digital competences of all teachers in the Republic of Serbia is addressed as a transversal key competence. Empowering teachers to become confident and skilled in using digital technology to support learning in an online environment is supported through provision of guidance, an official Digital Competence Framework for Teachers – Teacher in Digital Age (revised every second year), an Instrument for Self-Reflection (in preparation), various in-service teacher training programs and open educational resources.

The development of teacher-specific digital competences whilst in service to support the implementation of Computer Science in primary and secondary education has been continually organized since the 2017/18 school year. The Petlja Foundation (petlja.org) first organized training for teachers who teach Computer Science in the fifth and sixth grade. At that time, about 1,100 teachers participated in a two day, face-to-face training. In the following 2018/19 school year in cooperation with the Institute for Education Improvement (IEI), a new cycle of trainings was organized, this time for the Computer Science teachers who teach in the sixth and seventh grade of primary school and the

first grade of secondary school. The training was organized in a form of blended learning, one day face-to-face and one day online.

During the 2019/20 school year, the Petlja Foundation in cooperation with IEI organized a new cycle of trainings, this time for computer science teachers who teach in the seventh and eighth grade of primary school and the second grade of secondary school. The training was also organized in a form of blended learning, one day face-to-face and one day online. All trainings have the status of trainings of public interest as they were accredited by the decision of the Minister and were free for participants.

The Faculty of Teacher Education, in cooperation with the Ministry of Education, Science and Technological Development and the Institute for the Advancement of Education, has organized online training for primary school teachers who were teaching Digital World in the first grade of primary school for the first time during the 2020/21 school year.

The training has been accredited by the decision of the Minister as a training of public interest and provided examples for teaching activities and useful educational resources that can be used during teaching practice. The training lasted 16 hours (within the timeframe of two weeks). 4,000 teachers have finished the training. Upon completion of the training, all educational materials and training resources continued to be available as a form of support to primary school teachers who have successfully completed the training.

COMPUTER SCIENCE IN HIGHER EDUCATION

The Republic of Serbia has a long tradition of training personnel in electrical engineering. Qualified computer science engineers were educated since 1980s within the Faculty of Electrical Engineering, Faculty of Mathematics, and Faculty of Organizational Sciences in Belgrade; the Electronic Faculty in Niš; and the Faculty of Technical Science and Faculty for Natural and Mathematical Sciences in Novi Sad. Today, ICT education exists at 51 higher education institutions distributed in 23 cities educating around 1,500 graduated IT experts annually. There is almost the same number of IT experts graduating from other departments, with skills related to informatics. Tertiary type-A education is of strategic importance for developing the capacity of the ICT industry.

The number of students enrolled in IT courses at higher vocational schools and universities is constantly increasing. In the period 2012-2018, an impressive growth of freshmen was registered – from 5,523 in 2012 up by 76.5% in 2018. The average growth rate in the six-year period was 9.9%. The number of freshmen directly influences the number of future experts the sector could count on three to five years later. 60% of enrolled students graduate, while a certain number of students get employed during their studies – which is the main reason the majority of those never graduate. Whether IT students receive a diploma or not, a significant number of them finds a job easily (ICT in Serbia – At a Glance, 2020).

FURTHER DEVELOPMENTS

Currently, the *Draft Education Development Strategy of the Republic of Serbia until 2030* is a subject of public consultations, focusing primarily on gathering feedback from the professional community. Adoption of the new Strategy is expected in mid-2021.
In the new Strategy, Digital Education is recognized and comprehensively considered. It includes long-term measures aimed to continually strengthen digital competences of teachers and students, as well as measures that foster the pedagogical and effective use of digital technologies. The measures stipulate evolutionary changes that will hopefully, over time, assure high-quality blended and online education for all students.
Some of the long-term approaches are:

- Improving the strategic and regulatory framework for Digital Education development.
- Further curriculum development in the field of Digital Literacy and Computer Science (Digital World in the first cycle of primary education, students age 7-10; Computer Science for the second cycle of primary education, students age 11-14; Computer Science for secondary education, students age 15-19).
- Providing instances of a Learning Management System that enable teaching and learning based on contemporary and efficient theories of learning (e.g. constructivism) for all primary and secondary schools.
- Empowering teachers to become confident and skilled in using digital technology to support learning in an online environment through provision of guidance, Digital Competence Framework, an Instrument for Self-Reflection, in-service teacher training programs, open educational resources.
- Supporting leadership and school development by encouraging self-reflection of schools in the area of their digital maturity.
- Fostering collaboration and sharing of good practice (e.g. Digital Education Conferences organized as a result of public/private partnership).

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SLOVENIA

TANJA RUPNIK VEC

Tanja Rupnik Vec, PhD psychologist, supervisor and coach is the head of the Center for Quality and Research at the National Education Institute of Slovenia. She provides group supervision and a variety of training and counselling for schools on various psychological topics. She is the author or co-author of several scientific and professional monographs and articles in the field of critical thinking, teaching of psychology, implementing changes in schools, learning motivation, supervision and professional development, socio-emotional learning and empathy. In the last few years she coordinated Slovenian activities in the two ICT international projects (EU folio and ATS2020) and has in co-authorship just finished a research report about the quality of distance learning during covid-19 in Slovenia.

AMELA SAMBOLIĆ BEGANOVIĆ

Amela Sambolić Beganović is a teacher of Mathematics and Physics and has worked in education since 1996. She is the Senior Consultant for Mathematics in the Department for Secondary School Education at The National Institute of Education.

As a consultant for mathematics at National Institute of Education she worked with teachers who teach mathematics at primary, secondary and high school. She educates, helps and supports teachers in different school fields. Her favourite challenge is working with a group of mathematics teachers that develops didactic approaches of using ICT in schools and implementation on learning and teaching mathematics. At National Institute of Education, she also worked on different international and international projects. She has been involved in a number of different national or international project such as: e-Education; EU CLassroom ePortfolio, E-school bag, E-book for science and mathematics; MENTEP, ATS 2020 etc.
She also authored and co-authored several seminars and counselling which develop teachers e-competences. She executes most of them, so she is actively involved in training of teachers and principals in Slovenia.

NATAŠA POTOČNIK

Nataša Potočnik, PhD., is the Head of regional office at National Education Institute, where she is mostly responsible for supporting principals of kindergartens, basic and secondary schools in the area of instructional leadership. She's worked as a teacher in primary school and as an Assistant on The Faculty of Education. Her areas of expertize are connected to literacy - early reading and writing, reading strategies, writing process – and has a large bibliography on those subjects. She is a co-author of National standardized reading tests and numerous textbooks for Slovenian language in primary school. Currently she is a member in strategic team in ESF-project Reading Literacy and Development of Slovenian as a First and Second Language.

RADOVAN KRANJC

Radovan Krajnc is a Senior Consultant at National Education Institute of Slovenia in the field of computer science and informatics. He has been working in education since 1998. He is the author or co-author of several webinars for teachers. The field of his research work is effective methods of teaching computer science in primary and secondary schools and the efficient and meaningful use of ICT in teaching.
At National Institute for Education he also worked on different projects where the main focus was use of ICT.

Promoting change in teaching through digital competencies

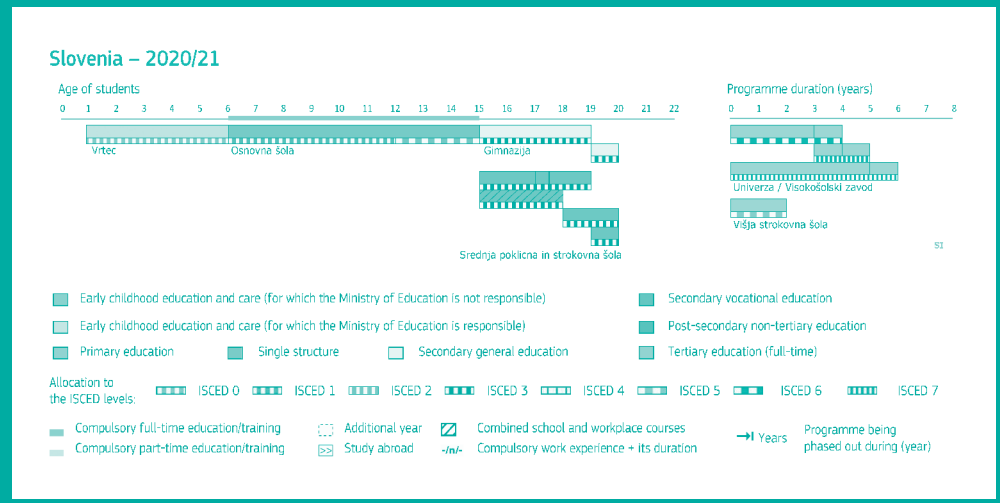
ABSTRACT

Recent activities in the field of the usage of digital tools/technologies for the purposes of learning and teaching have a considerable tradition in the Slovenian school environment. We started to introduce technology into education with the national project e-Education (2008-2013). It involved almost all Slovenian schools, and it pursued several goals: equipping schools with digital technology, raising digital competencies of teachers and raising the quality of knowledge and the development of skills and competencies of students. This project was followed by a number of others, both national and international, which involved a smaller number of schools and which to some extent addressed the issue of meaningful use of digital technologies for the purpose of achieving higher quality learning and teaching.

In the last five years, we have implemented several such projects with schools, which differed in some of the goals, but were similar in aiming at the use of digital tools to promote changes in teaching with a focus on developing students' transversal skills (critical thinking, collaboration and communication, creativity, self-regulation and others).

In this article, we will briefly present four such projects, which excelled both in terms of the quality of encouraging schools to realize the project objectives, and in terms of the results / achievements of teachers who participated in these projects. Each project is presented through goals, theoretical background, strategy for achieving goals and examples of project outcomes. In the article, the latter are merely indicated since more demanding readers are appointed to online resources where teachers' achievements are presented. In this article, we will focus on strategies of institutional support to teachers in implementing changes in their practice and suggest possible solutions for achieving the sustainability of project objectives

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN SLOVENIA

Digital Competencies of Students and Teachers for Encouraging Changes in Learning and Teaching

INTRODUCTION

When we talk about changes in learning and teaching, we especially want to encourage innovation, while recognizing and using the power of digital technologies and competencies.
The steep increase in the use of digital devices and the Internet and the rise in the level of education show that education is linked to the use of digital technologies. So schools have an important role to play - to equip the individual with all the skills he or she needs to benefit from new technology in life. According to research, digital skills significantly increase employment opportunities, income and other social benefits, and at the same time represent a major barrier to life opportunities for those who do not have these skills[1].
In recent years, much has been invested in digital technology (DT) in schools across the OECD countries. The quality of digital technologies, Internet access, has increased significantly in recent years. However, according to international studies, digital technology is not yet fully integrated into learning and teaching. Teachers do not feel sufficiently trained to use it effectively; they mostly use digital technology to complement their prevailing teaching practice.
We note that students generally have better-developed digital competence and feel more comfortable using technology than their teachers. There is no real connection between how students use learning technology and how teachers use it to teach.
This is due to a number of changes in the use of technology outside the school, especially in the area of social and other interactions through technology in the daily lives of students.

The introduction of DT into schools has not yet led to the promised progress. For example, the analysis of PISA results in relation to the effects of DT use in school shows only a weak and often a negative link between the use of DT in teaching and results in mathematics and reading literacy - even if we control the variables like national income and SES. This is partly due to the focus solely on technology and web connectivity.

The reason for this is partly that the curricula have last been updated in 2012. Back then, 8 key lifelong learning competencies have been added to all curricula. One of the competencies was digital competence, which was however not defined in detail and was only mentioned. The European Commission only published the DigComp 1.0 a year later (2013), so the people responsible for updating the curricula did not systematically include digital competencies in them. The renewed curricula from 2012 focused more on the use of ICT in schools, which was however not generally understood by the teachers as an obligation to support the development of the student's digital competencies. The renewal of curricula was followed by teacher education to use digital technology in school, but that did not bring much change, because the development of students' digital competencies was not explicitly demanded in the curricula and was also not systematically vertically and horizontally included in all curricula.

Some of the fault for this can be attributed to the misunderstanding or confusion regarding the individual concepts of digital technology, digital literacy and digital competence.
The concepts of digital literacy and digital competence are often used synonymously but they have distinct origins and meanings. They are often used to underpin each other. Regarding the systematic review of both concepts in higher education research (Spante et. al, 2018) digital literacy "originates in a skill-based2 understanding of the concept and thus relates to the functional use of technology and skills adaptation" (p.7). It was first defined in late 1990s by Glister as: "the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers" (p.7)

Regarding the authors of the review, digital literacy has been used more frequently and has more established use historically. It is also commonly referred to in research whereas digital competence is mostly defined for policy use – primarily for EU and OECD policy documents and it is oriented towards use of technology in professionally purposeful ways in various contexts (p.14).

Nevertheless, the definition of digital competence evolved and changed since the first EU framework of key competencies of all citizens (EC, 2006). From "confident and critical use of Information Society technology for work, leisure and communication" (2006) to "confident, critical and responsible use of, and engagement with, digital technologies for

[1] Innovating Education and Educating for Innovation; The power of Digital Technologies and Skills. OECD, 2016

[2] Digital skills are defined as a range of abilities to use digital devices, communication applications, and networks to access and manage information.

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 cyber-security), intellectual property related questions, problem solving and critical thinking." (2019)

It was aligned with The Digital Competence Framework for Citizens and now keeps sufficient scope for future changes, primarily for the development of this competence in students.

DT has the potential to change teaching and learning and open up new horizons. More than going beyond technological barriers, it is important to introduce new ways of teaching.

Digital Technology can facilitate:

- Innovative pedagogic models, e.g. based on the principle of gaming, online labs and monitoring tools, which help develop higher thought processes, understand concepts and in many cases stimulate creativity, imagination and problem-solving skills;
- Remote or virtual experimental learning,
- International collaborations that enable students to gain insight into other cultures, multicultural communication, and thus emulate the collaborative nature of today's professional environments;
- Formative assessment and skill-based assessment that enable teachers to monitor learning while it is happening, which leads to adapting teaching to the needs of students. Digital supported evaluation and the assessment of skills allows for a clearer awareness/evaluation of progress (than without technology);
- e-Learning, open educational resources, massive open, on-line courses (MOOC) etc. – intended for independent work and learning.[3]

The differences between the expectations and reality are due to the gaps in digital competence of both teachers and students, difficulties in locating high-quality digital resources and programs, unclear goals and insufficient pedagogical preparation for the meaningful use of technology in the classroom.

The National Education Institute of Slovenia boasts a rich history of projects aimed at the digital literacy of professionals. The beginnings of the computer literacy of teachers under its auspices date back to the 1990s (RO project, 1994). One of the major projects that, in addition to teacher training and the development of e-materials, also provided counselling, didactic and technical support to educational institutions, was the E-education project (2008-2013).

Based on the new knowledge we tried to support the teachers in the sensible use of digital technology through various projects. For this, we took into account the DigComp and DigCompEdu frameworks and other knowledge on the necessity of developing transversal skills.

This article tries to showcase through the example of three successful projects, which aspects of digital competence we tried to encourage in students and how the teachers encouraged the development of the students' digital competencies. We also focused on teacher support to fulfil the goals of the below projects:

- Development ePortfolio in the function of developing transversal skills (28 schools – 6% of Slovenian schools; duration: three years)
- Innovative learning environments (75 schools – 13% of Slovenian schools, duration: five years)
- The digital literacy of students in secondary vocational schools (12 vocational schools - 12% of Slovenian secondary technical and vocational schools; duration: two years).

DEVELOPMENT ELECTRONIC PORTFOLIO FOR A STUDENT IN THE FUNCTION OF DEVELOPING TRANSVERSAL SKILLS

The development of transversal skills represents an important educational objective in the Slovenian school environment, which is why we have created a series of initiatives at the National Education Institute of Slovenia (NEIS) aimed at systematically promoting the development of these with students. The basic concepts on which this project was based were: a) development e-portfolio, b) transversal skills; c) explicit teaching/learning or the formative assessment of transversal skills.

DEVELOPMENT ELECTRONIC PORTFOLIO

In both projects, the developmental electronic portfolio was defined as a "student's personal electronic environment, in which he/she plans, monitors and evaluates his/her progress in different dimensions of learning (knowledge, skills), collects different products and evidence of learning, reflects on her/his work and communicates with the interested public (teachers, classmates, parents, peers)." (Rupnik Vec in Stanojev, 2013, modif.) The ePortfolio goes beyond the classical definitions, which assume the student's collection of achievements and reflection on them for the purposes of demonstrating various knowledge and skills (presentation ePortfolio) or an electronic environment in which the student learns by communicating and cooperating with others (learning ePortfolio) (Giannandrea, 2006, Baumgartner 2011). Learning through a developmental ePortfolio, as defined in the project, is based on the philosophy of formative assessment of knowledge and skills (Wiliam, 2007, 2013), on the concept of the explicit teaching of skills (Ennis, after Plath, 1999) and the concept of self-regulatory learning (Ryan and Deci, 2020). It represents a powerful tool for the self-regulation of learning, as it supposes the students' cooperation and co-deciding at all stages of the learning process: planning learning objectives (concepts and/or skills), co-defining success criteria, planning

[3] Right there.

learning strategies, collecting evidence of learning, looking for feedback, self-reflection, self-evaluation of learning and – if necessary – redefining learning objectives.
Students in the project used one of the two tools for the purpose of creating their own electronic portfolios, and at the same time for the purpose of explicit learning and monitoring the development of their own skills: The Mahara or O365 web application. For the purposes of the project, a new functionality was designed in the open source web application Mahara, named the My Learning tab. This consists of six fields in which the student enters records as he/she passes through different phases of explicit learning skills: a. checking prior skill (including knowledge about skill), b. planning learning objectives and success criteria, c. path planning towards the goal, d. gathering evidence, e. obtaining feedback on the activity or products in accordance with the success criteria and f. self-evaluation. So in our understanding, the developmental e-portfolio is more of a process than a result/content.

TRANSVERSAL SKILLS

For the purposes of encouraging and directing Slovenian students in the explicit learning of skills and using a developmental ePortfolio in the function of promoting transversal skills, the National Institute of Education has developed a model of transversal skills consisting of the following elements: cooperation and communication, effective thinking and problem solving, creativity, digital skills/competencies and self-regulation. (Fig. 1)

FIGURE 1: MODEL OF TRANSVERSAL SKILLS IN THE EUFOLIO AND ATS 2020 PROJECTS FOR THE PURPOSE OF DIRECTING LEARNING (AND TEACHING) IN SLOVENIAN SCHOOLS (RUPNIK VEC, 2015; RUPNIK VEC AND SAMBOLIĆ BEGANOVIĆ, 2016).

With the model, we wanted to highlight the fundamental transversal skills while illustrating their mutual relations, as we understood in the project: students learned to self-regulate their critical thinking skills, cooperation and communication skills and creativity, using digital technology and digital skills/competencies [4[1]] for this purpose. Our model partly overlaps with some digital literacy models, for example the Son (2015) model. In Son's model, digital literacy includes: 1) information search and evaluation, 2) creation, 3) communication, 4) collaboration and 5) online safety, all using digital technologies. In our model, students use digital tools and skills to: 1) be creative (which corresponds with creation in Son's model), 2) solve problems and think effectively (which corresponds with Son's information search and evaluation), 3) communicate and collaborate effectively (which correspond to Son's communication and collaboration). In our model, students use digital skills and digital tools also to regulate different aspects of self, including the transversal skills and knowledge mentioned in the model.

THE EXPLICIT LEARNING OF TRANSVERSAL SKILLS USING DEVELOPMENT E-PORTFOLIOS

An important theoretical starting point for both projects in the Slovenian context was the concept of the visible (explicit) teaching of skills, as opposed to the hidden (implicit) teaching of skills. The mentioned difference in encouraging the development of students' skills was first pointed out by the authors in the field of teaching critical thinking. So Enis (1989, after Plath et al. 1999) distinguishes four approaches to critical thinking (in the context of both projects, we extended the idea to other skills): a) *general approach* (teaching the principles of skills as a special teaching material or learning subject), b) *infusion* (encouraging skills within an object or area where the principles of the skill are apparent to the student), *c) immersion* (the student has the opportunity to use the skill, but the principles of the skill are not visible and remain hidden), d) *mixed approach* (a combination of a general approach with infusion or immersion).

The visible teaching of skills (critical thinking) is more effective than hidden (implicit) teaching (Paul, 2005, Ikenube, 2001, Solon, 2007). Even Van Gelder (2004), based on a review of research in the field of encouraging the development of critical thinking, stresses that practice in one area is more effective if it is supported by a certain level of theoretical insight. Knowledge of the theory of critical thinking enables an in-depth understanding of the thinking process and its self-management. By analogy, we conclude that the same applies to other areas of skills.

In the projects EUfolio and Assessment of Transversal skills 2020 projects, students were supported to monitor and evaluate their own transversal skills while learning the content of different school subjects (math, science, language etc.).

At the most general, schematic level, the process of explicit learning of transversal skills was understood as a cycle of five steps in which students pass through key self-reflective questions about the skill, placed in a new element of the Mahara app: My Learning.

4 [1] As the concepts "digital skills", "digital competencies" have various definitions, the exact comparison of the two goes beyond the scope of this article, and on a pragmatic level we can use them interchangeably. In Slovenia we more often think of digital skills as smart use of DT in various contexts for various purposes, while when using the digital competencies, we think of the DigComp 2.0 framework.

The My Learning tab in Mahara consists of six fields that guide the students' reflection on learning skills, which is explained using the example of learning argumentation skills (Rupnik Vec and Sambolić Beganović, 2016), which we perceive as an important element of (digital/reading/information/media) literacy:

1. *Skill awareness* (What is quality argumentation? How skilled am I in argumentation at the moment?)
2. *Acquaintance with the learning objectives and the co-creation of success criteria* (What is the goal of learning argumentation? What are the success criteria of effective argumentation? What is the proof that I am arguing well about something?)
3. *Planning and participating in activities* that require the use of argumentation skills and the *gathering of evidence* (Which activities allow me to learn argumentation? These activities are: I write argumentative essays, debate, analyse and evaluate others' arguments, analyse others' debates … What is the proof that I am becoming more effective? How am I going to practice argumentation? In which situations can I improve? What am I going to do? When? Etc.)
4. Obtaining *constructive feedback in accordance with the success criteria* from the teacher and classmates (How efficiently have I, according to the success criteria, argued in this debate, essay …? How efficiently have I, according to the success criteria, analysed and evaluated argumentation in the author's essay? What was I good at? What remains a challenge for me? Etc.)
5. *Self-reflection and self-evaluation* (I succeeded in this debate … I wrote this essay in … Presentation of the seminar paper was excellent in … The challenge remains … Based on my own findings and feedback from classmates and teachers, next time I will change …)

The most decisive stage of this process is the co-creation of success criteria for quality argumentation. The co-creation of success criteria for progress in skills took place in two phases: students initially independently thought about the components of skilful handling (e.g. skilful argumentation, effective cooperation and communication, etc.), then they confronted their ideas, and the final list was created in dialogue (adjusted to the students' age); the teacher added the essential success criteria, if necessary. The process of co-creating success criteria took place in collaborative online learning environments (Mahara, O365, others), where students set their ideas, then compared and coordinated them using various web applications (x-mind, Padlet, etc.). An example of a final list of objectives and success criteria for skills in analysing, evaluating and formulating arguments might be the one written in a student's portfolio, in the My Learning tab. (Figure 2)

FIGURE 2: SCREENSHOT OF THE PART OF THE STUDENT'S MY LEARNING TAB TO ILLUSTRATE THE FIRST THREE PHASES OF SELF-REGULATION OF LEARNING CRITICAL THINKING SKILLS

The self-reflection and self-evaluation of skill are also essential processes in learning skills and can be supported with e-apps and environments. In the following section there are two examples of a filled in MyLearning tab from two students in our project (Figure 3 and figure 4).

Evidence

Essay 1: Napoleon was the most important person in the whole history.

Essay 2: Sun electricity - the energy of our future.

Essay 3: It's essential to maintain our woods

Debate 1: Marihuana should be legalised in our country (Maja's feedback on my deb

Debate 2: It's crucial to be well educated (Marko's feedback on my contribution)

Attached files Attachments 3

Essay_It's essential to maintain our woods.docx

Essay_Napoleon is the most important pearson in history.

Essay_Sun electricity - the energy of our future.docx.1

Self-reflection and self-evaluation

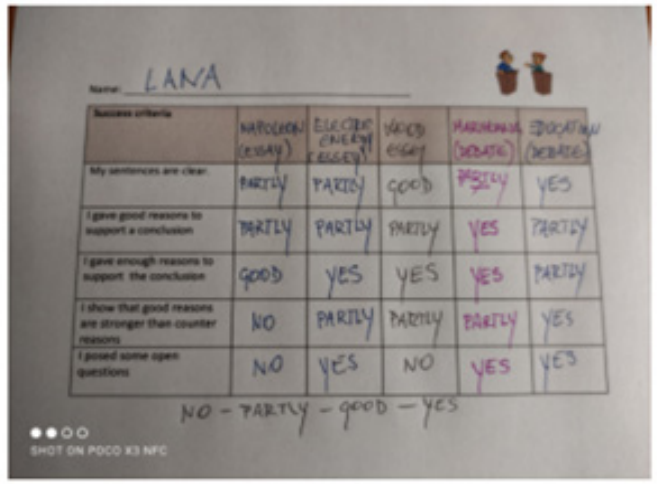


FIGURE 3: SCREENSHOT OF THE PART OF THE STUDENT'S MY LEARNING TAB TO ILLUSTRATE TWO PHASES OF SELF-REGULATION OF LEARNING CRITICAL THINKING / ARGUMENTATION SKILLS: COLLECTING EVIDENCE OF LEARNING AND SELF-REFLECTION ON THE LEARNING PROCESS.

SIO SLOVENSKO IZOBRAŽEVALNO OMREŽJE

Search users

English lesson: Space

I will learn about space. I will learn new words about space.

Prior knowledge

Space - My vocabulary list:

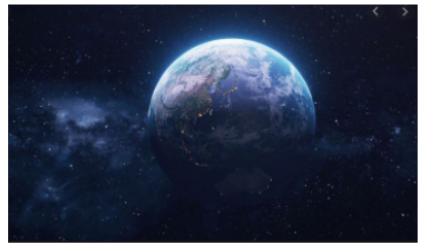
space, spaceship

planets: Mercury, Venus, Earth, Mars, Jupirter, Saturn, Uranium, Neptune

stars, the Sun, solar system, Moon

galaxy, Milky way, black hole

asteroids, satelites, meteoroids, atmosphere



Source: https://www.boston25news.com/news/trending/space-junk-unknown-object-zooms-past-earth/Y6SJGXTE5FAULMLIRP3X7ZGU2Q/

Goals and criteria of success

I want to learn new vocabulary and also new facts about space. And maybe something with grammar (this my teacher should told us)

I will suceed if I will:

- learn new words (for example 15)
- use those words in new sentences
- be able to tell a text about space in English
- be able to set a few questions about space in English

FIGURE 4: AN EXAMPLE OF STUDENTS' EXCELLENT WORK (FROM THE ARCHIVE OF THE TEACHER VESNA GROS, POLJE PRIMARY SCHOOL, 6TH GRADE: 11–12 YEAR-OLD STUDENTS LEARNING ENGLISH)

In a similar way, students were supported also in the process of developing cooperation skills. In the first stage they clarify the meaning of good cooperation, debating about questions as: What exactly is cooperation? Did you cooperate in the past? What are your good and not so good experiences? Etc. Following insights in searching for answers to these questions they were invited to create success criteria of good cooperation. In this stage they used different apps (exp.: Padlet, Google Drive etc.) and also talked about the difference in cooperation in vivo and cooperation in online platforms. They wrote these criteria in their e-portfolios and had used them always after they cooperated. Sometimes they evaluate themselves using rubrics, sometimes they write reflections as

spontaneous responses on cooperation experience. At the end of the year, they reflect on the whole learning path and their progress in cooperation skills.
In the project some teachers systematically supported their students in learning digital competencies, following the principle of formative assessment as well. In this process students searched for the meaning of the concept (What are digital competencies?), defined their goals (What will I learn? Which digital competency?), defined success criteria (How will I know that I have/I'm better and better in this competency?). During the school year they used the competency in different learning contexts, self-evaluated or/and gained feedback on skilfulness according to the success criteria and finally, they either redefined their goals of learning the competency or celebrated success.
The process of formative assessment of different aspects of digital and other skills was determined to be challenging for the students and teachers as well, but with the very deliberate support NEIS gave teachers in the projects they overcame all obstacles and fond a lot of excitement in the overall process.

INNOVATIVE LEARNING ENVIRONMENTS

The Innovative learning environments supported by the digital technology Project is a research and development project involving 75 schools, 1000 teachers, 2500 students and 4 development institutions. It upgrades and connects the experiences and results of many previous projects, in which the meaningful use of digital technology in teaching and learning has been one of the main focuses of the research.

PURPOSE AND GOALS OF THE PROJECT

One of the main purposes of the project is the creation of innovative learning environments, developing the competence of 21st century students and the meaningful integration of digital technology into class. It should be emphasized that the development of 21st century student's competence can be encouraged by a teacher who has also developed these competencies and who knows and is able to introduce innovations in their work and use innovative learning environments meaningfully and effectively.
In order to achieve lasting changes in the implementation of lessons, where students would develop digital and other transversal skills, we supported all stakeholders (teachers, principals, technical staff) in the education project with the schools. In doing so, we relied on the Creative Classroom Framework (Johnson et al., 2015).

Based on this model, we organised 11 development teams in the project, which are working in the following areas: 1. Upgrading the pedagogical strategy, 2. Upgrading methodology, 3. Teacher training, 4. E-communities, 5. Examples of good use, 6. Implementation, 7. Performance curriculum, 8. Technical area, 9. Testing and introduction of didactic e-services, 10. Evaluation, 11. Promotion.

STRATEGY AND DEVELOPMENT TEAMS

The core of the development in the project consists of development groups in which teachers, principals and researchers from faculties participate. Development groups plan activities in the project, prepare policies and materials, and participate in the work with schools. They consistently cover all the areas and steps described in the model 21 Steps to the Successful Implementation of Innovative Pedagogy (Aberšek et al., b. d.). In doing so, schools perform a 21-step methodology in four stages: planning, preparation, execution, evaluation.

Given the degree of understanding and implementation of the innovative learning environment, at the beginning of project 75 schools, we divided into two groups: 18 advanced, development schools and 57 implementation schools. Teachers in schools were encouraged to follow the 21 steps for the successful implementation of innovative pedagogy:

- during the planning phase to prepare a vision, analyse the situation, involve parents and the interested public and prepare a project plan.
- during the preparation phase, the schools equipped teachers with digital devices, properly prepared and equipped classrooms, organised teacher training, selected the appropriate software and hardware to achieve the educational objectives and adopted strategic decisions related to innovative learning environments.
- during the execution phase, students in the innovative classes were distributed devices and started lessons according to the principles of innovative pedagogy.
- during the evaluation phase in schools and in the project, we analyse the results achieved and introduce changes to the curriculum implementation plan.

In the second year, the development schools shared their experience with the remaining 57 so-called implementation schools. Each development school transfers its knowledge and experience to approximately three implementation schools in its surrounding area. Such an approach has proved successful for several reasons:

- The transfer of knowledge and the implementation of training is simplified as each development school independently agrees with its implementation schools on the date, content and execution.
- Teachers at the development schools are motivated to demonstrate their best practice, because in this way, they develop and upgrade their innovative approaches more quickly.
- Teachers at the implementation schools receive training and examples that have already been tested in practice.

PROJECT RESULTS

Training Model

We developed a model of four types of training to empower teachers to change their own pedagogical practices and to transfer new knowledge to their own and other collectives:

- Regular training at schools: Teachers at development schools attend 6 training sessions every year, and teachers at implementation schools 4 sessions, one of which is carried out by the development institutions.
- Transmitter training: "transmitter" teachers are trained in at least 4 training sessions per year. They transfer their knowledge to colleagues from their development school and to teachers from the implementation schools.

- Videoconferencing training: In the third year of the project, we upgraded the transfer of knowledge with videoconferencing training, which is attended by interested teachers from both groups of schools.
- Joint training: Before closing the schools, we organised all-day training sessions, which were carried out once a year. Up to 10 teachers from each school took part in this training. During the distance learning, we replaced the joint live training with a week of innovative pedagogy, where the all-day training program is divided into five training sessions in the evening.

The goal of the training is to change the way the teachers teach and most importantly, the improved competencies of students.
In order for a teacher to be able to introduce new learning approaches and develop the digital competence and competencies of the 21st century, they must also become a lifelong learner. In addition, the teacher must become a change holder and innovator, which is precisely what we encouraged through these different forms of training.

The training is prepared by the institutions (National Educational Institute Slovenia, faculties) together with experienced teachers, many training sessions are developed by the teachers of development schools according to the needs of teachers in the implementation schools.

- In the first year of the project, 2017/18, the training was focused on the didactic
- use of applications, which were then used by the teachers in their work with
- the students.
- In the second year of the project, 2018/19, we also added training for the development of digital competence from the Digcomp 2.1 framework. In doing so, we developed only some digital competencies from the DigComp 2.1 framework:*)* 1.1 Browsing, searching, filtering data, information and digital content, 1.2 Evaluating data, information and digital content, 2.1 Interacting through digital technologies, 2.2 Sharing through digital technologies, 2.4 Collaborating through digital technologies, 3.1 Developing digital content, and 3.2 Integrating and re-elaborating digital content. The training was set up so the teachers could immediately start developing and supporting these digital skills in their students. In the second year of the project, we also started formative assessment training
- In the third year of the project, we implemented training for the development of competence for the 21st century and we also included the DigCompEdu framework for the educators.

Organization and Management of Schools
The introduction of innovation in schools, in particular changes in the teaching field, requires time and, therefore, the gradual and multi-annual introduction of innovative learning environments was planned. Development teams were set up at all schools that, depending on the specific situation at the school (technological equipment, competence of teachers, characteristic of the school environment), prepared a deployment plan.

The principals were trained for new leadership ways in which they encouraged the participation of all participants.
In implementing the changes, the school management has followed the already developed 21-step-methodology with four levels (planning, preparation, implementation and evaluation).

At each school, teachers planned the development of digital competencies and the competencies of the 21st century for the entire school year. The teachers entered their plans for the development of competencies in the same table, so other teachers could see what competencies the students have already developed and what digital tools they already know how to use. This way we made sure not all teachers developed the same competencies and the students were developing all agreed competencies all year through.

Management pays special attention to in-class observations and the exchange of innovative practices between teachers and also principals. Principals share the experience of introducing an innovative learning environment with each other at regular working meetings.

It is important that teacher training was organised in the so-called preparatory year, that is before the teachers started implementing innovative pedagogy in the implementation class. At regular meetings at the school, the teachers not only trained but also exchanged experiences, analysed examples of good use and reflected on their practice. At the beginning and at the end of the school year, all students filled in a questionnaire, so we could measure the current state of the development of digital competencies and digital competencies of the 21st century and the students' progress at the end of the school year.

Recommendations
The project develops recommendations for the development of a supportive environment (https://www.inovativna-sola.si; Project results menu). Recommendations have already been developed for: Innovative learning environments, Preparation of examples of promising use, Technical recommendations for the purchase of tablets and the Golden Rules for renting tablets, and four more recommendations are in the final phase of preparation.

Tools (Pedagogical Wheel, 21st Century Learning Design,
We have translated and adapted several tools to help teachers plan and implement classes in an innovative learning environment. Teachers have at their disposal: 1) Digital Bloom taxonomy (Churches, b.d.), which directs teacher planning at all levels of taxonomy; planning takes place with the help of digital devices and applications 2) Padagogical wheel, which helps teachers plan lessons by focusing on lesson objectives rather than applications. In doing so, the teacher plans the activities, thinks about changes in classes that they want to achieve and only at the end thinks about the applications the students will use. They also have in mind the SAMR model (Puentedura, b.d.), with the help

of which the teacher thinks about the level of change in the lesson; 3) Guide with criteria and guidelines for the evaluation of learning activities. 21st Century Learning Design). With the help of this tool, the teacher analyses the planned activities of students and establishes at what level students will develop the competencies of the 21st century. Based on the findings, they try to plan the activity so that students develop this competence at the highest possible level.

Examples of good practice

The teacher's didactic material is the foundation for exploring one's own practice and professional discussion on innovative teaching approaches, developing competence and improving school practice. It is referred to as an example of good practice in the project and published in the e-community online classroom and on the project website. The recommendations for creating examples of good practice contain some theoretical starting points for planning innovative lessons, and the main part is a form for recording examples of good practice. In the form, the teacher plans a topic set in which he/she writes down operational objectives according to Bloom's taxonomy, assesses what digital competence the teacher needs, what digital competence the student primarily develops, which digital tool the students will use and, most importantly, which activities students will use to achieve the set objectives. The teacher also records the stages of the learning process with the elements of formative assessment and tries to evaluate the planned example of good practice with the SAMR model. The form also contains a Reflection section in which the teacher writes his own reflection on the performed set, adds the students' reflections, adds evidence of learning and adds annexes such as worksheets.

Examples of good practice are published in the closed online community of the project. From these examples, teachers get new ideas, test them or get guidance on how to conduct the learning process with the meaningful integration of digital technologies. The most effective examples are already published on the project website. The teacher must, of course, be able to think professionally and adapt such an example to the learning environment, the prior knowledge of the students and other working conditions. Selected examples of good practice will be published after the project is finished and will be available to teachers who are not currently participating in the project.

E-Community

The online community/classroom of teachers in the project was established. In it, teachers share their knowledge and experience in various fields, such as: digital competence, the meaningful integration of digital tools into lessons, active lesson planning and so on. Teachers share their experiences among colleagues from all schools and also among teachers of the same subject. The E-community Development Group has prepared and implemented a number of online training courses, mainly on the topic of planning innovative teaching. In live training, the online classroom is used to give feedback to workshop performers and to exchange findings when teachers use the presented content in their classes. In this classroom, individual subject areas also have their own space in which questions and examples are already more subject-specific. Teachers may engage in discussions in the following areas: Languages, First cycle of elementary school, Natural sciences, mathematics, sports, design and technology, Social sciences, art and professional subjects.

We have found that teachers need a lot of encouragement to publish their cases or to ask professional questions. The reason is also that in our culture, this is an area where teachers are reluctant to expose themselves to professional dilemmas. The Facebook page of the project is very popular, where teachers publish news about the activities performed and publish photos of products or recordings of learning processes.

Infrastructure

As part of the project, guidelines were developed for the acquisition and preparation of digital devices for students and teachers. Special attention was paid to the physical image of the classrooms for which a flexible classroom model was developed in the Innovative Pedagogy 1:1 project.

At the national level, we also have a developed support environment offered by ARNES (The Academic and Research Network of Slovenia). Arnes provides schools with broadband connections, Wi-Fi networks and a web centre with apps and services. There are more than 10,000 online classrooms for more than 200,000 users available on http://skupnost.sio.si and a single AAI login and so on is enabled.

CHALLENGES AND LOOKING AHEAD

Experience has shown that, with the sudden closure of schools due to the coronavirus, schools and teachers have had fewer problems with the transition to distance learning. Students and teachers have already created adequate digital identities and experience using digital tools. The infrastructure at the school has already been established and decisions on which communication channels to use uniformly at the school were made more quickly.

Changing pedagogical practice has proven a very demanding process in which all stakeholders must work together. The inclusion of digital technologies into classes, the development of different competencies and different, active classes, pose a challenge also for the students. As the project is still ongoing, it is difficult to predict whether the changes in pedagogical practice will be permanent. In any case, the systematic and planned training of teachers and school management equips them with skills to help them step out of their comfort zones and include innovative teaching methods in their practice.

THE DIGITAL LITERACY OF SECONDARY VOCATIONAL SCHOOL STUDENTS

Although it seems to us that young people are skilled users of digital technology because they are surrounded by it from birth and grow up in the digital world, the research results show otherwise. In 9 out of 14 member states participating in the International Computer and Information Literacy Study 2018 (European Commission, 2018) more than a third of students achieved results below the ICILS level 2, which can

be seen as a failure in the digital literacy/education of students. According to reports by Slovenian schools (Fraillon et al., 2014), access to digital devices in schools in Slovenia is satisfactory and general equipment at schools, according to participating countries, is at the top of the international scales. Despite the favourable conditions in Slovenia, according to the results of the 2nd survey on the use of ICT in schools, there is a lack of use of digital devices by students in the classroom and opportunities for the digital literacy of children and youth. (European Commission, 2019).

Chan Min et al. (2013) conclude that the integration strategies for any technology depend on the teacher's beliefs about the nature of learning and on their previous teaching experience. They also point out that access to digital technologies does not in itself cause the change of a teacher's pedagogical practice, but the context and circumstances of its use are crucial. The teacher implements changes in their own pedagogical practice, provided that different and continuous training is also available in connection with the integration of digital technologies into classes. Therefore, the proper equipping of schools with digital technology does not mean that the transition from conventional forms of teaching to newer and more innovative forms, such as the use of digital technology for teaching and learning, will occur automatically. Given this fact, it is undoubtedly necessary to pay special attention to the digital literacy of teachers. Brečko (2016) believes that a digitally competent/literate teacher is capable of using digital teaching technologies and, through the competent use of various digital tools in the teaching process, can teach students digital skills.

On the questions of how teachers should tackle these challenges and how to keep pace with the changes brought by new technologies, the National Education Institute of Slovenia (NEIS) provides various forms of professional support for teachers who prepare students for a different technological reality and the professional environment into which they will enter as adults.

PROJECT, PURPOSE AND OBJECTIVES

At secondary vocational and technical schools, we educate pupils for jobs requiring both basic and specific digital skills (Cedefop, 2017). This is why it is necessary to come up with a strategy for the digital education of students at these schools, who will become digitally literate during their schooling for a quality life in digital society and the competent pursuit of a profession. Guided by this idea, the National Education Institute of Slovenia (NEIS) in cooperation with The Institute of the Republic of Slovenia for Vocational Education and Training (VET) prepared a two-year development project (2018-2020) for the development of the digital competence of teachers of secondary technical and vocational schools and the use of digital teaching and learning technology entitled *The Development of the Pedagogical Digital Competence of Teachers of Vocational and Technical Schools in Order to Support Students in Their Digital Literacy (for their Profession and Everyday Life in Digital Society)*.

The main purpose of the project was therefore to support teachers at secondary vocational and technical schools in an effort to adapt education to the needs of new generations for inclusion in digital society (Government of the Republic of Slovenia, 2016). The need for such cooperation with teachers also became apparent after the implementation and analysis of the responses of teachers of vocational and technical schools to the online questionnaire, which in November 2017 provided information on the attitude, knowledge and use of digital technologies in planning and implementing lessons in secondary vocational and technical schools, both in general subjects and in professional modules. Encouraged by these findings, we have set two main objectives in the project:

1. making better use of digital technology for teaching and learning
2. developing digital competencies and skills

In April 2018, we invited all Slovenian secondary technical and vocational schools (Slovenian Institute of Education, 2018) to participate in the project by means of a public tender/invitation. In May 2018, we selected 12 secondary technical and vocational schools with 12 teachers to participate in the project. The selection of participating schools took into account the references and experience of the school and the development plan for digital competence in the use of digital technology for learning. Below we present how we supported teachers during the project to introduce changes in their teaching practice and what we developed together with the purpose of keeping the resulting change in teaching practice even after the completion of the project.

STRATEGY FOR THE DEVELOPMENT OF THE PEDAGOGICAL DIGITAL COMPETENCE OF TEACHERS IN THE PROJECT

The objectives and expected results of the project dictated a systematic and thoughtful offer of didactic support to participating teachers. The consultants of the two institutions who jointly managed and coordinated the project, together devised a strategy for the development of the digital competence of secondary technical and vocational school teachers. We were guided by experience from past projects (MENTEP, EUFOLIO, ATS 2020 - Also, the strategy of the project in some steps coincided with the Innovative Learning Environments project supported by the ICT.

When we talk about the definitions of pedagogical digital competence, we cannot pass over the European DigCompEdu; Digital Competence Frameworks for Educators (Redecker, 2017). The framework defines 6 areas with a set of 22 specific digital competences for teachers focusing on different skills to help them think about the potential and improvement of their own teaching practice. Areas of professional engagement (1), digital resources (2), teaching and learning (3) assessment (4), and the empowering of learners (5) describe the professional and pedagogical digital competences of teachers. Facilitating learners' digital competence (6) provides a description of the specific pedagogical competence of teachers to support students in digital literacy. Each of the models/frames presented, in its own way, contributes to creating a standard of a digitally competent teacher through their views on the knowledge needed for effective teaching with digital technologies. In accordance with the aforementioned categories and fields of digital competence, we present below a part of the strategy for developing the digital competence of teachers in the project, which relates to the professional support of teachers and the plan for classwork.

Professional Support for Teachers

With the desire for the digital literacy of teachers and the integration of digital technologies to be successful and maintained after the project, we paid special attention to *professional meetings, the training of teachers and the implementation of digital teaching*. Through our activities, we sought to improve the digital competence of teachers to support students in digital literacy. During the first half of the project, we tried to understand and learn to use new technologies in a meaningful and efficient way through joint meetings and training. We have prepared five training sessions, live and remotely. The training objectives focused on:

- filling the gap in digital competence area and
- unification in terms of understanding which digital competencies teachers need to acquire and which ones their students need to gain through schooling.

Training topics covered the field of digital pedagogy (the planning and implementation of classes through digital technology, the planning and implementation of learning activities), selection and production of digital content, information literacy, communication and cooperation and responsible use. In the second half of the project, we focused on professional support for school development teams of teachers (SDT) in the planning and implementation of digital lessons.

Classroom Work Plan

In the design of the learning scenarios, we have focused on the development of various strategies that will help teachers in their teaching practice to offer students as many diverse, meaningful and effective learning experience as possible through which they will be able to become digitally literate. Guidance for the digital literacy of secondary school students (for their profession and everyday life in digital society) was found in DigComp 2.1: The digital competence framework for citizens (Carretero et al. 2017). We chose it because it defines the areas (5 fields) and digital competence (21 digital competences):

- that all citizens need in a rapidly developing digital society, in which our students will soon be the engine.
- which will be able to serve the participating teachers of the subject/module as a starting point in the preparation of learning experiences for students, with whom they will develop 21 digital competencies from the framework of digital competence for citizens

Teachers from the SDT had the task of conducting 3 teaching cycles in the class of the selected educational program. A teaching cycle with a common leading topic specific to the profession for which the students are being educated (specifics of the educational program) could cover the learning content for a duration of at least one hour. During each cycle, teachers co-planned a variety of learning experiences that allowed students to:

- realize the objectives of the learning content from the common topic (operational, content, process)
- achieve the intended learning outcomes or results (what the student should know or be able to do)
- develop meaningfully selected digital competence from the Digital Competence Framework for Citizens (DigiComp 2.1).

Since several teachers taught in each class, the cycles were carried out:

- In parallel: At the same time, the teachers of SDT began carrying out cycles and dealing with a common topic. From the perspective of the student, this meant that, in less time, more intense and concentrated, they were exposed to greater learning experiences that enabled the development of the selected digital competence. Normally, this implementation model lasted for one to two project weeks.
- Consecutively: The teachers of the SDT determined the order of performance of the cycles. In this case, the period of one cycle could have lasted several weeks. Students were exposed to the same number of learning experience, only they lasted longer and had a lower concentration.
- Regardless of the model of cycle implementation, the SDT teachers strived for mutual and interdisciplinary connection, interweaving, upgrading and complementarity. With the teams of teachers, in determining the digital specificity of the subject/module and planning, both institutes' consultants worked closely together. Collegial in-class observation enabled teachers to learn from each other, exchange experiences and, with the help of quality feedback, got an opportunity to improve their own teaching practice. In order to evaluate the results of the digital teaching, two instruments were developed in the project: (1) a scale for analysing the use of digital technology to achieve digital learning objectives and (2) a reminder to prepare feedback for teachers.

EXAMPLE OF PROJECT RESULTS

The SDT teachers also kept record of each cycle performed. For this purpose, we created a Learning scenarios template in the project, which enabled a more unified approach and easier orientation for the participating teachers. In forming the template, we started from our previous professional work at NEIS and VET in connection with the digital literacy of teachers and students. The structure of the template envisaged an introductory part, a core of the example and other elements that were in line with the objectives and purpose of the project.

In the introductory part of the Learning scenarios *teachers* provided information about themselves, the school, the subject or module, the year, the title and the duration. They defined goals, learning outcomes and digital competencies, which they primarily develop in students through planned Learning activities. Special attention was paid to the concise note - the description of the heart of the digital story in the Learning scenarios, which served as answers to the questions:

- Which digital competence have the students developed?
- Which digital competencies of the teacher were needed to carry out these activities? How is the use of the digital tool/application/solution meaningfully integrated into the learning content/set?
- What was different? What were the advantages and why?
- At the core of the Leaning scenarios, they presented an implementation model for dealing with the learning content. For each subject or module objective and digital competence, they recorded the planned students' learning activities and the methods of work, as well as the expected proofs (how the students will prove that they achieved the subject/module objectives and the level of digital competence).

During the project, the participating teachers wrote 252 lesson plans. Their preparation work was analysed according to the questions stated above. For the purpose of this contribution, we are presenting the results which refer to the planning of activities for students, with the help of which 21 digital competencies from the DigComp 2.1 framework were developed as a priority. The analysis showed that during class, the teachers most often enabled the students to develop the competencies of browsing, searching and selecting data, information and digital content (1.1), sharing and collaboration through the use of digital content (2.2 and 2.4), and the least often planned activities for developing competencies from the fields of safety (4) and problem-solving (5).

After the conclusion of the project, the participating students were questioned, which digital competencies they have developed through various activities in classes. We created an online questionnaire consisting of 5 questions. Three questions were of informative type and we used them to learn what school the students are visiting, what grade they are and what education programme they are part of. Two questions were content-connected. One question included 16 statements. We asked the students to what measure they agree with the statements regarding their and the teachers' work. The second question was an open-type question and by answering it, we learned what the students would like to do more with regard to the digital technologies in the field of teaching and learning. The questionnaire was in total completed by 495 students and 12 participating schools.

Considering the answers by the students to the 5 statements in the first question regarding content, we have established that in classes, the students most often had the opportunity to use different digital means of communication and collaboration among each other and with the external audience (96%), create digital content (88%) and use digital technologies and participate in groups (88%). Half of the students learned in classes how to act safely and responsibly online. The answers by students confirm our findings which we have established by analysing the teachers' lesson plans. We have noticed a large correspondence between the answers by the teachers about which digital competencies they have primarily focused on developing during classes and the students' perception. The analysis of the lesson plans and the answers by the students brings valuable information for future professional work with teachers.

Conclusion

With the projects presented, we wanted to launch digital transformation with teachers in order to develop and upgrade their digital competence and use digital technologies in their teaching in an innovative and creative way to support the development of students' digital literacy.

The results of the projects show how important it is to have a clear strategy for the development of the pedagogical digital competence of teachers, a strategy based on continuous professional training and regular support from experts and school management to achieve this goal. It is very important that the school does not omit any of the aspects described in the 21 steps of implementing innovative pedagogy. Only in this way can we ensure that teachers, through their innovative teaching, also provide innovative learning opportunities for students.

The strategies and methods of working in the projects presented are the legacy and an upgrade of the rich experience we have gained in all our previous projects.
However, over and over again before, during and after the completion of the project, we face recurring challenges.

- How can we further empower teachers in their digital competencies to support students in developing their digital competencies/literacy?
- How to achieve sustainability of the project results, such as teachers' beliefs that DT is an important educational goal, and their intention to support students' digital literacy after the completion of the project?
- How to empower principals to understand the importance of their role in the process of developing students' digital literacy?

We are looking for answers to the above questions in national projects where students develop different competences from the European reference framework. Their common red thread is digital literacy.
We are also looking forward to the new project Raising Digital Competence, which will involve teachers and students from majority of Slovenian schools. In this project we will search for answers to the questions above with a special attention to implementing innovative strategies for developing digital literacy of both – students and teachers.

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SWEDEN

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The added value of digitalisation – the Swedish experience

ABSTRACT

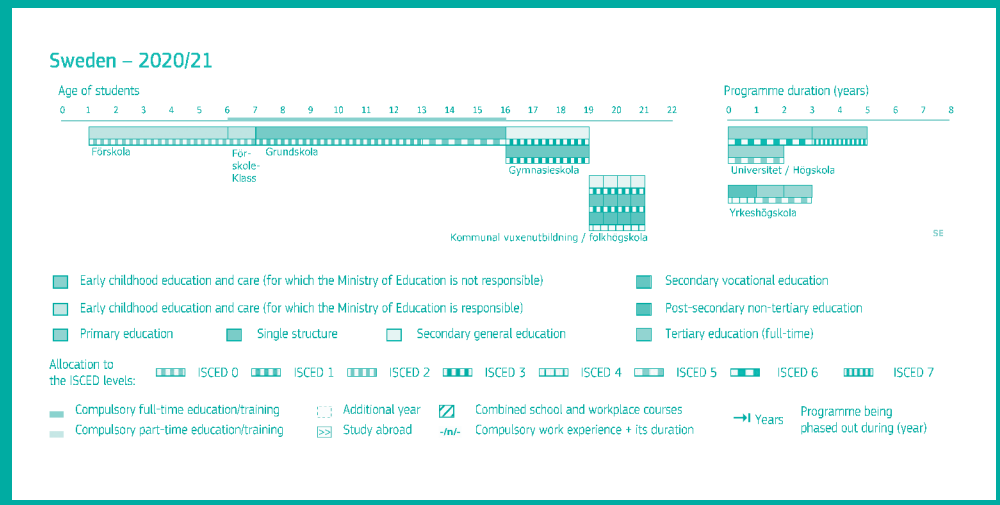
Sweden aims to be a global leader in utilising the opportunities created by digitalisation. Starting with a National Strategy of Digitalisation, the government commissioned the National Agency for Education to promote digitalisation in the school system.

This chapter will describe how digital literacy is implemented for school organisers, staff, and pupils from preschool and compulsory school through upper-secondary school and adult education.

By integrating digital skills in the curriculum and across subjects, pupils will develop basic ICT skills, computational thinking and media and information literacy. School organisers received special contributions to guide and support equal access and use, and to support head teachers in leading their school´s digital transformation. Finally, teachers are offered ICT skill development and guidance in teaching methods.

One of the driving forces to reach the goals for digital transformation in the Swedish school system is the digitalisation of national tests. During the COVID-19 pandemic, and the subsequent expansion of remote learning, the Swedish school system has taken a step forward in digital transformation. Yet, many challenges remain. Socio-economic differences, and lack of equal access and use of technology, are some of these challenges.

Educational system



OVERVIEW OF THE EDUCATIONAL SYSTEM IN SWEDEN

INTRODUCTION

Sweden aims to be a global leader in utilising the opportunities created by digitalisation. Starting with a National Strategy of Digitalisation, the government commissioned the National Agency for Education to promote digitalisation in the school system. In addition, the agency has been commissioned to digitise the national tests, which means that organisers and head teachers need to prepare organizationally and technically. When the Covid- 19 pandemic hit the world, the digital capabilities of the school system were really challenged.

Digital literacy is a question of equality and democracy. For the school, the goal is clearly defined - digital competence for all and equal access and use. It is a big challenge to get there. Has the Swedish strategy been involved up until this time? What are the achievements and what work is yet to be done?

The Swedish chapter will describe our national digitalisation strategy, how we implemented digital competence in our steering documents, and how we support schools, staff, and students to achieve the goals of the strategy.

Specific efforts to include digital competence in the steering documents

The first part of the chapter will describe the government's national strategy and the responsibility of the Swedish National Agency for Education (NAE). The second part will give a mode description of digital translation at Swedish schools of today. Because the Swedish education system is so decentralised, we face specific obstacles to achieving digital literacy goals for the entire school system. Therfore the end of the chapter will give a brief description of how the Swedish school is structured.

THE SWEDISH MODEL OF DIGITALISATION IN THE SCHOOL SYSTEM

The EU´s Key Competence, and the description developed by the Swedish Digitalisation Commission, provide the starting point for how digital competence was written into governance documents (SOU 2014:13, SOU 2016:89, OECD 2010, Kozma 2008, Dalla et al 2015, The Royal Society, 2012). The Commission pointed out six strategic areas to achieve the ICT policy objective of making Sweden a leader in utilising the opportunities created by digitisation. One recommendation was to mobilise schools and higher education to utilise digitalisation opportunities, and to give students the skills necessary for a digital society.

The common overall description in the curricula, and the progression presented in the subject syllabus, mean that digitalisation runs as a common thread throughout the school system (Skolverket, 2018). In this way, students can be challenged to broaden and deepen their knowledge. Four aspects of digital competence are described in the steering documents. It is about developing an understanding of how digitalisation affects the individual and the development of society. Digital competences entail developing the ability to use and understand digital systems and services, to relate to media and information in a critical and responsible way, and to solve problems and turn ideas into action in a creative way, using digital technology.

A NATIONAL STRATEGY AND AN ACTION PLAN

In 2017, the Government decided on a national digitalisation strategy for the school system. The overall goal of the national strategy is for the Swedish school system to be at the forefront of digitalisation opportunities to achieve a high level of digital competence among children and students, and to promote knowledge development and equality (Regeringen 2017). The digitalisation strategy contains three focus areas for actions that, taken together, will lead to the achievement of the overall objective. Each focus area has a main goal as well as several milestones to be achieved by 2022.The focus areas are:

- Digital skills for everyone in the school system
- Equal access and use
- Research and follow-up on digitalisation possibilities

To realise the national digitalisation strategy, Swedish Association of Local Authorities and Regions, SALAR, in cooperation with NAE, the rest of the Swedish National Education System and the business community, have developed a national action plan, the Skoldigiplan (SKR, 2019) The plan proposes national initiatives and activities based on the general needs formulated through cooperation among the partners. These needs must be met through national coordination and development. Involved actors must take responsibility, invest resources, and actively promote the implementation of the initiatives. Some of the initiatives have been established by the government, others are under preparation, or soon to be prepared The first initiative gives NAE the main responsibility for coordinating the state's work on digitalisation in the school system. At the same time as the action plan was introduced, the Swedish National Agency for Education was commissioned by the government to digitise the national tests. This means, schools need to acquire new or upgrade their existing computers and tablets so that they can manage browsers that support modern web standards. In addition, schools need a digital infrastructure. Schools need to be able to handle certain user data, requiring, for example, that there is a digital register of teachers and students. It places new demands on competence. Such a radical driver of change in digitalisation in school.

SECTORAL RESPONSIBILITY

Since February 2020, NAE has been the sector responsible authority for school digitalisation. This means that NAE is responsible for ensuring that the school system can make the best possible use of digitalisation's opportunities for increased achievement of goals and equality (Skolverket 2021a).

The NAE´s sector responsibility means working to create national conditions beneficial to school digitalisation. This will make it easier for organisers to assume their responsibilities to provide schools with the resources and conditions they need and make digitalisation part of their systematic quality work. The sector responsibility also requires gathering, supporting, and stimulating by formulating and clarifying the necessary development of school system digitalisation. The NAE, pooling needs with various actors and stakeholders, collects knowledge, current research, and learning examples in relevant areas that are then disseminated to all relevant actors.

To be supportive, and to remove national barriers to further development, the NAE works actively to ensure that teachers and head teachers have adequate digital skills. The agency is also pushing for a national digital infrastructure and the development of standards. Encouraging actors in the school sector to take responsibility for digitalisation in their specific areas is another way that NAE drives digitalisation. To fulfil all parts of NAE's sector responsibility, new contacts will be established and collaboration with other authorities and actors in the field of digitalisation will be strengthened. The Government has previously commissioned the NAE to promote school digitalisation and to digitise national tests. The NAE´s sector responsibility creates an opportunity to support and drive the development of the authorities and actors responsible for creating good conditions for the digitalisation of the school system, and thus will complement and reinforce these.

THE NAE´S DIGITAL DEVELOPMENT PLAN

To ensure its ability to carry out its tasks effectively in an increasingly digitised environment, the NAE conducts strategic development work regarding the agency's own digitalisation. This is also a prerequisite for successfully and credibly promoting the digitalisation of the school system. Over the past year, the agency has increased its focus on building strong basic conditions for digitalisation and development, thus raising the NAE´s ability to adapt to changing conditions in the outside world quickly and efficiently to meet new and changing needs of the target groups. Not to mention how the Covid-19 pandemic has influenced our way of working, both internal and external. Some results have also been achieved that are directly visible to the outside world. For example, the NAE website and several other digital services have been redesigned to increase accessibility and user-friendlines, government grant services have been developed to make things easier for head teachers, and steps have been taken towards increased accessibility of NAE´s information sets as open data. Within the implementation of the digital development plan, several measures regarding the management and development of NAE´s digital service offering have been taken over the past year. These include platforms for managing education, steering documents, and mapping of knowledge and competence within different school forms.

DIGITAL TRANSFORMATION SO FAR

NAE was commissioned by the government to monitor the goals of the digitalisation strategy. This follow-up is part of the NAEs mission to promote digitalisation in the school system, and make it easier for schools and organisers to take advantage of digitalisation's opportunities in teaching and administration.
The NAE´s first follow-up to the national digitalisation strategy was published in February 2019 and was based on surveys aimed at head teachers, teachers, preschool staff, and pupils. Overall, the report pointed to the importance of organisers´ and head teachers developing strategic leadership around digitalisation and highlighting digitalisation as part of systematic quality work (Skolverket, 2019a). The main results of the follow-up are:

- Digitalisation has had a greater impact at later years of compulsory school and upper-secondary schools, in terms of access to digital tools in schoolwork, but also on the extent to which teachers work to develop pupils' digital skills.
- The new parts of the digital competence curricula are familiar to head teachers and teachers, but preschool staff and teachers feel the need to develop their digital skills in, for example programming.
- Access to technical and educational support varies in preschools, schools, and municipal adult education and many lack a connection with the capacity to conduct digital national tests.

The second follow-up was published in February 2020, and deals with the organisers work with school digitalisation (Skolverket 2020a). The organisers are the legal body responsible for education provision. Municipal and independent organisers of primary and secondary schools have participated in a survey and thereby pictured the responsibilities taken by the head teachers, and the extent to which they work strategically based on the objectives of the national digitalisation strategy. The results show that for digitalisation to have an impact in schools, it is important that organisers develop local strategies or plans linked to national strategies or objectives.

The national digitalisation strategy has reached many organisers of primary and secondary schools. Most respondents say that they have taken it as a starting point to develop strategies, plans or goals for work on the digitalisation of their schools.
There are differences between municipal and independent organisers. The proportion of respondents who have established their national digitalisation strategy or developed a digitalisation plan for their schools, is lower among the independent organisers.
In addition to strategic leadership, digital competence among organisers, head teachers and school staff are also required to achieve the strategy's goals. The report shows that most organisers have examined the needs of head teachers and school staff for competence development in digital skills, but one in four organisers have not examined the needs of head teachers, and one in five organisers have not examined the needs of pedagogical staff.

One of the objectives of the national digitalisation strategy is for pupils and staff to have good and equal access to digital tools and resources. The results of the survey show that almost all organisers state that they have examined the needs of their school(s) in terms of access to computers and tablets. In addition, just over eight out of ten have investigated whether teachers receive the technical and educational support they need.
The next follow-up is a national survey that will be reported in February 2022. It will focus on the objectives of the strategy, and is aimed at head teachers and teachers/preschool staff in preschool, compulsory school, upper- secondary school, and adult education, including all school forms for pupils and students with learning disabilities.
In addition to the strategy, we also look to some extent at the consequences of the COVID-19 pandemic for digitalisation issues related to the digitalisation of national tests.

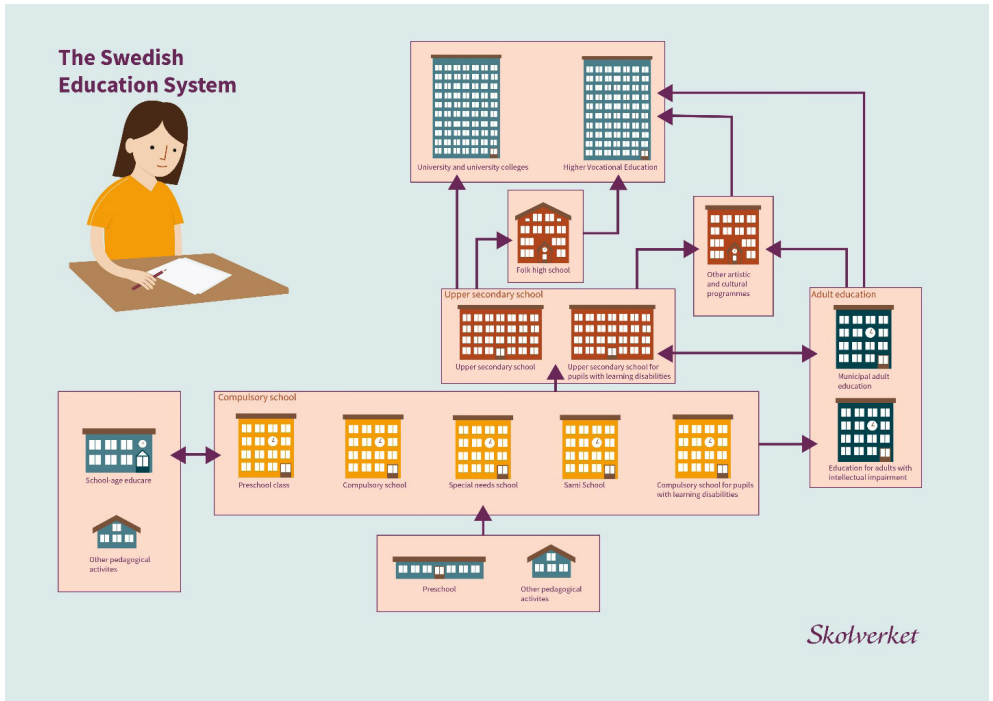
THE SWEDISH DECENTRALISED SCHOOL SYSTEM

In Sweden, the Parliament and the government decide what pupils and students should learn in school. The organisers and the head teachers design the education and are responsible for ensuring that the pupils and students achieve the goals. The state governs schools through laws, regulations, curricula, and syllabi These set out objectives and guidelines count for all school activities. The Education Act, ratified by the Parliament, specifies the frameworks that apply to all school activities (Riksdagen 2010). The government establishes curricula which, together with the Education Act, govern the activities of the school (Skolverket 2000). The school system is mainly a municipal responsibility, but independent schools are increasing in numbers, especially in upper secondary education. For public schools, the municipality is the organiser and the school's board organise the independent schools. The organiser decides how the school should work, ensures that the school has the necessary resources and will constantly work to make the school better. It is the organiser who is responsible for ensuring that all pupils and students achieve the goals. The organiser also certifies that the training is compliant with the regulations.

There are three different authorities that help the government and the Parliament to produce documentation and to implement what the Parliament has decided. These authorities are the Swedish National Agency for Education, (NAE), the Swedish Schools Inspectorate and the The National Agency for Special Needs Education and Schools. The goal of the authorities is for all students to receive a good education in a safe environment. The NAE is the national authority responsible for monitoring, evaluating, developing, and supervising school activities.

Everyone in the school is obliged to work towards the common goals. This ensures equal education. Swedish schools, both municipal and independent, are mainly publicly funded and free of charge. Almost 17 per cent of primary and secondary school pupils attends an independent school (Skolverket 2021b). In upper secondary school, the proportion is higher than in compulsory schools; 35 per cent of upper secondary schools students´ attend an independent school (Skolverket 2021c).

Sweden has a nine-year primary school. All children and young people between the ages of seven and 16 are obliged to go to school. The education system includes activities for children starting at one year of age. Before children start school, they can attend preschool, which is an independent school form with their own curriculum. Almost all children being primary school the year they turn seven. While children may begin first form as six-year-olds, most parents choose to place their children in the voluntary preschool class instead. For pupils deemed not to be able to reach the knowledge requirements for primary school there is a special school form, compulsory education for pupils with learning disabilities.



No one school resembles any other. Each has different conditions depending on its students body, teaching staff and geographic location. Location differences are evident in student base and geographical constrains, like the size of the municipality from which the student body is drawn. Because schools are the responsibility of municipalities, municipal politicians must plan school activities and carry out evaluations and follow-ups. Each school then has the freedom to choose practical schoolwork. For compulsory school, hourly schedules regulate the amount of teacher-led teaching students are entitled to. The total number of hours in each subject is regulated, not how many hours a student must have in a particular subject per year. Upper-secondary school, there is a total sum of guaranteed teacher-led hours.

Each municipality has the right to decide which upper-secondary education programmes to offer, but they are obligated to offer an all-round range. All pupils in primary and secondary schools have the right to apply to any school they wish to attend. Primary and secondary school students can also choose an independent school not organised by the municipality. Independent schools must be open to all pupils, and must be approved by the Swedish Schools Inspectorate. Their activities are financed through public funds; – schools receive grants for each enrolled student from the municipality. As for primary school, there is upper secondary school, and also adult education, for intellectual disabilities.

Adult education in Sweden takes place in many different forms, and through many different educational activities. These include state and municipal adult education. Each municipality has an obligation to organise municipal adult education. This should include adult basic education, that is, primary education, for those lacking primary school skills. Adult basic studies are adapted to each student's prior knowledge, and students choose their own rates of study. Municipalities are also obliged to offer adult education at the upper secondary level. Adult students can, for example, earn an upper-secondary school equivalent diploma or receive vocational training. Adults and youth use the same syllabi.

Implementation of digital skills

The second part of this chapter describes strategic decisions made by NAE, as well as what NAE does, and has done, to achieve digitalisation goals. First, it describes how digital competence has been written into curricula, diploma goals, and syllabi. This is followed by an account of NAE´s recent and current implementation efforts. The chapter concludes with an account of how digitalisation´s development in the Swedish school system, and how the recent COVID-19 pandemic has affected development.

DIGITAL COMPETENCE IN THE CURRICULA

The government has established curricula for each compulsory school form and corresponding school forms, as well as for upper-secondary school, and adult education. Programs for the learning disabilities in compulsory school, upper-secondary school, or adult education also have their own curricula The curricula express overarching objectives of education, such as norms and values, knowledge, students' responsibility and influence, assessment and grades, and the headteacher´s responsibility.

The language concerning digitalisation is identical or similar in the respective curricula of compulsory school and equivalent forms of school, upper-secondary school, and adult education curriculum (Skolverket, 2020b, 2017a). The common overall description in the curricula, and the progression presented in syllabi, are constant throughout the school system. In this way, students can be challenged to broaden and deepen their knowledge. Pupils who have completed primary school or an equivalent school form must have developed the digital skills necessary to live and thrive as citizens of our society. Here it is important to emphasise some students in upper-secondary school and adult education have not completed primary school, or have sufficient prior knowledge. These include recent immigrant students who began school in Sweden late in life, pupils who complete their education in adult education, or students who take introductory programmes in upper-secondary school.

The curricula for the different school forms have a similar structure, and comparing their content it becomes clear that the entire education system is based on the same values and conception of knowledge (Skolverket 2010, 2013). Education from preschool to upper-secondary education can be understood as a logical progression, where students' knowledge and experiences are utilised, and where new knowledge is developed based on students´ past learning experiences.

COMPULSORY SCHOOL

The overall goals and guidelines describe the norms and values as well as the transversal skills that all students should have developed before leaving primary school or equivalent school forms. The goals indicate the focus on the school's work, but not how far the students should have developed by any given time. The guidelines also describe the responsibility of all who work in the school to ensure that pupils and students develop towards their goals.

All curricula have goals and guidelines that relate in different ways to digitalisation. There are goals that are clearly targeted, such as that each pupil and student must be able to *use digital as well as other tools and media for knowledge search, information processing, problem solving, creation, communication, and learning.* Sometimes the goals are less defined for example that each pupil and student can use *critical thinking and independently formulate positions based on knowledge and ethical considerations*. A critical approach, and the ability to apply source criticism, are of course equally important in digital environments. In teaching, pupils and students should be given the opportunity to *use digital tools in a way that promotes knowledge development*. Therefore, it is important to be aware that digital tools and media are primarily means of learning, while knowledge of digital tools and media, and the skills to use them, are ends in themselves. Furthermore, teaching needs to be deliberately organised and implemented so that digital tools are used in such a way as to support pupils' learning. A more unplanned use of digital tools and media with no clear purpose or goal risks impairing learning (Skolverket 2018).

At the beginning of the second part of the curriculum, it is stated that it is the school's responsibility that students acquire and develop the *knowledge necessary for each individual and member of society, and what provides a basis for continued education*. It is important for students to have digital competence, regardless of whether they work or continue their studies. It is therefore clear that schools, preschool classes, and school-age care have a common mission to support students in developing digital skills. The basic idea is that a well-developed digital competence benefits student learning and development, and makes it easier for students to participate in different situations and contexts.

The mission to support students in developing digital skills is important for everyone working in the school. To meet this objective requires certain conditions. Among other things, the curriculum states that the head teacher is responsible for ensuring that the school's work environment is designed so that all pupils and students have access to and conditions to use good quality teaching materials, as well as other learning tools for a contemporary education, including school libraries and digital tools. It also says that the school library's activities are used as part of teaching to strengthen students' linguistic and digital skills. Schools may choose what equipment and method to employs. But lack of equipment should not limit students' ability to develop the knowledge and abilities described in the curriculum.

PRESCHOOL CLASS

In preschool classes, teaching should be based on the needs and interests of the pupils as well as on the knowledge and experience that pupils have already acquired (Skolverket 2019b). In addition, teaching must contribute to continuity and progression of pupils' development and learning, and prepare pupils for further education. Many pupils have previously encountered digital tools and media, so their experiences can be the starting point for teaching in preschool classes. Digital tools and media for communication should *emphasise the importance of digital technologies*. Pupils should *develop the ability to create and express themselves through aesthetic forms of expression.* To challenge pupils further, they should be offered a variety of ways of working, forms of expression and learning environments, both digital and otherwise. They should also be given the conditions to be able to think, learn and communicate in different contexts and for different purposes. By meeting such a variety challenges with versatility, pupils are given the opportunity to develop an understanding of how digitalisation affects themselves and the outside world.

SCHOOL-AGE EDUCARE

The curriculum section on the school-age care states that teaching aims to *promote pupils' imagination and ability to learn together with others through play, movement, and aesthetic forms of creative expression, as well as with exploratory and practical ways of working* (Skolverket 2019b). These are important parts of active learning and in the school-age educare work can take the form of physical activities, drama, dance, music, image, sculpture or in pupils' own play, both with and without digital technology. Digital tools and media can open new avenues for communication as well as for listening, talking, and understanding. The tools can strengthen learning but also give pupils the opportunity to develop knowledge about them and at the same time gain an experience that develops technical know-how.

Digital tools and media are increasingly assuming a place in many pupils' everyday lives, and the curricula highlights this aspect by allowing pupils to encounter and use digital tools and media for communication as well as aesthetic expression. Pupils should also be given the opportunity to develop their ability to communicate with linguistic forms of expression in different contexts and for different purposes, as well as opportunities to create and express themselves through different aesthetic forms. Therefore, it is important that pupils are given rich opportunities to both meet and gain experience with digital tools and media in teaching, for example in connection with various creative activities or when working with stories, images, and documentation.

UPPER-SECONDARY SCHOOL

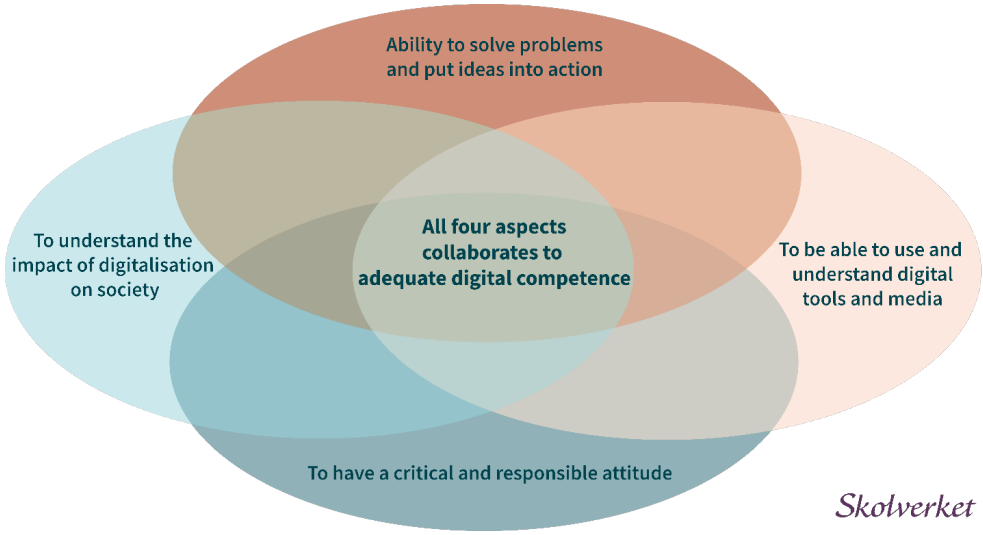
The curriculum for the upper-secondary school consists of two parts (Skolverket 2011). The first part describes the fundamental values and tasks of the school, and the second part includes overall goals and guidelines for the work. For each national programme, there is a diploma goal that specifies the objectives of the programme, the orientations within the programme and the diploma project. Each subject has a subject plan with the courses included in the subject. The diploma goal, together with the curriculum and the subject plans, shall form the basis for the planning of the education on the national programs in upper-secondary school (Skolverket, 2017b). They will control the teaching and the design and content of upper-secondary school work. The diploma goal provides an overall description of what knowledge is needed for further studies and to be able to work in relevant professional areas for each program.

Through the rapid development of technology, more and more people are encountering digital tools. Therefore, the diploma goal state that students should be given the opportunity to develop their ability to use digital technology and media in the professions or in the further field of study to which their education is directed. On the one hand, students should be prepared to actively participate in work and society, and on the other hand, they should be prepared for further studies. Digital competence is therefore described differently for different programs. Students must have knowledge of the different computer systems used in their eventual professions. Therefore, education should develop students' ability to use computers and computer systems in the way suitable to their future profession. Within the vocational programs, such as the Building and construction programme, or the Health and social care programme, the diploma goal states that the vocational training will *contribute to the development of pupils' ability to use digital technologies that occur in the relevant professional fields of education.* Within the higher preparatory education programmes, such as the Technology or the Social science programmes, the diploma goal states that the education should *develop students' ability to search, sift and process information with source-critical awareness.*

The curricula for upper-secondary schools for students with intellectual disability have corresponding content. However, the programmes and diploma goals differ. For each national programme there are programme goals, and each subject has subject plan for the included courses. Curriculum, programme goals, and subject plans play a role individually, but together provide the starting points for the teaching plan.

ADULT EDUCATION

As with other school forms, the adult education curricula describe the values on which teaching activities should be premised and objectives of the education (Skolverket 2017c). The adult education curricula states that *education should contribute to all students developing an understanding of how digitalisation affects the individual and the development of society. All students should be given the opportunity to develop their ability to use digital technology. They shall also be given the opportunity to develop a critical and responsible approach to digital technologies, to be able to see opportunities and understand risks and to be able to evaluate information.* The adult education curricula also states that the student should be *given the opportunity to acquire good knowledge of the courses included in the student's individual study plan, which can be used for further studies and in social life, work, and everyday life*. The subjects and courses used in upper-secondary adult education are the same as in upper-secondary school. However, there are no national programmes or diploma goals in upper-secondary adult education. Other adult education programs use the corresponding school forms' course, subject and subject area plans.



DIGITALISATION IN SYLLABI

In addition to general writings on digital competence in the curriculum, there are also various aspects of digital competence in the syllabis linked to subjects and programs. The syllabus states the aim and core content of the teaching of each subject. The syllabus does not dictate how to teach, or what working methods to use. On the other hand, the syllabus addresses the quality of knowledge to be developed in students. In this way, a framework for teaching and content is provided, in addition to curricula, and diploma goals for each national programme.

In primary school there are syllabi for each subject and in upper-secondary school there are diploma goals for the national programs and syllabuses for each subject. Within each schools for pupils with learning disabilities, there are both subject and subject area plans, and adult education follows the syllabuses that belong to each school form. The report below is organised according to the four aspects of digitalisation. Under each aspect examples from the different school forms are given. The italicised parts are excerpts from the subject plans, sometimes shortened to make reading easier.

UNDERSTANDING THE IMPACT OF DIGITALISATION ON SOCIETY

This aspect of digital competence is about how students can be given the opportunity, through teaching to develop their understanding of the impact of digitalisation on society, and what risks and opportunities digitalisation can bring. It is also partly about understanding how such changes affect society and the individual, as well as how individuals can influence society and their own situation.

In **compulsory school** the syllabuses in for example Swedish, social study objects and Technology express what pupils should learn and what abilities to develop (Skolverket 2017a). The syllabus for Swedish language courses specifies that *a rich and varied language is important to understand and operate in a society*. Teaching should give pupils *the opportunity to develop knowledge about how to formulate their own opinions and thoughts in different kinds of texts and through different media, as well as* develop the ability to create and process texts, individually and together with others.

Teaching in socially oriented subjects and Technology should give students opportunities to develop knowledge about changes as well as the causes and consequences of change. In Social studies teaching shall give the pupils opportunities to *reflect on how individuals and societies are formed, changed, and interacted.* In the syllabus of Civics for pupils in year 4-6 one core content is *digitalisation for the individual, such as increased opportunities for communication and electronic commerce*. For pupils in year 7-9 the core content has widen to the *importance of digitalisation for social development in various areas, such as impact on the labor market and infrastructure and changed attitudes and values.*

Teaching in Technology should develop the understanding that technical activities and their own use of technical solutions have an impact on, and affect, people, society, and the environment.

For **upper-secondary school and adult education** the students can deepen their knowledge in the subjects described above (Skolverket 2017b). Teaching in Swedish should deal with how society's *development and digitalisation affect language, language use and forms of communication*. Students should develop *their ability to orient themselves to, read, sift, and communicate in a digital text world with interactive and changing texts*.

The teaching of social science gives students opportunities to develop knowledge about *digitalisation and media content*, *as well as news evaluation in connection with issues of democracy and politics*. Other examples from the social oriented subjects are in History and Religion. The teaching of History should *develop students understanding of historical social changes and develop their historical education and ability to use history as a frame of reference to understand issues that matter to the present and the future* to understand how digitalisation affects society today.). One of the aims of the syllabus of Religion states that teaching should treat *the identities of individuals and groups, how they can be formed in relation to religion and philosophy on life based on, for example, religious writings, traditions, social media, and historical and contemporary events.*

The Technology subject should highlight *how technology has developed and developed in interaction with the surrounding society*. Students should also gain an understanding of how gender is perceived in the field of technology. One of the aims of the syllabus is *knowledge about people's different conditions and accessibility to technology and technology development.* This includes not least digital technology. In the subject Applied programming students should apply programming with another area of knowledge, for example music, industrial production, or economics. Students should develop the *ability to analyse the consequences of programming and what it means for the individual, the society, and the technological development. This should be done considering sustainability, ethics, and gender.*

BEING ABLE TO USE AND UNDERSTAND DIGITAL TOOLS AND MEDIA

Digital technology is used in many contexts in society and in more and more professions. This aspect of digital competence is about how students can be given the opportunity through teaching to deepen and broaden their knowledge and use of digital tools and media, including programming.

In **compulsory school** the teaching of Swedish pupils should learn how to use digital tools and media for *planning and conducting oral presentations (*Skolverket 2017*a).* Digital tools are also used to support documenting processes and results in many topics. In the syllabus of Crafts for pupils in year 7-9, one of the core contents is *documentation of the work process in words and images, both with and without digital tools.* One of the aims in the syllabus of Art says teaching should give pupils the ability to *create images with different materials, using digital as well as artisanal techniques and tools*. Pupils should also learn how to *produce and present their own images using different methods, materials, and forms of expression.* Art is a communicative topic where digital techniques and tools are a common form of expression for communicating. In previous grades, pupils can take photographs with, for example, a learning pad, to use more advanced digital tools in later grades. Digital tools can also be used to post-process images of various kinds to create new expressions. Examples of digital tools include drawing programs and 3D-animation applications.

Teaching of Music should give pupils the opportunity to develop knowledge *to use voice, musical instruments, digital tools and musical concepts and symbols in different musical forms and contexts*. Digital tools are equated with other tools, such as musical instruments, to understand music. Musical instruments are tools for creating music, which means that digital tools can play a dual role by functioning both as a means and as a goal in teaching. When digital tools are used as instruments, they are an end in themselves. Therefore, when applications and other computer programs are used to create, edit, and process music, it is reasonable to consider them as musical instruments.
To be able to orient yourself in different environments, maps and sketches are often used. Teaching of Sport and health is aimed to give pupils the opportunity to *orient themselves the nearby natural and outdoor environment using maps, both with and without digital tools*. Examples of such tools include GPS map functions in a mobile phone, or applications or other computer programs. Teaching of Mathematics should give pupils the opportunity to *use digital tools and programming to investigate problem scores and mathematical concepts, make calculations and to present and interpret data*. Digital tools offer several possibilities to apply and experiment with mathematics to develop a pupil´s understanding of the subject. In lower grades, understanding entails developing a basic understanding of programming, mainly based on concrete situations. Later, with increased knowledge and experience, pupils can use programming as a tool in mathematics. Understanding digitalisation also entails visual programming environments, while students in higher grades should be allowed to work in different programming environments, such as with text-based programming.

In **upper-secondary school and adult education** all subjects, should give students the opportunity to use digital technology (Skolverket 2017b). Of course, the use of digital technology can vary across different subjects and training courses. For example, students can use digital tools and media to search for information or to make presentations. It is about how digital technology can best be used to support the content to be conveyed.

Teaching Swedish should give students opportunities to use digital tools to interact, respond and communicate with others. The syllabus says students should use digital tools in written production for *text processing and for feedback and collaboration on texts*, to gain knowledge of how they can use the tools effectively.

In mathematics, students can use digital tools to manage procedures and solve tasks of a standard nature. Different types of digital tools are used to *solve problems, deepen mathematics skills, and expand the areas where mathematical know-how can be used*.
Many vocational subjects in upper-secondary school aims to teach students different digital tools for a certain vocational skill. The subject Industrial automation is about industrial automated systems often used in manufacture and process industry. Teaching should give the students *ability to handle tools and equipment in the chosen area* and give the students *skills in using information technology to support the construction, operation, and maintenance of automated systems.*

HAVING A CRITICAL AND RESPONSIBLE APPROACH

Modern society is characterised by a rapid pace of change and digital technology gives us the opportunity to access an abundance of information (Skolverket 2017a). This aspect of digital competence is about developing the ability to review and evaluate information from different sources based on relevance and credibility. This includes being able to sort through and sift large quantities of information, as well as asking questions and limiting searches to obtain the information sought. It is also about establishing personal positions, and acting responsibly towards yourself and others.
One important purpose of teaching Swedish in **compulsory school i**s to give pupils the ability to search and critically assess information. Pupils should be able to find the information they need, how to sift information and to disregard superfluous information, and how to value sources. Teaching Civics should give pupils the *knowledge about how to search and value information from different sources*. These sources can be *social media, websites, or newspapers*.
Pupils should also be able to formulate relevant questions knowing which sources are useful for answering the question asked, being able to critically evaluate the information, and to select relevant information based on the purpose and questions of the search. This is one of the topics in Science where pupils should be able to gain a *source critical review of information and arguments that the pupil encounters in various sources and societal discussions, both in digital and in other media.*
Digitalisation increases the pace of society, placing greater demands on those who live and work in it. One overarching goal is that after completing their education, each pupil *can use critical thinking and independently formulate positions based on knowledge and*

ethical considerations. Pupils also need to develop ability to reflect on the opportunities and limitations that technology brings. For example, digital technology makes it easier to handle large amounts of data and to perform advanced calculations, but it is also important to be aware of the limitations of the designs and models used. Therefore, pupils need to be given the opportunity to learn to reflect critically on, for example, the results of calculations to redo them if necessary.

Teaching should also give pupils the opportunity to reflect on the importance of digitalisation for the environment and sustainable development. Teaching Technology can help pupils understand how technology use affects people, society, and the environment. Digital technology brings both opportunities and risks, and pupils need, for example, to be given the opportunity to understand the risks associated with using different services on the internet, to transfer information and to store data. The teaching of Crafts highlights issues of resources, society, and development. This includes looking at the origin of different materials and their environmental impact. Pupils learn about the use of the most common materials and how digital technology can facilitate human adaptation to a more environmentally friendly society, where the earth's resources are better utilised.

A central purpose of social studies is how *digital tools and media are used*. Pupils should get knowledge about methods for *seeking, valuing, and processing information from different sources, and how information in digital media can be controlled by underlying programming*. The teaching gives space to discuss both *opportunities and risks associated with the internet and digital communication*. The teaching will thus give pupils the opportunity to use and relate to digital technology and digital media with a critical approach. In **upper-secondary school and adult education** students also are taught to review and evaluate information and to develop their source-critical capabilities (Skolverket 2017b). Teaching Swedish will help students develop knowledge about how to *apply, compile and critically review information from different sources.* In the syllabus of History, one of the core contents are *critical review, interpretation and use of different types of source material, in digital and other form, based on source critical criteria and methods.* The syllabus of Social studies states that teaching should develop student's media and information literacy. Students should learn *methods for searching, critically reviewing, valuing, and processing information from sources in digital and other form*, as well as their ability to evaluate the relevance and *credibility of the sources*.

A common subject at technical programs and programs of social science is Sustainable society. Here technical achievements are aimed to be analysed, both traditional technology and digital. Students should develop knowledge about how technical problems have been solved and can be solved. They should also be given the opportunity to *critically and creatively analys the solutions. This gives students the opportunity to develop an understanding of different options for action and their consequences.*

BEING ABLE TO SOLVE PROBLEMS AND TURN IDEAS INTO ACTION

This aspect of digital competence is about how digital tools and media can make it easier to solve problems and turn ideas into action. It is important to understand that it is people who have created today's technical solutions and that it is therefore we who can and come up with new solutions. These range from minor, individual, and everyday issues to larger societal problems.

In **compulsory school** the syllabus in Mathematics, mathematical problem solving is about interpreting the mathematical content and designing a question using different mathematical forms of expression (Skolverket 2017a). Pupils should therefore encounter material about *how algorithms can be created when programming for mathematical problem solving.*

When pupils use programming to solve mathematical problems, they should also be able to create, test, and improve the algorithms. Therefore, teaching Technology should give pupils knowledge to *solve different problems and meet needs through technology. Pupils should also be given the opportunity to develop their own technical ideas and solutions.* Pupils should also be given the opportunity to meet different ways of working to develop technical solutions and all parts of the different phases of *technology development work: identification of needs, examination, proposals for solutions, construction, and testing.* Finally, pupils will encounter *how digital tools can be a support in technology development work, for example to make drawings and simulations, as well as to control their own designs or other objects with programming*. For example, it can be about controlling objects in a visual programming environment where students can "drag-and-drop" predefined graphic elements to put their programs together. It can also be physical objects that are programmed at the touch of a button, for example.

The syllabus of Music states that pupils should learn how to use *digital tools for music creation, recording and processing.* This can include, for example, putting text to a song, making movements to their own music or another´s, or soundtracking a movie sequence using digital tools. The syllabus for Crafts *states that crafts are a form of creation that involves finding concrete solutions in craftsmanship tradition and design based on needs in different situations.* Design involves, among other things, developing innovative solutions based on users› needs, considering functional and aesthetic requirements. When pupils can combine different materials with each other and with digital technology, it can *awaken their curiosity to explore and experiment and to take on challenges in a creative way.*

In **upper-secondary school and adult education** students in Mathematics should develop knowledge about *strategies for problem solving including modelling of different situations, both with and without digital tools* (Skolverket 2017b).

The syllabus of Programming is deliberately described in such a way that it is possible to vary how much and in what forms there may be when it comes to problem solving in teaching. When it is not specified what type of tool to use, it is possible for students to choose the tool that they think is most appropriate.

The subject of CAD (computer-aided design) should give the students ability to *develop action, curiosity, ingenuity, and problem-solving skills.* CAD is a common subject used in various technical and design programs. In the subject of applied programming, students shall be given the ability to *identify, formulate and solve problems by applying programming to the chosen area of knowledge as well as the ability to reflect on and evaluate selected strategies, methods, and results.* This subject can be applied to any subject area and be chosen by any student independent of programme choice.

How digital competence is promoted The efforts made by the NAE to support and strengthen the digital competence of the target groups are based on the national strategy (Regeringen 2017)) The actions are therefore presented on the basis of the points contained in the strategy, i.e. digital skills for everyone in the school system, equal access and use, and research and follow-up on the possibilities of digitalization.

DIGITAL COMPETENCE FOR EVERYONE IN THE SCHOOL SYSTEM

Since 2017, the NAE has planned, revised, developed, and published on the NAE website several modules and web courses, for collegial learning and support (Skolverket 2021d). Some of these are presented below. Several of the programmes continue to support the target groups in the steering document changes implemented. For example, a web course in programming for mathematics and technology teachers, modules for adult education and web courses for preschool have been developed and published. Several modules, web courses and online support have also been developed and published in recent years, including a digitalisation process for organisers and head-teachers to support systematic quality work.

The NAE currently offers 27 modules and eight web courses to strengthen the ability of teachers and school librarians to develop children's and pupils' digital skills in different school forms. One of the modules and web courses is aimed at organisers and head-teachers to support their work leading digitalisation development and to provide support for organising remote and online teaching. Some of the latest modules and web courses are:

- Programming in compulsory school for pupils with learning disabilities. For teachers in mathematics.
- Mathematics teaching with digital tools. The aim of this module is to give teachers in municipal adult education support the use of digital tool in mathematic teaching.
- Digital competence in social sciences. For teachers of social sciences in grades 7-9 and upper-secondary school.
- Choosing digital learning resources. The web course is aimed at teachers in mathematics, social study objects and science studies for grades 4-9.

The NAE has also conducted several workshop series in programming. One workshop series was aimed at teachers of mathematics and technology teachers at primary schools and corresponding school forms. To promote students' desire to learn programming, a new subject, applied programming, has been developed for upper-secondary school and adult education. The subject is optional for schools to offer and can be offered on any national program. Several training activities with workshops have been carried out across Sweden for upper-secondary teachers. The subject of applied programming is intended to link programming to another area of knowledge, such as music, biology, or retailing, thus introducing programming to more student groups. Further training in industrial digitalisation has also been carried out for upper -secondary teachers in industrial engineering programs. Both initiatives have been made in collaboration with other actors such as higher education institutions, science centers and industry.

The NAE also organises, in collaboration with several higher education institutions, scoring courses in basic programming with subject education. Both basic and continuing courses of 7.5 ETCS credits each have been offered for mathematics and engineering teachers, at both the primary and secondary levels. In addition, courses have been developed for primary school teachers. Another accredited course offered is education on pedagogical leadership and digitalisation of the school system, for 7.5 ETCS credits. This training for head teachers aims to develop participants' knowledge and understanding of overall concepts and relevant policies for school digitalisation, and to understand the interaction between digitalisation, organisation, and development.
The NAE is also implementing a number of targeted efforts to support school digitalisation. The most extensive of these efforts are the targeted actions made for those organisers, head-techers and schools where major digitalisation development needs are identified (Skolverket 2020c). A basic precondition of support is that they are subject to national tests. Organisers and head-techers can apply to receive targeted support during a semester. The school is assisted by the NAE's process investigators to find

methods and techniques to meet their specific challenges and digital development needs. The school will also have access to a web-based inspirational material that can be used in their development work. The support material is based on collegial learning and is specifically developed for activities with high development needs in digitalisation. Under the project of "Targeted efforts for newly arrived immigrants learning", the NAE cooperates with selected organisers to carry out development efforts that lead to improved conditions for good knowledge results for newly arrived immigrant children and students, as well as for children and students with a narrative language other than Swedish (Regeringen, 2019)). Analyses of the current situation that led to implementation of this project make clear that digitalisation is also in focus, and should be included in future planned activities. For example, the digital competence of teachers and guidance councellor is included in efforts to increase language proficiency and knowledge-developing working methods. There are also examples of interventions where digital resources improve administrative work.

EQUAL ACCESS AND USE

The Government has commissioned the NAE to develop and implement the digital transformation of national tests (Skolverket 2019c). The tests are compulsory in certain subjects, for example Swedish, English and Mathematics. This transformation of national tests and assessment support is an important modernisation, and a driving force for the mainstreaming of digitalisation in schools. The NAE supports schools and organisers in the preparatory work.

To support equal use, the NAE contributes to the release of common standards to be used in digital systems used in Swedish schools. The Forum for Information Standardisation in the School System (FFIS) is led by the NAE and includesrepresentatives from the The Swedish Association of Local Authorities and Regions (SALAR) and Swedish Edtech Industry (Skolverket 2021e). Activities of FFIS, development forums, and various working groups offer participation opportunities to representatives of other authorities, national organisations of school organisers, representatives of independent school organisers and suppliers. As ofspring 2021, FFIS include seven active working groups, dealing with, inter alia:

- school-administration systems, such as rating management, scheduling, attendance management and service allocation
- student admissions
- basic NAE data – how IT services can exchange information and how data can be made available and published

RESEARCH AND FOLLOW-UP ON DIGITALISATION POSSIBILITIES

The NAE has the task of compiling and disseminating knowledge about research results to the agency's target groups; preschool teachers, teachers, head teachers, and other school staff (Skolverket, 2021f). Several research articles have been published on the NAE´s website, some produced by the University of Gothenburg on behalf of the agency. Through a search function for research on the website, research results in digitalisation are presented in the form of articles written and adapted for the target groups in an easily accessible way. The knowledge overview «Digitalisation in school opportunities and challenges» is available to download from the NAE´s website. The NAE´s modules, web courses, and support materials on the web offer the target groups access to, for example, films and texts based on research in the field.

In 2020, Sweden joined the International Computer and Information Literacy Study (ICILS), which investigates computer and information literacy and computer logical thinking among year 8 compulsory school pupils. The study is organised by the International Association for the Evaluation of Educational Achievement (IEA) and is based on student tests supplemented by questionnaires for pupils, teachers, head teachers, and IT coordinators. ICILS has been implemented on two previous occasions: 2013 and 2018. Sweden will participate for the first time in ICILS 2023. A feasibility study will be carried out in spring 2022. As of 2020-2021, work is underway to develop frameworks, tests, and surveys.

THE CHALLENGES OF DIGITAL TRANSFORMATION AND DIGITAL LITERACY

Finally, it is no exaggeration to say that the digitisation of the Swedish school system has gained real momentum in recent years. But has the Swedish strategy been involved up until this time? What are the achievements and what work is yet to be done?
Since March 2019, the COVID-19 pandemic has affected the Swedish school system in various ways. Primary schools remained open during the pandemic, and carried out their activities in the usual way. Upper-secondary schools, and to some extent also lower secondary school, however, switched to distance education after March 2019. Teaching has not always been completed as planned, pupils in vocational education and training have in some cases had to postpone work-based learning, and distance learning has affected pupils in various ways. The risk that students will not receive the knowledge or skills they would normally have gained because of the pandemic is also considered to be greater for certain groups of students. For lower secondary school, the risk is particularly high for students with high absenteeism and students in need of support. In upper-secondary school, in addition to pupils in need of support, socio-economically vulnerable pupils are also highlighted as more likely than others not to gain the knowledge or skills they would normally have gained.

The NAE supports schools to deal with the consequences of the COVID-19 pandemic. In March 2020, the platform #Skolahemma was launched (Skola Hemma 2020)). It is a website that provides school activities with combined support to meet challenges when parts of teaching are conducted as remote or distance learning. The website is maintained by RISE, Research Institutes of Sweden, with funding from the NAE. Partners in this work are other agencies, employers' organisations, municipal associations, research institutes and non-profit organizations. The website contains links to material produced by the NAE and other actors in connection with the pandemic, such as up-to-date information, compilations, and analyses of experiences, research, and relevant knowledge, as well as teaching and support materials. One challenge that became clear during the pandemic is that of safety, regarding the storage of students' school assignments, since

not all of the digital systems used by individual schools are approved. Another challenge is the difference in the digital maturity of schools in the run-up to the introduction of national tests.

More and more people are highlighting an equity gap in Sweden in terms of how to understand and manage digital development and the changing conditions that both society and schools face (Skolverket 2018). This can be seen in studies done on the internet habits of the Swedes, and in studies on the effects of the pandemic in school. Therefore, targeted actions for schools with a need for special digitalisation support, are important to maintain, such as those implemented by the NAE (Skolverket 2020c). In the age of digitalisation, it is important to gain knowledge about the applicable conditions and circumstances for participation. Otherwise, we run the risk of increased polarization among individuals and groups. An equity gap may be demonstrated by a lack of common strategies at the operational and occupational levels, where there is a lack of joint action. Overall, this means that many of the challenges posed by digitalisation land in the laps of individual teachers, whose individual competence varies. At the same time, many teachers are aware that more and more work is being moved from teaching and learning to administrative work.

Policy decisions are needed at the national level to ensure the gradual and systematic integration of work with digital skills at all levels of the education system. Integration should be based on insights into the importance of national education policy for the promotion of freedom of expression, freedom of information laws, and international agreements on fundamental rights and freedoms.

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