CIDREE **YEARBOOK 2021**

Digital Literacy: Curriculum Development and Implementation in European Countries

Imprint

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LAYOUT AND COVER DESIGN
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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.

SLO, NETHERLANDS INSTITUTE FOR CURRICULUM DEVELOPMENT
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.

HEGE NILSSEN
PRESIDENT

President of the CIDREE board

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.

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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SERBIA

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Development of the Digital Competences of Students in the Republic of Serbia

DIGITAL LITERACY IN PREUNIVERSITY EDUCATION

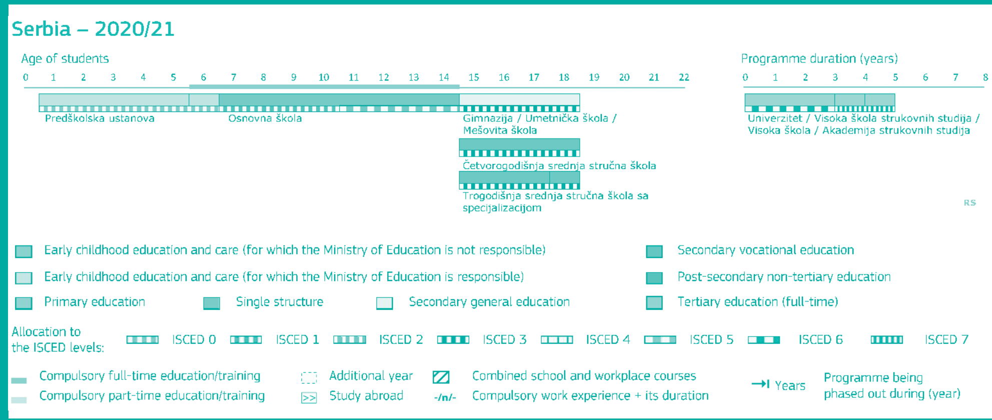
ABSTRACT

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 multi-layered 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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