sciendo

e-Learning in Higher Institutions and Secondary Schools during Covid-19: Crisis Solving and Future Perspectives

Mateja Brozović, Marina Ercegović
The University of Zagreb, Faculty of Economics and Business, Croatia
Gunther Meeh-Bunse
The University of Applied Science Osnabrück, Lingen Campus, Faculty of Management, Technology and Culture, Germany

Abstract

Background: The pandemic of Covid-19 brought significant changes to the education system and forcibly accelerated the process of digitizing teaching. Students and educators had to adapt to the new way of education, facing challenges such as technical problems and a lack of technical skills and social contact. **Objectives:** The purpose of the paper was to explore the attitudes of the university and high school educators and students towards the pandemic's impact on digitization in teaching. **Methods/Approach:** Data were collected through a questionnaire distributed to university and high school educators and students in Croatia, Poland, Serbia and Germany in the field of accounting, finance, trade, tourism, and other areas of interest, resulting in 2,897 responses. The results were analyzed using descriptive statistics and non-parametric tests. **Results:** The research showed that: 1) high school students were less optimistic about the positive impact of the pandemic on applying digital tools in teaching than university students, 2) educators generally prefer traditional exams, while students generally prefer e-exams, 3) a higher proportion of university respondents believe that e-learning should be used as an important addition to traditional teaching when compared to high school respondents. **Conclusions:** The pandemic has changed how the teaching process will be performed, but we should learn from experience and address the issues with e-learning.

Introduction

E-learning, i.e., online learning using digital technologies in teaching, existed before the pandemic. Still, with the pandemic's arrival in the short term, the entire education system had to move from classrooms to online mode to prevent the spread of viruses among the population. Most students and educators did not encounter an online way of teaching until the pandemic, so the transition to online learning has caused several challenges. Educators had to adapt teaching materials and how knowledge was transferred to the new conditions in no to a short period to meet the learning outcomes. In addition, they had to get acquainted with and adapt to online platforms that most of them hadn't used before. Students also had to adapt to the new conditions while being isolated from their colleagues, which affected their social life. At the same time, they were to adapt to new teaching methods through online platforms. Besides the teaching process, exams during online classes are also a special challenge. It is more difficult to control student activities during the assessment of their knowledge when students are remote, given that there is an increased possibility of cheating on exams and technical disruption.

This paper aims to analyze online learning or e-learning during the pandemic, what challenges students and educators faced, and how online learning will develop in the future. Also, through the questionnaire distributed to university and high school educators and students in Croatia, Poland, Serbia and Germany, students' and educators' attitudes about the use of digital tools during the pandemic, e-exams during the pandemic, and the future of e-learning were examined.

It is expected that there is a difference in how respondents view e-learning, depending on their level of education, i.e., whether they work at or attend high school or university. The expectation is that e-learning requires more self-discipline from students and digital competencies, especially distance. Therefore, e-learning might be more appropriate for students at higher levels of education. In line with these expectations, we compared respondents across institutions and formed research propositions as follows:

- o *RP1: University students value the positive impact of digital tools in teaching during the pandemic higher than high school students.*
- o *RP2: University respondents put greater emphasis on e-learning as an important addition to traditional teaching in the future than high school respondents.*

Regarding e-exams, we expect more opinion differences between educators and students than between university and high school respondents. Students know only a portion of educators' efforts in preparing e-exams. In addition, some characteristics of e-exams (such as the possibility of cheating) might be viewed differently by educators and students, meaning that educators could view something as a disadvantage while students consider it an advantage. This resulted in the third research proposition:

- o *RP3: Educators prefer traditional exams, while students prefer e-exams.*

The organization of the paper is as follows. Section 2 provides a literature review regarding perceptions of online learning during the pandemic, the extent of applying digital tools in teaching and the future of e-learning. Section 3 contains information about the primary research methodology, including the research sample, time frame, description of the questionnaire and methods used. Results of the research are presented in Section 4 and discussed in Section 5, while the concluding remarks are presented in Section 6.

Literature review

Perception of Online Learning During Pandemic

Digitalization has been a major case in public teaching before, but with the Covid-19 pandemic in the whole world, the process of digital transformation accelerated. It showed inequalities in the education system since some schools were better prepared than others. Since there aren't mandatory online education standards, digitalization variations exist among different schools (Andersson et al., 2021). During the pandemic, the picture of the digital divide became strong. There are differences in children's positions to engage in digitalized basic education, such as issues concerning the using technologies, with skills and competences needed to integrate digital tools in learning and teaching practices in a meaningful way. There is a difference in children's perception of new approaches during the pandemic; some benefited from the situation, and some suffered. Digital education transformation should be important to empowering children to successfully manage their digital future through basic education (Iivari et al., 2020; Zeqiri et al., 2022).

Given that there are differences in the equipment of individual schools and faculties in the education system and in the technical skills of educators and students, not all of them had the same approaches and opportunities in the transition to online teaching. As a result, there were certain problems and challenges during such a sudden transition to online teaching. The following is an overview of research conducted on students' perceptions of online teaching during the pandemic and their problems.

A survey conducted at a college in Northeastern North America showed a successful transition to online learning regarding academic outcomes and instructional standards. Results also show that students reported increased stress and anxiety and difficulties concentrating. Therefore, when planning and delivering online instructions, educators and educational specialists cannot ignore the social and affective dimensions (Lemay et al., 2021). Esteban Jr. and Cruz (2021) researched the digital divide among educator education institution students in Nueva Ecija, Philippines. Results indicated the digital divide as predicted by demographic factors: "residence, annual family income and parents' highest educational attainment" (Esteban Jr. and Cruz, 2021). Significant differences in internet access, mobile internet expenses, and the number of hours spent on the internet were also found. Analyzing the perspectives of Bhutanese students about online learning during the pandemic, research results indicated that the cost of the internet in Bhutan is too expensive, and about 70% of research participants don't have their laptops or smartphones to participate in online classes. Also, according to the research results, educators lack the knowledge and skills to manage online classes (Wangdi et al., 2021). Most PINE students from Estatal Peninsula de Santa Elena in Ecuador had never attended classes online before the pandemic. They mostly used their cell phones to connect to online classes. Only 5% never felt stressed, while 20% hardly ever felt stressed during online classes. Educators must also consider students' feelings (Carabajo Romero et al., 2021). The current pandemic scenario showed that when students were asked to use their webcam in interactive sessions, those from a lower socio-economic background were dissatisfied with others knowing their surroundings, which could affect their self-image and confidence (Varyani et al., 2020, pp. 107). The transition to online teaching and the situation itself caused stressful situations. That stress can result from more difficult adaptation due to a lack of technical skills and equipment, a difference in material and financial capabilities among students, and a lack of social interaction with colleagues and educators.

Through various research, the problem that is often mentioned is technical skills, problems with technology and the internet. According to research results in developing countries like Pakistan, online learning could not produce effective results. All the students faced the same problems, whether at the school or university level. Among the major challenges, there were a lack of internet facilities, a lack of proper interaction with students and instructors, and ineffective technology. They also indicated a lack of campus socialization, group learning problems and educator response time as a problem (Ullah et al., 2021). A study investigating challenges in online learning during the pandemic among English language learners at Taibah University in Saudi Arabia indicated problems such as difficulties in accessing the Blackboard platform as well as other technical issues (internet connectivity problems, accessing classes, downloading materials, inability to open online exams on mobile phones). Less than 50% of students are satisfied with online learning, and 43% don't fully support online education if it is not necessary, as in a crisis (Mahyoob, 2020, pp. 360). Polish medical students indicated that lack of interactions with patients and technical problems considering IT were the main disadvantages of it. They also address e-learning as less effective in increasing skills and social competencies than traditional face-to-face learning (Bączek et al., 2021). Analysis of problems faced in distance learning education during the pandemic according to the group of per-service educators studying at the faculty of education in Turkey indicated problems according to the five themes. The main problems in their themes were: lack of time spared for live courses regarding theme implementation, inability to communicate with friends, absence of internet, sound problems and lack of communication when the theme is about instructors (Özüdoğru, 2021). Ghanian students who participate in online learning at universities in China expect challenges of how to impart a sense of togetherness in a community during online learning, as well as high cost of internet data for students outside of China and slow connectivity for students in dormitories (Demuyakor, 2020, pp. 6). Lack of communication with colleagues and difficult communication with educators can be noticed as a common problem, in addition to the already mentioned problems with technical skills, equipment and the internet.

In research among Polish medical students, they indicated the ability to stay at home, continuous access to online materials, learning at their own pace and comfortable surroundings as the main advantages of online learning during the pandemic (Bączek et al., 2021). A comparative analysis between academic and high school students from Romania about their perception of the effectiveness of online education during the pandemic indicated that they react differently to online education. It depends on their expertise in online tools, ability to technically access online courses, and how educators conduct learning activities (Butnaru et al., 2021). According to the research results, the overall evaluation of e-learning experiences during the pandemic was positive for students at Hashemite University in Jordan. They mostly preferred Microsoft Teams as a platform. Problems they compound with e-learning are mostly related to technical issues (Obeidat et al., 2020). According to the survey results conducted among Ghanaian students who participated in online learning in different higher educational services in China, they perceived online learning as very useful and effective. They were satisfied with the learning resources available (Demuyakor, 2020). A survey among undergraduate students in an Indian University showed that during the pandemic, most students felt that learning is better in physical classrooms than online education. Undergraduate students in India think that educators have improved their online teaching skills since the pandemic's beginning and online education is useful now. Most of them think that adequate material study is available online and appreciate it (Chakraborty et al., 2021). During

the pandemic, a survey among educators and students in Morocco was conducted to assess distance learning in higher education. Results indicated that students and educators state that online learning isn't more interesting than the ordinary, and educators should do at least 50% of their teaching face-to-face. Results indicated limited experience with distance education among students and educators (Elfirdoussi et al., 2020). According to this, although the students pointed out the problems mentioned above, they also found positive aspects of the transition to online learning. However, some results suggest that students still prefer the traditional way of learning, face-to-face or a hybrid of traditional and online learning.

Taking exams posed a particular challenge during the pandemic. Given that students took exams from their homes, where they were not under the control of educators, it is more difficult to assess whether any unallowed actions took place during these exams. In addition, since exams require a time limit, technical difficulties during exams can cause stress to students and make it difficult for them to take exams. According to research in Morocco, 64,4% of educators think that conducting exams from a distance isn't feasible. In comparison, most students (81,45%) cannot take distance exams (Elfirdoussi et al., 2020). According to undergraduate students in India, when it comes to online assessments, 48% of them think that they can properly evaluate their knowledge, and 45,2% think that weekly tests facilitate studying. However, it must be stated that they also think online education is stressful and affects their social life and health (Chakraborty et al., 2021). Comparing the results from traditional onsite learning with the results of e-learning shows that there are higher grades during e-learning for most courses. It could be due to the extra time and effort spent on learning, but it could also be because of easier cheating at online exams (Mladenova et al., pp.1165-1166).

Digitalization in Teaching During Pandemic

During the pandemic, educators were thrown into new challenges since they had to use digital technologies to do their job in the best possible way and ensure learning outcomes. Many educators struggled to cope while using online platforms during the pandemic. Therefore, education systems should provide educators with training and support in using digital technologies, so they can adhere to pedagogical principles and best practices to successfully involve students in learning. There is a change in the social aspect of learning, so teachers should think about how to maintain connection, inclusion, awareness, reflection, and dialogue in an online environment to provide students with the same learning experience as in a traditional environment (Ben, 2020). The Covid pandemic required a change of the approach and delivery of learning and education, where educators are shifting their approach from transmitting knowledge to sharing data and guiding learners. When transitioning from on-ground to online education, the approach should be student-centered, with a clear understanding of the objectives and a plan to address each learning goal. Online education "will provide opportunities for synchronous and asynchronous interactions and require students to complete assignments and projects to demonstrate comprehension and mastery of the subject matter" (Camacho et al., 2021).

Educators faced many challenges during the pandemic. In addition to changing the way of teaching, exams, and adapting teaching materials, they also had to acquire new technological skills quickly to be successful in their work. Perifanou et al. (2021) surveyed Greek educators in primary and secondary schools who have just completed short training on using digital technologies. Research results indicate that they mostly use digital technologies to find, evaluate, and develop educational resources, such as teaching. They also used digital tools for self-study, student

assessment, and interacting and communicating with students. The use of digital tools was weak in the area of feedback, final evaluation of the students and revising the educational resources. There is also a shortcoming when using digital tools to support and advance school and education since most don't use or use a little in that area. Pozo et al. (2021) conducted a study among Spanish primary and secondary school educators about the uses of digital technologies during school lockdowns. Research results showed that educators used reproductive activities more than constructive ones, i.e., preferred educator-centred activities before student-centred ones. Also, those who stated previous use of ICT used it more and more constructive during a pandemic. In addition to the problem of rapid adaptation to the new way of transferring knowledge, educators had other problems. There were cases of educators being bullied by students or their parents on online platforms. Also, they faced the problems of students losing concentration, eating during class or sleeping (Varyani et al., 2020, pp. 107).

Based on their research results in Pakistan, Ullah et al. (2021) suggest that institutions and academic units provide and promote training for students regarding technologies that will be used in courses. Students will use commercially available tools such as Google Drive and Microsoft office, but they also will use institutionally specific ones. Lack of confidence and knowledge in using technology could be the point of failure for students. Therefore, institutions should identify the most critical need and provide and promote training opportunities.

Future of Online Education

E-learning refers to the use of information and communication technology to enhance and/or support learning, where e-learning could be divided into different types: web-supplemented, web-dependent, mixed mode and fully online (OECD, 2005). In all of them, the campus-based institution is offering the courses. E-learning is the next big thing in the education sector which is user-oriented, appropriate, and timely. Access to it is determined by factors such as availability of electricity, access to internet devices and high-speed internet (Varyani et al., 2020, pp. 102). The e-learning concept with Instructor Led Training (ILT) has advantages and disadvantages. The advantage of e-learning is that it can be nonstop accessible while ILT has scheduling conflicts and inconveniences. Another advantage is that e-learning can be cost-effective since course content can be easily modified once it is developed. At the same time, ILT is expensive since there are several costs like course development costs, good teaching professional salary, printing and paper, infrastructure, electricity, training material, travel and meal expenses and others. With e-learning, students can learn at their speed and skip unnecessary information, while with the ILT, all students are learning through all the same information at the same level as the rest of the class. Therefore, e-learning is often assessed as better, inexpensive and learner-friendly than ILT (Goyal, 2012, pp. 240).

Because of the paramount importance of knowledge, life-time learning, mobility and globalization, e-learning is gaining importance. However, having an e-learning strategy and programs is not enough to guarantee success. There should be a clear and well-thought-out implementation strategy and plan (Georgescu, 2006). Personal Learning Environment (PLE) recognizes that learning is continuing, and tools are needed to support that learning. PLE is a set of tools, many of which will be based on social software. In this concept, social software supports networks of people, content and services that can adapt and response to changes in needs and goals. It is not an application but a new approach to using new technologies for learning. PLE recognizes the role of the person in organizing their learning. Therefore this concept

provides learners with their own space where they have control and can develop and share their ideas (Attwell, 2007).

By Kadeniz (2009), flexible design for distance learning requires using different appropriate learning and teaching theories, strategies, media, technologies, interaction tools and others to enrich the learning environment. Changes today allow accessing information from everywhere and at every time; therefore, various learning environments should be blended to design the future of distance learning in which learners can decide where, how and when to learn. Since future learners are searching for flexibility in the learning process, developing, improving and expanding the technologies and pedagogical approaches is necessary to create that flexibility.

Previously in the paper, there were pointed problems with online education during the pandemic that need to be addressed in the future. Since the beginning of the pandemic, online teaching has gained relevance and will continue after the pandemic. Even though some barriers have been discovered during that process, schools and universities must be aware of them and overcome them. They should enable technical training and pay attention to digitalizing learning processes (Garcia-Morales et al., 2021). Since the measures are taken to slow down the pandemic forced remote teaching, Backes et al. (2021) stated that it allowed them to re-examine conventional teaching, test new digital and analogue concepts, and inspire curriculum-making in this century. Therefore, they indicated a need for a digital framework curriculum as a framework reflected in the respective cultures of technical subjects. It a) forms a matrix for subject-related transfer of teaching contents, methods and social forms into the change of leading media; b) takes into account referentiality, communality and algorithmic as characteristics of digital culture and c) gives orientation for educators and students. Technological producers should develop solutions that support the following: (a) technology should be cheap but work for a longer period with few updates; (b) e-learning products should be easy to use, and it should overcome language, cultural and age barriers and (c) technology should work on low data and internet speed (Varyani et al., 2020, pp. 109).

State and national governments impact the further progress of e-learning since they have a significant role in the strategic direction and funding of higher education in all OECD countries. In countries where institutions have greater autonomy, governments influence their behaviour by utilizing strategic funding or policy. In some counties, especially those that are emerging, the government needs to focus that there need for further development of infrastructure. The government should focus on developed countries' social, organizational, and legal aspects to further develop e-learning (OECD, 2005). The rise of e-learning presents new challenges for the government. They should find solutions and policies to regulate e-learning scenarios, control related crimes, and lead the education sector toward a sustainable approach to development (Varyani et al., 2020, pp. 109-110).

Online education demands adequate planning and designing instructions with available theories and models, but the pandemic caused migration, with online learning serving as an educational platform. This migration process to online education becomes questionable since it lacks proper planning, design and online instructional programs (Adedoyin et al., 2020). Although online education existed and evolved before, the pandemic accelerated the process. However, given that everything was going very fast, it was impossible to make the appropriate learning strategy that such a form requires. The pandemic pointed out all the shortcomings and problems. Thus, it allowed online learning to develop as successfully as possible because now it is known what to pay attention to. Given the aforementioned technical difficulties of students and educators, pieces of training should be held to make the whole process as

successful as possible. Certainly, reducing anxiety and dissatisfaction due to lack of socializing should be considered to solve this problem due to the increase in the scope of online learning compared to traditional face-to-face.

Methodology

Data were collected through primary research to achieve research goals and test the propositions presented in the introduction. It is comprehensive research designed and conducted by team members of the DIGI4Teach Erasmus+ project, focused on digital competencies, quality of e-learning, digital tools, mobile technology, and e-exams on a sample of high school teachers, university professors and their pupils/students in the field of accounting, finance, trade, tourism, and other interest areas. To explain the research results, the terms *teacher* and *student* (high school and university) are used in the paper. The questionnaire was distributed in Croatia, Serbia, Poland, and Germany via online platforms used for teaching. The responses for students were collected from November 2021 to January 2022, while the collection period for teachers was from December 2021 to January 2022. The the total number of responses collected is 2,897. University students dominate (1,679 responses), followed by high school students (795 responses), university professors (328 responses) and high school teachers (95 responses). University professors and high school teachers will be referred to in the text as educators.

The research instrument used in this paper is presented in Table 1. In addition to general information related to demographic characteristics, respondents were asked to answer questions divided into three segments according to the topic: 1) the impact of the Covid-19 the pandemic on digitization in teaching, 2) the e-exams, and 3) the future of e-learning. Questions depending on the group of respondents differ only in part related to e-exams, where educators were given 7 statements to assess and students 3 statements. When assessing their opinions regarding the the pandemic's impact and the advantages and disadvantages of e-exams, respondents were asked to mark from 1 to 5 the extent to which they agree with the provided statements. On the other hand, when answering how they see e-learning in the future, respondents had to choose the most appropriate statement between the 4 provided statements.

To explore the attitudes of educators and students towards e-learning in present the pandemic conditions and future post-pandemic conditions, we used a non-parametric test in the form of a Mann-Whitney test. Regarding questions answered on a Likert scale in the first and second part of the questionnaire, we first calculated measures of descriptive statistics. We used both means and medians of responses and compared them across different groups of respondents. Mann-Whitney test was first calculated/performed on individual items or statements and then on a summative or Likert scale. A summative scale is a the total score calculated for every respondent by adding values assigned to responses for each item or statement within the same question. Since different groups of respondents had different central tendency values, we tested the equality of medians (non-parametric test) between series. The test was performed in EViews.

The third part of the questionnaire was analyzed by calculating the proportions of respondents that selected each of the 4 suggested statements related to the future of e-learning. To test if there is a statistically significant difference between groups of respondents, we performed two proportion z-test.

Table 1
Research instrument

Part of the questionnaire	Group	Question	Type
General information	Educators	• Institution of employment • Main interest area • Years of teaching • Location of school/university (country & city)	Multiple choice questions Open-ended questions
	Students	• Attending institution • Main interest area • Current year of study • Location of school/university (country & city)	Multiple choice questions Open-ended questions
1st part - Impact of Covid-19 on Digitization in Teaching	Educators & Students	• 6 statements	Likert scale (1 - I completely disagree, 5 - I completely agree)
2nd part - E-exams	Educators	• 7 statements	Likert scale (1 - I completely disagree, 5 - I completely agree)
	Students	• 3 statements	Likert scale (1 - I completely disagree, 5 - I completely agree)
3rd part - Future of e-Learning	Educators & Students	• e-learning in the future	Multiple choice question (choice between 4 statements)

Source: Authors

Results

The structure of respondents according to different characteristics such as group, main field of interest, number of years teaching/studying, and location are presented in Figure 1 and Tables 2-4. Out of the total number of responses, 85% was collected from students, while the remaining 15% is related to educators. Despite the lower number of respondents in the group's *high school educators* (95) and *university educators* (328), samples are considered large for statistical tests. As seen in Figure 1, the largest group is interested in finance (24%), although there are certain variations when each group is considered separately.
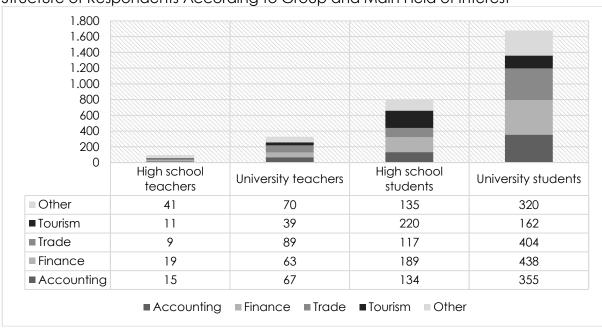
Figure 1
Structure of Respondents According to Group and Main Field of Interest

	High school teachers	University teachers	High school students	University students
▪ Other	41	70	135	320
▪ Tourism	11	39	220	162
▪ Trade	9	89	117	404
▪ Finance	19	63	189	438
▪ Accounting	15	67	134	355

▪Accounting ▪Finance ▪Trade ▪Tourism ▪Other

Source: Authors

The distribution of respondents according to location is shown in Table 2. Most respondents work at or attend a university or school in Croatia (51%), primarily in Zagreb. Poland is the second most represented country (29%), with Cracow as the dominant location, followed by Serbia and Germany. All countries in Europe contribute to the comparability and unification of results. Since the goals of the paper are related to comparing attitudes of educators and students, for statistical analysis, respondents are divided into groups according to their status/occupation and not a geographical location.

Table 2
Structure of respondents according to the country where the attended school/university is located

Country	No. Educators	% Educators	No. Students	% Students	No. Total	% Total
Croatia	173	41%	1,298	52%	1,471	51%
Serbia	98	23%	432	17%	530	18%
Poland	137	32%	699	28%	836	29%
Germany	15	4%	45	2%	60	2%
Total	423	100%	2,474	100%	2,897	100%

Source: Authors

On average, university educators that participated in the research have more experience teaching than high school educators (Table 3). Most high school educators have up to 5 years of experience, while most university educators belong to the group with 16-25 years of teaching. However, the dispersion is high, which means that their experience varies and that all possible answers are represented in the sample. This is favourable for the correlation analysis, which was aimed to analyze to what extent experience in teaching is correlated with expressed opinions regarding e-learning. A similar conclusion applies to students in terms of their experience. Most of them are currently in their second or third year in high school or university (Table 4),

meaning they have both experiences studying in normal conditions and during the pandemic. Therefore, the respondents that participated in the research are eligible to make conclusions about the advantages, disadvantages, and prospects of e-learning. Their answers are analyzed in the following three subchapters.

Table 3
Number of years that educators participated in the research and have been teaching

	No. High School Educators	% High School Educators	No. University Educators	% University Educators	No. Total	% Total
Up to 5 Years	30	32%	36	11%	66	16%
6 – 15 Years	26	27%	108	33%	134	32%
16 – 25 Years	25	26%	119	36%	144	34%
Over 25 Years	14	15%	65	20%	79	19%
Total	95	100%	328	100%	423	100%

Source: Authors

Table 4
Current year of study for students that participated in the study

	No. High School Students	% High School Students	No. University Students	% University Students	No. Total	% Total
1	124	16%	411	24%	535	22%
2	182	23%	455	27%	637	26%
3	298	37%	449	27%	747	30%
4	186	23%	239	14%	425	17%
5	5	1%	125	7%	130	5%
Total	795	100%	1,679	100%	2,474	100%

Source: Authors

Impact of Covid-19 Pandemic on Digitization in Teaching

To assess the impact of the ongoing pandemic on e-learning and the application of digital tools in teaching, respondents were given 6 statements in Table 5.

Table 5
Codes used for statements and groups of respondents (first part of the questionnaire)

Statement / Group of Respondents	Code
The pandemic has positively impacted the application of more digital tools and materials in teaching.	DIGI-TOOLS
The pandemic pointed to the need to replace a certain part of traditional teaching with e-teaching.	E-TEACH
The pandemic has had a positive impact on increasing my digital competencies.	DIGI-COMPET-NEW
The pandemic has shown me how many more digital competencies I need to acquire and / or improve.	DIGI-COMPET-ACQ
The pandemic will significantly negatively affect the learning outcomes achieved during its duration.	NEG-LEARN
The pandemic will forever change the approach to learning and teaching.	CHANGE
High School Educators	HSCH-TEACH
University Educators	UNI-TEACH
High School Students	HSCH-ST
University Students	UNI-ST

Source: Authors

The statements are related to the extent digital tools were used in teaching, their advantages, and potential disadvantages in terms of negative impact on learning outcomes. Each statement was coded, as well as each group of respondents. Codes were used in the following tables when presenting research results.

Responses were first analyzed individually for each statement. The outcome of the descriptive statistics is presented in Tables 6-8. It should be noted that this question was formulated similarly for both educators and students, allowing a comparison of the responses between groups. Since the first 4 statements (Tables 6 and 7) are related to the positive impact of digital tools (on teaching, as well as on assessing and improving individual digital competences), mean and median values of responses across different groups of respondents, suggest that high school students are the most sceptical group. The median of their responses is 3 for the 3 out of 4 observed statements, meaning that generally, they have a neutral opinion regarding assessing if the impact was positive. For example, 51% of high school students completely disagree, mostly disagree or neither agree nor disagree that the pandemic has positively impacted the application of more digital tools and materials in teaching. However, most agree that the pandemic pointed to the need to replace a certain part of traditional teaching with e-teaching (51% mostly or completely agree).

Table 6
Descriptive statistics (first part of the questionnaire; individual items; statements DIGI-TOOLS and E-TEACH)

Measure	DIGI-TOOLS				E-TEACH			
	HSCH-ST	HSCH-TEACH	UNI-ST	UNI-TEACH	HSCH-ST	HSCH-TEACH	UNI-ST	UNI-TEACH
Mean	3.39	3.46	3.98	3.59	3.97	3.74	4.41	3.84
Median	3	4	4	4	4	4	5	4
Std. Dev.	1.45	1.36	1.00	1.17	1.12	1.18	0.80	1.09
Skew.	-0.36	-0.40	-0.66	-0.52	-0.95	-0.66	-1.38	-0.68
Kurtosis	1.80	1.97	2.89	2.63	3.13	2.59	4.83	2.59
P-Value	0.00	0.00	0.03	0.09	0.00	0.00	0.00	0.00
Obs.	795	795	95	95	1,679	1,679	328	328

Source: Authors

Table 7
Descriptive statistics (first part of the questionnaire; individual items; statements DIGI-COMPET-NEW and DIGI-COMPET-ACQ)

Measure	DIGI-COMPET-NEW				DIGI-COMPET-ACQ			
	HSCH-ST	HSCH-TEACH	UNI-ST	UNI-TEACH	HSCH-ST	HSCH-TEACH	UNI-ST	UNI-TEACH
Mean	3.34	3.86	3.60	4.05	3.40	3.91	3.69	3.88
Median	3	4	4	4	3	4	4	4
Std. Dev.	1.37	0.99	1.19	1.00	1.35	1.06	1.17	1.03
Skew.	-0.33	-0.60	-0.58	-1.04	-0.34	-0.72	-0.60	-0.87
Kurtosis	1.97	2.94	2.54	3.66	1.97	2.92	2.54	3.35
P-Value	0.00	0.06	0.00	0.00	0.00	0.02	0.00	0.00
Obs.	795	95	1,679	328	795	95	1,679	328

Source: Authors

On the other hand, university educators are the most optimistic and uniform group since their measures of central tendency are the highest, while the dispersion is the lowest. It is interesting to see that, even though educators value the positive impact of the pandemic on applying digital tools higher than students, they are, on average,

more concerned by the impact of the pandemic on achieving learning outcomes (statement NEG-LEARN in Table 8). Regardless of the differences in opinion regarding its positive and negative impacts, 60% of the total respondents agree (mostly or completely) that the pandemic will forever change the approach to learning and teaching.

Table 8
Descriptive statistics (first part of the questionnaire; individual items; statements NEG-LEARN and CHANGE)

Measure	NEG-LEARN				CHANGE			
	HSCH-ST	HSCH-TEACH	UNI-ST	UNI-TEACH	HSCH-ST	HSCH-TEACH	UNI-ST	UNI-TEACH
Mean	3.30	3.79	3.44	3.73	3.42	3.69	3.81	3.96
Median	3	4	3	4	3	4	4	4
Std. Dev.	1.38	1.24	1.24	1.08	1.35	1.24	1.10	1.01
Skew.	-0.22	-0.71	-0.30	-0.42	-0.34	-0.65	-0.69	-0.71
Kurtosis	1.84	2.50	2.10	2.28	1.97	2.48	2.79	2.85
P-Value	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00
Obs.	795	95	1,679	328	795	95	1,679	328

Source: Authors

We used Mann-Whitney non-parametric test to examine if the measures of central tendency between groups of respondents differ enough for this difference to be statistically significant. The results are presented in Table 9.

Table 9
Test for equality of medians between series (first part of the questionnaire; individual items)

Statement	Group	Mann-Whitney U	P-value
DIGI-TOOLS	HSCH-ST VS UNI-ST	8.70	0.000***
	HSCH-TEACH VS UNI-TEACH	3.65	0.000***
	HSCH-ST VS HSCH-TEACH	3.33	0.001***
	UNI-ST VS UNI-TEACH	5.96	0.000***
E-TEACH	HSCH-ST VS UNI-ST	4.22	0.000***
	HSCH-TEACH VS UNI-TEACH	1.81	0.070*
	HSCH-ST VS HSCH-TEACH	0.61	0.539
	UNI-ST VS UNI-TEACH	1.12	0.262
DIGI-COMPET-NEW	HSCH-ST VS UNI-ST	4.08	0.000***
	HSCH-TEACH VS UNI-TEACH	1.83	0.067*
	HSCH-ST VS HSCH-TEACH	3.26	0.001***
	UNI-ST VS UNI-TEACH	6.17	0.000***
DIGI-COMPET-ACQ	HSCH-ST VS UNI-ST	4.48	0.000***
	HSCH-TEACH VS UNI-TEACH	0.19	0.849
	HSCH-ST VS HSCH-TEACH	3.25	0.001***
	UNI-ST VS UNI-TEACH	2.51	0.012**
NEG-LEARN	HSCH-ST VS UNI-ST	1.92	0.055*
	HSCH-TEACH VS UNI-TEACH	0.84	0.401
	HSCH-ST VS HSCH-TEACH	3.17	0.002***
	UNI-ST VS UNI-TEACH	3.62	0.000***
CHANGE	HSCH-ST VS UNI-ST	6.14	0.000***
	HSCH-TEACH VS UNI-TEACH	1.54	0.123
	HSCH-ST VS HSCH-TEACH	1.75	0.081*
	UNI-ST VS UNI-TEACH	1.98	0.048**

Note: *** statistically significant at 1%; ** 5%; * 10%
Source: Authors

If the probability is lower than 5%, it is concluded that the medians are not equal between observed groups. The test indicates that the median for the two groups of educators is equal, except for the statement DIGI-TOOLS, where the median for university educators is statistically significantly higher than for high school educators. When comparing two groups of students, there is a difference in opinion. Medians are higher for university students than high school students, which aligns with the previous conclusion that high school students are the most sceptical about the positive impact of digital tools.

The validity of conclusions drawn from analyzing individual items in the first part of the questionnaire was additionally tested by summing up the responses of each respondent. Statement NEG-LEARN was excluded when calculating the total score because it does not necessarily reflect the impact of digital tools on achieving learning outcomes. Achieving or not achieving learning outcomes during the pandemic might be affected by other reasons, such as students not attending classes, organizational issues, lack of communication, etc. The total score of the remaining 5 statements may be described as assessing the positive impact of applying more digital tools in teaching and learning during the pandemic. Measures of descriptive statistics (Table 10) again confirmed that high school students are less inclined to conclude that the pandemic has positively impacted applying digital tools and improving digital competencies since their mean and median is the lowest. University students are more optimistic than high school students and high school educators compared to high school students. The non-parametric test suggests that medians of the total scores between groups of respondents are statistically significantly different (Table 11).

Table 10
Descriptive statistics (first part of the questionnaire; summative scale; statements DIGI-TOOLS + E-TEACH + DIGI-COMPET-NEW + DIGI-COMPET-ACQ + CHANGE)

Measure	HSCH-ST	HSCH-TEACH	UNI-ST	UNI-TEACH
Mean	17.01	19.03	18.81	20.15
Median	18	19	19	21
Std. Dev.	5.74	4.12	4.42	3.75
Skew.	-0.39	-0.42	-0.57	-0.65
Kurtosis	2.28	2.85	2.96	2.82
P-Value	0	0.23	0	0
Obs.	795	95	1,679	328

Source: Authors

Table 11
Test for equality of medians between series (first part of the questionnaire; summative scale; statements DIGI-TOOLS + E-TEACH + DIGI-COMPET-NEW + DIGI-COMPET-ACQ + CHANGE)

Group	Mann-Whitney U	P-value
HSCH-ST VS UNI-ST	6.85	0.000***
HSCH-TEACH VS UNI-TEACH	2.40	0.017**
HSCH-ST VS HSCH-TEACH	3.03	0.002***
UNI-ST VS UNI-TEACH	4.92	0.000***

Note: *** statistically significant at 1%; ** 5%
Source: Authors

To test if the experience in teaching or the year of study is correlated with the responses, we calculated Spearman correlation coefficients and probabilities. Using a 5% significance level, we can see that the correlation is statistically significant only for

one group of respondents – university students (Table 12). Correlations that are statistically significant at 5% are in bold letters.

Table 12
Correlation between responses (individual items) and number of years an educator/student has been teaching/studying (first part of the questionnaire)

Group	Measure		DIGI-TOOLS	E-TEACH	DIGI-COMPET-NEW	DIGI-COMPET-ACQ	NEG-LEARN	CHANGE
HSCH-TEACH	Spearman Correlation	Coefficient	-0.045	-0.046	-0.099	-0.097	-0.012	-0.167
		P-Value	0.666	0.655	0.341	0.348	0.911	0.106
UNI-TEACH	Spearman Correlation	Coefficient	-0.021	0.015	-0.029	0.029	0.015	0.039
		P-Value	0.701	0.791	0.602	0.605	0.793	0.487
HSCH-ST	Spearman Correlation	Coefficient	0.034	-0.001	0.035	0.045	-0.009	-0.006
		P-Value	0.339	0.982	0.330	0.205	0.797	0.873
UNI-ST	Spearman Correlation	Coefficient	**0.128**	**0.166**	**0.147**	**0.124**	**-0.058**	**0.066**
		P-Value	0.000	0.000	0.000	0.000	0.018	0.007

Source: Authors

Positive correlation coefficients for individual statements indicate that university students in higher years of study value the positive impact of digital tools during the pandemic higher than their colleagues in lower years of study (Table 12). On the other hand, university students in higher years of study are less inclined to think that the pandemic will negatively impact learning outcomes achieved, which can be seen from negative correlation coefficients for the statement CHANGE. Although the correlation for university students is significant, it is very weak (Schober, 2018) since the absolute values of correlation coefficients range from 0.058 to 0.166.

E-exams

Educators were asked to express their agreement with 7 statements (Table 13). Statements are related to comparing traditional exams with e-exams regarding efficiency and reliability.

Table 13
Codes used for statements and groups of respondents (second part of the questionnaire responded to by educators)

Statement / Group of Respondents	Code
Conducting e-exams requires more effort than conducting traditional exams.	EFFORT
It takes more time to prepare e-exam than the traditional exam.	TIME
Correcting a traditional exam takes more time than correcting an e-exam.	CORRECTION
Written distance e-exams are a more efficient way of conducting exams than traditional written exams.	DIS-WRITT-EFFIC
Written e-exams on school premises are a more efficient way of conducting exams than traditional written exams.	SCH-WRITT-EFFIC
Oral distance e-exams are a more efficient way of conducting exams than traditional oral exams.	ORAL-EFFIC
When conducting a distance e-exam, there is a greater possibility of cheating, and it isn't easy to prevent it.	CHEAT
High School Educators	HSCH-TEACH
University Educators	UNI-TEACH

Source: Authors

E-learning often includes e-exams, although not necessarily. However, when social contacts were restricted during the pandemic, e-learning and e-examining were combined. Digital tools and competencies facilitate conducting e-exams, but educators and students face additional issues regarding e-exams. Question-related to e-exams in the second part of the questionnaire were different for educators and students, which is why the responses were first analyzed for educators, and then for students.

Results of descriptive statistics presented in Tables 14 and 15 suggest that educators think e-exams are less efficient and reliable than traditional exams.

Table 14
Descriptive statistics (second part of the questionnaire; individual items; statements EFFORT, TIME, CORRECTION and DIS-WRITT-EFFIC)

Measure	EFFORT		TIME		CORRECTION		DIS-WRITT-EFFIC	
	HSCH-TEACH	UNI-TEACH	HSCH-TEACH	UNI-TEACH	HSCH-TEACH	UNI-TEACH	HSCH-TEACH	UNI-TEACH
Mean	4.14	3.92	4.05	3.98	3.57	3.32	1.92	2.43
Median	5	4	4	4	4	3	1	2
Std. Dev.	1.10	1.20	1.13	1.15	1.37	1.45	1.19	1.26
Skew.	-1.15	-0.88	-1.07	-0.99	-0.42	-0.23	1.07	0.43
Kurtosis	3.64	2.78	3.48	3.09	1.93	1.69	3.04	2.16
P-Value	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
Obs.	95	328	95	328	95	328	95	328

Source: Authors

Table 15
Descriptive statistics (second part of the questionnaire; individual items; statements SCH-WRITT-EFFIC, ORAL-EFFIC and CHEAT)

Measure	SCH-WRITT-EFFIC		ORAL-EFFIC		CHEAT	
	HSCH-TEACH	UNI-TEACH	HSCH-TEACH	UNI-TEACH	HSCH-TEACH	UNI-TEACH
Mean	2.73	3.04	1.99	2.63	4.42	4.28
Median	3	3	2	3	5	5
Std. Dev.	1.46	1.26	1.13	1.23	0.91	0.96
Skew.	0.30	-0.10	1.03	0.23	-1.45	-1.32
Kurtosis	1.77	2.13	3.39	2.18	4.38	4.15
P-Value	0.02	0.00	0.00	0.00	0.00	0.00
Obs.	95	328	95	328	95	328

Source: Authors

Namely, 72% of high school educators and 67% of university educators agree (mostly or completely) with the statement that conducting e-exams requires more effort than conducting traditional exams. Measures of central tendency also confirm that conclusion. This especially applies to preparing e-exams since 69% of high school and 71% of university educators agree it takes more time than preparing traditional exams. There is a little less issue with correcting e-exams because the percentages are lower – 52% / 47%, probably because the application of digital tools sometimes, depending on the type of questions used in the e-exam, offers different autocorrection possibilities. Considering previous responses, it is understandable that educators, on average, disagree with the statements that e-exams are more efficient than traditional exams. Only 12% of high school educators and 20% of university educators agree that written distance e-exams are a more efficient way of conducting exams than traditional written exams. Percentages are similarly low when comparing e-exams on school premises with traditional written exams (30% / 35%) and oral distance e-exams and traditional oral exams (8% / 23%). In addition to questioning their effectiveness,

they also have issues with their reliability. In that context, 81% of high school and university educators agree that with e-exams, there is a greater possibility of cheating, and it is difficult to prevent it.

The results obtained by analyzing each statement in the question related to e-exams were compared with the results from the summative scale. When calculating the total score within a Likert scale question, all statements must have the same direction. In this case, statements DIS-WRITT-EFFIC, SCH-WRITT-EFFIC and ORAL-EFFIC were formulated in the reverse form compared to other statements. While other statements emphasize potential disadvantages of e-exams, these 3 statements emphasize potential advantages. This is why these 3 statements were reversed, as shown in Table 16. The responses were also reversed, meaning that, e.g., if a respondent answered that they completely agreed with the original statement (coded 5), the same respondent then completely disagreed with the reverse statement (coded 1).

Table 16
Codes used for reverse statements used for summative scale (second part of the questionnaire responded to by educators)

Statement / Group of Respondents	Code
Written distance e-exams are a less efficient way of conducting exams than traditional written exams.	DIS-WRITT-EFFIC(r)
Written e-exams on school premises are a less efficient way of conducting exams than traditional written exams.	SCH-WRITT-EFFIC(r)
Oral distance e-exams are a less efficient way of conducting exams than traditional oral exams.	ORAL-EFFIC(r)

Source: Authors

After reversing statements that were formulated in the opposite direction, we were able to calculate a sum of all responses. The total score can be interpreted as to what extent respondents agree that e-exams are less efficient and reliable than traditional exams. Since there were 7 statements and the answer *completely agree* is coded as 5, the maximum score possible is 35, while the minimum score possible is 7. Values of descriptive measures are presented in Table 17. Mean and median values confirm that educators are aware of the issues that come with e-exams.

Table 17
Descriptive statistics (second part of the questionnaire; summative scale; statements EFFORT + TIME + CORRECTION + DIS-WRITT-EFFIC(r) + SCH-WRITT-EFFIC(r) + ORAL-EFFIC(r) + CHEAT)

Measure	HSCH-TEACH	UNI-TEACH
Mean	27.55	25.41
Median	28	25
Std. Dev.	4.90	4.52
Skew.	-0.07	0.21
Kurtosis	1.79	2.68
P-Value	0.05	0.14
Obs.	95	328

Source: Authors

Interestingly, the average and median score for high school educators is higher when compared to university educators. A slight difference can also be seen when

comparing measures of central tendency for individual statements. Results of the test of equality of medians are presented in Tables 18 and 19.

Table 18
Test for equality of medians between series (second part of the questionnaire responded to by educators; individual items)

Statement	Group	Mann-Whitney U	P-value
EFFORT	HSCH-TEACH VS UNI-TEACH	1.46	0.145
TIME	HSCH-TEACH VS UNI-TEACH	0.51	0.614
CORRECTION	HSCH-TEACH VS UNI-TEACH	1.42	0.156
DIS-WRITT-EFFIC	HSCH-TEACH VS UNI-TEACH	3.59	0.000***
SCH-WRITT-EFFIC	HSCH-TEACH VS UNI-TEACH	2.08	0.038**
ORAL-EFFIC	HSCH-TEACH VS UNI-TEACH	4.50	0.000***
CHEAT	HSCH-TEACH VS UNI-TEACH	1.34	0.182

Note: *** statistically significant at 1%; ** 5%
Source: Authors

The medians for the total scores related to e-tests are not equal for both groups of respondents (Table 19). This inequality results from 3 statements (DIS-WRITT-EFFIC, SCH-WRITT-EFFIC and ORAL-EFFIC) since the tests suggest that medians are equal for the remaining 5 statements (Table 19). It can be concluded that high school educators are more sceptical about the efficiency of written and oral distance e-exams than university educators. At the same time, their opinion regarding other aspects analyzed within this question does not differ.

Table 19
Test for equality of medians between series (second part of the questionnaire responded by educators; summative scale; statements EFFORT + TIME + CORRECTION + DIS-WRITT-EFFIC(r) + SCH-WRITT-EFFIC(r) + ORAL-EFFIC(r) + CHEAT)

Group	Mann-Whitney U	P-value
HSCH-TEACH VS UNI-TEACH	3.56	0.000***

Note: *** statistically significant at 1%; ** 5%
Source: Authors

In addition to previous conclusions, the correlation analysis presented in Table 20 indicates no statistically significant correlation between the experience in teaching and educators' responses to e-exams. Therefore, the number of years of teaching does not affect the opinions or preferences of educators when comparing e-exams and traditional exams.

Table 20
Correlation between responses (individual items) and number of years an educator has been teaching (second part of the questionnaire responded to by educators)

	Measure		EFFORT	TIME	CORRE-CTION	DIS-WRITT-EFFIC	SCH-WRITT-EFFIC	ORAL-EFFIC	CHEAT
HSCH-TEACH	**Spearman Corre-lation**	**Coe-fficient**	-0.077	-0.050	0.072	-0.073	-0.069	-0.031	0.107
		P-Value	0.457	0.629	0.486	0.485	0.509	0.768	0.302
UNI-TEACH	**Spearman Corre-lation**	**Coe-fficient**	-0.079	-0.016	0.019	0.030	0.043	-0.024	-0.085
		P-Value	0.154	0.771	0.734	0.591	0.434	0.669	0.127

Source: Authors

In the version of a questionnaire distributed to students, the question related to e-exams had only 3 statements. Only 1 statement is common with educators – a statement about the possibility of cheating during e-exams. In the other 2 statements, students were asked to rate to what extent they prefer written or oral e-exams to traditional exams. Statements and their codes are listed in Table 21.

Table 21
Codes used for statements and groups of respondents (second part of the questionnaire responded to by students)

Statements / Group of Respondents	Code
I prefer written distance e-exams rather than traditional written exams.	PREF-WRITT
I prefer oral distance e-exams rather than traditional oral exams.	PREF-ORAL
The distance e-exams provide an opportunity for cheating, making it difficult to prevent.	DIS-CHEAT
High School Students	HSCH-ST
University Students	UNI-ST

Source: Authors

According to descriptive measures (Table 22), students prefer written distance e-exams to traditional written exams since 54% of high school students, and 56% of university students agree with the first statement. They also mostly prefer oral distance e-exams over traditional oral exams. However, the percentage is lower than for written exams (45%/41% of high school/university students agree with the second statement, while 32%/34% do not agree). In the end, 51% of students agree that e-exams provide more opportunities for cheating and are less reliable. This is a much lower percentage than with educators (81%).

Table 22
Descriptive statistics (second part of the questionnaire; individual items; statements PREF-WRITT, PREF-ORAL and DIS-CHEAT)

Measure	PREF-WRITT		PREF-ORAL		DIS-CHEAT	
	HSCH-ST	UNI-ST	HSCH-ST	UNI-ST	HSCH-ST	UNI-ST
Mean	3.57	3.56	3.27	3.11	3.50	3.46
Median	4	4	3	3	4	4
Std. Dev.	1.41	1.40	1.46	1.46	1.39	1.30
Skew.	-0.53	-0.56	-0.24	-0.11	-0.44	-0.38
Kurtosis	2.00	2.04	1.71	1.69	1.97	2.05
P-Value	0.00	0.00	0.00	0.00	0.00	0.00
Obs.	795	1,679	795	1,679	795	1,679

Source: Authors

Responses for the first 2 statements were summed up to calculate the total score, confirming that students prefer e-exams over traditional exams. The 3rd statement was excluded from calculating the total score because it is not an indication of what type of examining students prefer (e.g., some students might prefer e-exams if they offer more opportunities for cheating, while another student might view this as a negative side because the grades are not objective). On a scale from 2 to 10, the median for

both written and oral exams is 7 (Table 23), confirming that e-exams are generally more preferred by students.

Table 23
Descriptive statistics (second part of the questionnaire; summative scale; statements PREF-WRIT + PREF-ORAL)

Measure	HSCH-ST	UNI-ST
Mean	6.85	6.66
Median	7	7
Std. Dev.	2.62	2.50
Skew.	-0.29	-0.32
Kurtosis	1.92	2.17
P-Value	0.00	0.00
Obs.	795	1,679

Source: Authors

The central tendency for the two groups of students is very close for individual statements and the total scores, suggesting that high school students and university students, on average, have similar attitudes towards e-exams. This was additionally verified by testing the equality of medians (Table 25). The test showed a difference in oral distance e-exams, which high school students prefer more than university students, which is significant at a 1% level. As for the other two statements and the total score, the medians are not statistically different.

Table 24
Test for equality of medians between series (second part of the questionnaire responded to by students; individual items)

Statement	Group	Mann-Whitney U	Probability
PREF-WRITT	HSCH-TEACH VS UNI-TEACH	0.39	0.693
PREF-ORAL	HSCH-TEACH VS UNI-TEACH	2.60	0.009***
DIS-CHEAT	HSCH-TEACH VS UNI-TEACH	1.18	0.240

Note: Statistically significant at 1%
Source: Authors

Table 25
Test for equality of medians between series (second part of the questionnaire responded by students; summative scale; statements pref-writ + pref-oral)

Group	Mann-Whitney U	Probability
HSCH-TEACH VS UNI-TEACH	1.67	0.095*

*Note: * Statistically significant at 10%*
Source: Authors

As was the case with educators and their experience in teaching, correlation analysis (Table 26) shows no statistically significant correlation between the year of study and students' responses regarding e-exams. This means that they prefer e-exams regardless of their year or class. However, this leaves a possibility that they have different reasons for preferring e-exams to traditional exams, which was not questioned as part of this survey.

Table 26
Correlation between responses (individual items) and current year of study (second part of the questionnaire responded to by students)

Group	Measure		PREF-WRITT	PREF-ORAL	DIS-CHEAT
HSCH-ST	Spearman	Coefficient	-0.026	-0.005	-0.041
	Correlation	P-Value	0.457	0.894	0.243
UNI-ST	Spearman	Coefficient	0.030	0.035	0.015
	Correlation	P-Value	0.216	0.157	0.550

Source: Authors

Future of e-Learning

In addition to assessing present aspects of e-learning during the pandemic, educators and students were asked to express their opinion regarding e-learning in the future or post-pandemic circumstances. Using e-learning and digital tools during the pandemic was more a necessity than a choice, which is why it is questionable to what extent new methods and ways of teaching and learning will continue in the future. This question was the same for educators and students, which allows for a comparison of answers. Respondents were given 4 potential answers, and the percentages are shown in Table 27. The most represented answer across all respondents is that e-learning should be implemented as an important addition to traditional learning. This indicates that the respondents have recognized the value and advantages of e-learning. Still, they are also aware of the disadvantages, which is why very few respondents think e-learning should be used as an independent form of education.

There are certain differences between groups of respondents. A higher percentage of educators (67%), compared with students (46%), agreed that e-learning should be an important addition to traditional learning. Moreover, when using a combined sample of educators and students, university respondents (52%) are more inclined to this statement than high school respondents (40%). High school students are again the most sceptical group since many view e-learning only as a side to traditional teaching.

Table 27
Respondents' view on e-learning in the future

Answers	% HSCH-TEACH	% UNI-TEACH	% HSCH-ST	% UNI-ST
It should be used as an important addition to traditional teaching.	53%	66%	38%	50%
It should be used as a side addition to traditional teaching.	46%	28%	37%	31%
It should be implemented as an independent form of education (only e-learning).	0%	5%	13%	14%
It should be completely returned only to traditional teaching.	1%	2%	12%	5%
Total	100%	100%	100%	100%

Source: Authors

To test if there is a statistically significant difference in the way different groups of respondent value e-learning in the future, we conducted the two proportion one-tailed z-tests. With a 5% significance level, it can be concluded that the proportion of educators that chose the first answer is statistically higher than that of students. The

same applies to university respondents were compared with high school respondents. The remaining results are presented in Table 28.

Table 28
Results of the two-proportion z-test (one-tailed, a =0.05) related to statements reflecting respondents' view on e-learning in the future

Statement	Educators VS Students	High School Respondents VS University Respondents
It should be used as an important addition to traditional teaching.	z = 6.4651 p< 0.001***	z = -5.9628 p< 0.001***
It should be used as a side addition to traditional teaching.	z = -0.4047 p = 0.34458	z = 4.2427 p< 0.001***
It should be implemented as an independent form of education (only e-learning).	z = -5.7391 p< 0.001***	z = -0.7459 p = 0.22663
It should be completely returned only to traditional teaching.	z = -4.7561 p< 0.001***	z = 5.9007 p< 0.001***

*Note: *** statistically significant at 1%*
Source: Authors

Discussion

Overall research results presented in the previous chapter confirmed that the pandemic forced educators and students to introduce more digital tools than they were using before the pandemic. This is understandable, considering the conditions in which the teaching process was mostly performed during the pandemic. The need to substitute traditional learning with e-learning led to improving individual digital competencies of both educators and students but also understanding that they still have a lot to learn when it comes to digital tools and their possibilities. However, results have also shown that educators were to some extent concerned about achieving learning outcomes during the pandemic, which might be partially caused by the fact that introducing digital tools and new teaching methods at the beginning of the pandemic was sudden and forced rather than systematically planned. As with previous researchers (e.g., Lemay et al., 2021, or Carabajo Romero et al., 2021), it is understandable that this increased students' stress levels. Since most educators and students were inexperienced in e-teaching/e-learning, this change has certainly caused some insecurities about the final effect, especially since there were challenges in controlling students and verifying that they participated. High school students were less optimistic about the positive impact of the pandemic on applying digital tools in teaching than university students. This confirmed the first research proposition (RP1). There are several potential reasons for such results. University students are older and expected to be more independent and self-disciplined, meaning they probably better adapted to the transition. The finding that aligns with this claim is that even university students with higher years of study value the positive impact of digital tools during the pandemic higher than their colleagues at lower years. They are also less inclined to think that it will negatively impact the achieved learning outcomes. In addition, during the pandemic, university students had more classes online than high school students, which consequently means that they probably used digital tools more and/or longer.

Regardless of the differences in opinions between different groups of respondents, it seems certain that the pandemic has forever changed the way the teaching and learning process has been performed. Despite several disadvantages of e-learning, some forms will be kept even when the pandemic is over. Research results confirm this

assumption since a very small percentage of respondents answered that we should completely return to traditional teaching. However, it was confirmed that a statistically higher proportion of university respondents (educators and students combined) believe that e-learning should be an important addition to traditional teaching compared to high school respondents. This confirms the second research proposition (RP2). The reasons behind these results may be similar to already explained potential reasons why university students are more optimistic about the pandemic's positive impact by introducing more digital tools in teaching. Both educators and students know that e-learning, especially distance, requires self-discipline, self-motivation and independence, which is easier to accomplish at higher levels of education, such as the university level. A compromise solution might be implementing e-learning in high schools and universities but in different forms. High school students might respond better to using different digital tools in classrooms, while university students are more equipped to adapt to distance e-learning and individual work.

One of the challenges during the pandemic, when we suddenly switched from traditional to online teaching, was how to conduct exams. Different forms of e-exams were introduced, and different ways of supervising students during e-exams. Not all courses were equally suitable for distance e-examining, and there was certainly a learning curve both for educators and students. Even before conducting the research, it was expected that educators and students, at least to some extent, would differ in opinion when asked if they prefer e-exams rather than traditional exams. Research results showed that educators generally prefer traditional exams because they are more aware of the disadvantages of e-exams compared to the advantages, while students generally prefer e-exams. This finding confirms the third research proposition (RP3). The disadvantages from the standpoint of educators refer to more time they spend preparing and correcting e-exams, which is why they believe they are less efficient than traditional exams.

However, a more serious issue is the questionable reliability of e-exams since many educators believe that they offer more opportunities for cheating. This might also suggest that most educators have not been able to implement appropriate supervision measures to ensure students are not cheating. We believe that this is because these supervision measures must be researched, developed, supported and implemented at the institutional level, meaning that schools and universities should provide solutions and instructions that would prevent non-academic behaviour rather than leaving this issue to be resolved by each educator. At the same time, a mutually accepted code of conduct could be supportive. Different approaches, lack of institutional support and viewing e-exams as a temporary solution during the pandemic have possibly made them less reliable.

On the other hand, e-exams (especially distance) for most students have more advantages than disadvantages. They usually do not require more preparation and can be more efficient because students do not have to travel to school or university or be nervous about being late. From the standpoint of university students, who start to work during their studies, the ability to write exams from their workplace might be especially valuable. However, some uncertainty still exists because IT technology used for conducting e-exams might fail before or during the exam. Another reason for potentially preferring e-exams is the different approach some educators had to implement when switching from traditional to distance e-exams. Aware that it is difficult to prevent students from consulting available literature and online sources, certain exams were converted to open-book exams, which might suit students better than closed-book examinations. In the end, although educators viewed the higher possibility of cheating during e-exams as a negative side, at least some students might

view this as a positive side of e-exams. Our research results align with the conclusions from Maroco, where Elfirdoussi et al. (2020) found that educators believe that it is not feasible to conduct exams from a distance. In addition, Mladenova et al. (2020) stated that students achieved higher grades during the pandemic, which might also result from cheating. Therefore, the integrity of the examination process in online circumstances is widely recognized.

Limitations of the research are related to sample sizes and the truthfulness of the respondents. Although the total sample is very large, more responses were collected from students than educators, especially high school educators. In addition, the questionnaire was completely anonymous. Still, there is always the possibility that some respondents were not truthful when giving their opinion due to superficial reading of questions, disinterest, etc.

Conclusion

With the appearance of the Covid-19 virus during the pandemic, there have been significant changes in the education system. In a short time, there was a digitalization of the entire school system, given that classes were held online, both in schools and universities. Since it all happened suddenly, there wasn't time to develop a strategy for such a way of teaching, which caused certain problems. Students and educators do not have the same prior knowledge and experience in using digital technologies in online learning, which leads to different perceptions about the satisfaction of online teaching concerning traditional, face-to-face teaching. In addition to technical difficulties and difficulties with the internet, problems are also manifested in stress among students and the lack of social interaction. Given that online teaching will certainly be maintained in a certain proportion even after the pandemic, all identified shortcomings should be analyzed and corrected so that online learning is as effective as traditional, face-to-face learning.

Undeniably, the pandemic forced educators and students to introduce more digital tools in the education process, as the research shows, leading to improved individual digital competencies. On a sample of 2,897 educators and students from four European countries, it is evident that there are certain differences in opinion between students and educators, as well as between university respondents and high school respondents. When assessing the positive impact of the pandemic on applying digital tools, high school students are less optimistic than university students, which might be partially caused by the fact that university students had more classes online and, therefore, more opportunities to use digital tools. During the pandemic, high schools and universities were forced to implement e-exams, at least during one period, which resulted in discussions regarding their effectiveness. Research results showed that educators are more aware of the disadvantages of e-exams, which is why they prefer traditional exams, while students are more inclined towards e-exams.

Regarding the future of e-learning, it should be noted that e-learning, especially distance, requires self-discipline, self-motivation and independence, which is why it might be more appropriate for students at higher levels of education. This might explain why a higher proportion of university respondents, compared to high school respondents, believe that e-learning should be an important addition to traditional learning. In conclusion, the results of our research, as well as the results of the previous research, proved that e-learning definitely would and should be used in the future, but in a form that suits educational level, ensures the adoption of learning outcomes and reliable examination of acquired knowledge, which are some of the issues that arose during the pandemic and sudden transition to e-learning.

References

1. Adedoyin, O. B., Soykan, E. (2020), "Covid-19 the pandemic and online learning: the challenges and opportunities", Interactive Learning Environments, https://doi.org.10.1080/10494820.2020.1813180 (3 January 2022)

2. Andersson, P., Mattsson, L. G. (2021) "Future digitalization of education after COVID-19" available at https://www.hhs.se/contentassets/419c7b2f06a94ee183bf52ca748c98b5/a54.pdf (3 January 2022)

3. Attwell, G. (2007), "Personal Learning Environments – the future of ELearning?", eLearning papers, Vol. 2, No. 1, pp. 1-8.

4. Backes, S., Baumann, I., Harion, D., Sattler, S., Lenz, T. (2021), "Why flipping the classroom is not enough: Digital curriculum making after the the pandemic", Prospects, Vol. 51, pp. 347-361.

5. Bączek, M., Zagańczyk-Bączek, M., Szpringer, M., Jaroszyński, A., Wożakowska-Kapłon, B. (2021), "Students' perception of online learning during the COVID-19 the pandemic: A survey study of Polish medical students", Medicine, Vol. 100, No. 7, pp. 1-6.

6. Ben, F. (2020), "Forced into it: Digital Technologies for Teaching and Learning During a Global Pandemic", in 1st International Conference on Information Technology and Education (ICITE 2020), Atlantis Press, pp. 588-592.

7. Butnaru, G. I., Niţă, V., Anichiti, A., Brînză, G. (2021), "The effectiveness of online education during covid 19 the pandemic—a comparative analysis between the perceptions of academic students and high school students from Romania", Sustainability, Vol. 13, No. 9, pp. 1-20.

8. Camacho, D. J., Legare J. M. (2021), "Pivoting to online learning – The future of learning and work", The Journal of Competency-Based Education, Vol. 6, No. 3.

9. Carabajo Romero, I. R., González Reyes, S. D., Quinto Ochoa, E. D., León Abad, E. G. (2021), "The impact of COVID-19 from FACE to FACE to ONLINE learning", available at: https://www.adayapress.com/wp-content/uploads/2021/06/refpred18.pdf (3 January 2022)

10. Chakraborty, P., Mittal, P., Gupta, M. S., Yadav, S., Arora, A. (2021), "Opinion of students on online education during the COVID-19 the pandemic", Human Behavior and Emerging Technologies, Vol. 3, No. 3, pp. 357-365.

11. Demuyakor, J. (2020), "Coronavirus (COVID-19) and online learning in higher institutions of education: A survey of the perceptions of Ghanaian international students in China", Online Journal of Communication and Media Technologies, Vol. 10, No. 3, pp. 1-9.

12. Elfirdoussi, S., Lachgar, M., Kabaili, H., Rochdi, A., Goujdami, D., El Firdoussi, L. (2020), "Assessing distance learning in higher education during the COVID-19 the pandemic", Education Research International, Vol. 2020, pp. 1-13.

13. Esteban Jr., A. M., Cruz, M. J. P. (2021), "Digital Divide in Times of Pandemic among Teacher Education Students", Open Access Library Journal, Vol. 8, pp. 1-12.

14. García-Morales, V. J., Garrido-Moreno, A., Martín-Rojas, R. (2021), "The transformation of higher education after the COVID disruption: Emerging challenges in an online learning scenario", Frontiers in Psychology, Vol. 12, pp. 1-6.

15. Georgescu, M. (2006), "The Future of E-Learning: Designing Tomorrow's Education", available at https://www.researchgate.net/publication/228242459 (3 January 2022)

16. Goyal, S. (2012), "E-Learning: Future of Education", Journal of Education and Learning, Vol. 6, No. 2, pp. 239-242.

17. Iivari, N., Sharma, S., Ventä-Olkkonen, L. (2020), "Digital transformation of everyday life–How COVID-19 the pandemic transformed the basic education of the young generation and why information management research should care?", International Journal of Information Management, Vol. 55, pp. 1-6.

18. Kadeniz, S. (2009), "Flexible design for the future of distance learning", Procedia - Social and Behavioral Sciences, Vol. 1, No. 1, pp. 358-363.

19. Lemay, D. J., Bazelais, P., Doleck, T. (2021), "Transition to online teaching during the COVID-19 the pandemic", Computers in Human Behavior Reports, Vol. 4, pp. 1-9.

20. Mahyoob, M. (2020), "Challenges of e-Learning during the COVID-19 Pandemic Experienced by EFL Learners", Arab World English Journal (AWEJ), Vol. 11, No. 4, pp. 351-362.

21. Mladenova, T., Kalmukov, Y., Valova, I. (2020), "Covid 19–A major cause of digital transformation in education or just an evaluation test", TEM journal, Vol. 9, No. 3, pp. 1163-1170.

22. Obeidat, A., Obeidat, R., Al-Shalabi, M. (2020), "The Effectiveness of Adopting e-Learning during COVID-19 at Hashemite University", International Journal of Advanced Computer Science and Applications, Vol. 11, No. 12, pp. 96-104.

23. OECD (2005), "Policy brief. E-learning in Tertiary Education", available at https://www.oecd.org/education/ceri/35991871.pdf (3 January 2022)

24. Özüdoğru, G. (2021), "Problems faced in distance education during Covid-19 Pandemic", Participatory Educational Research, Vol. 8, No. 4, pp. 321-333.

25. Perifanou, M., Economides, A., Tzafilkou, K. (2021), "Teachers' digital skills readiness during COVID-19 the pandemic", International Journal of Emerging Technologies in Learning - iJET, Vol. 16, No. 8, pp. 238-251.

26. Pozo, J. I., Pérez Echeverría, M. P., Cabellos, B., Sánchez, D. L. (2021), "Teaching and learning in times of COVID-19: uses of digital technologies during school lockdowns", available at https://www.frontiersin.org/article/10.3389/fpsyg.2021.656776 (3 January 2022)

27. Schober, P., Boer, C., Schwarte, L. A. (2018), "Correlation coefficients: appropriate use and interpretation", Anesthesia and Analgesia, Vol. 126, No. 5, pp. 1763-1768.

28. Ullah, A., Ashraf, M., Ashraf, S., Ahmed, S. (2021), "Challenges of Online Learning during the COVID-19 Pandemic Encountered by Students in Pakistan", Journal of Pedagogical Sociology and Psychology, Vol. 3, No. 1, pp. 36-44.

29. Varyani, H., Navaneeth, M. S. (2020), "The Past, Present and Future of E-Learning: In India", International Journal of Policy Sciences and Law, Vol. 1, No. 1, pp. 99-118.

30. Wangdi, N., Dema, Y., Chogyel, N. (2021), "Online learning amid COVID-19 the pandemic: Perspectives of Bhutanese students", International Journal of Didactical Studies, Vol. 2, No.1, pp. 1-10.

31. Zeqiri, J., Kareva, V., Alija, S., Pejic Bach, M. (2022), "Challenges and opportunities for higher education in North Macedonia during the COVID-19 pandemics: a survey of student satisfaction and gender-related anxiety", International Journal of Technology Enhanced Learning, Vol. 14, No. 2, pp. 163-179.

About the authors

Mateja, Brozović, PhD, is an Assistant Professor at the Department of Accounting, Faculty of Economics and Business, University of Zagreb, with a PhD in auditing financial statements. She actively participates in teaching courses related to accounting, analysis of financial statements and auditing at university and professional study programs. She has co-authored several scientific and professional papers, presented papers at international and domestic scientific conferences, and participated in writing three textbooks and one handbook. As a collaborator, she has participated in scientific projects funded by the University of Zagreb, the Croatian Science Foundation, the European Social Fund and Erasmus+. The author can be contacted at **mbrozovic@efzg.hr**.

Marina Ercegović, PhD is working as a Postdoctoral Researcher at the Department of Accounting, Faculty of Economics and Business, University of Zagreb, Croatia. She received her PhD at the Faculty of Economics and Business, the University of Zagreb, in July 2018. She teaches financial and management accounting courses: Accounting II, Financial Accounting, Managerial Accounting, Business planning and application of financial reporting standards. She has participated in scientific papers at conferences in Croatia and internationally and co-authored scientific and professional papers in accounting. The author can be contacted at **mmicin@efzg.hr**.

Gunther Meeh-Bunse, PhD is a Full Professor at the University of Applied Science Osnabrück, Lingen Campus, Faculty of Management, Technology and Culture, Germany. He received PhD from the University of German Armed Forces at Munich in Social and Economic Sciences. He has vocational experience in international corporate banking and corporate control. As faculty head of international relations, he enjoys collaboration with established and new partner universities. He invented a successful business administration study program and taught at the bachelor's and master's levels. Corporate Finance, IFRS, Rating, and Sustainability are the main fields of interest. The author can be contacted at **g.meeh-bunse@hs-osnabrueck.de**.