



Crna Gora
Ministarstvo prosvjete,
nauke, kulture i sporta

**EDUCATION SYSTEM
DIGITALIZATION STRATEGY**
WITH THE ACTION PLAN FOR 2022 AND 2023

2022
2027

Podgorica, October 2021

Table of Contents

ABBREVIATIONS	4
INTRODUCTION.....	5
BASELINE ANALYSIS.....	9
EDUCATION SYSTEM	9
LEGAL FRAMEWORK	10
INFRASTRUCTURE	11
EDUCATION INFORMATION SYSTEM OF MONTENEGRO	11
E-SERVICES	14
Microsoft 365.....	14
Portal for teachers	14
Podaci.edu.me portal.....	15
School network	15
Portal for parents	15
UčiDoma portal	15
School statistics.....	15
Electronic enrolment of children	16
SCHOOL (LOCAL) AND REGIONAL ICT COORDINATORS	16
TEACHING COURSES/MODULES.....	17
Compulsory ICT courses/modules:	17
Elective ICT courses/modules:	17
IT LITERACY LEVELS AMONG TEACHERS AND STUDENTS	19
DIGITAL CONTENTS	21
SELFIE SURVEY ANALYSIS	21
Comparative data from SELFIE self-evaluation in academic years 2019/2020 and 2020/2021	29
SWOT ANALYSIS	31
ANALYSIS – PROBLEM TREE	32
STAKEHOLDER ANALYSIS.....	36
STRATEGIC GOALS AND OBJECTIVES.....	41
KEY ACTIVITIES FOR IMPLEMENTATION OF OBJECTIVES	42
STRATEGIC GOAL 1: IMPROVEMENT OF THE EDUCATION INFORMATION SYSTEM	42
Objective 1.1: Improvement of legislation.....	42
Objective 1.2: Improving the hardware infrastructure.....	42
Objective 1.3: Development and upgrading of software components.....	43
Objective 1.4: Improving the processing, use, accuracy and reliability of data	44
Objective 1.5: Introducing interoperability and development of e-services.....	45

Education System Digitalization Strategy 2022–2027

Objective 1.6: Improving HR structure.....	45
STRATEGIC GOAL 2: DEVELOPMENT AND UPGRADING OF THE DIGITAL ECOSYSTEM	47
Objective 2.1: Establishment of a mechanism for planning and development	47
Objective 2.2: Improvement of legislation.....	48
Objective 2.3: Improvement of IT infrastructure in educational institutions.....	49
Objective 2.4: Development of digital educational content	49
Objective 2.5: Establishment of a platform for independent learning	50
Objective 2.6: Improve online collaboration in all institutions involved in education	50
STRATEGIC GOAL 3: DEVELOPMENT AND IMPROVEMENT OF DIGITAL SKILLS AND COMPETENCES...52	
Objective 3.1: Raising the level of digital skills and competences of employees in educational institutions	53
Objective 3.2: Raising the level of digital skills and competences of students, with a special focus on children and young people from vulnerable groups	53
Objective 3.3: Improvement in safe use of technology	55
Objective 3.4: Improvement of digital skills and competencies and use of digital technology through promotional campaigns	56
DESCRIPTION OF ACTIVITIES OF THE RELEVANT AUTHORITIES AND BODIES FOR MONITORING OF STRATEGY IMPLEMENTATION.....	57
METHOD OF REPORTING AND EVALUATION	59
CONNECTION WITH NATIONAL AND EUROPEAN STRATEGIC DOCUMENTS	61
OBJECTIVES 2022–2027 AND ACTION PLAN 2022–2023	64
Gantt chart	86
Annex 1: Compulsory and elective IT courses/modules in secondary schools	95
Compulsory courses/modules	95
Elective courses/modules	99
Annex 2: List of specialized software by educational programme	102

ABBREVIATIONS

ABBREVIATION	FULL NAME
CIRT	Team responsible for computer security incidents in the cyberspace of Montenegro
CVE	Centre for Vocational Education
DNS	domain name server
DCDP	Directorate for Confidential Data Protection
EU	European Union
GSB	Government Service Bus
ECMN	Examination Centre of Montenegro
PHI	Public Health Institute
ICT	information and communication technologies
IS	Information System
MEIS	Montenegro Education Information System
MFSW	Ministry of Finance and Social Welfare
MPADSM	Ministry of Public Administration, Digital Society and Media
MONSTAT	Statistics Administration
MESCS	Ministry of Education, Science, Culture and Sport
MoI	Ministry of the Interior
PKCG	Chamber of Commerce of Montenegro
OJ MNE	Official Gazette of Montenegro
UCG	University of Montenegro
UN	United Nations
PD	Police Directorate
MEF	Montenegro Employers' Federation
ITTA	Institute for Textbooks and Teaching Aids
BES	Bureau for Education Services

INTRODUCTION

Information and communication technologies (ICT) are dynamically changing the world, enabling better connections between people and communities, innovation and productivity growth, as well as an increase in the living standards of the population globally. They require diverse knowledge and skills in order to use all their advantages in the right way, in both the private and the business environments.

The education system has a key role in raising the level of IT literacy among students and employees, which contributes to improving the quality of education, and thus improving the quality of life. The introduction of ICT into the teaching process and the learning process, carried out in accordance with predetermined goals and standards, can significantly contribute to the quality of educational work, to learning efficiency and to a better didactic organization of teaching.

Countries that are striving for a continuous development of society and high-quality education start from the fact that information and communication technologies are essential for the development of the social and economic potentials of the society and of each and every individual, and are an integral part of the new vision of education, according to which we are preparing children and young people for life and work in a society of high competencies. Such countries significantly facilitate work in educational institutions in every aspect: administration (management of pedagogical documentation); communication and networking with teachers, students and parents; and especially in the implementation of teaching. The importance of ICT in teaching is reflected in independent learning, an individual approach to students and an acceptance of different learning styles which encourage students to think analytically, simpler professional development and retraining. They are also important for the development of learning how to learn, which is one of the outcomes of quality education and one of the key competencies in the European Union, on which lifelong learning is based.

In addition, the COVID-19 crisis and the closure of educational institutions highlighted the urgent need to digitalize the education system, something that will make it more resilient to future crises, and thus create a basis for establishing a high-quality distance learning system in both normal and emergency circumstances, and also allow for the digitalization of other processes in the education system.

The introduction of innovations into the learning and teaching processes based on digital technologies, i.e. the digitalization of the educational system, is not a one-way street or a quickly achievable goal.

Digitalization of the education system involves not only the introduction of digital technologies into the teaching process, but also the digitalization of all the processes in the education system, development of electronic services for students, teachers and parents, and data exchange with other institutions with the aim of modernization and more efficient work when it comes to the administrative processes in all departments. At the same time, special

Education System Digitalization Strategy 2022–2027

attention during the development of the digitalization of teaching and the raising of the quality of education should be paid to children who do not have the conditions to use technology (the poor population), children with special educational needs, as well as talented students.

Having in mind the above, the scope and broad need for digitalization of the educational system, the need to involve a large number of institutions, as well as the interconnection of activities, it is necessary to develop an Education System Digitalization Strategy in order to ensure planned development in this area.

The Strategy aims to:

- 1. Develop new electronic services, improve the work of the public sector and encourage cross-sector cooperation**
- 2. Create appropriate conditions in educational institutions for the successful improvement of all digital processes and thus contribute to the quality and inclusiveness of education**
- 3. Develop and improve students' digital skills which they need for further learning/lifelong learning, the labour market and functioning in a society and economy that are knowledge- and innovation-based, and encourage students to choose ICT occupations**

The Education System Digitalization Strategy 2022–2027 was prepared in accordance with the Policy Development Methodology 2020, which is defined by the Decree on the Manner and Procedure of Drafting, Harmonizing and Monitoring the Implementation of Strategic Documents ("Official Gazette of Montenegro", 54/2018).

The working body for the development of the Education System Digitalization Strategy comprised:

1. Marina Matijević, Ministry of Education, Science, Culture and Sport, chairwoman;
2. Jelena Konatar, Ministry of Education, Science, Culture and Sport, member;
3. Ivana Mrvaljević, Ministry of Education, Science, Culture and Sport, member;
4. Nada Vuksanović, Ministry of Education, Science, Culture and Sport, member;
5. Sandra Brkanović, Centre for Vocational Education, member;
6. Nevena Čabrilo, Bureau for Education Services, member;
7. Nađa Durković, Institute for Textbooks and Teaching Aids, member;
8. Ranko Čabrilo, Examination Centre, member;
9. Vuko Jovanović, Chamber of Commerce of Montenegro, member;
10. Dijana Laković, PI "Pavle Rovinski" Primary School, Podgorica, member;
11. Radovan Sredanović, PI "Maksim Gorki" Primary School, Podgorica, member.

Several focus groups were held with various target groups: teachers, school administration employees, companies, state institutions, higher education institutions, representatives of educational institutions, ICT coordinators and non-governmental organizations. Interviews were held with children with special educational needs and the parents of children with special educational needs. An online survey was conducted on teachers' attitudes when it

Education System Digitalization Strategy 2022–2027

comes to digitalizing education. The results of the SELFIE survey (European Commission methodology) from two academic years (one before and one during the COVID-19 pandemic) were used. The findings from the document “Analysis and Guidelines for the Digitalization of the Education System” conducted by UNICEF, which was completed in February 2021, were also used. National strategies, the EU Digital Education Action Plan 2021–2027, the EU Digital Strategy and the Western Balkans Economic and Investment Plan were used to develop the Strategy.

The objectives and principles of the Education System Digitization Strategy are based on the common European goals and principles for adapting the education and training system to the digital age.

Education System Digitalization Strategy 2022–2027

The ***EU Digital Education Action Plan 2021–2027***¹ identifies two priority areas: Encouraging the development of a successful digital education ecosystem; and Developing digital skills and competences for digital transformation.

Based on the recommendations of the ***State Audit Institution***, another strategic goal related to the Improvement of the Education Information System has been identified in the Education System Digitalization Strategy.

The development of the Education System Digitalization Strategy is part of an EU-funded project implemented by UNICEF and aimed at mitigating the impact of the COVID-19 pandemic on the lives of children and families in the Western Balkans and Turkey.

International obligations are not assumed by this *Strategy*.

¹ https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_hr.

BASELINE ANALYSIS

EDUCATION SYSTEM

The education system of Montenegro is complex and comprises institutions at various levels of education, as follows:

- *21 state preschool institutions (two within educational centres, one within a primary school);*
- *35 private preschool institutions (five of which are international);*
- *162 state primary schools (two within educational centres);*
- *Six private international primary schools;*
- *50 state, one state–private and five private high schools (two state owned within educational centres, four private ones are international);*
- *13 state and one state–private music schools (four state and one state–private are also secondary schools);*
- *Two state educational centres;*
- *Three state resource centres;*
- *10 student dormitories (two boarding schools within educational centres, one within a primary school, one within an international school);*
- *117 licensed adult education organizers;*
- *70 driving schools;*
- *Four universities (one state and three private) and three independent colleges (one state and two private).*

The educational process is conducted in a large number of facilities located over the entire territory of Montenegro, and the locations of all the facilities can be found on the School Network website.² In order to continuously monitor the processes that are implemented in all facilities simultaneously, the Montenegrin Education Information System (MEIS)³ was introduced and used to collect and monitor data regarding students, employees, facilities, etc. Data in the field of education is published on the School Statistics⁴ website.

Higher education institutions have autonomy and their organization does not depend on the line ministry, so the Education System Digitalization Strategy applies to all institutions up to, but not including, the level of higher education.

Informal education is largely represented in the Digital Transformation Strategy, under the responsibility of the Ministry of Public Administration, Digital Society and Media.

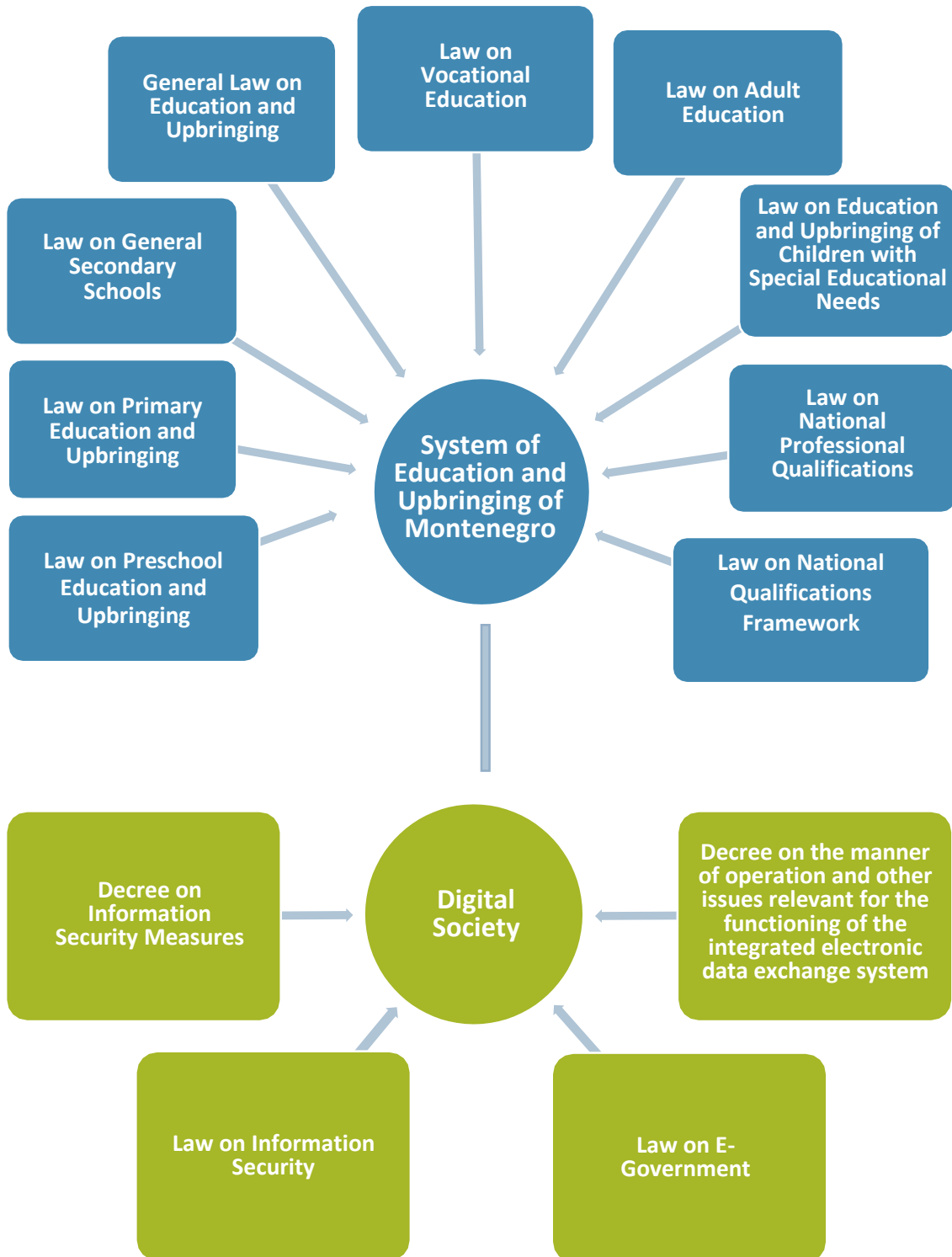
² www.skolskamreza.edu.me.

³ MEIS – Montenegrin Education Information System.

⁴ www.skolskastatistika.edu.me.

LEGAL FRAMEWORK

Laws and other acts that the system of education and digital society in Montenegro is based upon, and thus the digitalization of the educational system, are as follows:



INFRASTRUCTURE

The Ministry of Education, Science, Culture and Sport has provided a minimum amount of computer equipment in all educational institutions up to, but not including, the level of higher education. The equipment used in educational institutions was not procured in the same year, but the procurement took place over a period of five years, depending on how and when the institutions applied the reform of the educational system. The numbers of computers in each institution are not the same and are based on the number of students in the school. The age of the equipment is between 10 and 15 years, depending on the year the institution was equipped. In the past few years, schools have been procuring equipment using their own funds or through donations. The current number of computers used in computer classrooms, administration and teachers' common rooms is 5,320. The computer/student ratio in primary and secondary schools is 1:15. Priority in the use of computers in schools is given to computer classrooms for teaching in the field of IT, while a smaller number of computers are used in classrooms for other courses.

During the academic year 2020/2021, in all primary school facilities (main units and branches belonging to them) a local WiFi network was introduced and preconditions were created for making this accessible from all classrooms. Other educational institutions (preschools and high schools) are not completely covered by a local WiFi network, but only computer classrooms and administration offices. All main educational institutions up to the level of higher education have an internet connection. In 190 institutions, the internet connection is ensured via ADSL, while in 61 institutions it is ensured by satellite connection.⁵ In 40 institutions, in addition to ADSL, connection to the internet was also ensured through fibre-optic cables. An internet signal is available in a small number of regional schools (affiliated to different main school units), in only 21 facilities.

There are 25 servers within the Data Centre of the Ministry of Education, Science, Culture and Sport, so we can say that this is a very complex system. The equipment is 12 years old. It is important to point out that, within the server infrastructure, there is a root DNS server for the [edu.me](https://www.edu.me) zone, which allows all sites, portals and e-mails to be identifiable as part of the educational system of Montenegro.

EDUCATION INFORMATION SYSTEM OF MONTENEGRO

Montenegro's Education Information System (MEIS) contains a centralized database for all educational institutions and organizers of adult education, as well as a web application that collects data into a single database.

A large number of institutions resulted in a large number of users who enter data into the system (about 10,000 operators: administration, teachers and the pedagogical-psychological

⁵ Primary schools in rural areas where there is no technical capacity to introduce ADSL.

Education System Digitalization Strategy 2022–2027

service in the educational institutions), but there are also a large number of processes in the field of education that are automated.

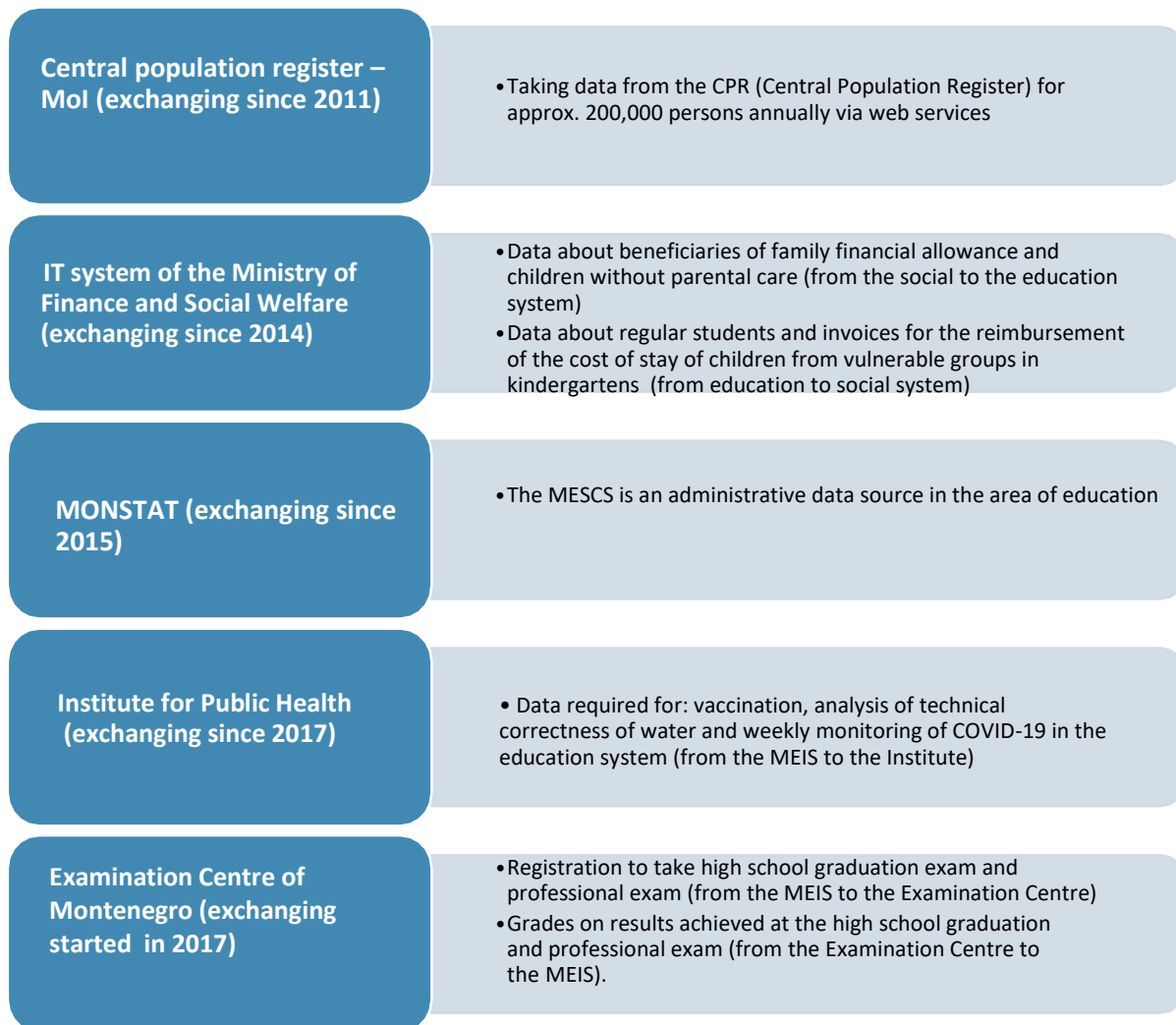
The system keeps records of approximately 130,000 children annually, approximately 14,000 employees in the educational institutions, as well as over 1,000 facilities. The processes implemented through the MEIS are as follows:

- Issuing a licence to teachers to work in educational institutions
- Invoices to reimburse the costs of a child's stay in a preschool institution
- Issuance of certificates for children and employees
- Issuance of educational documents (reports and certificates of student achievement)
- Creating a list and schedule for teachers
- Registration of students for taking the high school graduation exam and professional exam
- Early identification of children at risk of dropping out of school
- Monitoring of cases of violence in educational institutions

The system has been continuously developed and improved, so that it is now very complex and dynamic. Over time, there has been an increase in the number of MEIS data users, both for the purpose of conducting analyses, writing scientific papers and decision making, and in order to automate business processes in other departments. It is important to note that the system is continuing to develop in that direction, the volume of data exchange with other departments is increasing, so the system is both a data consumer and a data provider.

The graph below presents the institutions/registers with which the MESCS exchanges data.

Education System Digitalization Strategy 2022–2027



It is important to note that the MEIS is connected to the Integrated Information System for Electronic Data Exchange (GSB – Government Service Bus), so electronic data exchange is performed according to predefined standards and in line with legislation in this area.

With the development of the MEIS, preconditions have been created for the development of a series of electronic services for citizens and institutions, which will be significantly improved in the coming period, and new services will also be created. Electronic services created within the Education Information System are:

Application for parents (web and mobile)	Enrolment of children in preschool institutions
Enrolment of children in primary schools	Enrolment of children in high schools
Enrolment of children in primary music schools	Enrolment in higher education institutions
School statistics	School network

E-SERVICES

Microsoft 365

In cooperation with the UNICEF Montenegro Office, the MESCS has created the document “Digital School” that constitutes a concept and a framework through which, with the help of the Microsoft 365 (Office 365) software package, schools can implement all school activities through an adequate digital environment.

It is proposed that the digital environment be set up to have a specific purpose and to be actively used at the school level in different conditions:

- A complete interruption of regular classes at school – when all segments of educational work involve distance learning only.
- Partial teaching in school – when teaching in school takes place partly in classrooms and partly by distance learning.
- Regular teaching in school – when teaching is conducted in classrooms, but the school uses communication options and distance learning to make it more efficient and thus modernize the teaching process, but also for the work and collaboration between teachers, administration and professional assistants.

The technological basis of the school digital environment is the Microsoft Teams program, as part of the Microsoft 365 service. Employees in educational institutions have had this resource at their disposal for a decade, and all institutions have a recognizable edu.me e-mail domain. During the COVID-19 pandemic, the concept of “Digital School” was used significantly in both primary and secondary schools.

Portal for teachers

One of the resources created for the better functioning of the educational system is the Portal for Teachers – School Portal (<http://www.skolskiportal.edu.me>).

The portal aims to improve the use of ICT and bring the IT world and its capabilities closer to the teaching staff and other actors in education, which would raise the level of IT knowledge.

The portal allows teachers to publish papers and their lectures. Also, its purpose is to enable the exchange of ideas, knowledge and experiences between teachers, encouraging teachers to apply ICT in teaching, learning about new technologies and gaining new knowledge and experiences, as well as encouraging new forms of creativity among teachers in various fields of education. The school portal provides easy search and download of didactical software, as well as a list of useful links.

This portal contains: news, a document centre, a forum, links, a page dedicated to the school network, a category on child safety on the internet, pages on inclusive and preschool education, as well as pages with free tools applicable in educational work, etc.

Education System Digitalization Strategy 2022–2027

Having in mind that the portal is available to everyone, it can be used by parents and students.

Podaci.edu.me portal

One of the services intended for employees of the MESCS, Bureau for Education Services, Institute for Textbooks and Teaching Aids, Centre for Vocational Education and Examination Centre of Montenegro is the Data Exchange Portal (www.podaci.edu.me). The goal is for communication between institutions to be regular and purposeful. This provides an opportunity to intensify cooperation and improve action between the MESCS and educational institutions. On this portal, every employee from these institutions can download any report that includes statistics on the number of children, student achievement and absenteeism, data on employees, courses/modules, equipment in schools, working bodies, facilities, etc.

School network

On the website www.skolskamreza.edu.me, basic information on educational institutions in Montenegro by level of education is available (name of institution, address, telephone and fax number, e-mail address, location of the institution, etc.). In addition, there is information on the number of institutions by municipality.

Portal for parents

With the support of Crnogorski Telekom, and at the initiative of the NGO “Classroom on the Move”, the MESCS created the new Dnevnik portal (www.dnevnik.edu.me) which allows parents to monitor the grades, absences and behaviour of their child. The portal also allows parents to communicate with the form teacher and offers information on scheduled parent meetings, as well as other information. In addition to the web application, mobile applications for Android and iOS have also been created.

UčiDoma portal

Teaching materials recorded during the COVID-19 pandemic are available on the website www.ucidoma.edu.me. The contents are sorted by level of education, grade and course/module. Also, there are contents related to the preparation of students for external testing, high school graduation and professional exams. In cooperation with the British Council, content on critical thinking development, problem solving and the use of micro:bit devices was recorded and published. Content from the field of security was also published on the UčiDoma portal.

School statistics

With the support of the UNICEF Office in Montenegro, the MESCS created the School Statistics portal (<https://skolskastatistika.edu.me/>) where one can find statistical data in the field of education presented in graphical form.

The home page presents statistical data by level of education (preschool institutions, primary and secondary schools), as well as statistical data for primary music schools and resource centres, which relate to the number of educational institutions, public and private, the number of students, by gender, grade and educational programme, at the level of Montenegro, municipality and region. A graphical overview of the basic data for all

Education System Digitalization Strategy 2022–2027

educational institutions is possible, in the public part concerning the numbers by institution, grade and educational programme, and in the private part there is a lot of data concerning student success, behaviour, absences, etc. The private part of the data is accessible by educational institutions with their user accounts and is used to find out where they are in relation to the average relevant data in Montenegro, region, municipality and thus they are able to work to increase the quality of their institution.

In addition to the above data on formal education institutions, on this portal one can also find statistical data on institutions that provide non-formal education, i.e. on licensed organizers of adult education.

Also, the School Statistics portal provides up-to-date data on the impact of the COVID-19 pandemic on the educational system. The data is presented graphically by level of education (preschool, primary and secondary) and refers to children and employees in educational institutions in Montenegro, private and public. The data review is presented weekly. The percentages in graphs represent the percentage of children/teachers of a certain category (all, newly infected, infected, in self-isolation) in a zone/municipality in relation to the total number of children/teachers of the same category in all zones or all municipalities.

Electronic enrolment of children

During the calendar year 2020, three applications were introduced on the portal www.upisi.edu.me, through which an application for enrolment of children in preschool, primary and secondary schools can be submitted. An application for enrolment can be submitted for children enrolling in this level of education for the first time. As of 2021, new applications are being introduced, which allow the submission of applications for enrolment of students in primary music school, as well as for enrolment of students in the first year of undergraduate studies at the University of Montenegro.

Completion of the form begins with entering a unique identification number, and other data is taken from the relevant registers.

SCHOOL (LOCAL) AND REGIONAL ICT COORDINATORS

Schools have the opportunity to assign the position of school ICT coordinator to someone from the ranks of their employees. School ICT coordinators are responsible for: maintenance of computer equipment, reinstallation of computers and installation of necessary software for teaching and other activities in the institution, installation of antivirus protection, maintenance of internet connection, monitoring and maintenance of the computer network, motivating and assisting colleagues in using ICT in teaching, training of employees in the institution in the use of the MEIS application but also for the implementation of the concept of the “Digital School”, creating accounts and granting access rights in the MEIS application for employees, creating mail accounts for employees and students, creating teams in schools within the Teams application for the implementation of the “Digital School” concept, participating and promoting the School Portal, conducting SELFIE research, etc.

Regional ICT coordinators, in addition to the responsibilities they have in their institution as school coordinators, provide support to the school ICT coordinators in all the tasks they are obliged to implement, but also provide support to institutions that do not have school ICT coordinators (preschool institutions, primary music schools and resource centres). They are

Education System Digitalization Strategy 2022–2027

obliged to provide regular support within the team of ICT coordinators in the Teams application, which serves precisely for the exchange of experiences, discussion, exchange of materials (instructions), etc.

TEACHING COURSES/MODULES

Compulsory ICT courses/modules:

Primary school

- IT and Technology is studied in the fifth, sixth, seventh and eighth grades, for one lesson/hour per week;

General secondary school

- IT is studied in the first grade of general secondary school (gymnasium), for two lessons/hours per week;

Elective ICT courses/modules:

Primary school

- Creating Graphics and Processing Images and Photographs is studied in one grade from the seventh to the ninth, for one lesson/hour per week;
- Introduction to Programming, studied in the eighth or ninth grade, for one lesson/hour per week;

General secondary school

- Algorithms and programming, studied in the third or fourth grade, for three lessons/hours per week;
- Computer and web presentations, studied in the second or third grade of general secondary school, for two lessons/hours per week;
- Computer Science in Business is studied in the second or third grade of general secondary school, for two lessons/hours per week

An overview of compulsory and elective courses/modules in vocational high schools, by educational profile is given in Annex 1.

Elective subjects in the field of ICT are chosen by a small number of students in both primary and secondary schools. Their function is to provide students with specialist IT knowledge and skills. The percentages of children who chose elective IT subjects in primary schools and general secondary schools during the academic years 2019/2020 and 2020/2021 are shown in the table below:

COURSE TITLE	2019/2020	2020/2021
Creating Graphics and Processing Images and Photographs	2.57%	1.29%

Education System Digitalization Strategy 2022–2027

Introduction to Programming	3.99%	4.52%
Algorithms and Programming	7.70%	5.80%
Computer and Web Presentations	5.87%	6.56%
Business Informatics	6.37%	6.89%

IT LITERACY LEVELS AMONG TEACHERS AND STUDENTS

Learning about ICT (through IT courses/modules, compulsory and elective) and **learning through ICT** are complementary learning processes at school and partly at home. However, the dominant use of ICT in courses/modules in the field of informatics (in a relatively small number of lessons) and in IT rooms is noticeable. The use of ICT is much less permeable to the teaching and objectives of all other courses/modules in school.

The quality of the teaching process and learning when it comes to IT courses/modules in primary and secondary schools (learning about ICT) is assessed in the process of supervision by the Bureau for Education Services and by the Centre for Vocational Education. The findings of the Bureau for Education Services so far indicate a still **modest level of ICT knowledge** on the part of some IT teachers and the need for their continuous professional development, since changes in this area are constant and rapid.

The fact that the **professional profiles** of teachers of IT courses/modules cover a very wide range of qualifications is also a challenge in ensuring a better quality of teaching. Most of them are teachers of technical education, as well as electrical engineers or mathematicians, but also professors of biology, physical education, chemistry, history, etc. This problem points to the high level of unprofessionally represented teaching and the need for **standardization** in this area.⁶

On the other hand, the level of learning through ICT **in all other courses/modules** (learning through ICT) where this is possible and in line with the goals and standards, is insufficient. Namely, it is known that this contributes to the efficiency of learning (durability and applicability of knowledge), the active role of students in the learning process, but also more efficient learning by teachers (professional development of teachers). In the reports of the supervisory services, based on surveys of students, parents and teachers, the prevailing findings are that ICT is predominantly used in the teaching of regular and elective IT courses/modules.

The digital environment has become a natural environment for children and young people. However, schools have not yet, in line with the goals of education and upbringing, grown into an environment that strongly supports the development of digital and other competencies. Our students are part of the global digital generation, which even in our conditions has already reached a rate of computer use of 95% and of internet use almost 96%.⁷ However, the use of computers for participation in social networks is dominant, but that does not mean that they have a sufficient level of digital competencies. There is an obvious gap between teachers and students, the so-called digital gap, i.e. an imbalance in digital literacy. However, there is a lack of research on the level of digital literacy of teachers, as well as the factors that influence it (availability of equipment and training, motivation, attitudes towards the use of ICT, experiences and barriers).

⁶ [Pravilnik o oblasti \(profil\) obrazovanja nastavnika predmetne nastave u osnovnoj školi \(Rulebook on the field of education \(profile\) of teachers of particular subjects in schools\)](#)

⁷ Surveys about Children's Safety on the Internet, Ministry of Information Society and Telecommunications, with the support of the Ministry of Education, 2012.

Education System Digitalization Strategy 2022–2027

From 2017 until the present day, the Bureau for Education Services has organized six seminars for 117 participants for the following programmes:

- Digital Pedagogy
- Application of ICT in Mathematics Teaching – Trends
- Robotics
- Smartphones as a Teaching Tool
- Teaching Mathematics with the Use of Information and Communication Technologies
- Animation and Simulations in Science Teaching
- Development of Critical Thinking and Use of micro:bit Devices.

From 2017 until the present day, the Centre for Vocational Education has organized 23 seminars for 428 participants for the following programmes:

- The Role of Teachers in Preventing and Combating Hate Speech on the Internet
- Software Simulation of Telecommunication Network Operations
- Excel in Economics
- Using the SolidWORKS 3D Computer Program
- Using Microsoft Office 365
- Use of CMS to Build Sophisticated Webpages
- Development of a Multimedia Teaching Manual
- Teacher Networking
- Modern Education – technologies in education, e-gradebook, learning portals, applications for creating digital content for teaching, learning and knowledge testing

In the Catalogues of Professional Development Programmes for Teachers of the Bureau for Education Services and the Centre for Vocational Education, the number of accredited programmes in the field of ICT is increasing, but there is a very small number of teachers who have been educated in the last 10 years.

The MESCS has also organized a set of training courses in the past 10 years, as follows:

- 500 school ICT coordinators (basic level)
- 20 regional ICT coordinators (advanced level)
- 20 Web Design teachers
- 30 teachers of Algorithms and Programming
- 2,133 teachers for the ECDL Start certificate
- 30 teachers for the ECDL Core certificate
- 180 primary school students for ECDL Core certification
- 10,000 employees in educational institutions in the use of the MEIS application
- 150 ICT coordinators for the ECDL module on IT security
- 4,262 employees in educational institutions for Office 365 (Forms, Teams, OneDrive, OneNote)
- 79 employees in educational institutions for Java Foundations (Oracle Academy)
- 103 employees in educational institutions for Java Fundamentals (Oracle Academy)

Education System Digitalization Strategy 2022–2027

- 37 employees in educational institutions for Java Programming (Oracle Academy)
- 74 employees in educational institutions for Database Foundations (Oracle Academy)
- 62 employees in educational institutions for Database Design and Programming with SQL (Oracle Academy)

The training courses implemented by the MESCS were mostly financed from the IPA funds or through donations (Microsoft, Oracle, UNICEF), while a smaller amount of funds was allocated from the budget.

DIGITAL CONTENTS

The Institute for Textbooks and Teaching Aids worked on the following multimedia textbook contents: the Informatics textbook for the sixth grade of primary school; “I read, write, research, and create with Figo” – a set for preschool children; DAISY⁸ textbooks in a digital, audio-visual format that enable independent learning for all children, but which are especially suitable for children with special educational needs (made in collaboration with UNICEF); certain chapters from Montenegrin Language and Literature and Mathematics for the first grade of primary school; interactive educational application (online dichotomies key to plant determination) and “Mathematics through play” for the third grade of primary school.

The MESCS, in cooperation with the Bureau for Education Services, and with the support of the regional UNICEF office in Geneva and the UNICEF office in Montenegro has created the C-board application that converts text into speech and facilitates communication via symbols for children with special educational needs.

As part of the pilot project “Digital Classroom”, digital content was created for the first grade of primary school, which can be found on the website www.uci.me. The publishing house Klett was hired to produce the material, and it was financed by the company M:tel. This pilot project was implemented in primary schools during the academic year 2020/2021.

SELFIE SURVEY ANALYSIS

The **SELFIE instrument** was developed by the European Commission in collaboration with an international team of experts and is designed to help schools integrate digital technology into the teaching, learning and evaluation of students. It serves to identify areas that work well in the school and those that need improvement, and helps set priorities.

The SELFIE instrument anonymously, through surveys, collects the views of students, teachers and managers on how technology is used in their school.

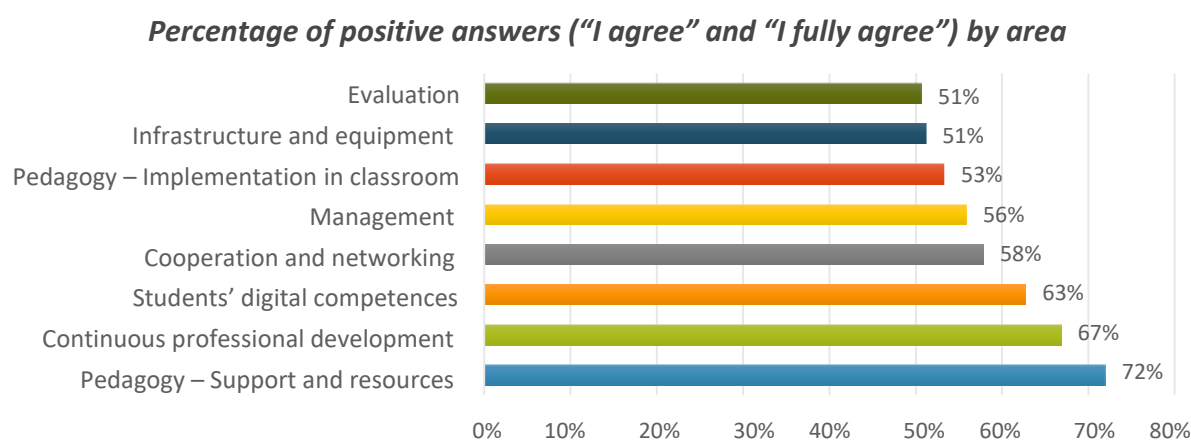
⁸ Daisy textbooks – <https://zuns.me/digitalna-izdanja>.

Education System Digitalization Strategy 2022–2027

SELFIE started to be used in Montenegro as a pilot project in 2019, and it was presented to all schools and recommended as an annual self-evaluation instrument in January 2020. Immediately before the closure of schools due to the COVID-19 pandemic (16 March 2020), **197** primary and secondary schools out of a total of 211 went through the self-evaluation process. In all **24,008** respondents participated, i.e. **19,321 students, 4,079 teachers and 608 employees in the administration of educational institutions**, of which **71.4%** are from the **ISCED2** and **28.6%** from the **ISCED3** levels of education. Some of the results will be presented in this analysis in the comparison with this year's results.

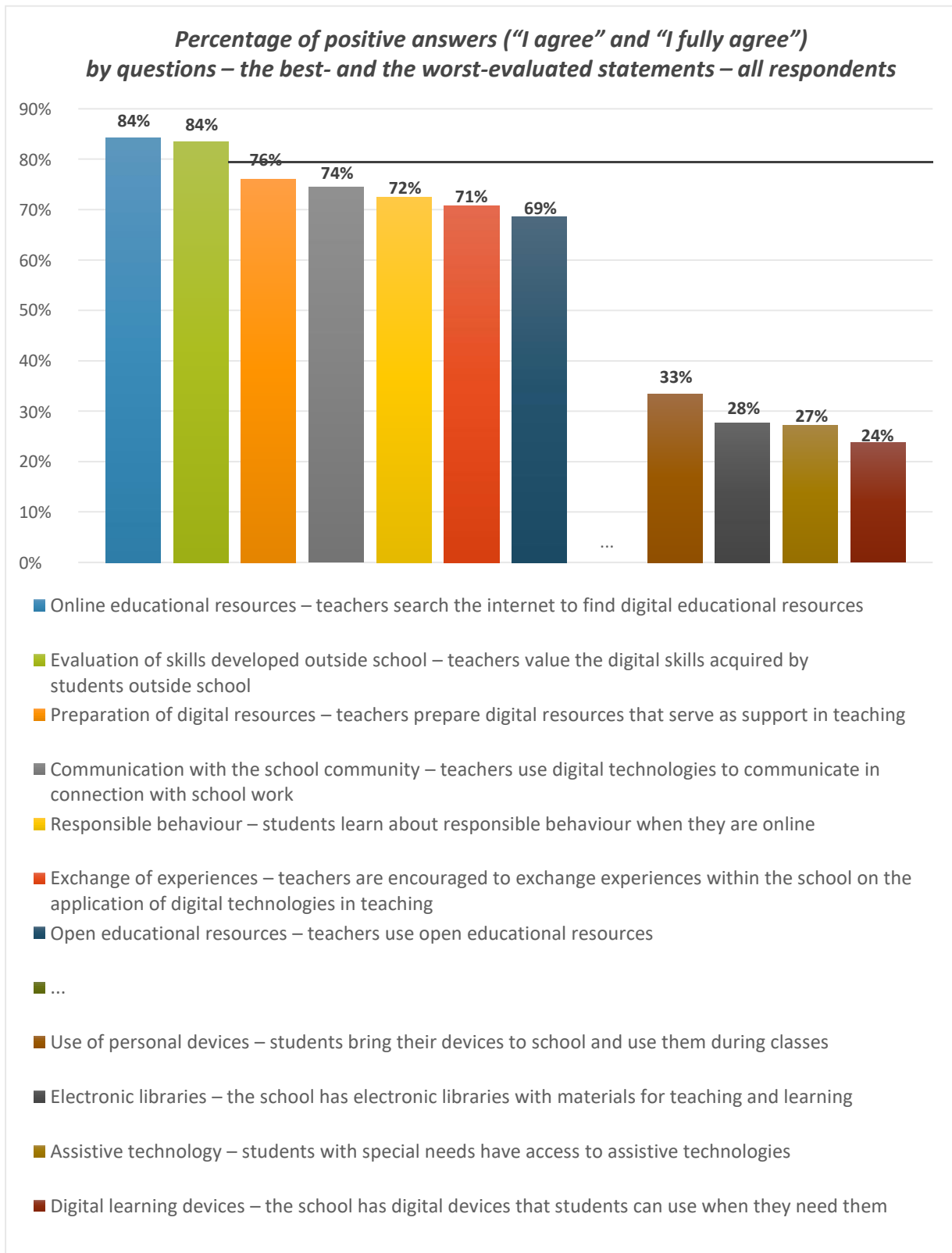
In the academic year 2020/2021 (during April 2021), **203** primary and secondary schools out of a total of 211 undertook the process of self-evaluation; **27,571** respondents participated, i.e. **22,294 students, 4,612 teachers and 637 employees in the administration**, of which **64.4%** are from the **ISCED2** and **35.6%** from the **ISCED3** levels of education.

The percentage of positive views of all respondents, by areas, is as follows:



Students, teachers and managers rated the best pedagogical preparation and resources for the use of digital technologies by updating and innovating teaching and learning practices (72%), while the implementation in the classroom received a significantly lower rating (53.4%). The digital competence of students was rated relatively high (62.8%). Areas where weaknesses have been identified and where it is necessary to take action are a low percentage of satisfaction with infrastructure and equipment (51.2%) and the evaluation of students beyond traditional practices (50.7%).

The best and the worst-evaluated statements according to all respondents are as follows:



When we look at the type of respondents, the situation is as follows:

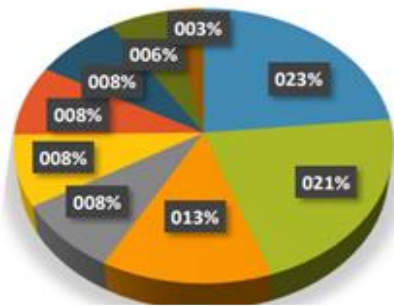
RESPONDENTS	BEST-EVALUATED STATEMENT	PERCENTAGE OF POSITIVE ANSWERS
Managers	Exchange of experiences – teachers are encouraged to exchange within the school experiences on the application of digital technology in teaching	85.60%
Teachers	Online educational resources – teachers search the internet to find digital educational resources	84.70%
Students	Use of virtual learning environments – teachers use online platforms in which we can also participate	71.40%

RESPONDENTS	WORST EVALUATED STATEMENT	PERCENTAGE OF POSITIVE ANSWERS
Managers	Electronic libraries – the school has electronic libraries with materials for teaching and learning	24.20%
Teachers	Electronic libraries – the school has electronic libraries with materials for teaching and learning	13.60%
Students	Digital learning devices – the school has digital devices that students can use when they need them	24.60%

A special set of questions concerns other factors that affect the use of technology (with special reference to online learning). The answers were given by school managers and teachers.

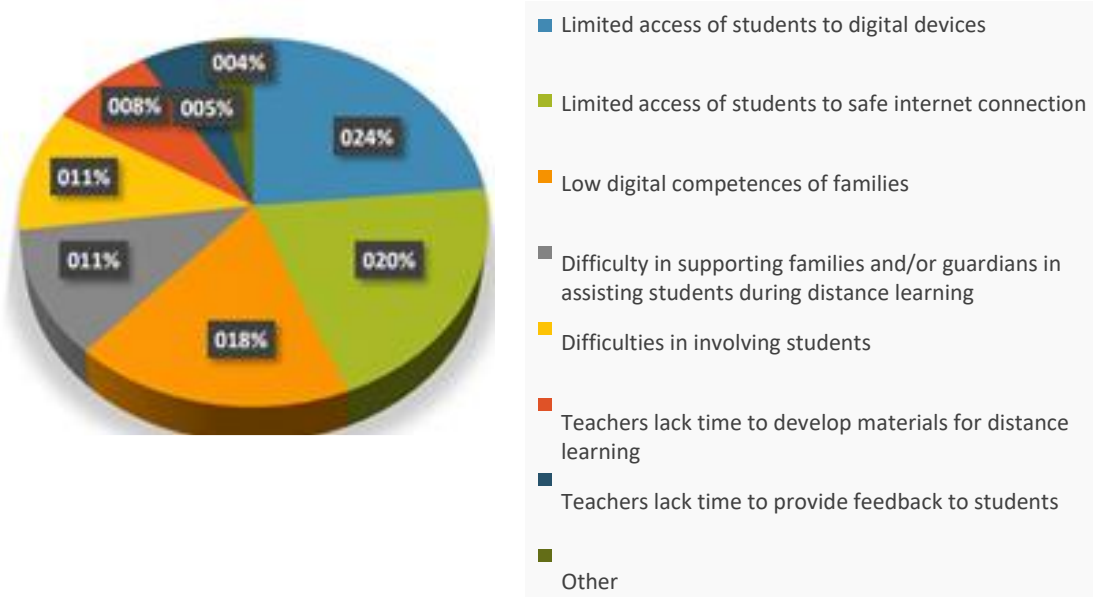
Education System Digitalization Strategy 2022–2027

Factors having a negative impact on the use of digital technology during teaching at school

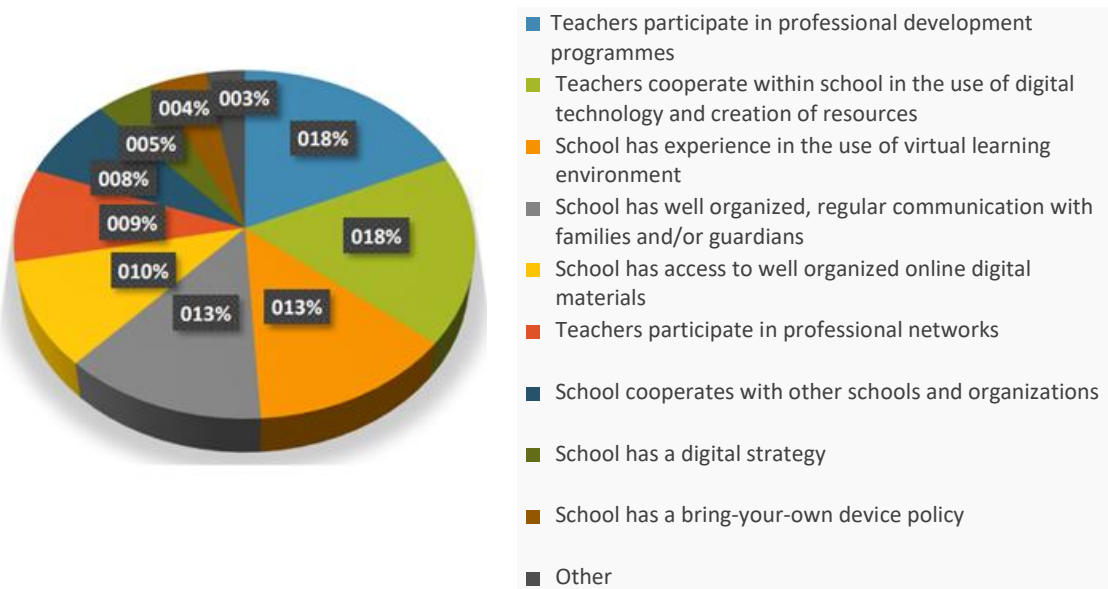


- Lack of digital equipment
- Lack of financial resources
- Unreliable or slow Internet connection
- Limited space in school
- Limited or no technical support
- Lack of time in case of teachers
- Low level of digital competences of teachers
- Low level of digital competences of students
- Other

Factors that have a negative impact on teaching and distance learning with the help of digital technology



Factors that have a positive impact on teaching and distance learning with the help of digital technology

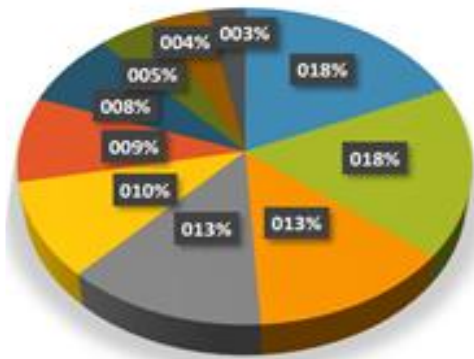


According to managers and teachers, the biggest problems, mentioned by 58% of respondents, are: a lack of digital equipment, lack of financial resources and unreliable or slow internet connection. As for the biggest challenges during online classes, 61.5% state one of the following: limited access of students to digital devices, limited access of students to a reliable internet connection and low digital competence of students’ families.

Education System Digitalization Strategy 2022–2027

Of particular importance are the students' answers about the difficulties they encountered during online classes.

Factors that affect teaching and distance learning with the help of digital technology

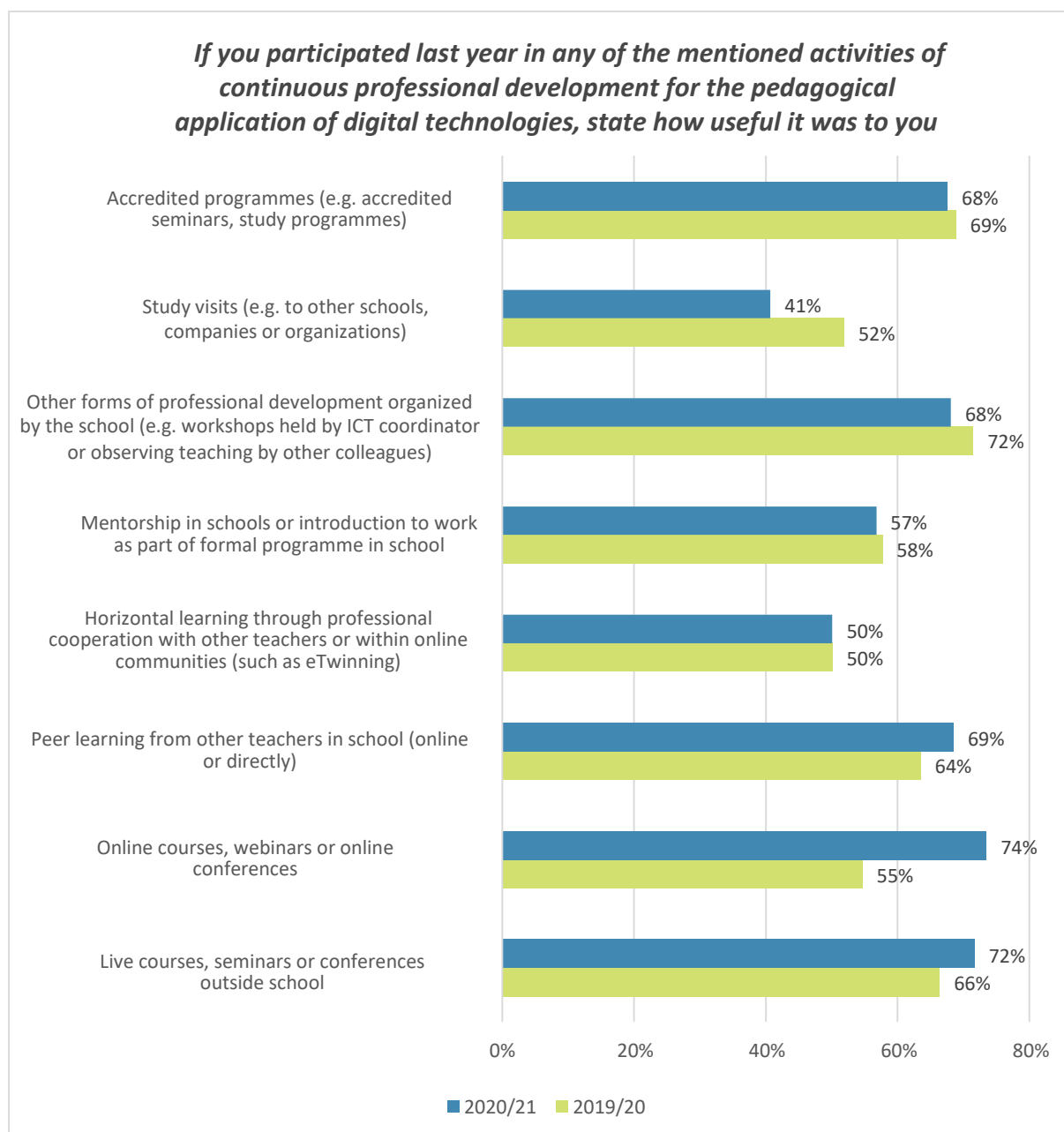


- I know how to use software/applications without assistance from others
- I seek help from the family/guardian on the use of software/applications
- I find help on the internet
- I seek help from friends on the use of software/applications
- I seek help from teachers or school on the use of software/applications
- I was given information about the use of digital devices
- It is hard to find a quiet environment for the use of digital learning devices
- I am frequently disturbed when using digital learning devices
- I have problems accessing the internet
- I would like to use digital technologies to have more contact with my peers
- Other
- I don't ask for help although I need it
- I have no one to help me with the use of software/applications

The largest percentage of children know how to use digital technologies independently (41.2%), while this figure is 76.4% for children who can use digital technologies either independently or with the help of others. However, it should not be overlooked that 16.8% of students have problems with the space where they work, their digital device, internet access, as well as with asking for help when they need it (they do not know how or do not know who to ask).

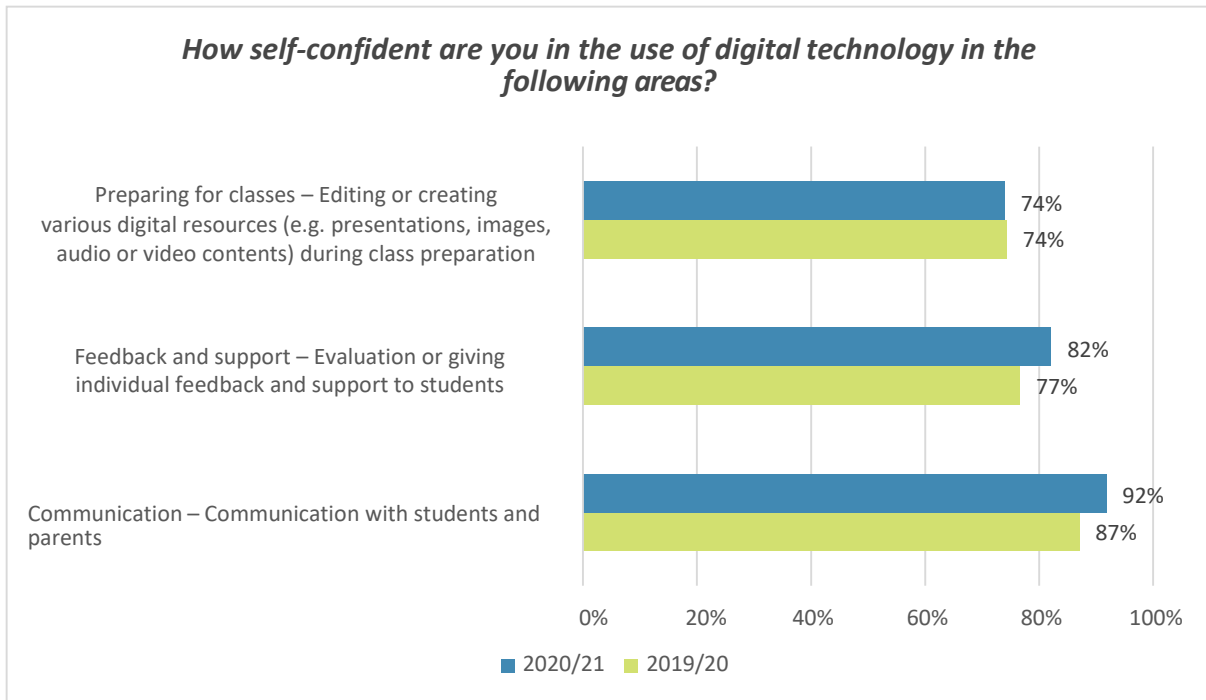
Comparative data from SELFIE self-evaluation in academic years 2019/2020 and 2020/2021

Opinions of the teachers regarding usefulness of the implemented continuous professional development activities (percentage of positive answers to the following question)



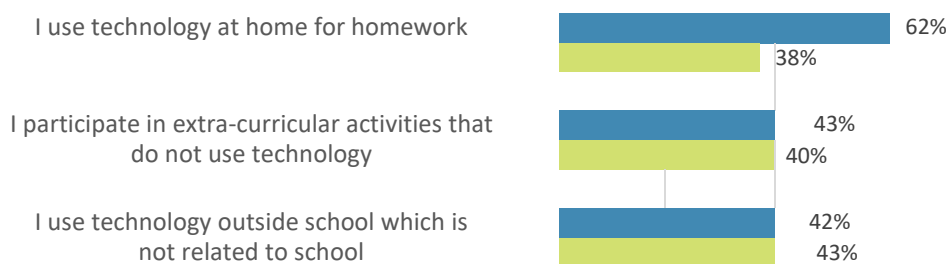
Regarding continuous professional development, the value of online training (an increase from 54.7% to 73.5%) was recognized, as well as training and seminars in general. Also, the satisfaction with peer learning from other teachers has increased, whether it takes place online or directly. These results are most likely the result of the COVID-19 pandemic.

Percentage of positive answers of teachers to the question about their self-confidence during the use of digital technologies



In the last year, as a result of the COVID-19 pandemic, there was an increase in teachers’ self-confidence when it comes to providing feedback and support to students with the help of digital technologies, as well as an increase in communication with students and parents.

Data about use of technologies by students



Due to the COVID-19 pandemic and online teaching, it was expected that there would be an increase in the percentage of use of technology by children at home to perform school tasks in the academic year 2020/2021 compared to the previous one.

SWOT ANALYSIS

S – Strengths

- Education IT system established
- Continuous data collection
- Data in the field of education available to all
- Portal for teachers introduced
- Office 365 package obtained
- Digital School concept created
- MEIS connected to GSB
- Data exchange portal introduced
- Teaching materials recorded (UčiDoma)
- During the COVID-19 pandemic teachers were more interested in online training, seminars regarding digital technology and thus increased their self-confidence in the use of technology

W – Weaknesses

- Outdated and insufficient IT equipment in educational institutions and the Data Centre
- Course/subject IT with technology (small number of lessons in the field of IT, teachers who are not IT specialists)
- Teaching in IT courses is not specialized
- Insufficient use of ICT in non-IT courses/modules
- Inadequate initial education of teachers
- Student–teacher digital gap
- Resistance from some teachers to acquiring digital competences
- Limited access of children to digital technology at home
- ▣ Insufficient digital competence among parents/guardians to assist children at home

- ▣ Digitalization and improvement of the quality of education are recognized as strategic directions of development of Montenegro
- Interest from UN and EU partners to support digitalization of the education system
- Opportunity to learn from countries that have advanced in the field of digitalization of the education system
- EU accession process

- Lack of financial resources
- Lack of interest from ICT staff to work in the MESCS and Bureau for Education Services
- Cyber attacks
- Cyber violence
- Digital gap and threat of it increasing with digitalization

ANALYSIS – PROBLEM TREE

Based on previous analyses, we have identified the key issues that the Education System Digitalization Strategy should address:

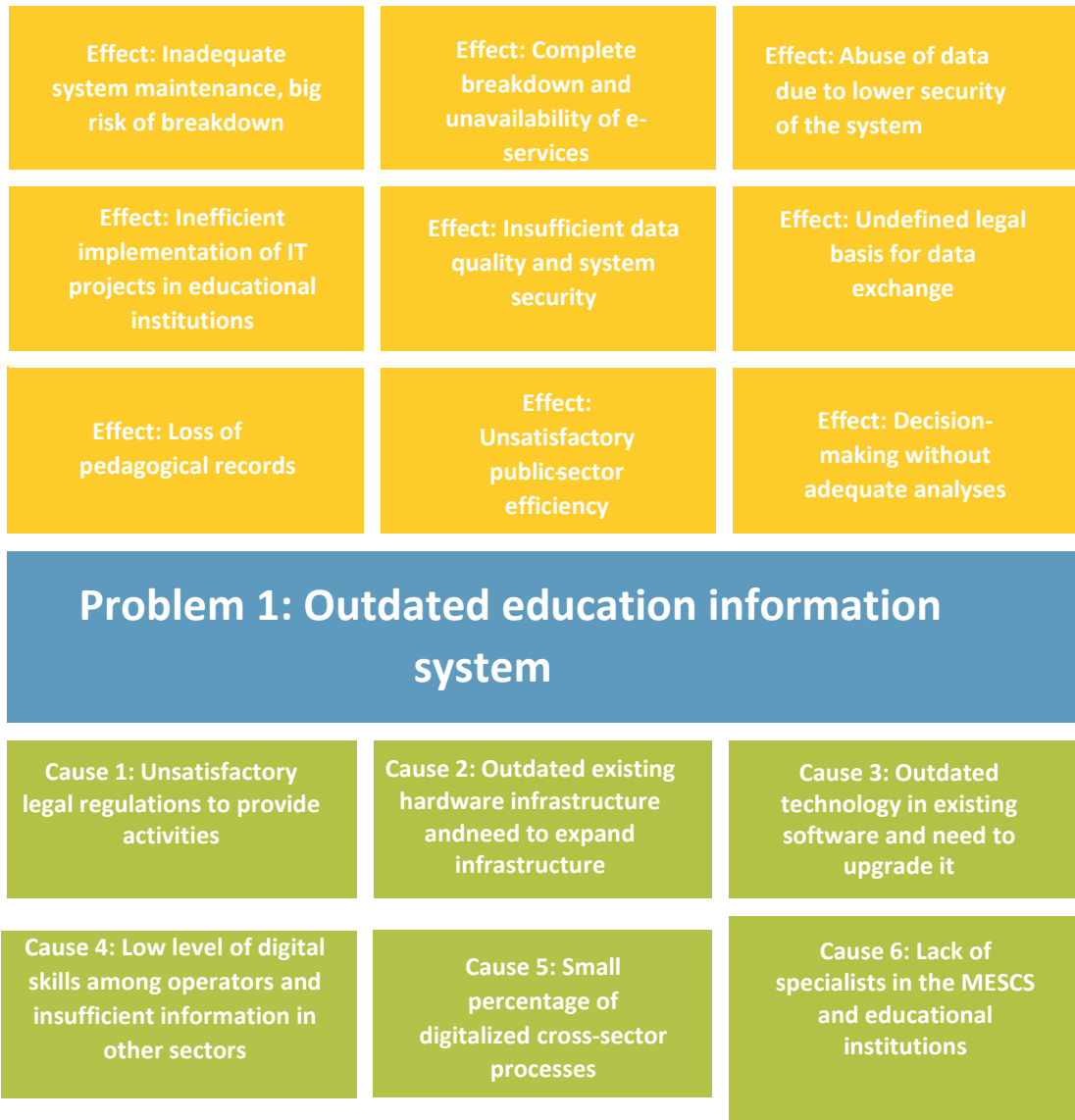
- Problem 1: Outdated IT system in education
- Problem 2: Non-existence of a digital ecosystem
- Problem 3: Low level of digital skills and competences among students and teachers

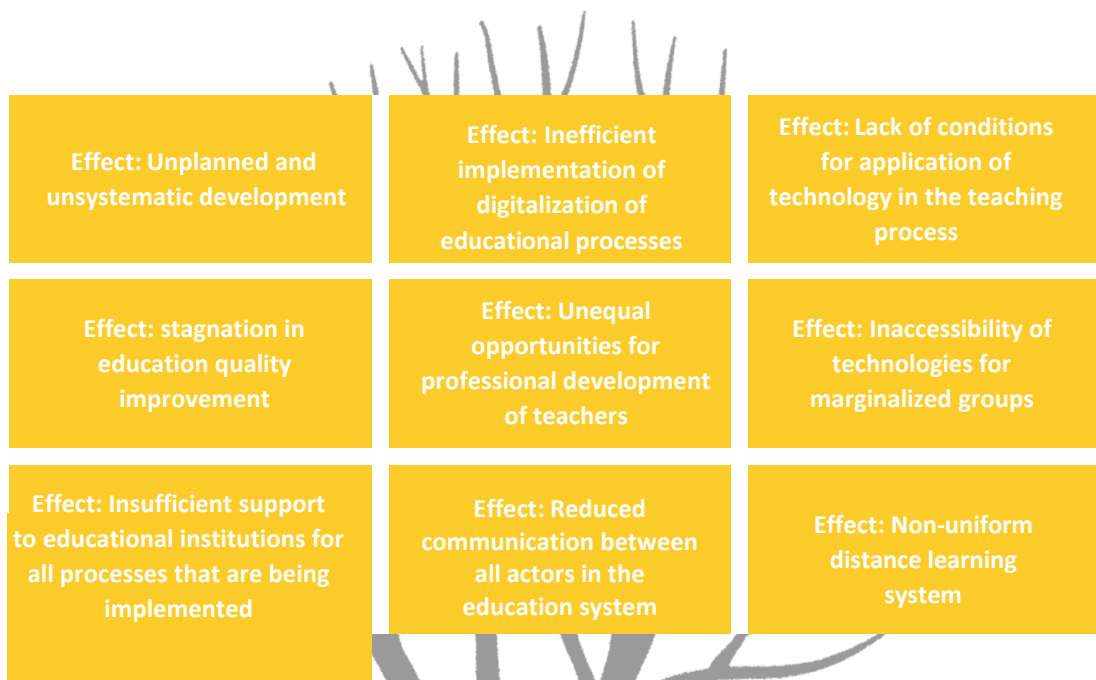
In order to show the connection between the identified problems, three problem trees were created. This methodological instrument enables clear and transparent identification of problems, their causes and consequences on the basis of which the goals were developed. Thus, the “tree” represents the relationship between cause and effect within the problem area.

The first problem is the fact that the Montenegrin Education Information System is outdated and underutilized. This is due to the outdated hardware and software components, low level of digitalization of interdepartmental processes, insufficient staff capacity and unsatisfactory legal regulations. This can lead to the disruption and unavailability of systems and electronic services, the loss of pedagogical records, the inefficiency of the public sector, decision making without adequate analysis of data quality, and security and inefficient implementation of IT projects in the education system.

The second problem is the lack of conditions in educational institutions for digitalization, due to the outdated and insufficient hardware infrastructure, a lack of digital educational content, a lack of a platform for independent online learning, partial implementation of online collaboration systems, unsatisfactory legal regulations and a lack of an adequate planning and development mechanism. This leads to unplanned and unsystematic development, inefficient implementation of digitalization of educational processes, unequal opportunities for teacher training, unavailability of technology for marginalized groups, delays in improving the quality of education, reduced communication between all actors, which prevents children and young people from acquiring digital competencies in school.

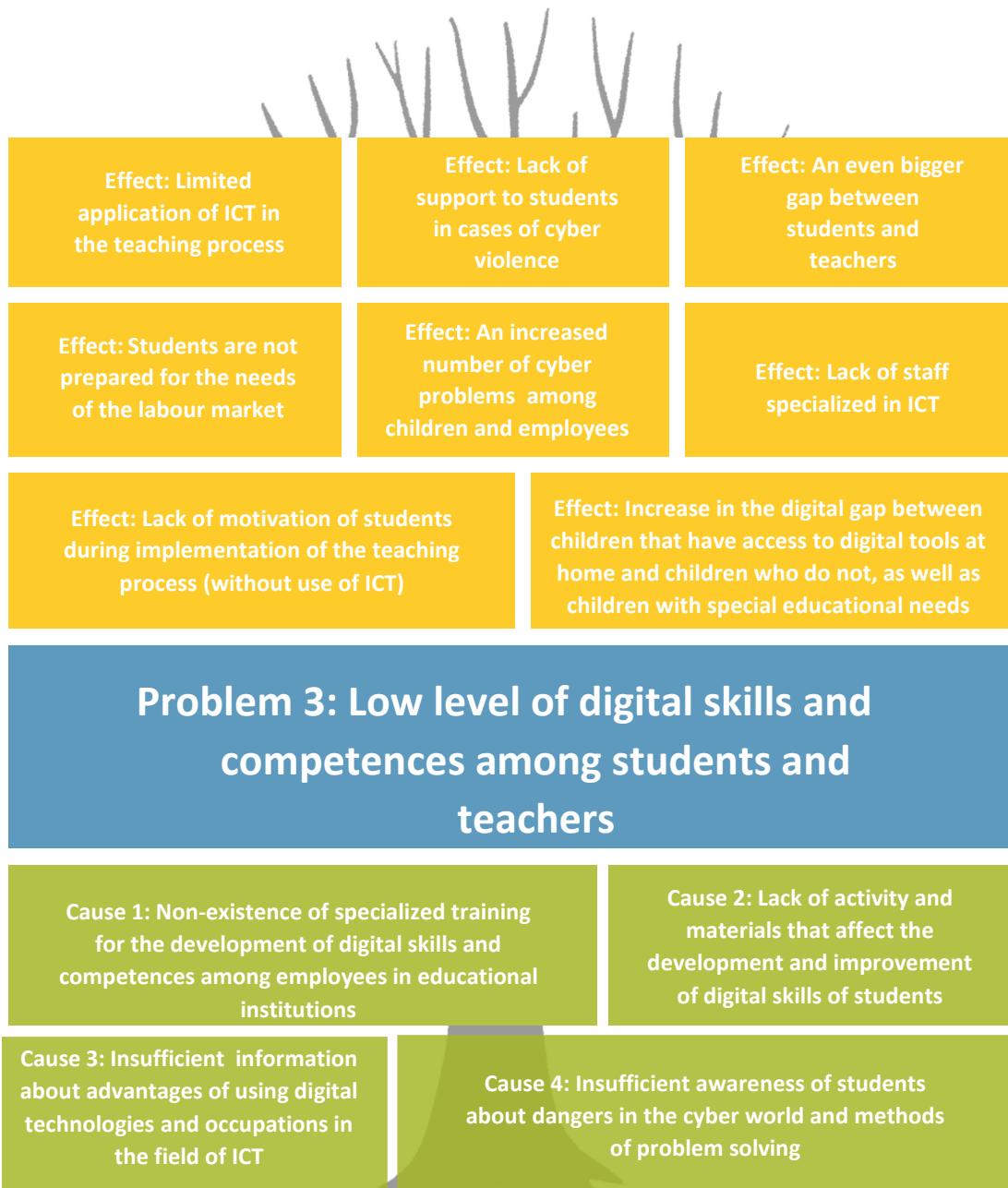
The third problem is the low level of digital skills and competencies of students and teachers and an insufficiently developed awareness of the importance of digitalization, advantages and opportunities for choosing occupations that are currently in demand in the labour market and are important for development of the overall society. These problems lead to limited ICT in teaching, a large “digital divide” between teachers and students, unpreparedness of students for the needs of the labour market, an increase in the number of cyber issues among children and employees, a shortage of ICT staff, a lack of student motivation during the realization of the teaching process and a lack of support for students in the case of cyber violence.





Problem 2: Non-existence of a digital ecosystem





STAKEHOLDER ANALYSIS

STAKEHOLDER	RELATION TO THE STRATEGIC DOCUMENT	INTEREST (VALUE 1–5)	IMPACT/POWER (VALUE 1–5)
MINISTRY OF EDUCATION, SCIENCE, CULTURE AND SPORT	It is responsible for planning, implementation and improvement of education policy. It is responsible for the Strategy and monitors its implementation.	5	5
BUREAU FOR EDUCATION SERVICES AND CENTRE FOR VOCATIONAL EDUCATION	They define and ensure the quality of education and perform development, advisory and research activities up to (but not including) the level of university education. They participate in the organization of continued professional development of teachers, external quality control of work of educational institutions, preparation of courses in the curricula for general and vocational education and curricula for adult education. They are partners in the implementation of some activities in the Action Plan of the Strategy.	5	5
EXAMINATION CENTRE	It organizes state knowledge competitions, implements PISA, TIMSS, PIRLS tests. It is a partner in the implementation of activities regarding competitions and promotion of relevant competitions in the field of IT.	5	2
INSTITUTE FOR TEXTBOOKS AND TEACHING AIDS	The publisher responsible for textbook development and distribution. This institution has one of the key roles in the digitalization and modernization of the education system. Development of digital educational contents has a direct role in the improvement of the quality of education. It is a partner in the implementation of some activities in the Action Plan of the Strategy.	5	5
EDUCATIONAL INSTITUTIONS	Almost all activities in the Strategy are aimed at educational institutions, and directly affect the improvement of work of institutions and quality of education process. They also affect the improvement of the education information system, e-service quality, cyber security, etc.	5	5
TEACHERS	They will benefit from the Strategy through improved working conditions, numerous trainings and digital processes, and their role is key for data accuracy in the	5	5

Education System Digitalization Strategy 2022–2027

	education information system and the quality of e-services.		
--	---	--	--

Education System Digitalization Strategy 2022–2027

CHILDREN/ STUDENTS	The whole Strategy is focused on the well-being of children/students. Through the establishment of a digital ecosystem preconditions are created for improving the quality of education, as well as for raising the levels of knowledge, skills and competencies. At the same time, the development of the education information system provides better support to children/students in prevention and overcoming of challenges such as cyber and peer violence and early school drop-out.	5	3
PARENTS	With the development of electronic services, parents are provided with constant insight into their children's achievements, better communication with class teachers, better information, as well as an easier way of enrolling at all levels of education.	5	3
MINISTRY OF FINANCE AND SOCIAL WELFARE AND CENTRES FOR SOCIAL WORK	They are responsible for the social care of children and families. In addition, they are in charge of caring for children in families that do not meet the legal obligation of regular schooling of children, as well as caring for those who have problems with child neglect and violence. They are partners in the implementation of activities in the area of identification of children who do not go to school in Montenegro. At the same time, they participate in the exchange of data with the education information system.	4	4
INSTITUTE FOR PUBLIC HEALTH	It regularly analyses the vaccination of children and technical correctness of water in the facilities of educational institutions, but also monitors the state of play regarding COVID-19 in them. At the same time, it is a user of the Education Information System data for these and other activities.	5	1
MONSTAT	The Administration for Statistics uses data from the education information system (the MESCS is an administrative source).	5	1
MINISTRY OF THE INTERIOR	It manages the Central Population Register, which is one of the key registers for downloading basic data on individuals in order to establish electronic services for citizens, but also for the needs of digitalization of processes such as determining which children are not in the education system in Montenegro, etc. The partners are involved in realizing activities related to identifying children who do	3	5

Education System Digitalization Strategy 2022–2027

not go to school in Montenegro, etc. They are partners in implementation of activities regarding identification of children who are not in the education system in Montenegro, identification of children who are staying illegally in Montenegro, and development of the Procedure for action in the case of cyber incidents in educational institutions.

Education System Digitalization Strategy 2022–2027

MINISTRY OF PUBLIC ADMINISTRATION, DIGITAL SOCIETY AND MEDIA	<p>It creates policies in the field of digitalization, it is responsible for the eGovernment portal, infrastructure and the Integrated Electronic Data Exchange system. All these shared resources and legal regulations are a precondition for implementation of the Strategy regarding education information system development, e-service development and digitalization process.</p>	<p style="text-align: center;">3 5</p>
DIRECTORATE FOR CONFIDENTIAL DATA PROTECTION	<p>It is a partners in the implementation of activities regarding cybersecurity, because the CIRT is an organizational unit within the Directorate for Confidential Data Protection</p>	<p style="text-align: center;">1 4</p>
UN AGENCIES	<p>UN agencies work on ensuring children’s rights (compulsory education, social care, etc.) and provide financial and consulting support for the implementation of activities defined in the Strategy.</p>	<p style="text-align: center;">3 4</p>

STRATEGIC GOALS AND OBJECTIVES

Digitalization of the educational system should encourage greater use of ICT in teaching in order to improve the quality and inclusiveness of the teaching process, but also to influence the development of digital competencies of students and employees in educational institutions. In addition, it should improve and modernize all the processes in the education system, from electronic pedagogical records to data exchange and the launch of a range of electronic services for citizens and other institutions. In this regard, three strategic goals have been identified: improvement of the Education Information System, development and improvement of the digital ecosystem, and development and improvement of digital skills and competencies.

STRATEGIC GOAL 1:

Improvement of the Education Information System

OBJECTIVES:

OBJECTIVE 1: Improvement of legislation

OBJECTIVE 2: Improvement of the hardware infrastructure

OBJECTIVE 3: Development and improvement of the software components

OBJECTIVE 4: Improvement of the processing, use, accuracy and reliability of data

OBJECTIVE 5: Introduction of interoperability and development of e-services

OBJECTIVE 6: Improvement of the HR structure

STRATEGIC GOAL 2:

Development and improvement of a digital ecosystem

OBJECTIVES:

OBJECTIVE 1: Introduction of planning and development mechanisms

OBJECTIVE 2: Improvement of legislation

OBJECTIVE 3: Improvement of IT infrastructure in educational institutions

OBJECTIVE 4: Development of digital education materials

OBJECTIVE 5: Establishment of a platform for independent learning

OBJECTIVE 6: Improving online collaboration in all institutions involved in education

STRATEGIC GOAL 3:

Development and improvement of digital skills and competencies

OBJECTIVES:

OBJECTIVE 1: Raising the level of digital skills and competencies of employees in educational institutions

OBJECTIVE 2: Raising the level of digital skills and competencies of students, with special focus on children and young people from vulnerable groups

OBJECTIVE 3: Improving safe use of technology

OBJECTIVE 4: Improving digital skills and competencies and use of digital technology through promotional campaigns

KEY ACTIVITIES FOR IMPLEMENTATION OF OBJECTIVES

STRATEGIC GOAL 1: IMPROVEMENT OF THE EDUCATION INFORMATION SYSTEM

Digitalization of the educational system, in a broader sense, in addition to modernization of the teaching process, refers to the improvement of all processes in education, namely: keeping electronic pedagogical records; digitalization of processes (registering for external/graduation/professional exams and contests, establishing the identities of out-of-school children, etc.); establishing inter-ministerial cooperation using data exchange systems (interoperability); and creating electronic services for citizens (parents, guardians and students) and institutions. In addition to the development of software solutions, with the help of which we are digitalizing these processes in education, it is necessary to work in parallel on improving the hardware infrastructure, but also on establishing the best possible models of system protection. For better utilization of the entire system, it is necessary to implement various models that affect the quality, reliability and accuracy of the data, but also to strengthen the structure of staff in the ministry and in educational institutions.

Objective 1.1: Improvement of legislation

Improving legislation is one of the requirements that accompanies every development, including the development of the Education Information System. For the implementation of a number of existing and new activities, it is necessary to improve legislation to ensure better reliability and accuracy of the data, but this also requires creation of a series of internal procedures that describe each activity in the implementation and maintenance of the Education Information System in more detail. In addition, it is necessary to harmonize laws in order to create the legal prerequisites for data exchange for all the processes that are to be digitalized (especially when it comes to the exchange of data between different ministries).

Special attention should be paid to the harmonization of the Education Information System with the GDPR, and it is necessary to conduct a relevant analysis of whether the Education Information System is a critical information infrastructure. If so, it is necessary to create appropriate laws that will ensure safe operation of the system, but also to adequately respond to the rights of citizens whose data is stored and processed in the Education Information System. This was also recognized in the document “Functional Analysis of the Montenegrin Education Information System” prepared by UNICEF and UNDP in March 2020.

Objective 1.2: Improving the hardware infrastructure

The hardware infrastructure in the ministry’s Data Centre, where the Education Information System is located, is very old; this is described in detail in the document “Functional Analysis of the Montenegrin Education Information System”. In order to ensure stability in its operation, but also higher system speed due to the increased number of users, it is necessary to renew the hardware infrastructure in the Data Centre. Besides this, it is necessary to establish a disaster recovery site in order to: secure availability of the system, especially due to the growing number of digitalized processes (which are no longer done in the classical way);

Education System Digitalization Strategy 2022–2027

ensure interoperability (other institutions depend on this system); and develop electronic services (some of which are active for only a few days, while, for example, a public call lasts). At the same time, it is necessary to work on raising the level of security and data protection, which means establishing a backup in a different location. Special attention should be paid to the security of the entire system, both in the field of network and application protection, and in the field of physical protection.

Objective 1.3: Development and upgrading of software components

During the many years of operation of the MEIS, several serious shortcomings have been identified as a result of significant changes in the field of information technology. Some modules of this information system have been implemented using technologies that are almost two decades old, which creates problems in its working. Maintaining such a system and improving the modules is significantly hampered by the obsolescence of the technologies that they were made with. Over the years the system has been in operation, there have been global changes in the IT industry (new browser versions, new standards in the field of security, etc.), so some system functionalities do not work properly because they are not compatible with the new standards and technologies. Due to technological obsolescence, security risks have emerged. Appropriate tests have been performed which have shown that new sophisticated tools are capable of compromising the security of the modules.

Having in mind the mentioned problems, several modules of the information system have already been developed using modern web technologies which are based on the concepts of service orientation. In practice, it has been shown that the new modules are much more resistant to breakdowns and enable scalability. In addition, modern protection measures have been implemented, which significantly impede unauthorized access to the system. In the coming period, it is necessary to create the remaining existing modules using the same technological solutions in order to make the entire existing information system stable, secure and fast.

In addition, it is necessary to work on creating new module applications, including:

- **Records on level V of education of the National Qualifications Framework;**
- **Records of professional development of teachers and their activities;**
- **Records of part-time students;**
- **Records of speech therapy and special education treatment;**
- **Records of equipment in educational institutions;**
- **Creating an administrator module;**
- **Creating a database of all projects implemented in the education system;**
- **Records of data on the work of driving schools.**

Objective 1.4: Improving the processing, use, accuracy and reliability of data

Although the MEIS was implemented in 2010, there is still a certain percentage of teachers who do not have the knowledge and skills to record data, despite numerous training courses. A lack of up-to-date data entry directly affects the quality of data in the Education Information System. The problem is reflected in the fact that these teachers do not use a computer, do not have basic knowledge, and therefore are resistant to recording data on their own. **Therefore, it is necessary for all teachers to be digitally literate**, which will be described in more detail in Strategic Goal 3.

Another way to achieve greater data reliability is to **raise the awareness of employees in educational institutions about the importance of information systems for large departments, with special reference to the importance of the MEIS for the education system, but also for the whole of society**. It is necessary for employees to better understand: the role of the information system; the importance of their timeliness; their contribution to improvement, which directly affects the improvement of quality of the information system, and thus the accuracy of data; and that this data affects further planning and work.

The number of MEIS users is growing year after year, but it is estimated that there may be many more, because it is a system that is complex, contains a large amount of data and in which data is entered and updated daily, etc.

There are still many institutions that are not aware of the existence of the Education Information System and the fact that they can also be consumers of data from that system (if they have a legal basis for the type of data they are looking for), and the like. In order to increase the number of users, it is necessary to present the system and its possibilities to various target groups that are not in the education system.

The proposal is to organize several presentations a year only with certain target groups, with which cooperation could be confirmed in the coming period, and two general presentations that would be just to introduce the Education Information System to a larger number of institutions or companies. It is necessary to monitor the HR capacity in the Ministry of Education, Science, Culture and Sport, whether they can establish cooperation with a larger number of users in a short period of time, having in mind that they also work on planning and monitoring development, implementation and maintenance, and other tasks within their competence that are not only related to the MEIS application.

It is necessary to work on greater promotion of the information system as well as a number of electronic services that are offered, in order to better inform the general public, which leads to an increase in the number of users of these electronic services.

Objective 1.5: Introducing interoperability and development of e-services

Special emphasis should be placed on data exchange, because in that way inter-ministerial cooperation can be significantly improved, procedures can be sped up, the time to implement a particular process can be reduced, the administrative burden of employees can be reduced, and the like.

Bearing in mind that the Education Information System is connected to the Integrated Information System for Electronic Data Exchange, all institutions that are also registered with this system already have technical capabilities for data exchange with the education system. As the plan is to increase the number of registers in the Integrated Information System for Electronic Data Exchange, better conditions are being created for the establishment of cooperation.

In addition, if some institutions cannot connect to the Integrated System for Electronic Data Exchange, there is still the possibility of establishing electronic data exchange if the difficulties with the network infrastructure are overcome.

The Strategy aims to introduce the exchange of data regarding:

- Establishing the identity of children who do not go to school in Montenegro
- A tracking study of high school students after high school
- Monitoring of candidates after completion of the adult education training programme
- Monitoring of part-time students
- Compilation of data on violence (peer, cyber, etc.)
- Prevention of epidemics
- Technical adequacy of water in educational institutions
- Energy efficiency of educational facilities
- Utilization of school facilities
- School drop-out monitoring study
- Monitoring of students in dual education
- Identification of persons with illegal residence in Montenegro
- PISA testing
- Developing a student registration system for external testing
- Student registration for competitions

The upgrading of the Education Information System is also reflected in the creation of electronic services that could be targeted at institutions or citizens. In addition to the mentioned exchange of data, which also includes electronic services for institutions, it is necessary to create electronic services for teachers, so that they can apply for a licence to work in educational institutions and apply for advanced positions.

Objective 1.6: Improving HR structure

The scope of work of the Department for ICT, Statistics and Digitalization is constantly increasing due to the significant advancement in the use of IT in all spheres of society. The competencies of the department are related to: establishment of computer infrastructure in

Education System Digitalization Strategy 2022–2027

educational institutions; implementation of the information system; education of the users; etc. In addition to users from educational institutions, data from this system is also used by other institutions (Ministry of Finance and Social Welfare, Centres for Social Work, Employment Agency, Public Health Institute and others). With the data from its information system, the ministry has become an administrative source of data for the national statistics administration – MONSTAT. The number of users of the information system in Montenegro has recently increased significantly (about 10,000 users from educational institutions, about 300 users from institutions providing education services, about 1,000 users from other departments, and potentially about 100,000 parents).

According to the standards of all international institutions, information systems are considered very important, especially for large ministries, due to faster information, research, analysis, preventive action, etc., which require the constant upgrading and improvement of such an information system. This entails a large number of electronic services needing to be launched, both for the more efficient working of employees involved in the development and education of children in educational institutions, and for parents, guardians and students. Besides this, international standards stipulate that each ICT sector should have employees in its structure who deal with data analysis. Therefore, data collection and reporting is not enough, but data analysis is also needed.

The current structure, as well as the number of employees in the department, cannot meet the needs of today, nor of the time to come. Not only the line ministry, but also all educational institutions, other state institutions, citizens (parents and guardians), etc., now depend on the Education Information System. Therefore, it is very important to change the structure of the department and increase the number of employees as soon as possible, based on the recommendations included in the document “Functional Analysis of the Education Information System”.

In addition to improving the HR structure in the department, it is necessary to work on strengthening ICT coordinators in educational institutions. The increasing digitalization among end users is leading to an increase in the volume of work and the need to increase the number of ICT coordinators, as well as the need for their additional training in order to successfully implement all projects.

STRATEGIC GOAL 2: DEVELOPMENT AND UPGRADING OF THE DIGITAL ECOSYSTEM

This strategic goal should include all the necessary conditions that need to be provided in order to systematically implement activities aimed at digitalizing the entire education system. It is necessary to develop a digital ecosystem that will include all central educational institutions and all other educational institutions, in order to improve the knowledge, skills and competencies of students, as well as of teachers. At the same time, it is necessary to create the necessary conditions for the smooth application of digitalized educational processes.

Objective 2.1: Establishment of a mechanism for planning and development

The Education System Digitalization Strategy includes a large number of activities from different domains, the implementation of which requires the involvement of several institutions. In the field of digitalization, needs and possibilities change in a very short time, so it is necessary to establish a Commission for Digitalization of the Education System. The obligation of the commission would be to monitor the implementation of the Strategy, consider the analyses necessary for the improvement of the education system by introducing digitalization, to plan research, as well as to determine the direction of further development of digitalization of the education system. One of the key roles of the commission is coordination with all relevant institutions that must participate in the development and improvement in this area. Based on consultations with the experts who drafted the Education Sector Analysis, it was concluded that the establishment of this commission is necessary, because at the system level there are insufficient capacities for the planning and monitoring of reforms and they must be improved, which includes improving the HR structure, staff training and creating mechanisms for efficient cooperation.

Regular research contributes to better planning for the improvement of all areas, including the digitalization of the education system. Bearing in mind that the SELFIE tool is available to all primary and secondary schools, and that research has already been conducted, it is necessary to continue its application, to conduct research every year so that the institution can make an annual improvement plan. At the same time, decision makers can follow the trends when it comes to progress in each segment that is important in the digitalization process.

One of the problems is the studying of teaching contents in informatics and technology within one course – *Informatics with Technology*. Apart from the fact that there was no increase in the weekly number of classes when the courses were merged, there is also a problem with the profile of teachers who can teach this course. The disadvantage is that in the ninth grade of primary school students do not have a compulsory course in the field of informatics. They can only choose an offered elective course in this field. Bearing in mind that a small percentage of children choose elective courses in the field of informatics, it happens that students have an interruption in their education in this field for a year. In high school, students have an informatics course.

It is necessary to develop a separate course in informatics, which would be separated from technology and which would be studied continuously from the fifth to the ninth grades of primary school, in order to maintain continuity in education. Furthermore, it is necessary to

Education System Digitalization Strategy 2022–2027

revise the course curriculum in informatics in high schools/general secondary schools (gymnasiums), and introduce it as a two-year course, in order to make it equal with the general education course in the four-year secondary vocational education programmes. Also, it is necessary to consider the introduction of programming into the educational programme for general secondary schools.

The topic of digitalization and digital literacy of society is addressed in several important international and national documents. We live in the 21st century, at a time when we are talking about the digitalization of tools for everyday use, e-learning, the dangers of the internet and when there is no possibility of applying successfully for a job if a person is not computer-literate.

The course in informatics for secondary vocational schools is designed to meet the needs of today whereby the material is studied over the course of two academic years in four-year programmes, and one academic year in three-year programmes.

In the “Definition of the Course Curriculum for Informatics for Secondary Vocational Schools” produced by the Bureau for Education Services, the following is stated: “The changes that the development of information and communication technologies brings with it, as well as the possibility of using various sources of knowledge, which are no longer limited to books, entail a new atmosphere in all aspects of modern life. Integration of information and communication technologies for the purpose of more efficient education is an inevitable process caused by social and technological changes. Therefore, through the course in informatics, students are expected to upgrade their IT literacy and increase their affinity for the use of information and communication technologies. Namely, the degree of development of information and communication technologies is a basic indicator of the development of society as a whole and is accepted as one of the basic indicators of the development of a knowledge-based society. Through this course, computer literacy in secondary vocational school should be raised to a higher level, because today it is part of the general literacy and culture of an individual. Only in this way can we be sure that we have adapted to modern educational trends, and enabled students to acquire the digital competencies necessary for life and work.”

It is necessary to consider introduction of the area of online collaboration into the course curriculum for Informatics. During the pandemic caused by the COVID-19 virus, online collaboration software has been the basis for the implementation of all activities in educational institutions, including the implementation of the teaching process. The technological basis for this can be Office365, having in mind that this resource is already available to all educational institutions and that teaching was mostly conducted with the help of this technology (Digital School concept – use of Microsoft Teams application).

Objective 2.2: Improvement of legislation

In addition to a large number of laws governing the education system, there are a number of rulebooks, decrees, decisions and procedures that regulate certain segments and processes in more detail. Having in mind that this Strategy will be used to implement a planned and systematic process of digitalization of the educational system both at the level of the work of educational institutions and at the national level, it is necessary to harmonize and amend the legislation. In some parts, it is necessary to create new legal acts, because certain activities that are recognized as necessary are being planned for the first time in the education system.

Education System Digitalization Strategy 2022–2027

Legal acts will need to regulate: the method of preparation and quality standard of digital textbooks, actions in case of cyber incidents, improvement of teachers' skills, use of equipment in educational institutions, procedures for the implementation of online teaching, etc.

Objective 2.3: Improvement of IT infrastructure in educational institutions

Providing computer equipment for educational institutions should be an ongoing process. Due to compulsory and elective subjects/modules in the field of informatics, it is necessary for schools to have computer classrooms. The number of computers and computer classrooms depends on the number of students in the school. Computer classrooms need to be refurbished every five to six years. Also, it should be borne in mind that computers are used in the teaching of other courses/modules. The priority of replacing computers in computer classrooms in relation to other classrooms is due to the upgrading of software that is necessary for the implementation of teaching in computer science courses/modules. New versions of software often require certain hardware features, so it may not be possible to install a new version of an operating system on the equipment currently in schools because the hardware does not have the capacity necessary to install that operating system.

In addition to the computer classroom, it is necessary to equip other classrooms with computers and smart TVs or projectors and smart boards in order to improve the use of ICT during the educational work in other courses/modules.

Also, it is necessary to equip school libraries with at least 5–15 computers, depending on the size of the school, so that students have the opportunity to use literature from school libraries and research on the internet to expand their knowledge through combined learning. This would be very important for students who do not have a computer or the internet at home, and who need it for homework or learning.

In schools, in addition to the computers needed for the implementation of teaching, it is necessary to continuously modernize the computers that are used by the administration and in the teachers' common rooms.

It is also necessary to expand the computer network within the school in order to provide internet connections in all rooms. Due to the expansion of the local computer network within the school, better internet connection should also be provided.

In addition, it is necessary to secure a licensed software for teaching: operating systems, the Microsoft Office software package and specialized software depending on the educational programmes (Annex 2).

Objective 2.4: Development of digital educational content

The level of development of digital materials for teaching and learning is still insufficient (didactic software, electronic textbooks, e-learning, etc.).

Educational content should be viewed as didactic software that can be divided into primary and secondary categories. Primary didactic software refers to electronic textbooks, i.e. software that is a set of interactive learning content (simulations, animations, etc.) and content for practicing and confirming knowledge. Secondary didactic software refers to digital content that does not have to relate to compulsory teaching content.

Education System Digitalization Strategy 2022–2027

The creation of digital educational content must be systematic, sustainable and based on pre-defined procedures and quality standards. Digital technologies and tools have a huge potential to improve the quality of teaching, whereby the way of teaching and learning is brought closer to the affinities and needs of each child. Priority areas for digital content development must be defined by the relevant institutions.

Educational content is not created all at once, but gradually, because in addition to requiring certain financial investments, which cannot be allocated in one year, it also requires a great deal of commitment to control the accuracy and quality of the created material.

In addition to the above, it is necessary to develop content for talented children from different fields, especially for those areas where there are not enough professional staff in schools due to deficient occupations (programming, development of STEM skills, artificial intelligence, etc.). Technology can significantly help children with special educational needs, so it is necessary to plan and develop content intended for such children. In addition to the creation of digital content, its application is very important, which is why it is necessary to train the teaching staff and create a mechanism to support teachers, as well as to improve the quality assurance system implemented by the Bureau for Education Services.

Objective 2.5: Establishment of a platform for independent learning

The training activities and workshops that are being implemented are not available to all teachers and are held over a certain period of time. In order to provide the training necessary for teachers, it is necessary to design online training that could be self-guided and available to all employees, regardless of the period during which they start working in the education system. In addition to training for employees, there is also training for parents, so it is necessary to create self-guided and constantly available training for them as well. A similar need arises with students, because there are a number of reasons why some children are not able to attend regular classes (students who are involved in home education, medical treatment, part-time students, etc.) and for that reason it is also necessary to provide appropriate self-guided training that would give them the opportunity to acquire the necessary knowledge. These types of training can be created in line with the regular teaching process, but also involve other areas in which children are interested. The Learning Passport platform, which is developed by UNICEF and Microsoft in cooperation with the University of Cambridge, and which is being piloted in Montenegro this year, could contribute to providing resources through which all these types of training could be available. The advantage of installing self-guided training on the Learning Passport platform is the fact that the platform is connected with the Microsoft Teams application, which gives greater opportunities to achieve better training quality. Establishing this platform would contribute to the quality and inclusiveness of the education system, but also to its resilience in times of crisis, such as the ongoing pandemic that has led to long school closures. Establishing a platform and developing digital content are the basic segments for creating a quality system of distance learning and work, which can be used by teachers and students in everyday work, but also in situations that so require.

Objective 2.6: Improve online collaboration in all institutions involved in education

Microsoft 365 (Office 365) is a resource available to all educational institutions, but also to the Ministry of Education, Science, Culture and Sport, the Bureau for Education Services, the Centre for Vocational Education, the Examination Centre and the Institute for Textbooks and

Education System Digitalization Strategy 2022–2027

Teaching Aids. Therefore, it is possible to establish online cooperation between all these institutions.

For example: With the Microsoft Teams application (which is one of the applications in the Microsoft 365 package), the MESCS can create a set of teams for the work of all directorates, units, sections or services, for the work of the cabinet, etc., but it can also use the application for working groups. At the same time, it can establish permanent teams at the level of educational institutions, such as: a team of directors of educational institutions; a team of pedagogues and psychologists; a team of secretaries and accountants; a team of ICT coordinators; a team of adult education organizers; the driving school team; etc.

With the help of the Microsoft Teams application, many other activities can be realized, which do not belong to the category of regular communication and teams, such as: interviews with candidates for school principals; the work of working groups; holding various meetings with individuals or groups; focus groups; public consultations; counselling; etc.

Examples of the organization of the online work of institutions have shown numerous advantages, and some of them are:

- Easier and faster organization of meetings (a large number of participants, no problems with a lack of adequate space, time savings, reduced travel costs, etc.)
- Easier access to the ministry's employees for the employees in educational institutions (sending notices, documents grouped by various topics, cooperation and exchange of experience of all members of the group, etc.)
- Possibility of easier organization of a large number of conferences aimed at raising the quality of work of the institution
- Quick and efficient implementation of a number of activities in order to create strategic documents and new legal acts (focus groups, research, interviews, public consultations, etc.)

This way of organization can be applied to institutions that deal with education: the Bureau for Education Services, the Centre for Vocational Education, the Examination Centre of Montenegro, and the Institute for Textbooks and Teaching Aids.

Accordingly, it is necessary to educate employees in these institutions and establish an implementation system, as well as to promote the implementation of the Digital School concept.

STRATEGIC GOAL 3: DEVELOPMENT AND IMPROVEMENT OF DIGITAL SKILLS AND COMPETENCES

Digital transformation is accelerating due to the increasing use and application of artificial intelligence, mixed reality, robotics and blockchain. The level of digital competitiveness, in all its subdomains, is becoming an increasingly important condition of modern economies for innovation and progress. This requires the recognition of digital competence as a key component for individual and social development and for inclusion in the labour market.

Today, digital competence is important and necessary for every individual in order to be able to actively, continuously and responsibly participate in society at all levels (political, economic, social, cultural and intercultural) and to take advantage of the internet while building resilience to potential risks. The use of digital technologies for social and democratic participation requires the ability to engage positively, critically and competently in the digital environment. Skills are needed to access, select and interpret information, communicate effectively and create content in a way that respects human rights and dignity and uses technology responsibly. However, levels of digital competence across Europe remain low on average.

Digital Competence⁹ is part of the Recommendation of the European Parliament and the Council of Europe on key competences for lifelong learning, which includes the decisive, safe and responsible use of digital technologies and their use for learning, work and participation in society. These include information literacy, data literacy, communication and collaboration, media literacy, digital content creation (including programming), security (including digital wellbeing and competences related to cybersecurity), intellectual property issues, problem solving and critical thinking.

The COVID-19 crisis has highlighted the importance of basic and advanced digital skills for sustaining the economy and society. In the years to come, the digital economy will play a leading role in the recovery, and the demand for digital skills will grow.

All phases of education have a key role to play in enabling students to continuously acquire and develop the digital competences needed for life, work and learning. There are also concerns about children's socio-emotional, cognitive and physical development due to the potential excessive "screen time". Given that the effects of technology can depend on many factors, including the type of technology used and its purpose, evidence-based guidelines and effective practices are needed to encourage healthy and meaningful use of digital technology from an early age.

Efforts cannot stop at the borders of formal education, as youth work, non-formal education and lifelong learning are an integral part of the education and training system in the digital age. The development and improvement of digital skills through the system of non-formal education will be included in the Strategy for Digital Transformation.

⁹ <https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework>.

Objective 3.1: Raising the level of digital skills and competences of employees in educational institutions

The task of the education system is to train teaching staff to ensure the development of students' skills and competencies. In order to achieve this goal, it is necessary to continuously conduct various types of training for employees in educational institutions. Training contributes to the development of skills and competencies, but also to raising awareness of the importance of the development of digital technologies and their impact on the development of society and the economy, but also on human development. It is necessary to define that training in the field of ICT is a priority and that teachers are obliged to attend these training sessions annually.

The types of training planned by this strategy for teachers are: acquiring basic digital skills according to the ECDL standard, using online collaboration, safe use of technology, application of digital key competencies in teaching, acquiring digital professional competencies, working with talented students in ICT, working with children with special educational needs with the use of ICT, etc.

In addition to the training of teachers already working in the education system, it is necessary to introduce appropriate changes in the initial education at teacher training colleges (changes in study programmes), which is included in the Strategy for Digital Transformation. At the same time, there is a need to expand the structure of taking the professional exam for working in educational institutions, as well as the number of compulsory hours of training to renew a licence to work in educational institutions, which would include this area as compulsory.

Objective 3.2: Raising the level of digital skills and competences of students, with a special focus on children and young people from vulnerable groups

Digitally enabled automation and artificial intelligence will become the primary drivers of the next technological revolution. As artificial intelligence systems evolve rapidly, with applications in many different fields, there is a need not only for professionals but also citizens to have a basic understanding of artificial intelligence to get involved in this increasingly present technology.

Implementation of the Framework of Digital Competences of Students (on which the National Education Council gave a positive opinion) will be a priority in the coming period, because it implies the development of skills within the relevant courses, but more importantly teaching and learning with the use of digital technologies. In this way, all children are included and have the opportunity to acquire appropriate digital skills and competencies through the education system (Roma, children with special educational needs, children from rural areas, etc.), and there is also the possibility to form clubs and organize thematic camps in the field of ICT in order to contribute to the improvement of knowledge and skills of students through these activities. Clubs and thematic camps can provide the most opportunities for students to supplement their knowledge and skills that they cannot acquire through the regular teaching process.

As ICT staff are in short supply everywhere in the world, the Digital Transformation Strategy envisages improvement in this area, while this strategy plans to involve ICT companies and university faculties in working with children in schools, but also the visits of children to

Education System Digitalization Strategy 2022–2027

companies and university faculties in order to do practical work, i.e. learning by doing in a real work environment.

In order to ensure the quality of teaching, it is necessary to educate the supervisors of the Bureau for Education Services (BES) so that they know how to recognize the level of implementation of the Digital Competence Framework in schools and the level of application of digital technologies in the implementation of the teaching process.

Objective 3.3: Improvement in safe use of technology

In an era of rapid technological advancement, students must use technology, but they must also be aware of the risks of all the attractive applications for smartphones and computers on which they spend a lot of time.

With the closure of schools during the COVID-19 pandemic, students attended classes and increasingly socialized online. Spending more time on virtual platforms can further expose children to sexual exploitation and harassment online. Lack of personal contact with friends and partners can lead to greater risks, while unstructured time spent online can expose children to potentially harmful and violent content, as well as an increased risk of cyber violence.

Therefore, we should continuously work on raising awareness among children, who are the focus of attention when it comes to education, among teachers, professional associates, but also parents. In the absence of experts in this field, it is necessary to include more of this topic in the educational system: at the general level of knowledge for all students and at an additional level for those who see their future profession in cybersecurity.

The activities planned in this Strategy are as follows:

- Establishing a clear procedure for educational institutions on dealing with cyber incidents
- Creating materials for children on the topic of cybersecurity (infographics, videos, modification of the NetFriends application ...)
- Annual visits to primary schools that should affect prevention, i.e. the culture of children's behaviour on the internet and better identification of the potential dangers – social networks, predators, online scams
- Annual visits to secondary schools that should affect prevention, i.e. the culture of children's behaviour on the internet and better identification of the potential dangers – social networks, predators, digital forensics, web application security, cloud system security...
- Launching a campaign for the enrolment of students on study programmes required in the labour market (IT and cybersecurity)
- Creating and accrediting training programmes for all employees in educational institutions
- Creating and accrediting training programmes for IT teachers
- Creating and accrediting training programmes for professional support services (pedagogues and psychologists)
- Creating and accrediting training programmes for managers of educational institutions
- Creating and accrediting training programmes for ICT coordinators
- Implementation of the mentioned training programmes for the duration of the strategy
- Creation of the mentioned training programmes as self-guided courses, which would be available not only to the staff of educational institutions but also to parents
- Creating workshops for students for four age groups that would be conducted in educational institutions.

Cross-sector cooperation between the MESCS, CVE, BES, MPADSM, CIRT (DCDP) and PD is necessary in the implementation of activities.

Objective 3.4: Improvement of digital skills and competencies and use of digital technology through promotional campaigns

The development of digital teaching content, equipping educational institutions with computer equipment and increasing the use of ICT in teaching, contributes to the development of digital skills and competencies of students. Courses/modules taught in primary and secondary schools need to be in line with technological change, so it is necessary for courses/modules in the field of computer science to be frequently revised and for other courses/modules to be upgraded. Interdisciplinary topics and extra-curricular activities related to digital skills and competencies can also be of great importance in all that.

Special attention should be paid to talented students who show interest in improving their knowledge in the field of ICT and they should receive support to participate in competitions. In addition to organizing competitions in our country, relevant competitions that are organized outside the borders of Montenegro will be promoted, so that our students are informed and given the opportunity to participate in some of them.

Promoting student and teacher mobility programmes in the field of ICT can also contribute to gaining experience by both students and teachers in this field in a different environment.

Continued celebration of the International Safer Internet Day and International Girls in ICT Day contribute to increasing the attention that is given to these topics. It is especially necessary to encourage girls so that they understand that IT occupations are not only for boys and that there are certain advantages they need to be aware of, in order to encourage them to choose occupations in this area.

DESCRIPTION OF ACTIVITIES OF THE RELEVANT AUTHORITIES AND BODIES FOR MONITORING OF STRATEGY IMPLEMENTATION

The Ministry of Education, Science, Culture and Sport is in charge of planning, implementing and improving education policy. The basic precondition for the realization of strategic goals and objectives defined by the Education System Digitalization Strategy in Montenegro for the period 2022–2027 is the consistent implementation of activities prescribed by the action plans for the implementation of the Strategy. After the adoption of the Strategy and the accompanying Action Plan, the Ministry of Education, Science, Culture and Sport will form a Digitalization Commission to monitor the implementation of the Strategy.

The Centre for Vocational Education is in charge of quality assurance, development, advisory support and research into the vocational education of young people and adults. The CVE coordinates the development of occupational standards, qualification standards, curricula and educational programmes; it trains working groups for the preparation of these documents, and trains teachers to implement curricula. Besides this, the centre supports the professional development of teachers, prepares catalogues of professional development programmes for teachers, participates in the process of external determination of the quality of educational work of institutions, provides support to institutions in establishing internal quality assurance mechanisms, monitors the quality of examinations, determines the conditions for practical education/internships with employers, organizes skills competitions for students and others. The centre organizes various events in order to promote lifelong education and learning.

The Bureau for Education Services defines and ensures the quality of education and performs development, advisory and research activities in pre-university education. The Bureau for Education Services is a partner in the implementation of certain activities from the Action Plan for the implementation of the Education System Digitalization Strategy in Montenegro for the period 2022–2027. The Bureau for Education Services, in cooperation with the Centre for Vocational Education, among other things, participates in the organization of continuous professional development of teachers, external determination of the quality of educational work of institutions, preparation of course curricula for general courses of vocational education programmes.

The Examination Centre tests students' achievements at the end of the second cycle of primary school, conducts external testing of knowledge at the end of the third cycle of primary school, as well as external testing of students' achievements in exams at the end of the four years of secondary education. The Examination Centre participates in the implementation of activities from the Action Plan which, among other things, relate to the training of members of working groups participating in the preparation of examination catalogues and graduation tests and professional exams, harmonization of concepts and definition of competition procedures for specific fields of vocational education. It also organizes training of examiners to check non-formal and previously acquired knowledge in order to acquire a national professional qualification.

The Institute for Textbooks and Teaching Aids is a publisher responsible for the production and distribution of textbooks. This institution has one of the key roles in the process of

Education System Digitalization Strategy 2022–2027

digitalization and modernization of the educational system. The development of digital educational content has a direct role in improving the quality of education.

The **Chamber of Commerce of Montenegro** and the **Montenegrin Employers' Federation** participate in the organization of expert discussions with employers in order to determine the needs of the labour market, they propose the members of working groups for drafting occupational standards, provide expert opinions on the defined occupational standards, etc.

The **Ministry of the Interior** manages the Central Population Register, which is one of the key registers for downloading basic data regarding individuals in order to establish electronic services for citizens, but also for the needs of digitalization of processes, such as determining which children are not in the education system in Montenegro, etc.

The **Ministry of Finance and Social Welfare** is responsible for the social welfare of children and families (children without parental care, financial family allowance, etc.). In addition, they are in charge of caring for children in families that do not meet the legal obligation in terms of regular education of children, as well as for those who have problems with child neglect and violence.

The **Ministry of Public Administration, Digital Society and Media** is in charge of creating public policy that regulates the public administration system in Montenegro and implements digital transformation. One of the basic factors for digital transformation is the development of digital skills and competencies of all population groups. At the same time, they are in charge of the Information System for Data Exchange, as well as the e-Government portal.

The **Computer Incident Response Team**, which is under the jurisdiction of the **Unit for the Protection of Classified Information**, is a team that was formed in 2012 in response to computer security incidents in the cyberspace of Montenegro, in accordance with the Law on Data Secrecy and the Law on Information Security. The CIRT performs the function of protection against computer security incidents on the internet and other risks related to information security. It is also the central contact point at the national and international levels for all computer security incidents in which one of the parties to the incident is in Montenegro, i.e. within the Montenegrin IP address space.

The **Institute for Public Health of Montenegro** performs a regular analysis of children's vaccination and the technical adequacy of water in the facilities of educational institutions, but also monitors the situation with regard to the COVID-19 epidemic in those institutions.

METHOD OF REPORTING AND EVALUATION

Implementation of the strategy for digitalization of the educational system will be organized through three action plans, the first of which is for the period from 2022 to 2023, the second from 2024 to 2025 and the third from 2026 to 2027. The action plans will contain an overview of the activities required to achieve the objectives, as well as the entities responsible for specific activities and the partners for each of them, the deadlines for implementation, performance indicators, as well as the method of financing.

A Commission for Digitalization of the Educational System will be formed to monitor implementation of the Strategy and to supervise the quality and dynamics of the planned activities. In addition to the representatives of the Ministry of Education, Science, Culture and Sport, the commission is planned to include representatives of the Bureau for Education Services, the Centre for Vocational Education, the Institute for Textbooks and Teaching Aids, the Examination Centre, educational institutions and the economy. The commission will be formed after adoption of the Strategy.

In addition to monitoring the implementation of the strategy, the commission is responsible for initiating various analyses and research, but also to adopt documents that arise as a result of the implemented activities, such as:

- Analysis of the profile and level of education of teachers who teach ICT courses/modules in primary and secondary schools;
- Development of a plan for the professional development of teachers who teach the course Computer Science in primary and secondary schools;
- Conducting research in primary and secondary schools in the field of digital education using SELFIE tools;
- Analysis of relevant national and international recommendations for improving the digital competencies of teachers;
- Analysis of the current state of digital competencies of teachers;
- Drafting of a Framework for the Development of Digital Competencies of Teachers.

The role of the commission will be to analyse all the activities planned by the Strategy, review the reports after the conducted research in the field of ICT, coordinate with all interested institutions to have its quarterly reports adopted by the institutions in charge of implementation, and prepare annual reports on implementation of the action plans. The annual implementation reports are sent to the Government of Montenegro for adoption. The reports will also be published on the website of the Ministry of Education, Science, Culture and Sport.

Six months after the expiration of the period covered by the Strategy, an external evaluation will be conducted, for which an independent consultant will be hired by the Ministry of

Education System Digitalization Strategy 2022–2027

Education, Science, Culture and Sport. Funds for this purpose will be planned in the Action Plan for 2026–2027.

Implementation of the activities involves the division of competencies between line institutions, educational institutions and other partners, as well as their coordination. Also, the implementation process emphasizes the need for constant dialogue and cooperation between the public and private sectors, because the digitalization of the education system depends on that cooperation and the environment in which it is implemented.

CONNECTION WITH NATIONAL AND EUROPEAN STRATEGIC DOCUMENTS

The ***Economic Reform Programme 2022–2024***, which is currently being developed, envisages the reform measure *Digitalization of education and development of digital skills*. This strategy fully covers all the planned activities for the mentioned reform measure.

In the ***Prime Minister's Exposé***, presented on 2 December 2020, it is envisaged that Montenegro, in line with the European approach, should be based on Smart Growth, advancing education by encouraging learning and improving citizens' skills, strengthening innovation and developing new products and services to respond to social challenges, applying ICT as the foundation of the digital society.

The Government's Work Programme for 2021 identified six priorities, including Education and a Knowledge-Based Society and Digital Transformation. In the thematic part on Digital Transformation, it is planned to develop a strategy for the digitalization of the education system.

There is a common goal in the Education System Digitalization Strategy and the ***Strategy for Digital Transformation – Development of digital skills and competencies***. Bearing in mind that the leader in the definition of the Digital Transformation Strategy is the Ministry of Public Administration, Digital Society and Media, and that the Digital Transformation Strategy refers a lot to the economy, to IT staff, but also to the level of digital knowledge of the whole society (population), it includes higher and non-formal education, while the Education System Digitization Strategy covers all the other levels of education (preschool, primary and secondary).

Montenegro has provisionally closed Negotiating Chapter 26 – Education and Culture. In the new EU accession methodology, education is in Cluster 3 – Competitiveness and Inclusive Growth. The ***Report of the European Commission for 2021*** identified several challenges for the upcoming period, of which we single out: further improvement of the quality and accessibility of education; and training with a focus on digitalization.

Adapting educational knowledge and skills to the process of digital transformation is in the focus of the ***Political Priorities of the European Union 2019–2024***.

In November 2020, Montenegro signed the ***Osnabrück Declaration 2021–2025***, which aims to strengthen vocational education and training as a driver of recovery and a fair transition to a digital and green economy.

One of the measures in the ***National Strategy for Teacher Education in Montenegro 2017–2024*** is Ensuring the acquisition of digital competence during initial teacher education, and the entire strategy emphasizes the need for continuous professional development and training in order to focus on digital skills.

The ***Vocational Education Strategy 2020–2024*** puts emphasis on the improvement of digital competencies among teachers and students, and an increase in the use of ICT in teaching.

Education System Digitalization Strategy 2022–2027

The National Sustainable Development Strategy 2030¹⁰ also defines the necessary management measures for the establishment of information systems and databases as key instruments that should enable the application of measurable indicators to monitor progress in implementing the sustainable development goals. Relevant measures are as follows: 1.3.4: Improve the conditions for lifelong learning, non-formal and adult education with a focus on vulnerable groups; 1.3.4.2: Increase the IT literacy of young people and adults.

The ***Inclusive Education Strategy in Montenegro (2019–2025)***,¹¹ through Strategic Goal 1: Ensure and implement access to and fairness of education for all children together with peers, is expected to improve access to education and educational services; and through Strategic Goal 3: Support and improve the quality of inclusive education, it is expected that there will be an improvement in the quality control system and data collection.

The ***Strategy of Early and Preschool Education in Montenegro 2021–2025***, through Objective 2: Improving and ensuring the quality of preschool education, sets a key benchmark – Strengthening support for parents and families: Production of media content and development of materials for an early distance learning platform.

The ***Smart Specialization Strategy***,¹² defines through its key activities, namely: development of qualifications and new educational programmes and development of professional skills for areas identified through S3 as priorities (three vertical priorities – Sustainable Agriculture and Food Value Chain; Energy and a Sustainable Environment; and Sustainable and Tourism, and one horizontal priority – ICT in the pronounced function of vertical priorities).

The ***Programme for the Development of and Support for Talented Students 2020–2022***,¹³ through Objective 3, focuses on enriching the curriculum in order to encourage talent and improve the IT infrastructure.

In the ***Strategy for Lifelong Entrepreneurial Learning of Montenegro 2020–2024***,¹⁴ within Strategic Objective 1 – To improve the development of entrepreneurial competency at all levels of formal education by means of Measure 1.1.4, states that it is necessary to create conditions for the development of digital competency and improvement of financial literacy as an integrative segment of entrepreneurial competency.

The ***Programme for the Implementation of Recommendations for the Improvement of Education Policy 2019–2021 based on the results of the PISA 2015 study***, through Objective 4 – Improved school environment for learning and development of key competencies as an indicator of performance, defines Measure 4.4: The percentage of schools in relation to the total number of schools implementing digital literacy programmes.

The ***Strategy of Teacher Education in Montenegro 2017–2024***,¹⁵ through the area of Study Programmes, defines the measure: Ensuring the acquisition of digital competence during the initial teacher education.

The goals and principles of the *Education System Digitalization Strategy* are guided by common European goals and principles of adapting the education and training system to the

¹⁰ <https://www.gov.me/dokumenta/6852d215-af43-4671-b940-cbd0525896c1>.

¹¹ <http://www.skolskiportal.edu.me/Inkluzivno%20obrazovanje/Strategija%20Inkluzivnog%20obrazovanja%20u%20Crnoj%20Gori%202019-2025.pdf>.

¹² <https://www.gov.me/dokumenta/18205a91-1afc-4eb7-a5cb-8ad5bd0b7712>.

¹³ <https://www.gov.me/dokumenta/8fa87afc-0a6c-474a-8474-d6bee3ad4b80>.

¹⁴ <https://www.gov.me/dokumenta/59a998e8-af01-4e54-a205-fc81584163f8>.

¹⁵ <https://www.gov.me/dokumenta/2f53913b-5300-4dbf-9b96-2efa1180085f>.

Education System Digitalization Strategy 2022–2027

digital age. The ***EU Action Plan for Digital Education 2021–2027***¹⁶ identifies two priority areas: Encouraging the development of a successful digital education ecosystem; and the development of digital skills and competencies for digital transformation.

The ***EU Digital Strategy*** through its objectives: Strengthening citizens' digital skills; and Protection against cyber threats.

The ***EU Economic and Investment Plan for the Western Balkans*** through the key area – Digital Future.

¹⁶ https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_hr.

OBJECTIVES 2022–2027 AND ACTION PLAN 2022–2023

Some indicators presented in the Action Plan must be quantified. For example, it is not possible to predict the total number of electronic services or digitalized processes that rely on the Education Information System, because it is a scalable system that is being continuously upgraded according to needs. At the same time, due to the change of technology from year to year, it is also difficult to define more visible progress, e.g. expressed as a percentage.

STRATEGIC GOAL 1	IMPROVEMENT OF THE EDUCATION INFORMATION SYSTEM					
OBJECTIVE 1.1	Improvement of the legislation					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Number of newly created and redesigned tools	0	4	6		8	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Development of the Rulebook on the Manner of Data Storage in the Education Information System	MESCS	Rulebook on the Manner of Data Keeping in the Education Information System adopted	III quarter 2022	IV quarter 2022	€1,500	Budget
Development of the Procedure for Creating and Storing Backups	MESCS	Procedure for Creating and Storing Backups adopted	II quarter 2022	III quarter 2022	€1,000	Budget

Education System Digitalization Strategy 2022–2027

Amendments to the Rulebook on Norms and Standards for Acquiring Funds from Public Revenues for Institutions that Implement Publicly Applicable Educational Programmes	MESCS	Amendments to the Rulebook on Norms and Standards for Acquiring Funds from Public Revenues for Institutions that Implement Publicly Applicable Educational Programmes adopted	I quarter 2023	II quarter 2023	€500	Budget
Drafting of the Rulebook on the Manner of Appointing School and Regional ICT Coordinators	MESCS	Rulebook on the Manner of Appointing School and Regional ICT Coordinators adopted	II quarter 2022	III quarter 2022	€1,500	Budget
OBJECTIVE 1.2	Improvement of the hardware infrastructure					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Status of the Data Centre	Equipment in the Data Centre 11 years old	Change of equipment in the Data Centre	Procurement of spare parts		Stable Data Centre established	
Status of the Disaster Recovery Site	No Disaster Recovery Site established	Disaster Recovery Site established	Model for control of work and physical control of the Disaster Recovery established		Stable Disaster Recovery system established	
Status of the Dislocated Backup	No Dislocated Backup established	Dislocated Backup introduced	Removable media (tapes or disks) provided for backup		Stable Displaced Backup established, regular copy testing model established	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Improving the physical construction of the Data Centre (construction works, replacement of air conditioners, antistatic floor)	MESCS	Improved physical construction of the Data Centre	III quarter 2022	IV quarter 2022	€10,000	Budget
Procurement and implementation of new equipment in the Data Centre (primary location)	MESCS	New equipment in the Data Centre (primary location) implemented	III quarter 2022	III quarter 2023	€350,000	EIB

Education System Digitalization Strategy 2022–2027

Procurement of equipment and establishment of Disaster Recovery site (secondary location)	MESCS	Disaster Recovery introduced	III quarter 2022	III quarter 2023	€200,000	EIB
Establishing a Dislocated Backup	MESCS	Dislocated Backup introduced	I quarter 2023	III quarter 2023	€30,000	Budget
Maintenance of hardware infrastructure at the primary and secondary locations	MESCS	Maintenance contract signed	IV quarter 2022	IV quarter 2023	€50,000 (€25,000 per year)	Budget
OBJECTIVE 1.3	Development and upgrade of software components					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Number of new and implemented modules in the application	0	3	6		9	
Percentage of improved and implemented modules in the application	35%	60%	80%		100%	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Creation and implementation of the Administrator module	MESCS	Administrative module created, 8 employees of MESCS trained	I quarter 2022	IV quarter 2022	€25,000	Budget
Creation and implementation of modules for speech therapists and special educators	MESCS	Modules for speech therapists and special educators created, 70 speech therapists and special educators trained	I quarter 2022	IV quarter 2022	€4,000	UNICEF
Improving the School module	MESCS	School module improved, 240 employees in educational institutions trained	I quarter 2023	IV quarter 2023	€22,500	Budget

Education System Digitalization Strategy 2022–2027

Upgrading the Grades module	MESCS	Grades module upgraded, 500 teachers trained	I quarter 2022	IV quarter 2022	€15,000	Budget
Upgrading the Reports module	MESCS	Reports module upgraded, 240 employees in educational institutions trained	I quarter 2023	IV quarter 2023	€15,000	Budget
Upgrading the Administration IS module	MESCS	Administration IS module upgraded, 180 ICT coordinators trained	I quarter 2023	IV quarter 2023	€3,000	Budget
Creation and implementation of the Equipment module	MESCS	Equipment module upgraded, 180 ICT coordinators trained	I quarter 2022	IV quarter 2022	€6,000	Budget
Software maintenance at primary and secondary locations	MESCS	Maintenance contract signed	I quarter 2022	IV quarter 2023	€50,000 (€25,000 annually)	Budget
Implementation of records of grades in primary music schools	MESCS	Implemented in 14 institutions	I quarter 2022	II quarter 2022	€8,000	Budget
Implementation of module for records of maintenance of educational facilities	MESCS	Implementation of module for records of maintenance of educational facilities in 240 institutions	I quarter 2023	IV quarter 2023	€3,000	Budget
OBJECTIVE 1.4	Improvement of data processing, use, accuracy and reliability					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Percentage of educational institutions that have received advisory support	0%	30%	60%		100%	
Number of business processes covered by self-guided training	0	15	20		25	

Education System Digitalization Strategy 2022–2027

Number of institutions/companies/organizations that are familiar with the Education Information System	7	15	25		35	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Organization of advisory meetings of principals and assistant principals on records and application of modules of the Education Information System	MESCS	5 advisory meetings	I quarter 2022	IV quarter 2023	€1,000	Budget
Organization of advisory meetings of homeroom teachers on records and application of the Education Information System module	MESCS	10 advisory meetings	I quarter 2022	IV quarter 2023	€2,000	Budget
Organization of advisory meetings for teachers on records and application of the modules of the Education Information System	MESCS	10 advisory meetings	I quarter 2022	IV quarter 2023	€2,000	Budget
Organization of advisory meetings for professional associates on records and application of the Education Information System modules	MESCS	5 advisory meetings	I quarter 2022	IV quarter 2023	€1,000	Budget
Organization of advisory meetings for ICT coordinators on records and application of the Education Information System modules	MESCS	5 advisory meetings	I quarter 2022	IV quarter 2023	€1,000	Budget
Development of self-guided trainings on the use of the MEIS application	MESCS	15 self-guided trainings	I quarter 2022	IV quarter 2023	€15,000	Budget
Promotion of the Education Information System	MESCS	5 presentations	I quarter 2022	IV quarter 2023	€1,000	Budget

Education System Digitalization Strategy 2022–2027

OBJECTIVE 1.5	Establishment of the interoperability and development of electronic services					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Creation of new and upgraded existing e-services	13 electronic services	15 e-services (2 new and 2 upgraded)	17 e-services		18 e-services	
Digitalization of new processes	6 digitalized processes	8 digitalized processes	10 digitalized processes		12 digitalized processes	
Number of endpoints	13	15	17		20	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Improving electronic enrolment in higher education institutions (private faculties)	MESCS and MPADSM	Electronic enrolment in higher education institutions improved	I quarter 2022	II quarter 2022	€8,000	Budget
Improving electronic enrolment in preschool institutions (private institutions and connecting groups)	MESCS	Electronic enrolment in private preschool institutions improved	I quarter 2022	II quarter 2022	€5,000	Budget
Identification of out-of-school children in Montenegro	MESCS, MoI, MFSW	A system for determining that a child is not in school established and implemented	I quarter 2023	IV quarter 2023	€8,000	Budget
Identification of children with illegal residence in Montenegro	MESCS, MoI	System for identification of children with illegal residence in Montenegro established and implemented	I quarter 2023	IV quarter 2023	€8,000	Budget

Education System Digitalization Strategy 2022–2027

Connect MEIS data with PISA testing	MESCS and ECMN	Exchange of data and analytics established	I quarter 2023	IV quarter 2023	€10,000	Budget
Improve information for parents with information from other departments (health, home affairs, social services, etc.)	MESCS	Parent information system improved	I quarter 2023	II quarter 2023	€1,000	Budget
OBJECTIVE 1.6	Improvement of the HR structure					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Increase in the number of employees in the Section for ICT, Statistics and Digitalization	8 employees with open-end contracts	9 employees with open-end contracts	10 employees with open-end contracts		11 employees with open-end contracts	
Number of implemented training activities for ICT coordinators	30	40	50		60	
Number of implemented training activities for employees in the Section for ICT, Statistics and Digitalization	0	3	6		9	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Create a training programme for ICT coordinators to use the MEIS application	MESCS	A training programme for ICT coordinators to use the MEIS application created	III quarter 2022	IV quarter 2022	€1,500	Budget
Implementation of training for ICT coordinators	MESCS	10 trainings realized (180 ICT coordinators)	I quarter 2023	IV quarter 2023	€3,200	Budget
Modification of systematization (increase in the number of employees) – ICT Department	MESCS	Systematization modified (increase in the number of posts)	III quarter 2022	I quarter 2023	€1,000	Budget

Education System Digitalization Strategy 2022–2027

Filling of vacancies in the ICT Department	MESCS	1 person employed	I quarter 2023	IV quarter 2023	€10,000	Budget
Training of employees in the ICT Department for monitoring in the Data Centre	MESCS	Training for 8 employees in the ICT Department	III quarter 2023	IV quarter 2023	€1,000	Budget
Training of employees in the ICT Department for the backup system	MESCS	Training for 8 employees in the ICT Department	II quarter 2022	IV quarter 2022	€1,000	Budget
Training of employees in the ICT Department in the use of the firewall	MESCS	Training for 8 employees in the ICT Department	I quarter 2023	II quarter 2023	€1,000	Budget
STRATEGIC GOAL 2	DEVELOPMENT AND IMPROVEMENT OF THE DIGITAL ECOSYSTEM					
OBJECTIVE 2.1	Establishment of mechanisms for planning and development					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Number of acts adopted by the Commission for Digitalization of the Education System (analyses, plans, reports, etc.)	0	5	8		12	
Number of implemented surveys	2	4	6		8	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Establishment and work of the Commission for Digitalization of the Education System	Government of Montenegro	Commission for Digitalization of the Education System established, 8 mtgs of the Commission (4 per year)	I quarter 2022	IV quarter 2023	€24,000	Budget

Education System Digitalization Strategy 2022–2027

Drafting of the Rules of Procedure of the Commission for Digitalization of the Education System	MESCS, Commission for Digitalization of the Education System	Rules of Procedure of the Commission for Digitalization of the Education System adopted	II quarter 2022	III quarter 2022	€1,500	Budget
Analysis of profiles and levels of education of teachers who teach courses/modules in the field of ICT in primary and secondary schools	MESCS, Commission for Digitalization of the Education System	Analysis of the structure of teaching staff that teaches IT courses/ modules adopted	III quarter 2022	IV quarter 2022	€2,000	Budget
Development of a plan for an increase in the knowledge of teachers who teach computer science courses in primary and secondary schools	MESCS, Commission for Digitalization of the Education System	Plan for increasing the level of knowledge of computer science teachers produced	III quarter 2022	I quarter 2023	€2,500	Budget
Conducting research in primary and secondary schools in the field of digital education using the SELFIE tool	MESCS, Commission for Digitalization of the Education System	SELFIE survey conducted in primary and secondary schools, SELFIE Survey Report adopted	I quarter 2022	IV quarter 2023	€4,000 (€2,000 annually)	Budget
Analysis of relevant national and international recommendations for improving the digital competencies of teachers	MESCS, CVE, BES, Commission for Digitalization of the Education System	Report on relevant national and international recommendations for improving the digital competencies of teachers	III quarter 2022	I quarter 2023	€2,500	Budget
Analysis of the current state of digital competencies of teachers	MESCS, CVE, BES, Commission for Digitalization of the Education System	Report on the current state of digital competencies of teachers	III quarter 2022	I quarter 2023	€2,500	Budget
Development of a Framework for the Development of Digital Competencies of Teachers	MESCS, CVE, BES, Commission for Digitalization of the Education System, National Education Council	Framework for the Development of Digital Competencies of Teachers developed	II quarter 2023	IV quarter 2023	€3,500	Budget
Analysis of existing educational programmes for primary and secondary school in the area of use of information and communication technologies	MESCS, CVE, BES,	Report on the Analysis of Existing Educational Programmes for Primary and Secondary Schools in the area of use of information and communication technologies	I quarter 2022	II quarter 2022	€2,000	Budget
Modification of the curriculum for primary school in order to improve the digital competencies of students	MESCS, BES, National Education Council	Curriculum for primary schools modified	III quarter 2022	IV quarter 2022	€1,500	Budget

Education System Digitalization Strategy 2022–2027

Modification of the curriculum for general secondary education in order to improve students' digital competencies	MESCS, BES, National Education Council	Curriculum for general secondary education modified	III quarter 2022	IV quarter 2022	€1,500	Budget
Development of the course programme in computer science for primary school	BES, National Education Council	Course programme in computer science for primary school developed	I quarter 2023	II quarter 2023	€1,500	Budget
Improving existing course programmes in the field of ICT for high school	BES, CVE, National Education Council	Course programmes in the field of ICT improved	I quarter 2023	II quarter 2023	€6,000	Budget
OBJECTIVE 2.2	Improvement of legislation					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Number of newly created legal acts	0	6	8		10	
Number of amended legal acts	0	4	6		8	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Amendments to the General Law on Education and Upbringing in the field of organization of the educational process (digital textbooks, etc.)	MESCS	Amendments to the General Law on Education and Upbringing adopted	I quarter 2022	II quarter 2022	€1,000	Budget
Development of the Rulebook for the implementation of the educational process in the online mode	MESCS	Rulebook for the implementation of the educational process in the online mode adopted	III quarter 2022	IV quarter 2022	€2,500	Budget
Development of Procedures for dealing with cyber incidents in educational institutions	MESCS, MOI, MPADSM and CIRT (DCDP)	Procedures for dealing with cyber incidents adopted	IV quarter 2022	II quarter 2023	€1,500	Budget

Education System Digitalization Strategy 2022–2027

Development of Procedures for the Development of Digital Educational Content, Their Installation and Management on the Platform for Independent Learning	MESCS	Procedures for the Development of Digital Educational Content, Their Installation and Management on the Platform for Independent Learning adopted	II quarter 2022	IV quarter 2022	€2,000	Budget
Development of Quality Standards for Digital Editions of Textbooks and Instructional Materials	ITTA	Quality Standards for Digital Editions of Textbooks and Instructional Materials adopted	I quarter 2022	II quarter 2022	€4,000	UNICEF
Amendments to the Rulebook on the Procedure for Obtaining, Assessing, Approving and Preparing Textbooks and Teaching Aids	MESCS, ITTA	Amendments to the Rulebook on the Procedure for Obtaining, Assessing, Approving and Preparing Textbooks and Teaching Aids adopted	II quarter 2022	IV quarter 2022	€1,000	Budget
Development of the Rulebook on Copyright Regulation for Digital Educational Content	MESCS, ITTA	Rulebook on Copyright Regulation for Digital Educational Content adopted	II quarter 2022	IV quarter 2022	€2,000	Budget
Development of the Procedure for Leasing Computer Equipment to Students	MESCS	Procedure for Leasing Computer Equipment to Students adopted	III quarter 2023	IV quarter 2023	€1,000	Budget
Amendments to the Rulebook on Taking the Professional Exam for Teachers	MESCS	Amendments to the Rulebook on Taking the Professional Exam for Teachers adopted	III quarter 2022	IV quarter 2022	€1,000	Budget
Amendments to the Rulebook on the Detailed Conditions, Manner and Procedure for Issuing and Renewing Work Permits for Teachers, Principals and Assistant Directors of Educational Institutions	MESCS	Amendments to the Rulebook on the Detailed Conditions, Manner and Procedure for Issuing and Renewing Work Permits for Teachers, Principals and Assistant Directors of Educational Institutions adopted	III quarter 2022	IV quarter 2022	€1,000	Budget

Education System Digitalization Strategy 2022–2027

OBJECTIVE 2.3	Improvement of the IT infrastructure in educational institutions					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Computer:student ratio in schools	1:15	1:13	1:12		1:11	
Percentage of facilities that have implemented a local computer network	65%	75%	85%		100%	
Availability of internet in regional facilities	47%	55%	75%		100%	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Equipping educational institutions with computer equipment	MESCS	Computer:student ratio in schools 1:13	II quarter 2022	III quarter 2023	€5,000,000 (€4,000,000 in the first year from EIB, €1,000,000 in the second year from the Budget)	EIB and Budget
Procurement of equipment for school libraries for work and rental of equipment to students	MESCS	50 school libraries equipped	III quarter 2022	III quarter 2023	€375,000	Budget
Installation of a local computer network in educational institutions	MESCS	Raise the percentage of facilities that have a local computer network by 10%	III quarter 2022	IV quarter 2023	€200,000	Budget

Education System Digitalization Strategy 2022–2027

Installation of internet connection in regional facilities of educational institutions	MESCS and operators	Internet installed in 100 regional facilities	I quarter 2022	IV quarter 2023	€1,000	Budget
Procurement of satellite internet service for 60 locations	MESCS	Satellite Internet Service Agreement Signed	III quarter 2022	IV quarter 2023	€73,000 (€36,500 annually)	Budget
Analysis of application software needs in accordance with educational programmes	MESCS, BES, CVE	Analysis of application software needs in accordance with educational programmes conducted	I quarter 2022	II quarter 2022	€1,000	Budget
Procurement of licensed operating system and application software	MESCS	Licensed operating system purchased	III quarter 2022	III quarter 2023	€600,000 (€300,000 annually)	Budget
OBJECTIVE 2.4	Development of the education digital content					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Number of textbooks supplemented with digital content	0	5	10		15	
Number of digital contents for talented children and children with special educational needs	1	5	10		15	
Number of digital contents on special topics (programming, science, art, etc.)	0	5	10		15	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Production of the publication Quality Standards of Digital Editions of Textbooks and Instructional Materials	ITTA	Publication Quality Standards of Digital Editions of Textbooks and Instructional Materials produced	I quarter 2022	II quarter 2022	€2,000	UNICEF

Education System Digitalization Strategy 2022–2027

Presentation of the publication Quality Standards of Digital Editions of Textbooks and Instructional Materials to the professional public	ITTA	Representatives of: MESCS, ITTA, BES, CVE, EC and possibly Colleges for teachers	I quarter 2022	II quarter 2022	€4,000	Budget and UNICEF
Development of digital educational content that complements the printed textbook	ITTA	10 contents	II quarter 2022	IV quarter 2023	€100,000	Budget
Creating digital educational content that is independent of printed textbooks, e.g. STEM, art, eLektira (electronic books).	ITTA	3 contents	II quarter 2022	IV quarter 2023	€30,000	Budget
Development of digital educational content for children with special educational needs	ITTA	3 contents	II quarter 2022	IV quarter 2023	€30,000	Budget
Creating materials for children on the topic of cyber security	ITTA	3 contents	II quarter 2022	IV quarter 2023	€30,000	Budget
OBJECTIVE 2.5	Establishment of platform for independent learning					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025	Target value by the end of 2027		
Percentage of children using the platform for independent learning	0	20%	50%	70%		
Percentage of employees in educational institutions (management, professional associates and teachers) who use the platform for independent learning	0	30%	60%	100%		

Education System Digitalization Strategy 2022–2027

Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Establishment of a platform for independent learning	MESCS	A distance learning platform established	I quarter 2022	I quarter 2022	€5,000	UNICEF
Appointment and training of chief platform administrators	MESCS	Chief platform administrators appointed and trained	II quarter 2022	II quarter 2022	€200	UNICEF
Development of materials for children	MESCS	20 materials	II quarter 2022	IV quarter 2023	€30,000	Budget and UNICEF
Development of materials for parents	MESCS	10 materials	II quarter 2022	IV quarter 2023	€10,000	Budget
Development of materials for employees in educational institutions	MESCS	20 materials	II quarter 2022	IV quarter 2023	€30,000	Budget
Training of employees to use the platform for independent learning	MESCS	5,000 employees	II quarter 2022	IV quarter 2023	€12,500	Budget and UNICEF
OBJECTIVE 2.6	Improvement of online collaboration in all institutions dealing with education					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025	Target value by the end of 2027		
Percentage of employees in educational institutions using online collaboration tools	55%	70%	85%	100%		

Education System Digitalization Strategy 2022–2027

Percentage of students using online collaboration tools	60%	75%	90%	100%		
Percentage of employees in educational institutions using online collaboration tools	1%	15%	30%	45%		
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Modification/extension of the “Digital School” concept with a platform for independent learning	MESCS	“Digital School” concept extended	I quarter 2022	II quarter 2022	€2,000	Budget and UNICEF
Presentation of the “Digital School” concept	MESCS	6 presentations held	II quarter 2022	II quarter 2023	€1,000	Budget and UNICEF
Development of a concept for online collaboration of educational institutions	MESCS	Concept for online collaboration of educational institutions developed	II quarter 2022	III quarter 2023	€2,500	Budget
Establishing a model for online collaboration in the Ministry of Education, Science, Culture and Sport	MESCS	A model for online collaboration established in the MESCS, the percentage of employees actively using online collaboration tools	III quarter 2022	IV quarter 2022	€800	Budget
Establishing a model for online collaboration in the Bureau of Education Services	MESCS and BES	A model for online collaboration established in the BES, the percentage of employees actively using online collaboration tools	III quarter 2022	IV quarter 2022	€800	Budget
Establishing a model for online collaboration at the Centre for Vocational Education	MESCS and CVE	A model for online collaboration established in the CVE, the percentage of employees actively using online collaboration tools	III quarter 2022	IV quarter 2022	€400	Budget
Establishing a model for online collaboration in the Examination Centre	MESCS and ECME	A model for online collaboration established in the ECME, the percentage of employees actively using online collaboration tools	III quarter 2022	IV quarter 2022	€400	Budget

Education System Digitalization Strategy 2022–2027

Establishing a model for online collaboration in the Institute for Textbooks and Teaching Aids	MESCS and ITTA	A model for online collaboration established in the ITTA, the percentage of employees actively using online collaboration tools	III quarter 2022	IV quarter 2022	€400	Budget
STRATEGIC GOAL 3	DEVELOPMENT AND IMPROVEMENT OF DIGITAL SKILLS AND COMPETENCIES					
OBJECTIVE 3.1	Raising the levels of digital skills and competencies of employees in educational institutions					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Percentage of employees in educational institutions trained according to the ECDL Start programme	20%	27%	35%		45%	
Percentage of trained employees in educational institutions for the application of the 'Digital School' concept	40%	50%	60%		70%	
Percentage of teachers trained to apply digital key competencies in teaching	0%	10%	20%		30%	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Training of employees in educational institutions according to the ECDL Start programme	MESCS, BES, CVE	750 employees trained and certified	I quarter 2022	IV quarter 2023	€60,000	Budget
Training of employees in educational institutions for the application of the 'Digital School' concept	MESCS, BES, CVE	1,000 employees trained and certified	I quarter 2022	IV quarter 2023	€16,000	Budget
Teacher training for the application of digital key competencies in teaching	MESCS, BES, CVE	1,000 teachers trained	I quarter 2022	IV quarter 2023	€48,000	UNICEF, Budget

Education System Digitalization Strategy 2022–2027

Teacher training for acquiring digital professional competencies	MESCS, BES, CVE	50 teachers trained	I quarter 2022	IV quarter 2023	€3,600	Budget
Training of teachers to work with talented students in the field of ICT	MESCS, BES, CVE, ECME	20 teachers trained	I quarter 2022	IV quarter 2023	€600	Budget
Teacher training for the application of ICT in working with children with special educational needs	MESCS, BES, CVE	400 teachers trained	I quarter 2022	IV quarter 2023	€10,000	Budget
OBJECTIVE 3.2	Raising the level of digital skills and competencies of students with a special focus on children and young people from vulnerable groups					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025		Target value by the end of 2027	
Percentage of primary and secondary schools that have clubs/groups in the field of ICT	10%	20%	35%		50%	
Number of primary and secondary school students who attended thematic camps in the field of ICT	0 in academic year 2020/2021	60	120		180	
Percentage of primary and secondary school students who participated in activities in schools and colleges/companies realized in cooperation with colleges and ICT companies	1.5%	3%	5%		7%	
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Implementation of the Student Digital Competency Framework	BES, CVE	1. No of promotional activities 2. No of schools that have included the implementation of digital key competences in the annual work plan through the school curriculum	I quarter 2022	IV quarter 2023	€1,000	Budget

Education System Digitalization Strategy 2022–2027

Establishment of clubs/groups in the field of ICT	Primary and secondary schools	1. Number of established clubs/groups in the field of ICT 2. Number of students involved in ICT clubs/groups	I quarter 2022	IV quarter 2023	€1,000	Budget
Organization of thematic camps in the field of ICT	MESCS, BES, CVE, ECME	Number of organized thematic camps in the field of ICT, number of children participating in thematic ICT camps	III quarter 2022	III quarter 2023	€40,000 (€20,000 annually)	Budget
Encouraging the involvement of colleges and ICT companies in the implementation of teaching, extracurricular and leisure activities in the field of ICT	MESCS, BES, CVE, ECME, primary and secondary schools	Number of implemented activities in schools in cooperation with colleges and ICT companies	I quarter 2022	IV quarter 2023	€1,000	Budget
Organizing competitions in the field of ICT at all levels of education	MESCS, BES, CVE, ECME, colleges, ICT companies/communities, primary and secondary schools	1. Number of organized competitions 2. Number of students who participated in competitions	I quarter 2022	IV quarter 2023	€80,000 (€40,000 annually)	Budget
Organizing visits of primary and secondary school students to ICT companies	Chamber of Commerce, Employers' Federation, ICT companies, primary schools, general secondary schools	Number of students who visited ICT companies	I quarter 2022	IV quarter 2023	€3,000	Budget
Organizing practical classes for high school students in ICT companies	Chamber of Commerce, Employers' Federation, ICT companies, high schools	Number of students who participated in practical classes in ICT companies	I quarter 2022	IV quarter 2023	€1,000	Budget
OBJECTIVE 3.3	Improvement of the safe use of technology					
Performance indicator	Baseline	Target value by the end of 2023	Target value by the end of 2025	Target value by the end of 2027		
Percentage of employees (management, administration and teachers) trained under general training programme in the field of cybersecurity	0	15%	30%	50%		
Percentage of employees trained under specialized training programme in the field of cybersecurity	0	20%	40%	60%		

Education System Digitalization Strategy 2022–2027

Number of students involved in cybersecurity activities	300 students in 2020	600 students (300 students per year)	800 students (400 students per year)	1,000 students (500 students per year)		
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Creating and accrediting a general cybersecurity training programme for all employees in educational institutions	MESCS, BES, CVE, MPADSM, CIRT (DCDP)	General cybersecurity training programme for all employees in educational institutions created and accredited	III quarter 2022	IV quarter 2022	€1,200	Budget
Creating and accrediting a specialized cybersecurity training programme for school ICT coordinators	MESCS, BES, CVE, MPADSM, CIRT (DCDP)	Specialized training programme for school ICT coordinators created and accredited	III quarter 2022	IV quarter 2023	€1,200	Budget
Implementation of a general training programme on cybersecurity for employees in educational institutions	MESCS, BES, CVE, MPADSM, CIRT (DCDP)	1,800 employees trained	I quarter 2023	IV quarter 2023	€14,500	Budget
Implementation of a specialized training programme on cybersecurity for school ICT coordinators	MESCS, BES, CVE, MPADSM, CIRT (DCDP)	180 ICT coordinators trained	I quarter 2023	IV quarter 2023	€1,600	Budget
Development of infographics for dealing with cyber incidents in educational institutions	MESCS, BES, CVE, MPADSM, CIRT (DCDP)	Infographics for dealing with cyber incidents in educational institutions developed	III quarter 2023	IV quarter 2023	€500	Budget
Creation and organization of a workshop on cybersecurity for ages 9 to 11	MESCS, BES, MPADSM, CIRT (DCDP)	Number of organized workshops, number of children included in workshops	I quarter 2022	IV quarter 2023	€3,200	Budget
OBJECTIVE 3.4	Improvement of the digital skills and competencies and application of digital technologies through promotional campaigns					
Performance indicator	Initial value	Target value by the end of 2023	Target value by the end of 2025	Target value by the end of 2027		
Percentage of schools involved in promotional activities in the field of ICT	20%	30%	40%	50%		

Education System Digitalization Strategy 2022–2027

Number of participants covered by promotional activities in non-formal education in the field of ICT	0	200	400	600		
Percentage of high school students covered by promotional activities of ICT occupations	0%	5%	10%	15%		
Activity that affects implementation of the Objective 2022–2023	Responsible institutions	Results indicator	Start date	Planned end date	Funds planned for implementation of activity	Source of finance
Promotion of relevant online competitions in the field of ICT	MESCS, BES, CVE,ECMN	Number of promoted competitions	I quarter 2022	IV quarter 2023	€1,000	Budget
Organizing promotional activities in order to encourage students to participate in competitions in the field of ICT	MESCS, BES, CVE,ECMN	Number of promotional activities to encourage students to participate in ICT competitions, number of students who participated in promotional activities to encourage participation in competitions in the field of ICT	I quarter 2022	IV quarter 2023	€1,000	Budget
Organizing promotional activities in order to encourage non-formal education in the field of ICT	MESCS, CVE	Number of promotional activities to encourage non-formal education in the field of ICT	II quarter 2022	III quarter 2023	€2,000	Budget
Promoting IT occupations to high school students	MESCS, BES, CVE, ECMN, universities, ICT companies/ communities, primary and secondary schools	Number of promotional activities for IT occupations for high school students, number of students who participated in promotional activities for IT occupations	II quarter 2022	II quarter 2023	€2,000	Budget
Celebrating International Safer Internet Day	MESCS, BES, CVE, ECMN, universities, ICT companies/ communities, primary and secondary schools	Two International Safer Internet Days celebrated, number of children who participated in the celebration of International Safer Internet Day, number of teachers who participated in the celebration of International Safer Internet Day	I quarter 2022	I quarter 2023	€1,000	Budget

Education System Digitalization Strategy 2022–2027

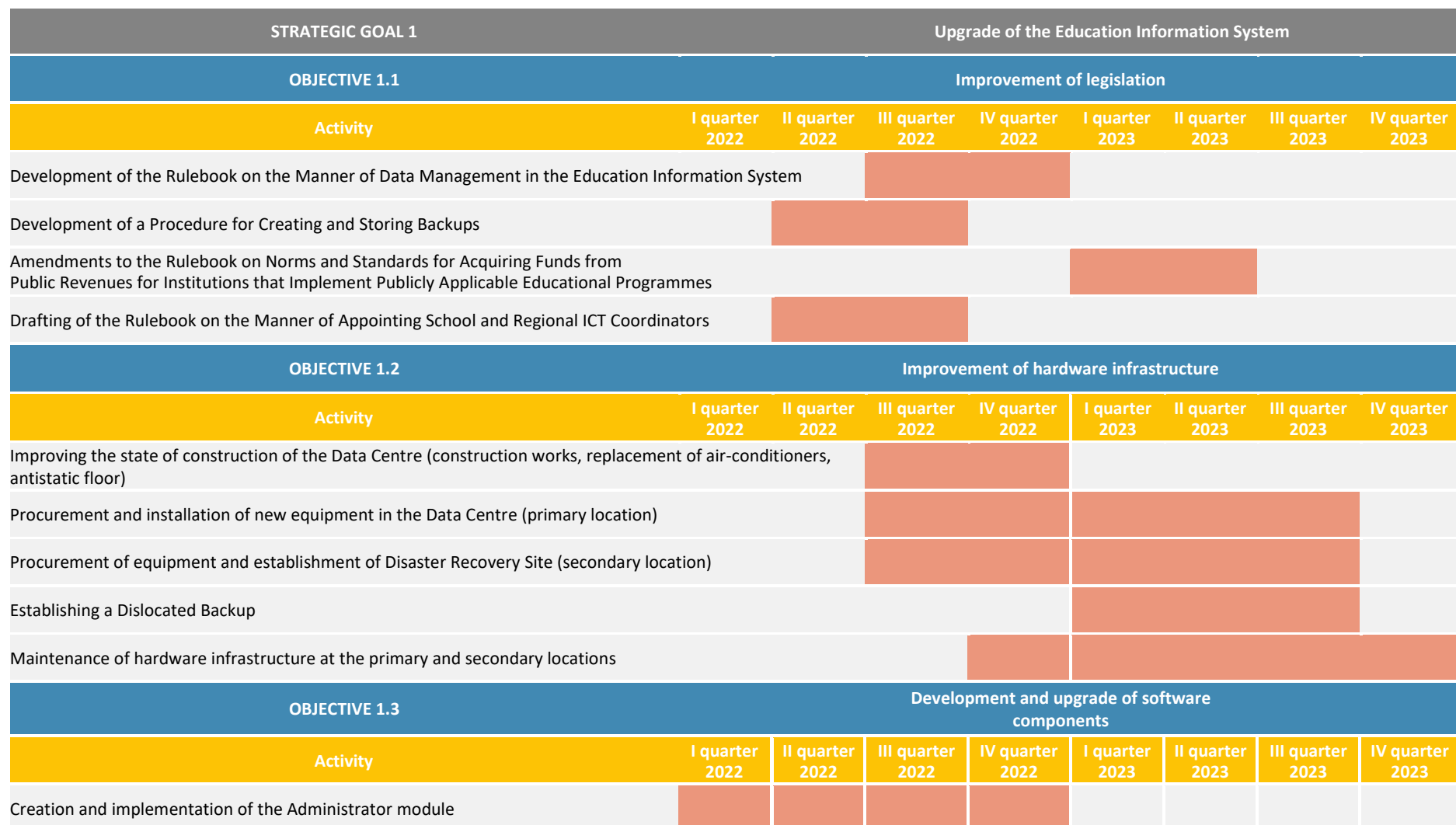
Celebrating International Girls in ICT Day	MESCS, BES, CVE, ECMN, universities, ICT companies/ communities, primary and secondary schools	Two International Girls in ICT Days celebrated, number of girls who participated in the celebration of International Girls in ICT Day	II quarter 2022	II quarter 2023	€1,000	Budget
Promoting international mobility programmes for students and teachers	BES, CVE	Number of promotional activities	II quarter 2022	II quarter 2023	€1,000	Budget

For the implementation of the Action Plan of the Strategy for the first two years, it is necessary to allocate €3,125,400 from the Budget (€1,532,100 for 2022 and €1,593,300 for 2023), while the allocations from the Budget for the remaining period of implementation of the Strategy will amount to approximately €1,000,000 annually.

UNICEF donations will support activities from the Action Plan in the amount of €112,700, while investment of €4,550,000 is planned through a loan from the European Investment Bank.

Education System Digitalization Strategy 2022–2027

Gantt chart



Education System Digitalization Strategy 2022–2027

Creation and implementation of modules for speech therapists and special educators								
Improving the School module								
Improving the Grades module								
Improving the Reports module								
Improving the Administration IS module								
Creation and implementation of the Equipment module								
Maintenance of software at the primary and secondary locations								
Implementation of records of grades in primary music schools								
Implementation of the module for records of maintenance of facilities belonging to educational institutions								
OBJECTIVE 1.4	Improvement of data processing, usage, accuracy and reliability							
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023
Organization of a consultative meeting of directors and assistant directors on recording and use of the Education Information System modules								
Organization of a consultative meeting of home-education teachers on recording and use of the Education Information System modules								
Organization of a consultative meeting of teachers on recording and use of the Education Information System modules								
Organization of a consultative meeting of professional assistants on recording and use of the Education Information System modules								
Organization of a consultative meeting of ICT coordinators on recording and use of the Education Information System modules								
Development of self-guided training for the use of the MEIS application								
Promotion of the Education Information System								

Education System Digitalization Strategy 2022–2027

OBJECTIVE 1.5		Establishment of interoperability and development of electronic services							
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023	
Improving electronic enrolment in higher education institutions (private universities)									
Improving electronic enrolment in preschool institutions (private institutions and connecting groups)									
Identification of out-of-school children in Montenegro									
Identification of children with illegal residence in Montenegro									
Link MEIS data with PISA testing									
Improving information for parents with information from other departments (health, internal affairs, social welfare, etc.)									
OBJECTIVE 1.6		Improvement of the HR structure							
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023	
Creation of a training programme for ICT coordinators to use the MEIS application									
Implementation of training for ICT coordinators									
Modification of systematization (increase in the number of employees) – ICT Department									
Filling vacancies in the ICT Department									
Training of employees in the ICT Department for monitoring in the Data Centre									
Training of employees in the ICT Department for the backup system									
Training of employees in the ICT Department in the use of firewalls									

Education System Digitalization Strategy 2022–2027

STRATEGIC GOAL 2	Development and improvement of the digital ecosystem							
OBJECTIVE 2.1	Establishment of a planning and development mechanism							
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023
Establishment and work of the Commission for Digitalization of the Education System								
Drafting of the Rules of Procedure of the Commission for Digitalization of the Education System								
Analysis of profiles and levels of education of teachers who teach courses/modules in the area of ICT in primary and secondary schools								
Development of a Plan for the improvement of teachers who teach the course in computer science in primary and secondary schools								
Conducting research in primary and secondary schools in the field of digital education using the SELFIE tool								
Analysis of relevant national and international recommendations for the improvement of the digital competencies of teachers								
Analysis of the current state of the digital competencies of teachers								
Development of a Framework for the Development of the Digital Competencies of Teachers								
Analysis of existing educational programmes for primary and secondary schools in terms of the use of information and communication technologies								
Modification of the curriculum for primary schools in order to improve students' digital competencies								
Modification of the curriculum for high schools (general secondary schools) in order to improve students' digital competencies								
Development of the subject programme in Computer Science for primary schools								
Improving the existing course programmes in the field of ICT for high schools								

Education System Digitalization Strategy 2022–2027

OBJECTIVE 2.2		Improvement of the legislation							
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023	
Amendments to the General Law on Education in the field of organization of the educational process (digital textbooks, etc.)									
Development of the Rulebook for the Realization of the Educational Process in the Online Mode									
Development of Procedures for Dealing with Cyber Incidents in Educational Institutions									
Development of Procedures for the Development of Digital Educational Content, their installation and management on the platform for independent learning									
Development of Quality Standards for Digital Editions of Textbooks and Instructional Materials									
Amendments to the Rulebook on the Procedure for Obtaining, Evaluating, Approving and Preparing Textbooks and Teaching Aids									
Development of the Rulebook on Copyright Regulation for Digital Educational Content									
Development of the Procedure for Leasing Computer Equipment to Students									
Amendment to the Rulebook on Taking the Professional Teachers' Exam									
Amendments to the Rulebook on the Detailed Conditions, Manner and Procedure for Issuing and Renewing Work Permits for Teachers, Principals and Assistant Directors of Educational Institutions									
OBJECTIVE 2.3		Improvement of the computer infrastructure in educational institutions							
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023	
Equipping educational institutions with computer equipment									
Procurement of equipment for school libraries for work and for leasing of equipment to students									
Installation of a local computer network in educational institutions									

Education System Digitalization Strategy 2022–2027

Introduction of internet connections in the regional facilities of educational institutions									
Procurement of satellite internet service for 60 locations									
Analysis of the application software needs in accordance with educational programmes									
Procurement of licensed operating systems and application software									
OBJECTIVE 2.4		Development of digital educational content							
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023	
Production of the publication Quality Standards of Digital Editions of Textbooks and Instructional Materials									
Presentation of the publication of the Quality Standard for Digital Editions of Textbooks and Instructional Materials to the professional public									
Development of digital educational content that complements printed textbooks									
Creation of digital educational content that is independent of printed textbooks, e.g. STEM, art, eLektira									
Development of digital educational content for children with special educational needs									
Creation of materials for children on the topic of cybersecurity									
OBJECTIVE 2.5		Establishment of a platform for independent learning							
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023	
Establishing a platform for independent learning									
Appointment and training of chief platform administrators									
Development of materials for children									
Development of materials for parents									
Development of materials for employees in educational institutions									

Education System Digitalization Strategy 2022–2027

Training of employees to use the platform for independent learning								
OBJECTIVE 2.6		Improvement of online collaboration in all institutions dealing with education						
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023
Modification/extension of the “Digital School” concept with a platform for independent learning								
Presentation of the “Digital School” concept								
Development of a concept for online collaboration of educational institutions								
Establishing a model for online collaboration in the Ministry of Education, Science, Culture and Sport								
Establishing a model for online collaboration in the Bureau of Education Services								
Establishing a model for online collaboration at the Centre for Vocational Education								
Establishing a model for online collaboration in the Examination Centre								
Establishing a model for online collaboration in the Institute of Textbooks and teaching aids								
STRATEGIC GOAL 3		Development and improvement of digital skills and competencies						
OBJECTIVE 3.1		Raising the levels of digital skills and competencies of employees in educational institutions						
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023
Training of employees in educational institutions according to the ECDL Start programme								
Training of employees in educational institutions for the application of the “Digital School” concept								
Teacher training for the application of digital key competences in teaching								
Teacher training for acquiring digital professional competencies								
Training of teachers to work with talented students in the field of ICT								

Education System Digitalization Strategy 2022–2027

Training of teachers for the use of ICT in working with children with special education needs								
OBJECTIVE 3.2		Raising the level of digital skills and competencies of students with a special focus on children and young people from vulnerable groups						
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023
Implementation of the Student Digital Competence Framework								
Establishment of clubs/groups in the field of ICT								
Organizing thematic camps in the field of ICT								
Encouraging the involvement of faculties and ICT companies in the implementation of teaching, extracurricular and optional activities in the field of ICT								
Organizing competitions in the field of ICT at all levels of education								
Organizing visits of primary and secondary school students to ICT companies								
Organizing practical classes for high school students in ICT companies								
OBJECTIVE 3.3		Improving the safe use of technology						
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023
Creation and accreditation of a general cybersecurity training programme for all employees in educational institutions								
Creation and accreditation of a specialized cybersecurity training programme for school ICT coordinators								
Implementation of a general training programme on cybersecurity for employees in educational institutions								
Implementation of a specialized training programme on cybersecurity for school ICT coordinators								
Development of infographics for dealing with cyber incidents in educational institutions								
Creation and implementation of a workshop on cybersecurity for children aged 9–11								

Education System Digitalization Strategy 2022–2027

OBJECTIVE 3.4	Improvement of digital skills and competencies and the use of digital technologies through promotional campaigns							
Activity	I quarter 2022	II quarter 2022	III quarter 2022	IV quarter 2022	I quarter 2023	II quarter 2023	III quarter 2023	IV quarter 2023
Promotion of relevant online competitions in the field of ICT								
Organization of promotional activities in order to encourage students to participate in ICT competitions								
Organization of promotional activities in order to encourage non-formal education in the area of ICT								
Promotion of IT occupations to high school students								
Celebration of International Safer Internet Day								
Celebration of International Girls in ICT Day								
Promotion of international mobility programmes for students and teachers								

Annex 1: Compulsory and elective IT courses/modules in secondary schools

Compulsory courses/modules

- **Vocational high schools – Compulsory vocational modules within the modularized educational programmes that have been applied since the academic year 2017/2018:**
- **Computer Science**, studied in the first and second grades of all modularized educational programmes in secondary vocational schools at the level IV1 for 2 hours per week, and in the modularized educational programmes of level III and level II in the first grade for 2 hours per week
- **Basics in Computer Science**, studied in the first grade of the educational programmes: Electronics Technician, Computer Systems and Networks Technician, Electronic Communications Technician and Web and Mobile Application Development Technician, level IV1 for 2 hours per week
- **Computer Science and Programming**, studied in the second grade of the educational programme Mechatronics Technician, level IV1 for 3 hours per week
- **Computer Hardware**, studied in the second grade of the educational programme Electronics Technician of Computer Systems and Networks, level IV1 for 4 hours per week
- **Maintenance of Computer Hardware**, studied in the third grade of the educational programme Electrical Technician of Computer Systems and Networks, level IV1 for 3 hours per week
- **Operating Systems**, studied in the first grade of the educational programme Electrical Technician of Computer Systems and Networks, and Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 3 hours per week
- **Administration of Operating Systems**, studied in the third grade of the educational programme Electrical Technician of Computer Systems and Networks, level IV1 for 4 hours per week
- **Basics of Computer Networks**, studied in the second grade of the educational programme Electrical Technician of Computer Systems and Networks, level IV1 for 2 hours per week
- **Computer Networks**, studied in the third grade of the educational programmes: Electrical Technician of Electronic Communications, level IV1, and Installer of Electronic Communication Systems, level III for 2 hours per week
- **Installation and Maintenance of Computer Networks**, studied in the fourth grade of the educational programme Electrical Technician of Computer Systems and Networks, level IV1 for 4 hours per week
- **Administration of Computer Networks**, studied in the third grade of the educational programme Electrical Technician of Computer Systems and Networks, level IV1 for 4 hours per week
- **Protection of Computer Systems and Networks**, is studied in the fourth grade of the

educational programme Electrical Technician of Computer Systems and Networks, level IV1 for 4 hours per week

- **Relational Databases**, studied in the third grade of the educational programme Electrical Technician of Computer Systems and Networks, level IV1 for 2 hours per week
- **Database Management**, studied in the second grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 4 hours per week
- **Application Software**, studied in the fourth grade of the educational programme Electrical Technician of Computer Systems and Networks, level IV1 for 2 hours per week
- **Basics of Programming**, studied in the second grade of the educational programmes: Electronics Technician and Electrical Technician in Computer Systems and Networks, level IV1 for 3 hours per week
- **Introduction to Programming**, studied in the first grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 5 hours per week
- **Basics of Graphic Design**, studied in the first grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 3 hours per week
- **Introduction to Web Programming**, studied in the second grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 5 hours per week
- **Object-Oriented Programming**, studied in the second grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 4 hours per week
- **Programming of Microcontrollers**, studied in the second grade of the educational programme Electronics Technician, level IV1 for 3 hours per week
- **Web and Mobile Design**, studied in the second grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 2 hours per week
- **Development of Web Applications I**, studied in the third grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 5 hours per week
- **Development of Web Applications II**, studied in the fourth grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 5 hours per week
- **Development of Mobile Applications I**, studied in the third grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 5 hours per week
- **Development of Mobile Applications II**, studied in the fourth grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 5 hours per week
- **Web and Mobile Communication Services**, studied in the third grade of the educational

programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 2 hours per week

- **Production of Multimedia Content**, studied in the third grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 3 hours per week
- **Advanced Front-End Programming**, studied in the fourth grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 3 hours per week
- **Software Project Management**, studied in the fourth grade of the educational programme Electrical Technician for the Development of Web and Mobile Applications, level IV1 for 3 hours per week
- **Software Tools for Design in Electrical Engineering**, studied in the third grade of the educational programmes: Electrical Technician for Energy, Electrical Technician for Electronics, Computer Systems and Networks Electrical Technician, Electronic Communications Technician, level IV1 for 2 hours per week
- **Design in Electrical Engineering**, studied in the fourth grade of the educational programme Electrical Technician for Energy, level IV1 for 3 hours per week
- **Computer Network Design**, studied in the fourth grade of the educational programme Electrical Technician of Computer Systems and Networks, level IV1 for 3 hours per week
- **Design of Telecommunication User Systems**, studied in the fourth grade of the educational programme Electronics Technician, level IV1 for 3 hours per week
- **Application of Software Tools in Mechatronics**, studied in the third grade of the educational programme Mechatronics Technician, level IV1 for 4 hours per week
- **Software Tools for Modelling and Design of Buildings and Spaces**, studied in the second grade of the educational programmes: Technician for Architecture and Interior Design, Technician for Decorating and Arranging Spaces, level IV1 for 4 hours per week
- **Design of Architectural Objects I**, studied in the third grade of the educational programme Technician for Architecture and Interior Design, level IV1 for 5 hours per week
- **Design of Architectural Objects II**, studied in the fourth grade of the educational programme Technician for Architecture and Interior Design, level IV1 for 4 hours per week
- **Interior Design**, studied in the fourth grade of the educational programme Technician for Architecture and Interior Design, level IV1 for 5 hours per week
- **Urban Design and Planning**, studied in the fourth grade of the educational programme Technician for Architecture and Interior Design, level IV1 for 3 hours per week
- **Making a 3D View of Decoration in Space**, studied in the third grade of the educational programme Technician for Decorating and Arranging Space, level IV1 for 3 hours per week
- **Photography and Presentation Techniques**, studied in the fourth grade of the educational programme Technician for Decorating and Arranging Space, level IV1 for 3 hours per week
- **Computer Technical Drawing**, studied in the second grade of the educational programmes: Construction Technician for Civil Engineering and Hydraulic Engineering, Civil Engineering Technician, level IV1 for 4 hours per week
- **Design of Hydraulic Installations**, studied in the fourth grade of the educational programme Construction Technician for Civil Engineering and Hydraulic Engineering, level IV1 for 4 hours per week
- **Development of a Project for the Organization of Construction**, studied in the fourth grade of the educational programmes: Construction Technician for Civil Engineering and Hydraulic Engineering, Construction Technician for Civil Engineering, level IV1 for 4 hours

per week

- **Architectural Design**, studied in the third grade of the educational programme Construction Technician for Building Construction, level IV1 for 4 hours per week
- **Design of Metal and Wooden Structures**, studied in the third grade of the educational programme Construction Technician for Building Construction, level IV1 for 4 hours per week
- **Design of Concrete Structures**, studied in the fourth grade of the educational programme Construction Technician for Building Construction, level IV1 for 5 hours per week
- **Databases**, studied in the third grade of the educational programme Economics Technician, level IV1 for 2 hours per week
- **Business Communication**, studied in the second grade of the educational programme Legal-Administrative Technician, level IV1 for 5 hours per week
- **Computer Drawing in Woodworking**, studied in the second grade of the educational programme Woodworking Technician, level IV1 for 2 hours per week
- **Construction, Modelling and Grading of Textile Products, Clothing Accessories and Clothing Details**, studied in the first grade of the educational programme Fashion Design Technician, level IV1 for 3 hours per week
- **Construction, Modelling and Grading of Women’s and Children’s Clothing**, studied in the second grade of the educational programme Fashion Design Technician, level IV1 for 5 hours per week
- **Construction, Modelling and Grading of Men’s and Light Clothing**, studied in the third grade of the educational programme Fashion Design Technician, level IV1 for 5 hours per week
- **Construction and Modelling of Unique Textile Products and Clothing**, studied in the fourth grade of the educational programme Fashion Design Technician, level IV1 for 5 hours per week

Vocational high schools – Compulsory vocational-theoretical courses/modules within educational programmes adopted before the academic year 2017/2018:

- **Geoinformatics**, studied in the second, third and fourth grades of the educational programme Geodetic Technician–Geometer for 2 hours per week
- **Graphical Programs**, studied in the second grade in the educational programme Graphic Designer–Associate for 3 hours per week
- **Graphic Design of Books**, studied in the second and third grades for 2 hours per week and in the fourth grade for 4 hours per week in the educational programme Graphic Designer–Associate
- **Railway Information Systems**, studied in the first grade of educational programmes: Towing Technician, Traffic Transport Technician and Road Technician, for 2 hours per week
- **Computer Prepress**, studied in the second and third grades in the educational programme Operator in the Preparation for Printing (for students with hearing and speech impairments) for 2 hours per week
- **Computer Modelling**, studied in the third grade for 4 hours per week and in the fourth grade for 5 hours per week in the educational programme Technician for Computer Design and Management

- **Computer Production Management**, studied in the third grade for 4 hours per week and in the fourth grade in the educational programme Technician for Computer Design and Management for 5 hours per week
- **Computer Science in Business**, studied in the first grade for 2 hours per week in the educational programme Administrator, in the second grade for 2 hours per week in the educational programme Sales Technician
- **Use of Computers in Architecture**, studied in the second grade in the educational programme Interior Designer for 3 hours per week
- **Use of Computers in Electrical Engineering**, studied in the third grade in the educational programme Electrical Telecommunications Technician for 2 hours per week
- **Use of Computers in Graphics**, studied in the third grade in the educational programme Graphic Technician for 2 hours per week
- **Computer Graphics and Animation**, studied in the fourth grade in the educational programme Electrical Multimedia Technician for 2 hours per week
- **Computer Networks**, studied in the fourth grade in the educational programme Computer Electrical Technician for 2 hours per week
- **Application of ICT in Business**, studied as a module in the first and second grades in the educational programme Tourist Technician for 2 hours per week

Elective courses/modules

Vocational secondary schools – Elective vocational modules within the modularized educational programmes that have been in use since the academic year 2017/2018:

- **Basics of Procedural Programming**, studied in the second grade of educational programmes: Electrical Energy Technician, Electronic Communications Technician, Civil Engineering Technician for Low-Rise Buildings and Hydrography, Civil Engineering Technician for High-Rise Buildings, level IV1, for 2 hours per week
- **Basics of Object-Oriented Programming**, studied in the third grade of the educational programmes: Electrical Electronics Technician, Electronic Communications Technician, level IV1, for 2 hours per week
- **Computer Graphics and Animation**, studied in the second grade of the educational programmes: Electronics Technician, Electronic Communications Technician, Computer Systems and Networks Electrical Technician, Civil Engineering and Hydraulic Engineering Technician, level IV1, for 2 hours per week
- **Basics of Computer Hardware**, studied in the second grade of the educational programme: Electrical Technician for the Development of Web and Mobile Applications, level IV1, for 2 hours per week
- **IT systems**, studied in the fourth grade of the educational programmes: Electrical Technician, Electrical Electronics Technician, Computer Systems and Networks Electrical

Technician, Electronic Communications Technician, Electrical Technician for Web and Mobile Application Development, level IV1, for 2 hours per week

- **3D Graphics**, studied in the third grade of the educational programme: Electrical Technician for the Development of Web and Mobile Applications, level IV1, for 2 hours per week
- **Photography**, studied in the second grade of the educational programmes: Electrical Technician of Computer Systems and Networks, Electrical Technician for Web and Mobile Application Development (in the fourth grade), Technician for Architecture and Interior Design, Construction Technician for Civil Engineering and Hydraulic Engineering, Civil Engineering Technician, Technician for Geodesy, level IV1, for 2 hours per week
- **Applied Programming**, studied in the fourth grade of the educational programme Mechatronics Technician, level IV1 for 2 hours per week
- **Computer Technical Drawing in Mechanical Engineering**, studied in the third grade of the educational programme Auto-Mechatronics Technician, level IV1 for 2 hours per week
- **3D Modelling in Auto-Mechatronics**, studied in the fourth grade of the educational programme Auto-Mechatronics Technician, level IV1 for 2 hours per week
- **Databases**, studied in the third grade of the educational programmes: Legal-Administrative Technician, Technician for Freight Forwarding, Customs and Organization of Transport, level IV1 for 2 hours per week
- **Internet and E-Commerce**, studied in the fourth grade of the educational programme Sales Technician, level IV1 for 2 hours per week
- **Construction, Modelling and Grading of Sports and Work Clothes**, studied in the second grade of the educational programme Fashion Design Technician, level IV1 for 2 hours per week
- **Construction, Modelling and Grading of Heavy Clothing**, studied in the third grade of the educational programme Fashion Design Technician, level IV1 for 2 hours per week

Vocational high schools – Elective vocational-theoretical courses/modules within educational programmes adopted before the academic year 2017/2018:

- **Digital Printing**, studied in the fourth grade in the educational programme Graphic Technician for 2 hours per week
- **Graphic Design in Fashion**, studied in the third and fourth grades in the educational programme Graphic Designer-Associate for 2 hours per week
- **IT in Restaurant Management**, studied in the 4th grade in the educational programme Culinary Technician for 2 hours per week
- **Internet and Electronic Business**, studied in the 4th grade in the educational programme Food Technician for 2 hours per week
- **Computer Typing**, studied in the first grade in the educational programme Graphic Technician for 2 hours per week

- **Computer Repro Photography**, studied in the second grade in the educational programme Graphic Technician for 2 hours per week
- **Computer Audio and Graphical Programs**, studied in the third and fourth grades in the educational programmes: Music Performer – Double Bass Player, Pianist, Violist, Violinist, Cellist, Flautist, Guitarist, Accordionist, Horn Player, Clarinettist, Saxophonist, Solo Singer, Trombonist, Trumpet Player and Music Associate for 2 hours per week
- **Basic computer networks**, studied in the 4th grade in the educational programme Electronics Technician for 2 hours per week
- **Computer Graphics and the Internet**, studied in the second and third grades in the educational programme Postal and Logistics Technician for 2 hours per week
- **Web Graphics**, studied in the third and fourth grades in the educational programme Graphic Designer-Associate for 2 hours per week

Annex 2: List of specialized software by educational programme

1. Specialized software in modularized educational programmes that have been in use since the academic year 2017/2018:

- **Software for simulating the operation of electrical circuits:** Tina, Electronics Workbench, LOGO! Soft Comfort, etc. in educational programmes in the field of electrical engineering (modules: Fundamentals of Electrical Engineering I, Fundamentals of Electrical Engineering II, Fundamentals of Electronics)
- **Software for simulation of time shapes and signal spectra:** Fourier Series Applet, Digital Filters, etc. in educational programmes in the field of electrical engineering (module Electronic Communications)
- **Software for simulation of automation system management:** Matlab Simulink or Automation Studio, etc. in educational programmes in the field of electrical engineering (module Industrial Electronics and Automation)
- **Software packages for simulation of electrical circuits with microcontrollers:** for educational programmes in the field of electrical engineering (module Microcontroller Programming)
- **Development environment Dev-C++** in educational programmes in the field of electrical engineering (modules Basics of Programming, Basics of Procedural Programming)
- **Software for design in electrical engineering:** AutoCAD, AutoCAD Electrical, MS Visio, etc. in educational programmes in the field of electrical engineering (module Software Tools for Design in Electrical Engineering)
- **Software for calculations in electrical engineering:** DIALux, Matlab, SCADA, etc. in educational programmes in the field of electrical engineering (module Software Tools for Design in Electrical Engineering)
- **Application software for PLC and SCADA systems:** for educational programmes in the field of electrical engineering (modules: Industrial Electronics and Automation Systems)
- **Software for designing electronic printed circuit boards:** PROTEL, PADS (PowerPCB), OrCAD, WG, Allegro, Eagle, Kicad, EasyEda, etc. in educational programmes in the field of Electrical Engineering (module Production of Electronic Devices and Systems)
- **Development environment and Java development tools JDK (Java Development Kit)** in educational programmes in the field of electrical engineering (module Basics of Object-Oriented Programming)
- **Vector graphics processing software:** Adobe Illustrator, Corel DRAW, etc. in educational programmes in the field of electrical engineering (module Computer Graphics and Animation)
- **Programs for creating 2D animation:** Adobe Animate, Adobe Flash, Macromedia Flash, etc. in educational programmes in the field of electrical engineering (module Computer Graphics and Animation)
- **Raster graphics processing software:** Adobe Photoshop, GIMP, Corel Photo-Paint, etc. in educational programmes in the field of electrical engineering and construction (module Photography)

- **Software for performing simple calculations of energy reduction** (e.g. CEI REACH – EXCEL PROGRAM) in educational programmes in the field of electrical engineering (module Principles of Energy Efficiency)
- **Software for simulation of computer and telecommunication network operation** (e.g. Cisco Packet Tracer, Opnet, etc.) in educational programmes in the field of electrical engineering (modules: Computer Networks, Computer Network Administration, Telecommunication Networks, Switching and Data Centres)
- **Software for testing the correctness of HDD sectors** (e.g. Hard Disk Sentinel, Hiren's boot, HD tune, etc.) in educational programmes in the field of electrical Engineering (module Computer Hardware Maintenance)
- **Operating systems (Windows, Linux)** in educational programmes in the field of electrical engineering (modules: Basics of Operating Systems, Operating Systems Administration)
- **Software for database management on computers** (e.g. MySQL Workbench, phpMyAdmin, Access, etc.) in educational programmes in the field of electrical engineering and IT (modules: Relational Database, Database Management)
- **Software for design in electrical engineering** (AutoCAD, AutoCAD Electrical, etc.) in educational programmes in the field of electrical engineering (modules: Software Tools for Design in Electrical Engineering, Design of Telecommunication User Systems, Design of Computer Networks, Design in Power Engineering, Design in Electronics)
- **Software for syslog protocols** (Kiwi syslog server) in educational programmes in the field of electrical engineering (module Protection of Computer Systems and Networks)
- **Software for simulation of time shapes and signal spectra:** Fourier Series Applet, Digital Filters, etc. in educational programmes in the field of electrical engineering (modules: Electronic Communication I and Electronic Communication II)
- **Software for simulation of logic circuits** (LOGO! Soft Comfort, etc.) in educational programmes in the field of electrical engineering (module Analogue and Digital Electronics)
- **Promotic SCADA software** for educational programmes in the field of electrical engineering (module Operation of Electric Power Systems)
- **Software codes for PLC and SCADA systems** in educational programmes in the field of Electrical Engineering (Module Management of Electric Motor Drives)
- **Software tools for creating web pages** (recommended Notepad++, Eclipse, Aptana Studio 3) for educational programmes in the field of IT (module Introduction to Web Programming)
- **Development environment for the PHP programming language** in educational programmes in the field of IT (module Web Application Development I)
- **Android Studio development environment** for educational programmes in the field of IT (modules: Development of Mobile Applications I and II)
- **Audio processing programs:** Adobe Audition, Audacity, Sound Forge, GoldWave, Cool Edit Pro, Reason, FL Studio (Fruity Loops), etc. in educational programmes in the field of IT (module Production of Multimedia Content)
- **Video editing programs:** Adobe Premiere Pro, Windows Movie Maker, Lightworks, Wondershare Filmora, etc. in educational programmes in the field of IT (module Production of Multimedia Content)
- **Programs for creating 2D animation:** Adobe Animate, Adobe Flash, Macromedia Flash, etc. in educational programmes in the field of IT (module Production of Multimedia Content)

- **CodeIgniter and Wordpress framework in web application development** in educational programmes in the field of IT (module Web Application Development II)
- **Xamarin development environment** for mobile application development in IT education programmes (module Mobile Application Development II)
- **Computer drawing software:** ProDesktop, AutoCAD, CATIA, SolidWorks, Inventor, Solid Edge, etc. in educational programmes in the field of mechanical engineering and mechatronics (module Technical Drawing with Descriptive Geometry)
- **Software modelling tools:** Solidworks, AutoCAD Mechanical, CATIA, Pro/ENGINEER, etc. in educational programmes in the field of mechanical engineering and mechatronics (modules: Application of Software Tools in Mechatronics, 3D Modelling in Auto-Mechatronics)
- **Software for simulation of control using PLC, such as LogixPro and Psim by Allen-Bradley,** in educational programmes in the field of mechanical engineering and mechatronics (module Electronic Control of Mechatronic Devices and Systems)
- **Software for simulation of system operation of a motor vehicle,** in educational programmes in the field of mechanical engineering and mechatronics (modules: Auto-Mechatronics, Diagnostics and Maintenance of Motor Vehicles, Passenger Cars and Commercial Vehicles)
- **Software programme CD EFA6** that accompanies the recommended literature in educational programmes in the field of mechanical engineering and mechatronics (most modules)
- **Software for synthesis, simulation and analysis of hydraulic control schemes** in educational programmes in the field of mechanical engineering and mechatronics (module Technique of Control and Regulation on a Motor Vehicle)
- **Software tools for creating technical drawings:** AutoCAD, CorelCAD, ARESMechanical, DraftSight, etc. in educational programmes in the field of mechanical engineering and mechatronics (module Computer Technical Drawing in Mechanical Engineering)
- **Software for creating the graphical part of project documentation in architecture:** AutoCAD, ArchiCAD, SketchUp, Photoshop, Illustrator, etc. in educational programmes in the field of construction and spatial planning (module Software Tools for Modelling and Designing Objects)
- **Software for the digital creation of 3D models** in educational programmes in the field of construction and landscaping: ArchiCad, AutoCad, SketchUp, 3dsMax, GIS, etc. (module Software Tools for Modelling and Designing Objects)
- **Software for creating renderings of 3D models** in educational programmes in the field of construction and landscaping ArchiCAD, Studio Artlantis, Lumion, SketchUp and others. (module Software Tools for Modelling and Designing Objects)
- **Software for technical drawing, modelling and processing of raster graphics:** Autodesk AutoCad, Graphisoft ArchiCad, Google Sketchup, Adobe Photoshop code, in educational programmes in the field of construction and landscaping (all modules related to design)

2. Specialized software in educational programmes adopted before the academic year 2017/2018:

- **Pro CAST** (Simulation of casting, hardening, obtaining ready-made modules) – in the

- educational programme Metallurgy Technician (Extractive Metallurgy)
- **ChemSketch** (Drawing the structure of chemical elements) – in the educational programme Environmental Technician (Environmental Chemistry, Chemical Account), in the educational programme Chemical–Technological Technician (General and Inorganic Chemistry, Organic Chemistry, Chemical Calculation), in the educational programme Chemical Laboratory Assistant (General and Inorganic Chemistry, Organic Chemistry, Chemical Calculus)
 - **Chemistry add-in for Word** (Program for writing chemical formulas) – in the educational programme Environmental Technician (Chemistry of the Environment), in the educational programme Chemical-Technological Technician (General and Inorganic Chemistry, Organic Chemistry), in the educational programme Chemical Laboratory (General and Inorganic Chemistry, Organic Chemistry)
 - **Chem Doodle** (Graphics in chemistry) – in the educational programme Environmental Technician (Environmental Chemistry, Sample Analysis), in the educational programme Chemical-Technological Technician (General and Inorganic Chemistry, Organic Chemistry, Analytical Chemistry), in the educational programme Chemical Laboratory (General and Inorganic Chemistry, Organic Chemistry, Analytical Chemistry)
 - **Yenca Inorganic Chemistry** (Experimental simulation program) – in the educational programme Environmental Technician (Environmental Chemistry, Sample Analysis), in the educational programme Chemical-Technological Technician (General and Inorganic Chemistry, Organic Chemistry, Analytical Chemistry), in the educational programme Chemical Laboratory Assistant (General and Inorganic Chemistry, Organic Chemistry, Analytical Chemistry)
 - **Adobe CS package** – Photoshop, Illustrator, InDesign (Creating vector and raster graphics, editing sheets – prepress) – in the educational programme Graphic Technician (Application of Computers in Graphics, Prepress Technology, Practical Classes, Computer Repro Photography)
 - **Jewel** (3D jewellery design) – in the educational programme Graphic Technician (Application of Computers in Graphics, Prepress Technology, Practical Classes, Computer Repro Photography)
 - **SolidWorks** (Parametric 3D modelling of parts and assemblies, preparation of technical documentation) – in the educational programme Technician for Computer Design and Management (Computer Modelling, Computer Production Management)
 - **SolidCAM** (Programming of all types of CNC cutting machines: lathes, milling machines, machining centres) – in the educational programme Technician for Computer Design and Control (Computer Modelling, Computer Production Control)
 - **MasterCAM** (Modelling and programming of CNC machines) – in the educational programme Technician for Computer Design and Control (Computer Modelling, Computer Production Management)
 - **Mechanical Desktop** (Specialized programme that speeds up the process of designing machines and devices) – in the educational programme Technician for Computer Design and Management (Computer Modelling, Computer Production Management)
 - **SSCNC** (Software for processing simulation) – in the educational programme Technician for Computer Design and Management (Computer Modelling, Computer Production Management)
 - **SolidWorks Simulation** (Software tools for simulation of real working conditions of structures and products in a virtual environment) – in the educational programme

Technician for Computer Design and Management (Computer Modelling, Computer Production Management)

- **Software for car diagnostics** – in the educational programme Car Mechanic (Motor Vehicle Technology, Car Mechatronic Systems)
- **Linux** (Operating System) – in the educational programme Computer Technician (Operating Systems)
- **Dev C++** (Compiler for the programming language C++) – in the educational programme Computer Electrical Technician (Programming, Object Programming), in the educational programme Electrical Multimedia Technician (Programming, Object Programming)
- **Notepad++** (Editor for HTML and Java) – in the educational programme Computer Technician (Programming, Object Programming), in the educational programme Electrician Multimedia (Programming, Object Programming)
- **Eclipse** (Editor for HTML and Java) – in the educational programme Computer Technician (Programming, Object Programming), in the educational programme Electrician Multimedia (Programming, Object Programming)
- **Aptana** (Editor for HTML and Java) – in the educational programme Computer Technician (Programming, Object Programming), in the educational programme Electrical Technician Multimedia (Programming, Object Programming)
- **Microsoft SQL Server** (Database creation) – in the educational programme Computer Electrical Technician (Databases)
- **Inkscape** (Vector graphics processing) – in the educational programme Computer Electrical Technician (Application Software and Multimedia, Computer Graphics and Internet Technology), in the educational programme Electrical Multimedia Technician (Production of Multimedia Content), in the educational programmes: Electronics Technician, Telecommunications Technician, Energy Technician, Electrical Technician for Refrigeration and Thermal Devices (Applied Computers in Electrical Engineering)
- **Sound Forge** – in the educational programme Computer Electrical Technician (Application Software and Multimedia, Computer Graphics and Internet Technology), in the educational programme Electrical Multimedia Technician (Production of Multimedia Content)
- **Audacity** – in the educational programme Computer Electrical Technician (Application Software and Multimedia, Computer Graphics and Internet Technology), in the educational programme Electrical Multimedia Technician (Production of Multimedia Content)
- **Adobe Photoshop** (Raster graphics processing) – in the educational programme Computer Electrical Technician (Application Software and Multimedia, Computer Graphics and Internet Technology), in the educational programme Electrical Multimedia Technician (Computer Graphics and Animation), in the educational programmes: Electronics Technician, Telecommunications Technician, Energy Technician, Electrical Technician for Refrigeration and Thermal Devices (Computer Graphics and Internet Technologies)
- **Corel DRAW** (Vector graphics processing) – in the educational programme Computer Electrical Technician (Application Software and Multimedia, Computer Graphics and Internet Technology), in the educational programme Electrical Multimedia Technician (Computer Graphics and Animation), in the educational programmes: Electronics Technician, Telecommunications Technician, Electrical Technician, Electrical Technician for Refrigeration and Thermal Devices (Computer Graphics and Internet Technologies)
- **Adobe Premier** (Video processing) – in the educational programme Computer Electrical

Technician (Application Software and Multimedia, Computer Graphics and Internet Technology), in the educational programme Electrical Multimedia Technician (Computer Graphics and Animation)

- **Autodesk 3ds Max** (Production of 3D animation) – in the educational programme Computer Electrical Technician (Application Software and Multimedia, Computer Graphics and Internet Technology), in the educational programme Electrical Multimedia Technician (Computer Graphics and Animation), in the educational programmes: Electronics Technician, Telecommunications Technician, Energy Technician, Electrical Technician for Refrigeration and Thermal Devices (Computer Graphics and Internet Technologies)
- **Adobe Macromedia Dreamweaver** (Web design) – in the educational programme Computer Electrical Technician (Application Software and Multimedia, Computer Graphics and Internet Technology), in the educational programmes Electronics Technician, Telecommunication Electrical Technician, Energy Technician, Electrical Technician for Refrigeration and Thermal Devices (Computer Graphics and Internet Technologies)
- **TINA** (Drawing and simulation of electrical and electronic circuits) – in the educational programme Computer Electrical Technician (Fundamentals of Electronics), in the educational programme Electrical Multimedia Technician (Fundamentals of Analogue and Digital Electronics), in the educational programmes: Electronics Technician, Telecommunications Technician, Energy Technician, Electrical Technician for Refrigeration and Thermal Devices (Electronics, Applied Electronics, Computer Applications in Electrical Engineering)
- **Siemens LOGO** (Drawing and simulation of electronic circuits) – in the educational programme Computer Electrical Technician (Fundamentals of Electronics), in the educational programme Electrical Multimedia Technician (Fundamentals of Analogue and Digital Electronics), in the educational programmes: Electronics Technician, Telecommunication Electrical Technician, Energy Technician, Electrical Technician for Refrigeration and Thermal Devices (Electronics, Applied Electronics, Computer Applications in Electrical Engineering)
- **AutoCAD** (Drawing and design, 2D and 3D modelling) – in the educational programme Electrical Multimedia Technician (Production of multimedia content), in the educational programmes: Electronics Technician, Telecommunications Technician, Energy Technician, Electrical Technician for Refrigeration and Thermal Devices (Applied Computers in Electrical Engineering)
- **Adobe Macromedia Flash** (Creation of 2D animation) – in the educational programme Electrical Multimedia Technician (Computer Graphics and Animation, Multimedia Script Tools)
- **Amadeus** (Global Reservation System) – in the educational programme Tourist Technician (Agency Business)
- **Fidelio** (Hotel business monitoring and management) – in the educational programme Tourist Technician (Hotel and Reception Business)
- **Point Office POS System** (Monitoring the work of waiters and chefs in the restaurant industry) – in the educational programmes: Waiter, Chef, Service Technician, Culinary Technician (Restaurant, Cooking).