



Country Report

Mapping the digital readiness and resilience of HEIs in response
to the COVID-19 crisis in Croatia in the context of:

Governance and enabling services

Teaching and learning practices and infrastructure

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Guidelines for creating DigitransformEdu Country Report

This report aims to inform the actors on the current state of affairs when it comes to digitalisation in the Country X . The report is part of the series detailing the developments in partner countries in Bulgaria, Germany, Croatia, Italy as well as the developments in the EU in general.

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Abbreviations:

- HE – higher education
- HEI – higher education institution
- VET – vocational education and training
- LLL – lifelong learning
- EU – European Union

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1. Executive Summary

Digitalization of Education in Croatia is part of several wider projects, as: e-Schools: a comprehensive informatization of school operation processes and teaching processes aimed at the creation of digitally mature schools for the 21st century, and Comprehensive curricular reform which involves all primary and secondary schools in Croatia, as well as Regional vocational competence centres with focus on vocational education.

Digital transformation of higher education is led by Science and Technology Strategy and E-learning strategy with aims to encourage innovative approaches to delivering study programmes, and to applying high-tech teaching aids through the substantial use of information and communication technologies. E-learning centres or e-learning support teams were established at almost all Croatian universities, with a network of experts to foster and facilitate e-learning in the academic community.

Main leaders of digital transformation in Croatia are CARNET – Croatian Academic and Research Network for pre-tertiary education and SRCE – University Computing Centre for higher education.

The challenges of digital transformation In Croatia can be grouped into five categories: learning styles and cultures, digital pedagogy, technology, technical training, and time management challenges. In other hand enablers are teachers, their passion and innovations in distance teaching and learning.

The recovery and resilience plan includes investments to support the development of digital skills aimed at upgrading teachers' and students' digital skills, the plan includes the continuation of the reform of the education system. The reform is expected to, inter alia, improve the basic skills of pupils through increased instruction time and strengthen the link between vocational and adult education on the one hand and the labour market on the other. Part of this reform includes the development of new curricula, which will include a focus on the digital transition.

The recovery and resilience plan includes the development of a strategic framework, "Croatia's 2030 Digital Strategy", which will steer the digital transformation of Croatia's society and economy for the next decade. It will set the frame for investments in the digital transition and will define strategic objectives in the following areas: (i) digital transition of the economy, (ii) digitisation of public administration and justice, (iii) digital connectivity/development of broadband electronic communications networks and (iv) development of digital skills and digital jobs.

2. Pre-Covid-19 Status Quo of digitalisation of HE/VET/LLL in Croatia

2.1. Policy and practice (national/federal, regional, local)

Digitalization of VET schools is part of the wider project "e-Schools: a comprehensive informatization of school operation processes and teaching processes aimed at the creation of digitally mature schools for the 21st century" which involves all primary and secondary schools in Croatia. project e-Schools is organized in two phases: a pilot in 2015 – 2018 for 151 schools and the second phase in 2018 – 2023 for all primary and secondary schools in Croatia (1310 schools) among which are 317 VET schools. Project e-Schools is one of the measures defined in the Education, Science and Technology Strategy ([MZO, 2014](#))

Objectives of the project are: efficient and transparent management of the school, the development of digitally competent teachers prepared for the application of innovations in their own pedagogical practices and the development of digitally competent students, who are prepared for a continuation of their schooling and competitive on the labour market.

The main objective of this segment of the project is to ensure all the infrastructural prerequisites for the realisation of the pilot project, which includes: the establishment of adequate data centres, the establishment of adequate school infrastructure (local wired and wireless network), including the equipping of classrooms and staff, the establishment of a network of Regional Training Centres. Schools are also equipped with two different types of classrooms, a presentation one – equipped with a PC computer, a touch screen monitor and loudspeakers – and an interactive one, which includes tablets or notebooks, along with the presentation equipment. All teaching staff is equipped with laptop computers. For the purposes of carrying out the systematic education of the project participants, Regional Training Centres are established and adequately equipped for educational activities (with tablets, laptop computers, touch screen monitors, videoconferencing equipment...). ([CARNET, 2022](#))

In 2018 reform of the vocational education started in Croatia with the appointment of 25 regional vocational competence centres with aim of establishing program and staffing conditions that will improve work-based learning opportunities for students and adult learners in the sub (sectors) of mechanical engineering, electrical engineering and computer science, agriculture and health. Along with 25 main project leaders, additional 200 VET schools and LLL partners are involved in regional competence centres' activities. Project activities are establishing the organization of work and development of the regional competence centre, development and improvement and implementation of regular vocational education programs, adult education programs and lifelong learning programs activities aimed at strengthening the competencies of educators and mentors and promoting professional occupations and work of the Center. Among other, some activities are dedicated to digital transformation. ([MZO, 2022](#))

In the late 1980s and early 1990s, most higher education institutions developed strategic plans aimed at implementing information technology. Equally, much of the discussion on information strategy focused on the use of management technology. When we mention the digital transformation of the University, it includes the organizational structure of the University, which is the concern of management, administrative and professional services, infrastructure capacity and technical equipment, information and communication infrastructure, which is a prerequisite for everything else that makes the University which is students and staff through the implementation of educational programs. Digital transformation involves digital technology and individuals: it is not enough to just introduce digital technology to business, it is also important to educate employees.

Since the adoption of the Education, Science and Technology Strategy ([MZO, 2014](#)) in Croatia, one of the goals is to expand and improve the application of ICT in learning and education. Thus, e-learning is recognized as an important factor in improving the educational process.

Strategy defines measures for the development and diffusion of e-learning and for the introduction of expert teaching systems and other modern teaching methods based on information and communication technologies. These measures will be aimed at all levels and types of education. Open educational contents and tools with free access will also be developed and supported.

E-learning provides temporally and spatially flexible access to up-to-date and current multimedia and interactive teaching materials. When integrated into teaching, it enables the dynamic use of Croatian

and international repositories of educational content, digital libraries, archives and museums. Furthermore, information and communication technologies (ICT) provide modern opportunities of adjustment to personal learning styles, collaborative learning and acquiring skills for project work and teamwork, as well as providing access to a wider range of learners (learners with special needs, learners in remote locations, foreign learners, etc.). The expansion of e-learning increases the role and importance of teachers, as mentors, coordinators and instigators of the educational process. E-learning also places learners at the centre of the learning process, thereby encouraging them to take an active role and responsibility for their educational outcomes.

Objective 1 in Education, Science and Technology Strategy is: to improve study programmes by consistently implementing the principles of the Bologna reform and by re-defining acquired competences; with measures: MEASURE 1.2.2. Introduce a system for encouraging innovative approaches to delivering study programmes, including the use of information and communication technologies.

It is especially necessary to encourage innovative approaches to delivering study programmes and to applying high-tech teaching aids through the substantial use of information and communication technologies. In this respect, it is necessary to introduce e-learning as a complementary form of teaching (i.e. as a mixed, hybrid approach).

Special attention should be paid to modernising study programmes for teacher competences, since they have a significant and direct impact on the quality of primary and secondary education, as well as an indirect impact on all levels of education. In addition, there is also a need to modernise programmes for the lifelong learning of civil servants.

In-service training of teaching staff will be introduced in the form of specially designed courses that will be a prerequisite for assuming teaching obligations, as well as a condition for appointment into a research/teaching grade. Such courses will be organised in the form of direct teaching or e-learning. In addition, short courses will be organised aimed at upgrading the competences of teaching staff, not only in terms of pedagogy, but also in terms of other transversal competences such as the use of information and communication technologies or the preparation and submission of a project proposal. Initial training for developing teaching competences will be obligatory for all teaching staff entering the system and will represent a minimum criterion for their first appointment into a teaching (or research/teaching) grade. Further in-service training of teaching staff in transversal competences will be among the prerequisites set by quality assurance plans of higher education institutions (Measure 3.1.3).

Objective 5 in Education, Science and Technology Strategy is: secure appropriate premises and information and communication technologies infrastructure for higher education institutions including measure 5.2. Upgrading information and communication technologies (ICT) infrastructure, with sub-measures:

- Develop a plan for developing an information and communication technologies infrastructure
- Upgrade and link existing information systems in the area of higher education. Link the higher education information systems to the systems in the area of science and lifelong learning in order to ensure the availability of integral and high-quality information needed for decision-making related to the system of higher education and science.
- Develop a package of programme tools for managing higher education institutions
- Define models and upgrade systems for the development and use of open educational contents, including literature and other open-access teaching material

In 2005, the international Tempus project EQIBELT12 (Education Quality Improvement by E-learning Technology) was launched, coordinated by the University of Zagreb and which then encouraged the systematic implementation of e-learning at three Croatian universities: University of Zagreb, University of Rijeka and University of Dubrovnik. The most important outcomes of this project were strategic and operational documents on e-learning and the establishment of e-learning support centres. Applications of ICT in learning and education. Thus, e-learning is recognized as an important factor in improving the educational process. The project finished in 2009, and had successfully fulfilled all planned goals and objectives. The universities of Dubrovnik, Rijeka and Zagreb prepared, discussed and adopted policy documents for the implementation and use of e-learning. E-learning centres or e-learning support teams at each of these universities have been established and are operational. A network of experts exists at each of the universities to foster and facilitate e-learning in the academic community. Good cooperation has been established with local teams and representatives for e-learning at faculties and departments within universities.

National Council for Science, Higher Education and Technology development already in 2013 adopted the Criteria for evaluation of online study and 2016 and revised the Criteria ([AZVO, 2022](#)). By the beginning of 2020, some higher education institutions are already conducting accredited online studies (13 of them at the end of 2020). Although classroom teaching is still the dominant model in higher education institutions, digital technologies present are on everyone to some extent. Mostly as a supplement continue you as mixed form of teaching with a lower percentage of e-learning, most often up to 20%. Higher education institutions mostly use the e-learning system SRCE for higher education or use their systems.

E-learning at the University of Zagreb has been in use from the nineties mostly by individual activities of some teachers or as a technological possibility in a few schools but these initiatives didn't result in systematic and sustainable use of e-learning. With the adoption of the E-learning Strategy in 2007, the process of systematic implementation of e-learning was started. Following E-learning Strategy stipulations, the University Office for E-learning, E-learning Centre and University Committee for E-learning was established. In addition to standard strategy elements (vision, mission, strategic objectives), the Strategy contains the action plan with a number of activities within several areas of strategic operations, concrete assignments of activities to competent/responsible bodies and deadlines for activity realization. Such systematic planning of activities enabled school managements to define the most appropriate paths and forms of e-learning in their particular educational environments. As the strategic goals of the E-learning Strategy are defined:

- Improving the quality of university education
- support teachers and students in fulfilling new roles in the educational process
- increasing the competitiveness of universities and university studies program
- training students to use lifelong learning techniques.

The strategy also contains an action plan with clearly defined operational plan activities, competent persons/bodies for each activity and deadlines for realization.

Areas of strategic action and planned activities were:

- A. Improving the formal-legal and organizational environment, ensuring sustainability
- B. Human resources development
- C. Teacher support
- D. Student support
- E. Development of educational content
- F. Development of basic and specific infrastructure. ([University of Zagreb, 2007](#))

The E-learning Centre (CEU) was established at the University Computing Centre of the University of Zagreb in 2007. The Centre holds a central role in the systematic implementation of e-learning at the University of Zagreb and supports other higher education institutions in Croatia (University in Dubrovnik, Zadar, Rijeka, Osijek, Sjever etc.).

The basic objectives of the E-learning Centre are:

- to provide support to teachers, students, e-learning teams and institutions
- to provide and maintain a reliable and generally accessible university platform for e-learning
- to support the university network of people involved or interested in e-learning
- to promote and foster the e-learning implementation. ([SRCE, 2007](#))

Systematic implementation of e-learning continues through the Strategy of Studies and Studies of the University of Zagreb 2014-2025 ([University of Zagreb, 2014](#)), and the part related to e-learning is specifically elaborated in Chapter 2 creativity, innovation and a motivating learning environment).

2.2. Drivers and motivators

While higher education institutions need to develop higher education strategies in the digital age to take full advantage of digital technologies, public policy should ensure that the environment in which higher education institutions operate supports digitalisation. The digital transformation of the university is thus a priority, and as part of the Digital Europe project, even entire graduate studies on certain topics such as, for example, artificial intelligence, high-performance computing and data sciences will be encouraged and funded.

Through the development strategy, the university coordinates the process of harmonizing study programs with the standard of the profession, while the design of digital curriculum proposals is left to the departments as holders of individual studies.

It is important to provide systematic and quality support to teachers, and identify and concretize their needs for improvement and acquisition of new knowledge, skills and competencies not only in relation to new technologies but also in developing methodological approaches to know which technologies and tools to choose for their teaching. improve study methods (Jandrić & Boras, 2012).

E-learning requires a different approach to pedagogy, especially in areas such as individual and group interaction and online evaluation. However, these skills are not completely unknown to teachers, distance learning has been present for decades.

In order to monitor the implementation of e-learning in the educational process, the Ministry of Science and Education, in cooperation with SRCE 2015, established the Catalogue of e-courses of institutions in the higher education system in the Republic of Croatia. The catalogue is conceived as a central place where basic data on all e-courses that are in the list of lectures and lectures in institutions in the higher education system in the Republic of Croatia will be located. In addition to providing a single overview of data on e-courses taught in institutions in the higher education system, the Catalogue also increases the availability and “visibility” of data on e-courses and e-courses themselves. At the same time, the Catalogue enables simpler monitoring of the implementation of e-learning at higher education institutions, planning further actions related to the systematic implementation of e-learning at the level of higher education and individual components, as well as at the national level and ensures greater availability of existing data. e-course. Data on e-courses are entered in the Catalogue from the academic year 2014/2015. and so far, 101794 e-courses have been enrolled, of which for the academic year 2019/2020. 24 520 e-courses. The Catalogue contains data on e-courses that are in the system ([SRCE, 2022](#)).

In research conducted at the end of 2017 (Kučina Softić, 2020), the aim was to determine the attitude of teachers towards e-learning and what digital competencies they need to apply e-learning in the educational process in a quality way. The research also sought to find out how much the lack or possession of digital competencies affects the willingness of teachers as well as their motivation to integrate new technologies into the educational process.

The research included teachers from the University of Zagreb and higher education teachers who use the Merlin e-learning system. The results of the survey indicated that teachers have a positive attitude toward the application of ICT and e-learning technologies in teaching, that the majority (72.7%) of teachers believe that they are digitally competent to apply e-learning in teaching in higher education, but they need professional training in digital pedagogy and to a lesser extent in modern technologies. Also, 78.0% of teachers believe that ICT-related training and education programs that are available do not meet their needs or do not have an opinion about it. The research also confirmed that the availability of e-learning technologies and tools and support in their application have a positive effect on the motivation of teachers to implement e-learning in the educational process. Participants assessed the situation on their college as extremely convenient (12.2%), convenient (55.9%), neutral (25.1%) and unfavourable (6.8%) (Kučina Softić, 2020).

According to the results of the survey, 90.1% of teachers have a positive attitude towards the application of ICT and e-learning technologies in teaching, 9.1% abstained, and only 0.8% have a negative attitude. The majority of teachers (63.7%) believe that e-learning is important for improving the quality of the educational process; 8.4% believe that it is crucial, and 55.3% that it is an important and essential contribution (Kučina Softić, 2020).

2.3. Barriers and obstacles

Croatia recognises education and science as its developmental priorities: they can provide Croatia with long-term social stability and economic development, as well as safeguard its cultural identity. The reasons for this are that Croatia is facing dynamic changes in its society, economy and culture in a globalised context where no country exists as a separated community; facing challenges such as the application of new technologies, environmental protection and population ageing, which can only be resolved through science; faced with limited human, material and natural resources, meaning that each of these resources must be used in the best possible way; faced with limited possibilities of predicting long-term development and has to be prepared to adjust. (MZO, 2014)

One aspect of this changing reality that has become evident during the early months of the pandemic is that digitalisation alone cannot solve issues of inequity. Indeed, limited access to technology clearly inhibited learning for people from different societal groups, with disadvantaged communities in both inner city and isolated rural regions being among the most severely affected during the pandemic. The rapid shift to online teaching has increased awareness of the need for mentoring, guidance and support to alleviate problems and prevent drop-out rates from increasing. Working out and targeting support to improve the quality of the learning experience will be a key challenge going forward.

It is important to understand digitalisation issues in the context of equipping individuals for lifelong learning in a fast-moving environment. Higher education institutions will themselves need support – including peer support – in making optimal use of digital technologies for learning and teaching, and helping to develop digital skills more broadly in society.

It is also important to reflect carefully on the way in which online or blended learning may change the nature of a higher education experience and indeed the nature of higher education institutions. Will campuses continue to exist as a main model for the organisation and delivery of higher education in a

digital age? Will the kind of facilities found in many higher education institutions today – accommodation, sports facilities, social services etc. – continue to be an integral part of higher education?

The attitude of the administration on the systematic introduction of new technologies and e-learning methods also affects the attitude of teachers, so it is likely that if the administration has teachers who do not apply these technologies in their teaching, such projects and changes will not support or initiate. (Kučina Softić, 2021)

The challenges of digital transformation can be grouped into five categories: learning styles and cultures, digital pedagogy, technology, technical training, and time management challenges.

Lack of basic methodological and broader andragogical education of higher education teachers. Most teachers use ICT to prepare classes and less to work with pupils and students. The reason for this is that they do not have the necessary competencies for the pedagogical use of ICT in teaching.

In the process of systematic implementation of e-learning, universities have faced several challenges in promoting and encouraging the application of technology in education and providing appropriate, quality, and sustainable support to teachers and students. In order to implement a digital transformation, universities need clear visions and good strategies for new education and e-learning.

3. During/Post-Covid-19 Status Quo of digitalisation of HE/VET/LLL in Croatia

3.1. Policy and practice (national/federal, regional, local)

In implementing digitalisation, the priority of the Ministry of Science and Education (MSE) was to ensure teachers' digital independence, which meant ensuring that teachers have their own laptops and classrooms are equipped with overhead projectors or interactive/smart whiteboards, so that various types of content and multimedia can be used in all classes. Thus 26.000 laptops were bought for teachers in 2019, and as many will be bought this year for the remaining teachers; projectors and smartboards were provided for classrooms without them.

After that, we focused on equipping students through the Comprehensive Curricular Reform project funded by the EU. The plan was to digitalise schools in line with the age of students, based on evidence collected in experimental schools and international comparisons. This meant that students in lower grades (6 to 10 years of age), who need to develop graphomotor skills, should only use tablets for activities such as group work, and thus get four to five tablets per class. In higher grades, when students (11 to 15 years of age) have subject classes, the principle was to provide each student with a tablet, thus encouraging the use of digital content and materials, and providing students with an opportunity to learn to use the learning technology responsibly. So far, tablets have been bought for all students in 5th and 7th grade of primary school (around 90.000 tablets), and 10.000 tablets were given to schools to use with their lower primary students under teacher supervision. In secondary schools, equipment was provided only to students from lower socio-economic backgrounds, as the research in the experimental phase of the curricular reform showed that the majority of secondary school students already own equipment with Internet access.

Strong emphasis was put on developing teachers' digital competences and enabling them to work in a virtual environment. Teacher training for curricular reform was launched online in 2018, via virtual

classrooms on the Moodle platform (Loomen) which enabled continuous professional development and online cooperation for teachers. In almost two years more than 50.000 teachers participated in these trainings. This was the key experience that later enabled teachers to establish virtual classrooms and communicate with students and other teachers without difficulty. All those virtual classrooms are now used as a support network for teachers, sharing learning resources, ideas and information and for direct communication with the Ministry. The trainings and support are provided by Mentoring teams that were established in 2017 and continuously prepared and organized trainings and support as part of educational reform.

All of this contributed to the swift and effective establishment of distance learning in the context of the COVID 19 crisis.

When school closure was announced as a potential measure, at the beginning of March, the Ministry started preparations for distance learning. It took two weeks to move all classes online, and distance learning was successfully launched on March 16th 2020.

The concept was based on two key principles:

1. Access has to be provided for every student, considering student age
2. Backup for every solution needs to be prepared

The priority was to create the content needed to launch distance learning, so that teachers would have time to establish the communication infrastructure and adapt to online teaching.

For upper primary and secondary level students, 15-minute videos were created on the basis of a national subject schedule which should enable all students to reach all learning outcomes planned in the curriculum by the end of the school year. Mentoring teams immediately started developing video lessons so by March 15th learning content for a whole week of learning for all 8 years of primary and 4 years of secondary education was prepared. Another priority for upper primary and secondary level students was to equip and provide Internet access for all of them.

Higher education institutions also received guidelines to transfer to distance learning, and SRCE University Computing Centre centrally provided software and support through its distance learning centre. The higher education institutions are able to autonomously determine how these will be implemented in practice.

Technical support to primary and secondary schools has been successfully provided by CARNET.

While preparing for distance learning, the Ministry published instructions for schools (Instructions to all primary and secondary schools for the organization of distance learning and Guidelines for distance learning for primary and secondary schools) focusing on:

- establishing communication channels
- equipping students from lower socio-economic backgrounds
- instructions for the age-appropriate use of the pre-prepared content
- monitoring and support

Organizational plan for schools

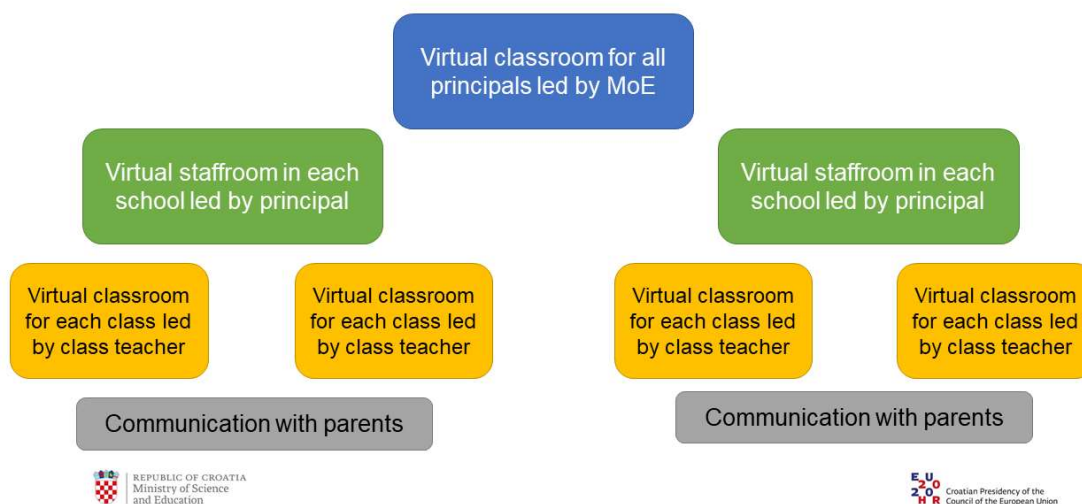


Figure 1: Organizational plan for schools

Support – multiple levels and agents

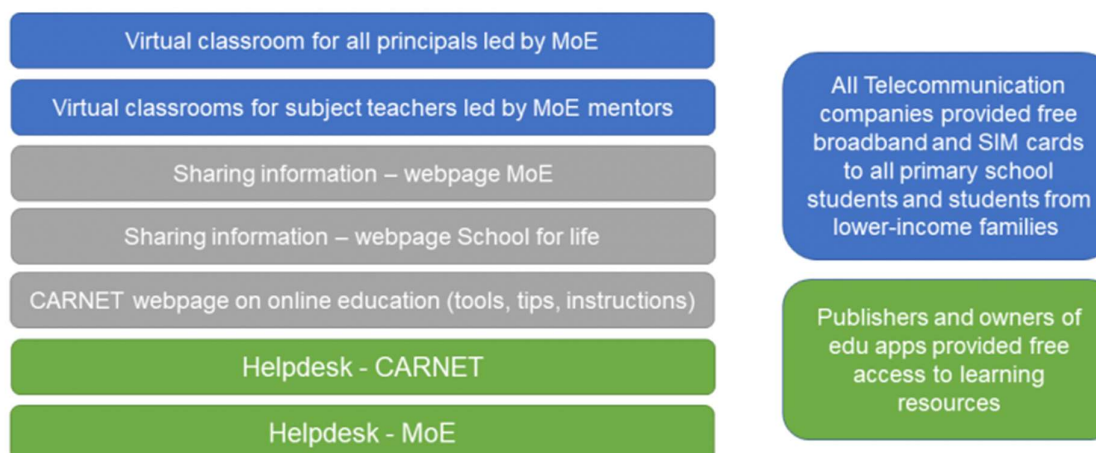


Figure 2: Support for schools

On the School for Life website guidelines and tutorials how to organize virtual staffrooms and virtual classrooms were published.

The backup principle was implemented as follows. Using multiple channels for publishing and sharing information:

- Three TV channels: HRT3, SPTV, RTL2
- Several websites: MSE, School for life, agencies
- YouTube channels
- E-Mail
- Messaging apps
- Social networks

Technical solutions:

- AAI@Edu.Hr nation-wide authentication protocol is used by all primary and secondary schools for all students and teachers.
- Different platforms accessible with AAI@Edu.Hr:
 - Moodle
 - Teams
 - Yammer
 - Google classroom
 - Edmodo
- Distributed set of systems, not a single platform – distributing the load
- We used to have 100 registered access/minute, now we have 1100 registered access/minute

National school schedule, learning scenarios, teaching resources and video lessons for all 12 years of primary and secondary education were continuously published on [School for life](#) website and on dedicated web site of [Agency for vocational education and training](#). From the first day of distance learning, direct communication with a helpdesk was established, and various media were used to answer frequently asked questions and provide guidelines to schools and higher education institutions. In addition to that, the questions frequently asked by schools, teachers, parents and students were answered. For example: Vocational schools, secondary school graduates, practical subjects and student participation ([MZO, 2020](#))

By the end of the first week, more than 50.000 virtual staffrooms and classrooms were established, with the participation of 450.000 teachers and students. In addition to that, more than 70.000 higher education students used the systems provided by SRCE, and the number does not include other distance learning systems which are used by higher education institutions.

In the second week the emphasis was on psychological support to students (via phone and email) and topical guidelines for other stakeholders in the system.

At the Ministry of Science and Education, a short questionnaire was prepared on distance teaching and learning, to get teachers' feedback. The questionnaire was available in virtual classrooms for a week, including 2nd April 2020 (closed one day before the Instructions for evaluation and grading were published).

The sample is related to the current situation, but it can be useful as a marker for further work and the planning for distance teaching support. Teachers had access to the questionnaire with their AAI identity, and so access was denied to others, everyone could fill out the questionnaire only once, the data were not linked to a person (they were anonymized). The questionnaire was accessed by total of 4139 teachers. Nearly all teachers (95%) are entirely or mostly satisfied with the way they perform distance teaching. As many as 93% of the teachers think that they have managed better than they had

expected before the beginning of distance teaching. A vast majority (90%) think that their students manage well or mostly well with distance teaching and learning. The teachers are mostly satisfied with the equipment they have. The results are similar in the evaluation related to provision of support. Namely, 87% think that the support they get from CARNET and the Ministry is good. The teachers are very pleased with the fact that video lessons and television programmes are available.

Concerning higher education, the results of the questionnaire that the Ministry conducted with the HEIs in Croatia, demonstrate that the majority of higher education institutions (80%) implement their study programmes by using different digital tools. However, some modules are more challenging for distance education, in particular, clinical practice, work-based learning or work in laboratories. The Ministry requested there is open access for all digital resources in HE.

The most challenging again is the student assessment. But the majority of HEIs in Croatia have already set up assessment procedures or are in the process of doing so.

Croatia – how we introduced distance learning?

An action plan for the implementation of distance education was published in June 2020 proposing some models for implementation of distance education for the next school year ([MZO, 2020](#)).

Although most study programs are accredited for the physical classroom, in the first phase it was necessary to ensure continuity of teaching by switching to emergency distance learning, but in the second phase (the early academic year 2020/2021) it was necessary to consider how to improve the quality of teaching. In the first phase, we had the transition to emergency distance learning, in the second phase from April to June 2020, after the initial shock, we started to secure the end of the academic year. In addition to classroom lectures held online, efforts are being made to provide other forms of teaching in the online environment. In the third phase, which ran from August to December 2020, although many hoped to return to classroom teaching, higher education institutions also had to be prepared for distance learning throughout the semester. It is now expected that classes will be prepared for distance learning and that the quality of teaching will be raised. In the fourth phase, which began in 2021, a higher percentage of online teaching is expected than before the COVID-19 pandemic (Kučina Softić, 2021).

Recovery & Resilience plans

The overall digital transformation of higher education is being carried out in line with the Digital Education Action Plan and in the light of the Council Conclusions on digital education in European knowledge-based societies from December 2020.

The digital transformation of Croatian society and the entire economy opens space for more intensive investment in strengthening the capacity of Croatian higher education institutions, which will enable the launch of new and increase existing study programs with a strong digital component. The digital transformation of higher education implies investment in digital teaching infrastructure and digitalization of administrative processes.

Through the project Preparation for the digital transition of Croatian higher education envisaged through the EC Technical Assistance Instrument, an analysis of digital maturity and readiness of Croatian higher education institutions will be made and recommendations for necessary investments and development activities will be the basis for further investments. Teachers and students in online teaching and distance learning. Recommendations for investments at the national level and recommendations for investments at the institutional level are planned for 2022. Based on the

recommendations that will result from this project at the national and institutional level, further investments are planned within the NPOO and other sources.

Digitization of administrative processes includes the development of a digital register of diplomas. The Digital Register of Diplomas will be based on the concept and technical specification of the platform for the digitization of diplomas and additional study documents to be developed through the ERASMUS + TRACER project, and will consider the University of Split's experience in piloting digital student documents, the Europass platform and through participation in the European Universities of the Seas alliance.

Education will benefit from investments to support digital skills development with particular attention to the digital shift of higher education.

Reforms and investments in the education system aim notably to increase access to early childhood education and care, introduce a full-day teaching model in primary schools, increase the percentage of pupils in general secondary education, which could lead to improved tertiary education attainment, modernise higher education, and increase the labour market relevance of curricula for vocational secondary education and higher education, and improve adult learning.

Second, under the Education component, the digital transformation of higher education is expected to stimulate and accelerate the stronger involvement of higher education institutions in cross-border and multinational projects, in particular projects for which digital maturity is a necessary condition for participation.

Investments under this component also aim to support the digital transformation of higher education and facilitate e-learning. This includes investments in digital infrastructures for teaching and the development of digital teaching tools. Skill acquisition is also partially addressed through component 4.1 by implementing a voucher system for re- and up-skill aimed at vulnerable groups, through component 1.6 with measures to educate students and unemployed persons to strengthen knowledge and skills in tourism, and through component 1.1 by funding a voucher system that will cover training for improving digital skills. C4.1. R3-I1. b Implementation of vouchers for the education of employed and unemployed persons – digital jobs (11,9 mil).

The overall envelope of the labour market component (4.1) amounts to EUR 179 million, with the majority of the allocation geared towards creating the adult education voucher system focused on reskilling, upskilling or uptake of new skills related to green and digital transition.

Investments under this component include the funding of vouchers for accredited adult education, training and upskilling programmes to acquire the skills needed in the labour market. These measures have the potential of increasing the competitiveness and employability of the labour force in line with labour market needs and with a particular focus on the activation of the long-term unemployed and the inactive population.

The plan includes measures to support businesses in adapting their operations to the digital environment, with a special focus on the cultural and creative sectors which were hit particularly hard by the COVID-19 crisis. Measures include a voucher system to support SMEs that want to develop a digital business model, strengthen their capacity to digitalise, or improve their cybersecurity. The voucher system will cover training for improving digital skills, adapting business models to the digital transformation, digital marketing, cyber resilience and the deployment of complex digital products and services. The plan also includes measures to provide grants to companies for the deployment of

digital solutions in their business operations, such as the purchase of digital tools and equipment, for strengthening digital skills to develop and deploy new products, services and processes.

In the education sub-component (C3.1) Modernisation of higher education, the investment for the digital transformation of higher education (C3.1.R2-I1), tagged at 100% with an allocation of EUR 84 million), also makes a significant contribution to the digital target.

The plan includes the development of a strategic framework, “Croatia’s 2030 Digital Strategy”, which will steer the digital transformation of Croatia’s society and economy for the next decade. It will set the frame for investments in the digital transition and will define strategic objectives in the following areas: (i) digital transition of the economy, (ii) digitisation of public administration and justice, (iii) digital connectivity/development of broadband electronic communications networks and (iv) development of digital skills and digital jobs.

The recovery and resilience plan includes investments to support the development of digital skills. In complement to the ongoing “e-Schools project” aimed at upgrading teachers’ and students’ digital skills, the plan includes the continuation of the reform of the education system. The reform is expected to, inter alia, improve the basic skills of pupils through increased instruction time and strengthen the link between vocational and adult education on the one hand and the labour market on the other. Part of this reform includes the development of new curricula, which will include a focus on the digital transition.

The plan also supports the digital transformation of higher education, with investments to equip public higher education institutions with modern teaching digital infrastructures and support online learning. At a time of expansion of digital learning and teaching tools, Croatia is confronted with insufficient and uneven equipment of higher education institutions, affecting the quality of higher education. The plan includes investments in digital teaching infrastructure and digital teaching tools. The plan also supports the development of a digital register of diplomas, which will be a significant step in the development of a graduate tracking system and aid to their integration into the labour market.

Infrastructure investments aimed at increasing the availability of higher education and, consequently, increasing the share of people with higher education qualifications are aimed at increasing accommodation capacities by building student dormitories, and investing in digital teaching infrastructure is essential for a comprehensive digital transformation of higher education and expansion teaching capacities in priority scientific and educational areas.

The digital teaching infrastructure will include the equipping of public higher education institutions on the basis of recommendations given by independent experts engaged through the European Commission's Technical Assistance Instrument. The purpose of the investment is to provide the necessary teaching infrastructure and open digital teaching resources for quality higher education, development and implementation of e-learning, online learning, and active learning. Investing in the digital transformation of higher education will help recover from the crisis and support the long-term and sustainable development of higher education. The rapid transition to distance learning and teaching will be an opportunity and impetus for the development of quality digital tools and resources.

This investment includes the development of open digital teaching resources with the purchase of active equipment (equipping classrooms with a projector, computer, sound system, and video recording studio) and improving the passive network (lighting, optics, electrical installations, switchboards, connectors, etc.) that will support new technologies and digital teaching resources.

Elements of infrastructure investments that will support new technologies and digital teaching resources:

- Network-LAN - access to the network and educational resources for employees with a reliable fast connection, on every teacher's desk, in every laboratory, in every institution. It consists of a passive network (wire), active equipment and electrical reconstructions.
- Network-Wi-Fi - network access for students who use laptops, tablets, smartphones, in all learning spaces and other work and living spaces, in each institution. It consists of active equipment, power supply and socket for powering mobile devices.
- Equipping projectors, computers, sound system and other equipment of each lecture hall in each institution.
- Procurement of cameras and audio equipment to be able to record live classes in front of an audience.
- Central equipment used for archiving digital teaching resources at the central institution, SRCE. It consists of a video server, a network content server and related software. (Croatian Government, 2021)

3.2. Drivers and motivators

Although the impact of the pandemic on higher education institutions was stressful and, in most cases, there was no contingency plan, higher education systems as a whole responded in solidarity, and acted uniformly on a global scale: they continued teaching using pedagogical modalities that did not require physical presence. As there was no time to prepare for these conditions when the University closed and the online environment, participants in education (teachers and students) sought their own paths and showed creativity and innovation and accelerated the entry into a new era of teaching and learning.

How to provide support to teachers and students in working with digital technologies and teaching in the online environment is a question that most universities faced at the beginning of the pandemic. At the beginning of the pandemic, most higher education institutions in the Republic of Croatia turned to the SRCE and the Centre for e-learning, which has been operating for more than 13 years. Some institutions have their own resources and e-learning offices and can provide support to teachers. The SRCE e-Learning Centre is continuously working on in-service teacher training in the field of e-learning. In courses and workshops, teachers learn to work with e-learning technologies and how to implement them in teaching. In addition to the courses, teachers have access to manuals which, in addition to describing how the technology itself is used, also provide examples of how to implement certain activities and resources in teaching.

A significant part of the work with teachers also takes place through a helpdesk through which teachers ask questions when they encounter problems in working with e-learning technologies. Teachers and students can communicate with the staff of the e-Learning Centre via e-mail, online form or telephone.

The role of the Centre for the development of digital competences and e-learning technologies is therefore aimed at ensuring and improving the quality of teaching and training of competent professionals for the needs of the real economy. An important task of the Centre is to encourage innovative approaches to the implementation of study programs and to develop services based

on educational technologies (e-learning) and to promote modern approaches to teaching, with continuous methodological changes.

Numerous teachers and higher education institutions turn to SRCE and the e-Learning Centre, move their teaching entirely to the Merlin e-learning system and use the SRCE webinar system, as well as numerous other video conferencing systems. Number of open e-courses for academic year 2019/2020 on March 1, 2020, there were 14,143, and already in the week of March 16, 6,000 new e-courses were opened. At the same time, there was a significant increase in demand for the webinar system, because, through it, online teachers in real time could still give lectures. The vast majority of higher education institutions and teachers managed to ensure the continuity of teaching. Classes are held as far as possible, except for the parts related to practical classes that could not be done at that time (Kučina Softić, 2021).

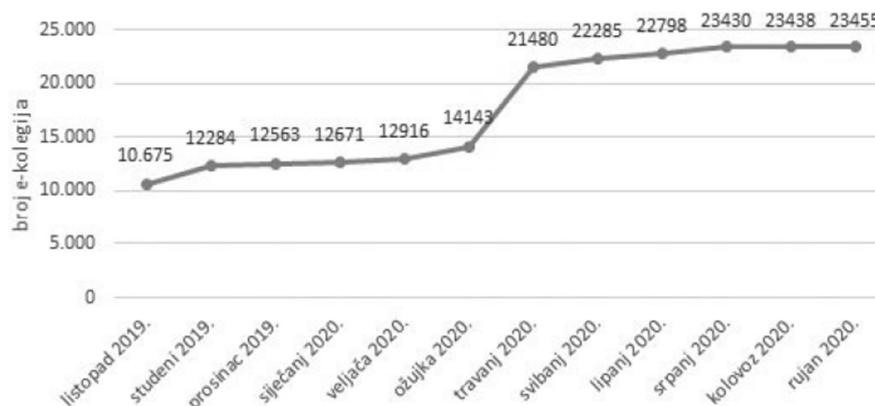


Figure 3: Number of e-courses in academic year 2019/2020

Academic year 2019/2020 It ended with 23,626 e-courses that are in the line of lectures of higher education institutions through which 9380 teachers for 85,978 students taught. In the academic year 2020/2021 by mid-March, more than 26,000 e-courses had opened. However, the use of digital technologies to hold classes that could not be held physically in the classroom does not become online classes. This is a classic teaching held in a virtual environment due to extraordinary circumstances with the help of digital technologies, or emergency distance learning.

Research conducted in Croatia indicates that teacher motivation is the strongest factor for the application of new technologies. Those who have already used digital technologies and introduced e-learning in teaching have found it easier to design teaching in an online environment they are already familiar with. But those who have resisted change have faced a major challenge - which technologies to choose and how to use them.

During the summer, professional training of teachers is organized, policies are changed, study programs and curricula are refined and adjusted for a higher proportion of teaching in the online environment (up to 50%), the necessary e-infrastructure is provided, activities are designed to provide students computers at a better price. An example of such a higher education institution is the University of Rijeka, which is ready to welcome autumn. The realization of priorities requires infrastructure and digital equipment, effective planning and development of digital capacities, including appropriate organizational skills. We need digitally competent and confident teaching staff, as well as high-quality educational content and tools tailored to users and secure platforms in line with privacy and ethical standards (Kučina Softić, 2021).

3.3. Barriers and obstacles

Lack of reliable data and records in higher education is an obstacle to effective policy management and strategically targeted financing of higher education (Croatian Government, 2021).

The quality of higher education largely depends on the availability of quality teaching resources available to all students. At the time of the expansion of digital tools for learning and teaching, there is an insufficient and uneven equipment of higher education institutions for quality higher education, which is why effective investment in digital transformation of higher education institutions is necessary (Croatian Government, 2021). Higher education from the student perspective is about more than academic learning. It is also a place and a time to develop social and civic skills, as well as confidence in personality and identity. These societal functions of higher education are vitally important.

At the time of the expansion of digital tools for learning and teaching, there is an insufficient and uneven equipment of higher education institutions for quality higher education, which is why it is necessary to effectively invest in digital transformation of higher education institutions in a digital environment.

In the weeks following the suspension of classical face-to-face classes in the classroom, shortcomings in the competencies of digital and methodological skills of working in the new environment became apparent. In order to improve the teaching competencies of the current teaching staff and introduce a system of competency development for new employees, the Centre for the development of digital Competences and e-Learning technologies has designed a program that will directly contribute to improving quality.

Although a large number of teachers and higher education institutions use digital technologies as an adjunct to teaching, some teachers are encountering online teaching for the first time. One of the major problems was that some students do not have the technical prerequisites to follow classes in an online environment (stable and strong internet connection, computer / laptop). Also, some teachers are facing technical problems, especially teachers in Zagreb who after the earthquake in March can not go to college and use university resources or their apartment was damaged in the earthquake. In addition to technical shortcomings, the lack of digital skills, the question of which tools and technologies to use, as well as the lack of pedagogical skills to work in a virtual environment were noticeable.

Students also find it difficult to learn in an online environment, organize time, lack concentration, social contact, and digital skills. It can be said that the new circumstances hit freshmen the most - first-year students because they failed to get acquainted with academic life for the faculty - get acquainted with the study and its infrastructure, colleagues and teachers and make new friends, which is extremely important for them to adapt more easily. transition from high school to higher education and gained belonging to the academic community. Students have most of their classes at a distance, so they spend their days indoors and find it difficult to cope in that environment. Practical classes at faculties cannot be held or are held on a much smaller scale and with delays, which especially in some faculties additionally affects the quality of teaching (Kučina Softić, 2021).

The crisis has shown that distance learning is crucial, they are placed in e-learning systems and exams are organized in the online environment. After the lecture, the challenge faced by higher education institutions was knowledge testing. Due to the improvement of the pandemic situation, some of the

institutions held part of the knowledge tests as before, on the premises of the institution, but most of them were held online. The Agency for Science and Higher Education has noticed that in these extraordinary circumstances, additional attention and care should be provided to students, but also to teachers because of their mental health, because the situation in which they find themselves is unexpected, unknown and uncertain.

Barriers to teacher participation in in-service training exist at the individual, institutional and systemic levels and are interrelated. Teachers' lack of interest in in-service training to improve their teaching and lack of time also stem from universities expecting teachers to focus on research. As long as teachers' research work and results are more important than their teaching work, it is unlikely that teachers will spend more of their time on professional development.

There was no Strategy that would say what and how in crisis situations, nor were there programs and obligations for professional development of teachers for new ways of working and for the process of evaluating students' knowledge and skills.

Libraries were a particular problem during the lockdown, mostly due to the lack of digital learning materials and digitized literature necessary for learning and teaching.

4. Future Outlook and Opportunities

The digital transformation that refers to the university as the umbrella institution of higher education brings changes brought by the ubiquitous use of digital technologies, that brings opportunities but also threats, social anxieties and feelings of insecurity. Teacher preparation must go in the direction of continuous professional development in the technological and pedagogical-methodological direction.

At this time, it is extremely important to provide teachers with continuous professional development in order to acquire digital skills, but also to know how to implement digital technologies in the educational process.

This strategic paradigm implies:

- approaches to teaching that encourage an active attitude towards the field of study
- teaching methods that develop students' intrinsic motivation for learning and research
- teaching situations that facilitate the transfer of theoretical knowledge and models to problem solving
- system of continuous monitoring and application of multiple methods of achievement assessment.

The outcomes of such approaches in teaching are:

- programs that rely on the results of science and encourage the development of science, technology and social relations
- programs that enable effective integration into the labour market
- teaching that engages teachers more, encourages two-way communication with students and provides better insight into their understanding and achievement
- teaching that provides the student with in-depth understanding (Kučina Sofitć, 2021)

The university teacher must be ready to develop and improve in both areas of activity: research and teaching, realizing that being a competent researcher is not a sufficient condition to be a good teacher.

The Bologna Digital 2020 document (Orr & Rampelt, 2018) states that the new tools and learning opportunities provided by digitalisation should be used as much as possible in order to reach their full potential. This requires improvement in three directions: educational content, learning experience and learning recognition

Today, every university strategy must have a clearly defined plan for responding to crisis situations, as well as a program and obligations for professional development of teachers for new ways of working for the process of evaluating students' knowledge and skills. It is especially important that the digital strategy is linked to other strategies at the institution level and directions of development. The digital strategy should cover all areas that want to develop or change in higher education, as well as explain the reasons why they need to change.

The areas most commonly found in digital strategy are:

- teaching, learning and evaluation in the digital environment
- digital content
- research infrastructure and services in the digital environment
- Stakeholder engagement and communication in the digital environment.

It is also important to develop an action plan for the implementation of the strategy with measurable goals. As part of the digital strategy and action plan, the higher education institution should ensure that staff have the necessary skills to be fully involved in the opportunities offered by digital resources (Kučina Softić, 2021).

5. Conclusion

Croatian education institutions started with digital transformation almost fifteen years ago with Higher education institutions leading the way. In meantime strategic measures and project were implemented in pre-tertiary education too. Project e-Schools and Comprehensive curricular were leading changes in primary and secondary school delivering equipment and training to all schools. All those significantly helped Croatian education system when COVID-19 pandemic started enabling establishment of distance learning and teaching in just two weeks in March 2020.

Further steps in digitalization are expected as part of National Recovery and Resilience plan which started in 2021. Besides ensuring modernization of equipment and network infrastructure, modernization of university programmes is expected. It is also important to develop an action plan for the implementation of the strategy with measurable goals. As part of the digital strategy and action plan, institution should ensure that staff have the necessary skills to be fully involved in the opportunities offered by digital resources.

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