European Journal of Contemporary Education
E-ISSN 2305-6746
2023. 12(2): 629-645
DOI: 10.13187/ejced.2023.2.629
https://ejce.cherkasgu.press

Higher Education Experience in the Shadow of COVID-19: The Hungarian Online Education

Katalin Szabó [a], Erika Varga [a], Tímea Juhász [b, *]

[a] Hungarian University of Agriculture and Life Sciences, Hungary
[b] Budapest Business School, Hungary

Abstract

It is a well-known fact COVID-19 has changed our concepts about crisis situations and forced us to make changes in every area of our lives, some of which are still there to stay. The article investigates online education in Hungary from the instructors' perspective focusing on experience, digital competences and the digital tools provided. After exploring the difficulties, the future of online education is addressed. It is hypothesised that the success of digital education depends to a large extent on digital competences, digital tools and also the content and structure of education. That is why difficulties are perceived differently. The research is based on a questionnaire completed by 681 instructors from 36 Hungarian higher education institutions in the summer of 2020. The research results indicate that due to the stringent emergency measures, teachers were forced to reschedule their classes, which led to a variety of difficulties, but online education will continue to play a significant role in the future. In the long run, digital learning environments and schools in general should be taken into consideration. According to the findings, developing digital skills is critical so educational systems and curriculum must be revised in terms of content and technology as it is of paramount importance to keep track of both instructors' and students' digital skills on a regular basis.

Keywords: higher, education, Hungary, COVID-19, pandemic, online education, IT, digital transformation, ICT, digital competence, digital skills, instructors, lecturers.

1. Introduction

With the outbreak of the pandemic, an unprecedented situation has arisen, which lead to a significant downturn in the economy and changes in working and educational conditions. Although some restrictions were lifted in the summer of 2020 as infection and mortality rates had decreased, it was only a year later, in the summer of 2021, when the economy started to recover with the

* Corresponding author
E-mail addresses: juhasz.timea@uni-bge.hu (T. Juhász)

advent of vaccinations, but the pandemic has not yet been completely eradicated. One area that has significantly been affected by the pandemic is education.

This article places Hungarian higher education in the limelight. During the lockdown, Hungarian universities were obliged to switch to online education, for which they were not fully prepared. Although some of the lecturers and instructors possessed an adequate level of digital competence, the picture is rather mixed. First, the paper analyses the concept of digital competence and then describes the rise of digital and ICT tools while emphasising the role of digital technologies. This is followed by a detailed discussion of the digital competences and skills of educators and a discussion of the difficulties and challenges of online education.

The second half of the article discusses primary research. After the methodological overview, a summary of the main findings is presented, which is followed by hypotheses test and the authors' conclusions and recommendations. A description of the limitations of the research also indicates further research directions.

Research problem

Developments that may have taken years happened in a matter of weeks of the lockdown and strict measures taken against the pandemic (European Commission, 2020a). As a result of physical distancing measures established in reaction to COVID-19, in the spring of 2020 tertiary education institutions changed to an emergency online learning model and distant education became universal (Grubic et al., 2020; Kim, 2020). COVID-19 caused onsite lessons to be cancelled for 86.7 % of pupils worldwide, according to Aristovnik et al. (2020). As a result, numerous types of online lectures have emerged. Real-time video conferences were used the most (59.4 %), followed by asynchronous types of lectures, such as emailing students presentations (15.2 %), video recordings (11.6 %), and textual communication via forums and chats (9.1 %).

The researchers conducted their research alongside the following research questions:

Q1. How do research participants perceive their digital competence?

Q2. What digital equipment did the employer provide during the pandemic to deliver the training?

Q3. How did the content and structure of education change during the pandemic?

Q4. What difficulties did teachers and academics face in delivering online education during the pandemic?

Q5. What future can be expected for online education after the pandemic?

The objectives (O) of the study can be summarised as follows.

O1. Describe the digital competences of the instructors based on gender, age and position before the pandemic.

O2. List all digital equipment provided by higher education institutions.

O2. Determine what changes took place in the structure and content of education due to the pandemic including digital (online) education.

O3. Analyse the difficulties they had to face.

O4. Present the future possibilities of online education.

Based on the questions and objectives above, the authors in the present study test the following hypotheses:

H1. The success of digital education during the COVID period depended largely on the digital competence of the instructors, the digital equipment offered, as well as the content and structure of the instruction.

H2: The difficulties of teaching during the pandemic were perceived differently by lecturers.

H3: Digital education introduced during COVID-19 will continue to be part of education after the end of the pandemic, mainly in the form of a hybrid course.

2. Literature review

Online education

Online education is a type of remote education in which students access the learning content using digital technology, online course materials, and online interactions. Online learning occurs as a result of online education (Yilmaz, 2019). Asynchronous and synchronous remote education are the two basic types of distant learning. Asynchronous learning supports work relationships among learners and between learners and teachers when participants cannot be online at the same time, whereas synchronous distance education can occur through live video and/or audio conferencing.

Synchronous online education can make students feel like participants, and instant feedback can be obtained (Hrastinski, 2008).

According to Kim (2020), there are various advantages to online learning, whether it is synchronous or asynchronous. Students, for example, are not required to be at the same physical area, which might boost participation rates. Online learning can also save money since it eliminates the need for travel and other expenses associated with attending in-person sessions.

On their digital action plan for 2020, the European Commission (2020b) held an open public consultation on digital education, which revealed that prior to the pandemic, about 60 % of respondents had not used distance or online learning. This demonstrates a lack of preparedness when change to online education was implemented. Sixty percent of respondents stated the pandemic enhanced their digital abilities, and 95 percent said the pandemic represented a point of no return in terms of how technology is utilized in education (European Commission, 2020a).

Digital competence

Introducing digital technology into the classroom presents instructors with recent problems and obligations. Apart from the existing professional competencies, digital skills have become a new need for handling instruction, guidance, and evaluation (Hatos et al., 2022).

The Council of the European Union defines digital competence as 'the safe, critical and responsible use of and interaction with digital technologies for learning, at work and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), security (including digital well-being and cybersecurity-related skills), intellectual property issues, problem solving and critical thinking.' (Council of the European Union, 2018: 9)

Digital competence, defined as the set of knowledge, abilities, and attitudes required to effectively utilize technology, has begun to take the lead in the educational arena, since it is one of the most important competences that teachers and educators must possess in today's world. The teacher's role is vital in integrating technologies and implementing Information and Communication Technologies (ICT) in the classroom, since education will depend, among other aspects, on educational action, which implies that teachers must have effective digital competencies (Basilotta-Gómez-Pablos et al., 2022).

According to a recent research by Erstad et al. (2021), the term 'digital competence' has become more complicated and confusing in the context of education and curriculum development, and multiple conceptual frameworks have been constructed to understand various parts of this complexity. Erstad et al. distinguish three theoretical approaches on digital competence, each with a unique perspective: (1) new literacy studies, (2) media cultures, and (3) learning science.

Digital transformation

The COVID-19 outbreak forced teachers to change their educational practice quickly to guarantee learning continuity (Cabero, 2020; Casado-Aranda et al., 2021; Usher et al., 2021). The health crisis since 2020 has resulted in a greater demand for ICT, the exponential increase in information, the use and the creation of digital media and other platforms that make distance teaching and learning or the adaptation of onsite teaching to emergency remote teaching possible (Trust, Whalen, 2020). According to the European Commission (2020a), increases in connectivity, greater usage of devices and digital apps, the need for individual flexibility, and growing demand for digital skills are the driving forces of the digital revolution in education. Digital technology may help students learn in a more personalized, flexible, and student-centred way, and can be a powerful and engaging instrument for collaborative and creative learning.

Otherwise, there has also been a profound digital revolution since the turn of the millennium, and higher education must be prepared to react to the demands of this digital society, as well as foresee the needs of the future society. The effort made by higher education institutions towards the virtual development of teaching, as a consequence of the pandemic, has led to a review of educational practices to adapt teaching to a digital environment (Sales et al., 2020). Digital technologies are now more prevalent in higher education than they were previously (Heidari et al., 2020; Murphy, 2020).

Challenges of digitalisation

Four essential ideas underline the necessity to handle technology in the context of teachers' digital competence: computer literacy, media literacy, digital literacy, and digital competence (Røkenes, Krumsvik, 2014). The constraints of online teaching, according to Kim (2020),

are frequently related to instructors' lack of expertise or technical abilities. In many cases, people face problems such as lack of access to the internet or the tools and skills to use it (Kovács, 2020).

Many educational and academic institutions use digital technology. Consequently, the academic community is facing several new challenges (Toquero, 2020). One of the issues tertiary education institutions confront in adjusting to new digital procedures is maintaining and enhancing students' academic involvement (Bond, 2020; Campbell et al., 2019). During the pandemic, a number of concerns in online learning surfaced, including excessive cognitive load, academic burnout, and disengagement, all of which have been raised repeatedly (Cao et al., 2020; Islam et al., 2020; Pohan, 2020). Teachers' digital skills are critical for optimizing innovative technologies in the classroom (Engen, Engen, 2019). As a result, it is critical to recognize that teachers' digital skills are linked to students' performance in digital learning environments (OECD, 2019a). Teachers' and students' perceptions of their digital abilities have been critical throughout this pandemic time, since an individual's judgment of their ICT skills is a key mediator in terms of how well they are put into practice (Winstone et al., 2021).

It has been found that the higher teachers rate their digital competence, the more likely they are to use ICT in their work (Sundqvist et al., 2020). However, teachers' limited ICT knowledge has caused anxiety about using ICT in the classroom, and they are hesitant to use it (Arkorful et al., 2021; Huang et al., 2021; Šabić et al., 2021), particularly in front of children who are perhaps more digitally literate than they are (Van Mechelen et al., 2021).

Computer anxiety (ICT anxiety) is a generic sense of discomfort, worry, nervousness of coping, or suffering in expectation of bad results from computer-related processes (Chang, 2005). It is 'the sensation of being uncomfortable when utilizing computers (technology in general in the context of our research).' (Awofala et al., 2017: 92). Awofala et al. (2019) discovered that computer anxiety is adversely related to self-efficacy. In some situations, perceived digital competencies can be a good predictor of real digital skills (Porat et al., 2018).

According to one theory (Maderick et al., 2016), individuals with low degrees of experience or training may overestimate their knowledge and skills because they are not aware of their level of competence. This may hold true for digital competences: people who do not understand or do not know digital knowledge and skills they possess may overestimate or underestimate their digital abilities. Those with a low level of digital abilities, on the other hand, are conscious of this and do not overstate their self-assessment as much as those who are aware of having a greater level of digital skills, according to Pavić and Černja (2019).

To sum up, in literature reviews, infrastructure; ICT devices available in the school; training in digital applications; cognitive and socio-emotional skills (Bacter et al., 2021), 'supported by effective lifelong learning systems' (OECD, 2019a, OECD, 2019b, OECD, 2019c); school environment; academic engagement; and appropriate ongoing technical support influence teachers' acquisition of skills for use in online environments (Hatos, 2019; Akmal et al., 2021).

Apparently, we would assume younger instructors to have a better digital competence score than their older counterparts (Cruz, Diaz, 2016) However, other studies found no significant relationship between the instructors' self-assessed digital competence and age (Drossel et al., 2017; Gil-Flores et al., 2017), so the age of the instructor has no impact on their usage of ICT.

Digital competence models

Several models and frameworks were adopted by some countries to indicate which digital competencies teachers should be trained in. A case in point is 'European Framework for Digital Competence of Teachers: DigCompEdu' which articulated around six differentiated competency areas that teachers must possess to promote effective, inclusive and innovative learning strategies using digital tools (Caena, Redecker, 2019; Lu et al., 2021). The Council of the European Union (2018) elaborated the so-called DIGCOM 2.0 model, which is the most widely used competence framework for the development and understanding of digital competence in Europe (digitally accessible: European Commission, 2021). Calvani et al. (2012) defined digital competence as having three dimensions: technical skill, cognitive skill, and ethical knowledge.

There is still a long way to go, but literature shows the interest and relevance of Teachers' Digital Competence (TDC). As Triadó states 'we never finish learning, (...) students change, knowledge advances, and it is always necessary to be up to date. A good teacher, like any professional who wants to stand out, cannot stop continuous training" (2020: 12).

3. Methodology

In the summer of 2020, the staff of the former Institute of Human Sciences of the Hungarian University of Agricultural and Life Sciences (MATE) launched a research during the COVID-19 outbreak designed to assess the experiences of digital education in response to the outbreak, including university lecturers and students.

The primary research was aimed to reach the greatest possible extent of representativeness and to conduct a survey with a national coverage. In compiling the questionnaire, the authors stressed to the respondents that the responses were voluntary and anonymous, and that the information provided would be used by the researchers for research purposes only. The current paper presents some of the results of the survey. The questionnaire was to be completed online by the research participants. The survey was also supported by the Hungarian Rectors' Conference, which helped to disseminate the call for research to the management of all higher education institutions. Data collection took place between 03 June 2020 and 09 July 2020. Thirty-six higher education institutions in Hungary participated in the survey, with 681 respondents from the teaching staff. This number also demonstrates that the authors were striving for a national coverage.

The higher education institutions involved in the survey were as follows: 25 % of the respondents worked at MATE University, 11.01 % at the Budapest Business School, 10.57 % at the University of Miskolc, 9.99 % at the University of Sopron, 5.58 % at the Pázmány Péter Catholic University, 4.26 % at the University of Kaposvár, 3.67 % at the National University of Public Service and 3.47 % at the Semmelweis University of Medicine.

In terms of study programmes (majors), staff members teaching in agricultural, technical, economic, natural sciences and social sciences responded to the questionnaire.

Statistical analysis

The data were analysed by the researchers using SPSS 25 statistical software and the following statistical procedures were applied: univariate and multivariate statistical methods, mean, standard deviation, Chi-square test, Mann-Whitney U test, ANOVA, factor analysis, correlation, logistic regression.

The questionnaire consisted fundamentally of closed questions; it was typically based on nominal and metric variables.

The structure of the questionnaire is summarised in Table 1.

Table 1. Structure of the questionnaire

Question Group 1 Experience before COVID-19	Question Group 2 Experience during COVID-19	Question Group 3 Sample specification
Characteristics of working in the digital space before the pandemic Digital competence of the respondent Digital equipment provided by employers before the pandemic	Characteristics of working in the digital space before the pandemic Impressions of online education Difficulties of online education Engaging students in online education The impact of the pandemic on higher education in the future	Gender Age Position Place of work

Source: authors' own research

The research, based on the five objectives, has the following structure.

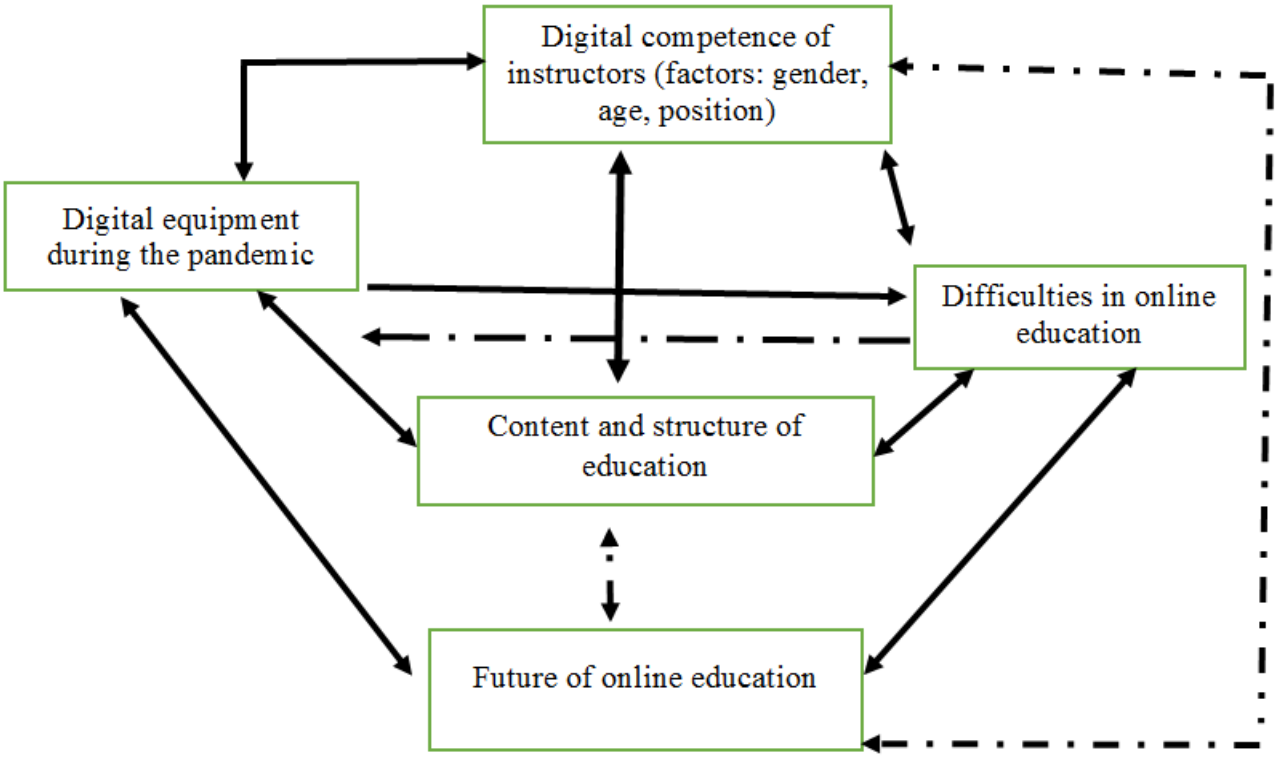

Fig. 1. The research objectives
Source: authors' own editing

In the figure the solid arrows show the direct effects, the dashed arrows the possible effects. The analyses were based on the digital competence of instructors, which the authors analysed by gender, age, and position. They also looked at the digital equipment that higher education institutions were able to provide for teaching purposes. In other words, these two areas analysed were closely related back and forth based on the researchers' assumptions. Of course, the way in which the content and structure of education had changed as a result of the impact of COVID-19 and the fact that both digital and hybrid education had become compulsory at university level could not be ignored. The success of these processes has depended, among other things, on the digital competence of the instructors, the quality of the digital tools provided and the flexibility of the educational content and structure. These experiences shed light on the future of digitalisation in education: are we going to live with it, integrate it into education, or are we going to return to traditional teaching tools, content and methods?

The specifications of the sample are presented in Table 2.

Table 2. Specification of the sample (%)

Specification	%
Gender	54 % male 46 % female
Age	0.3 % younger than 25 31.1 % between 25 and 35 31.5 % between 36 and 45 29.2 % between 46 and 55 17.5 % between 56 and 65 7.9 % older than 65
Position	1.2 % research fellow 11.7 % full professor 38.8 % associate professor 20.0 % assistant professor 28.3 % other

Source: authors' own research, n = 681

The highest proportion of men was in the 36-45 age group (31.1 %) while the highest proportion of women was in the 46-55 age group (33.2 %). By job title, those under 35 were most likely to be in the 'other' category (33.7 %), those aged 35-55 were predominantly associate professors (46.9 %) while among those older, associate professors and full professors (39.3 % and 31.8 %, respectively) were in high proportions.

4. Results

In the study, the authors analysed two time periods. One was the pre-emergency period, and the other was the post-emergency period. First, let us review the pre-emergency period.

Before the outbreak of COVID-19

Before the emergency was declared, the majority of respondents (33.9 %) spent an average of three to four hours a day working in the digital space, 15.1 % worked 1-2 hours, 28.8 % 5-6 hours, and 12.5 % 7-8 hours. By schedule, assistant professors were most likely to spend five to six hours a day (34.6 %), associate professors three to four hours a day (36.4 %) and full professors five to six hours a day (32.5 %) in the digital space.

By gender, both men and women were most likely to spend three to four hours a day on digital tools (31.9 % and 36.2 %, respectively).

The survey asked respondents what online educational activities they had previously engaged in regularly. 56.8 % of respondents had no previous experience in online education. 4.1 % conducted online oral exams, 18.4 % organised online written exams, 24.2 % consulted with students on online platforms and 12.0 % had online contact hours. Before the COVID-19, 60.9 % of women and one in two men had no online experience. The highest proportion of university lecturers had not worked in the online space before (56.3 %), while the highest proportion of associate professors had worked with digital tools (47.1 %). The most common platforms used for online communication before the COVID-19 were e-learning, email, Messenger, Neptun, Skype and Viber.

Prior to the COVID-19 emergency, higher education institutions most often provided their lecturers with the following tools: 58.9 % with a PC, 42.1 % with a laptop, 10 % with a microphone, while 22.5 % said they did not provide any of these tools.

The surveys showed that many institutions were unable to provide digital equipment to their colleagues. Digitalisation in education has been relatively modest. Approximately one in ten teachers had integrated digitalisation into the content and structure of their teaching and used it primarily for communication rather than for teaching activities. One of the reasons for this was that an extremely high proportion of respondents had not used or were not aware of the opportunities and solutions offered by digitalisation before the outbreak of COVID-19.

After the outbreak of COVID-19

The study then focused on the emergency situation after the COVID-19 outbreak. The proclamation of online education affected education stakeholders in a very unexpected and, in many places, unprepared way. While one day the course had been delivered in the classroom, the other day it was broadcast digitally from home, and at some places, in a hybrid format. The first semester of 2020 was conducted in these forms and under such circumstances, and examinations were also arranged predominantly in the digital space.

After the emergency was declared, 35.1 % of respondents spent more than eight hours a day in the digital space. This proportion was 9.8 % before the emergency. The highest proportion of women, 37.5 %, and 32.8 % of men spent more than 8 hours on digital devices during this period. By position, one-third of assistant professors typically spent 7-8 hours working digitally, while about one-third of associate professors and professors spent more than 8 hours.

The most common platforms include e-learning, email, Google Drive, Teams, Neptun, Skype and Zoom.

Respondents were asked to rate their impressions of online education on a five-point Likert scale. One was unsatisfactory and five was excellent. The mean and variance of the responses are summarised in Table 3.

The principal areas of dissatisfaction were the provision of institutional educational devices, online methodological skills and the active involvement of students in class. The strongest satisfaction could be found with the quality of online learning materials and teaching activities.

Afterwards, the authors examined the relationship between each variable. The results confirmed the following.

Table 3. Impressions of online education (mean and standard deviation, N:681)

Impression	Mean	Std dev
Supply of institutional equipment	2.69	1.263
My methodological background in online education	2.74	1.075
Active class participation/engagement of students	3.29	1.044
Digital literacy of my direct reports	3.53	0.852
Effectiveness of my online teaching activities	3.69	0.807
Digital literacy of students	3.71	0.741
My own digital readiness	3.79	0.860
My own tool availability	3.88	0.996
Quality of my online learning materials	3.89	0.757
Quality of my online teaching activities	3.91	0.708
Availability of my online learning materials	4.45	0.744

Source: authors' own research, n = 681

The more satisfied one was with their own digital literacy, the more positive one's impressions of the situation were, i.e., the more satisfied instructors were with their online methodological knowledge (Pearson correlation: .513 $p < 0.01$), the effectiveness of their online teaching (Pearson correlation: .323 $p < 0.01$), the quality of their online learning materials (Pearson correlation: .305 $p < 0.01$).

In relation to the online digital readiness of their immediate colleagues, respondents indicated that they were positively influenced by the digital readiness of students (Pearson correlation: .362 sig.: .001 $p < 0.01$), the quality of online learning materials of colleagues (Pearson correlation: .197 sig.: .001 $p < 0.01$).

The availability of their own tools is closely related to digital readiness (Pearson correlation: .384 $p < 0.01$) and online teaching methodology (Pearson correlation: .266 $p < 0.01$).

Institutional tool availability influenced the digital literacy of staff (Pearson correlation: .267 sign.: .001 $p < 0.01$), availability of online learning materials (Pearson correlation: .082 sign.:.001 $p < 0.01$) and effectiveness of teaching activities (Pearson correlation: .134 sign.:.001 $p < 0.01$).

The authors analysed how respondents rated their own digital literacy by classification. The Kruskal-Wallis test showed that there was a significant difference (Kruskal-Wallis: 18.547 df: 4 sig.: 0.001 $p < 0.05$). The most satisfied were assistant professors (mean: 3.99), while the least satisfied were full professors (mean: 3.53). There was also a significant difference confirmed by age (Kruskal-Wallis: 73.388 df: 4 sig.: 0.001 $p < 0.05$), meaning that those under 35 years of age felt their digital competence much stronger, while those over 56 years of age felt it less strong.

The results also confirmed that time spent in the digital space in the time before an emergency had an impact on digital competence (Kruskal Wallis: 41.216 df: 4 sig: 0.001), and those who spent more than 8 hours on average with digital tools were the most satisfied with their digital competence.

There were no differences of opinion in the provision of institutional devices, either by age or by job title. Assistant professors and academic staff aged 30-55 were the least satisfied with this issue.

The survey also asked about the success of online teaching, i.e., how they rated their teaching activities during the pandemic, to what extent they felt that their experience of online education was positive, or, on the contrary, whether they feel that it was possibly negative. 71.1 % of respondents thought it was a good opportunity, while 28.9 % said the opposite. Regarding this question, there was no difference in the ranking of the survey participants (Chi-square test: 5.488 df: 4 sig.: 0.240 $p > 0.05$), nor by age (Chi-square test: .146 df: 2 sig.: 0.930 $p > 0.05$). The study also examined the extent to which the impressions and opportunities given in Table 3 were correlated with perceptions of educational success. Table 4 shows the correlations and, where there are differences, indicates which group felt this factor strong.

The data show that both the prior digital skills of instructors and the availability of tools and methodological knowledge related to online education have an impact on how educators perceive the success of their teaching activity. These factors were perceived to be strong by those who rated the output of education as positive. Those who felt they were weak rated online education as

negative. However, the quality and availability of learning materials did not influence success. In the light of these results, the authors partially accept their first hypothesis.

Table 4. Correlation between impressions and educational success (Mann-Whitney U test results, p = 0.05)

Impressions	Correlations
Supply of institutional equipment	Whitney U: 41725.5, sig.: 0.01 Who is positive feels it stronger
My methodological background in online education	Whitney U: 36810 sig.: 0.001 Who is positive feels it stronger
Active class participation/engagement of students	Whitney U: 33340.5 sig.: 0.001 Who is positive feels it stronger
Digital literacy of my direct staff	No correlation
Effectiveness of my online teaching activities	Whitney U: 31818, sig.: 0.001 Who is positive feels it stronger
Digital literacy of students	Whitney U: 42442, sig.: 0.013 Who is positive feels it stronger
My own digital readiness	Whitney U: 37635, sig.: 0.01 Who is positive feels it stronger
My own tool availability	Whitney U: 41511, sig.: 0.005
Quality of my online learning materials	No correlation
Quality of my online teaching activities	Whitney U: 37019.5, sig.: 0.001 Who is positive feels it stronger
Availability of my online learning materials	No correlation

Source: authors' own editing

Table 5. Difficulties (average, standard deviation, N:480)

Difficulties	Average	St.dev.
Liaison with the Registrar's Office	1.80	1.65
My own internet connection problems	1.88	1.054
Contact with staff	2.00	1.085
Accessing necessary online learning platforms (e.g.: subscription)	2.09	1.284
Creating online learning materials	2.29	1.186
Ensuring adequate time for teaching at home	2.29	1.362
Maintaining contact with students	2.30	1.172
Providing adequate space for teaching in my home	2.39	1.369
Institutional communication on emergency management	2.40	1.277
Internet connection problems for students	2.41	1.119
Developing a set of requirements appropriate to the emergency	2.58	1.234
Knowledge and use of online educational platforms	2.64	1.162
Reconciling home office and private life	2.69	1.421
New administrative tasks	2.68	1.131
Personal presence, lack of direct contact with colleagues	2.74	1.295
Narrowing of the range of traditional teaching methods	2.90	1.277
Lack of personal presence and direct contact with students	3.49	1.278

Source: authors' own editing

The study also analysed the difficulties one encountered during online teaching. For the second hypothesis, the authors specifically considered the opinions of the instructors, thus

reducing the study sample to assistant, associate and full professors. The remaining sample size was 480. The difficulties were also rated by the respondents on a five-point Likert scale. A one was given as 'no difficulty caused' and a five as 'great difficulty caused'. The means and variances are summarised in Table 5.

The least difficulties were in the area of institutional relations. It was more difficult to organise home education and involve students in education. The most problematic was the minimisation of personal contacts and the need for a rapid rethinking of traditional educational opportunities. In other words, there was a need to adapt quickly and flexibly to a novel approach to education, with staff not necessarily having the adequate digital skills.

For further analysis, the authors developed factors from the variables. All variables were suitable for factor construction. The KMO Barlett's test scores were .835, the Chi-square was 2964.849, df: 136, sig. 0.000 and the explained variance ratio 65.344 %, respectively. Factor rotation was carried out by Varimax method. The following factors were obtained.

Table 6. Factors of difficulties

Difficulties	Factors				
	1	2	3	4	5
COM1Intense presence, lack of direct contact with students	0.750				
COM2Intense presence, lack of direct contact with staff	0.761				
COM3Communication with students	0.762				
COM4Communication with staff	0.718				
COM5Narrowing of methodological options in traditional education	0.647				
ED1Online creation of teaching materials		0.726			
ED2Developing a set of requirements adapted to the emergency		0.729			
ED3Knowledge and use of online learning platforms		0.672			
ED4New administrative tasks		.668			
OR1Allocate sufficient time for teaching at home			0.847		
OR2Balancing home office and private life			0.853		
OR3Allowing enough space for education at home			0.787		
D1Students' internet connection problems				0.758	
D2Their own internet connection problems				0.747	
D3Access to necessary online learning platforms (e.g.: subscription)				0.668	
IN1Liaising with the Registrar's Department					0.742
IN2Institutional communication on emergency management					0.713
Cronbach Alpha	.837	.751	.840	.639	.548

Source: authors' own research

The letter symbols in front of the variables are used in the construction of the SEM model (Figure 1)

Factors are named as follows:

Factor 1: Lack of personal communication

Factor 2: Organisation of education on the digital platform

Factor 3: The creation of home office

Factor 4: Providing digital access

Factor 5: Communication with the institution

The researchers used the SPSS AMOS 27 programme to further test their model. The essence of the model was how the difficulties were perceived by each group of instructors in the light of the

given factors. The idea of SEM (Structural Equation Modelling) is to examine the relationship between one or more exogenous variables (independent) and one or more endogenous (dependent) variables. The endogenous variables are affected directly and indirectly by the exogenous variables. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) studies aim to analyse the relationships between the variables under investigation and the latent variables. The EFA is used when the relationship between the investigated and the latent variables is not known. The CFA is used when the researcher has some knowledge about the structure of the latent variable. Path model analysis is the visual representation of relationships between variables.

The authors created the model of the factors and variables under study using SPSS AMOS Version 27. In the figure, each arrow next to the latent and test variables shows the effect of one variable on another, and the back and forth arrows symbolize the covariance, or correlation, between variables. The error variables are indicated by circles in the figure. These are the factors that were ignored in the analysis but have an effect on the variables.

The fit of the constructed model was checked by the researchers using a number of criteria. The first test metrics confirm 'absolute model fit': the Chi-square was significant ((480)494.031, df: 121, p: ,0.00). However, this is not sufficient for the researchers to reject the fit of the model, as the significance of the Chi-square is stronger after a sample size above 200. Additional measures were tested by the authors. For example, the RMSEA (Root Mean Square Error Approximation) value: .080, which should typically be below .08. This value is right at the limit. The third such indicator is the GFI (Goodness of Fit Index), which is acceptable for values above 0.9. In the authors' model, the value is .897, i.e., at the limit. In the context of Incremental Model Fit, the authors checked four indices, AGFI, CFI, NFI, TLI, with values above 0.9. In the model, AGFI: .854, CFI: .872, NFI: .839, TLI ..838, i.e., these indices are also close to the fit value. For Parsimonious Fit, the Chi-squared/df value is 4.083, which is less than threshold value of 5, hence, it indicates that the model is fit. Figure 2 shows the model.

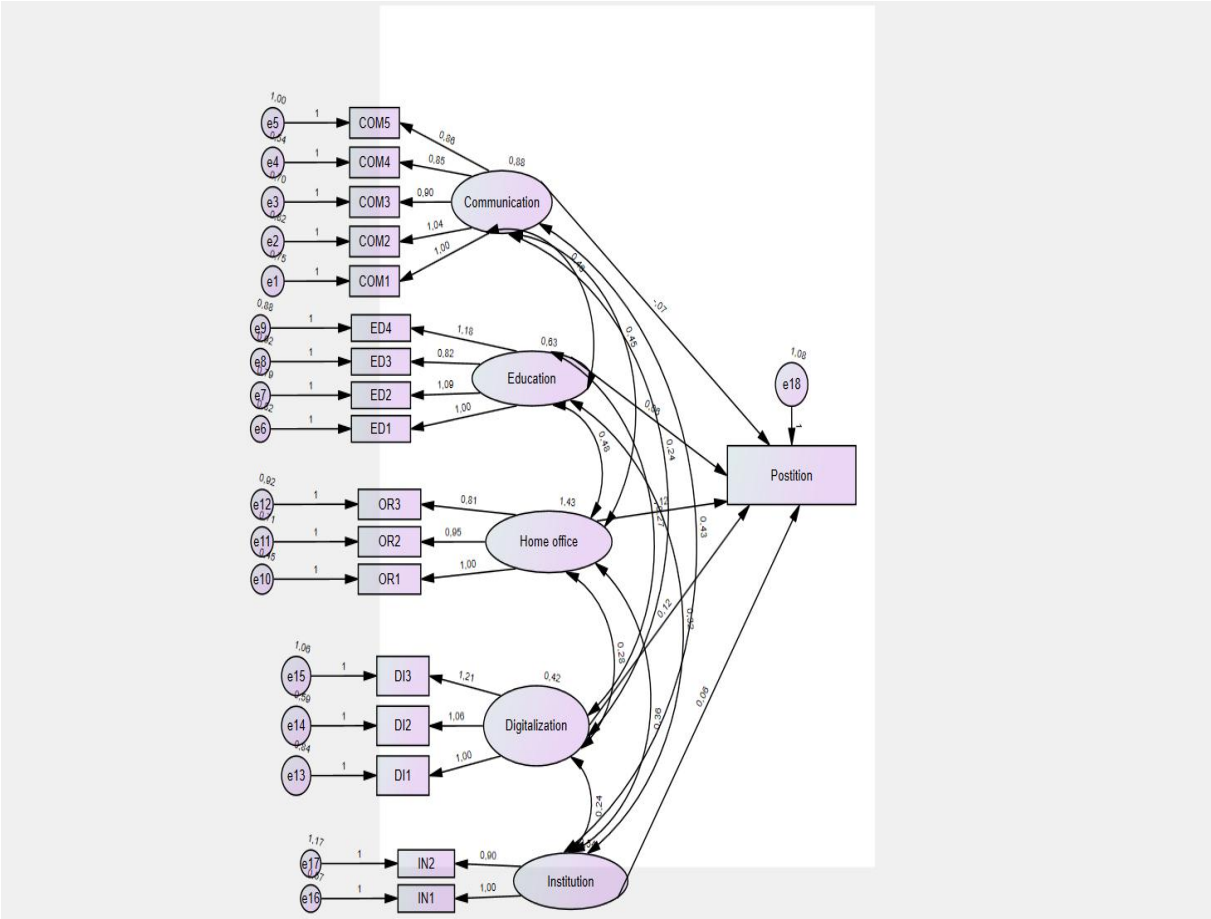

Fig. 2. Perception of difficulties in the light of the positions (N = 480)
Source: authors' own editing

In addition to the five factors shown in the figure, the following were added to the positions: assistant, associate and full professors. The letter names of the variables that make up each factor were shown in Table 5. Table 7 presents the standardized and nonstandardized regression weights.

Table 7. Regression results (p = 0,05)

			Nonstandardized				Standardized
			Estimate	**S.E.**	**C.R.**	**P**	**Estimate**
COM1	<--	Communication	1				0,718
COM2	<--	Communication	1.044	0.071	14.658	***	0.742
COM3	<--	Communication	0.917	0.064	14.257	***	0.719
COM4	<--	Communication	0.895	0.06	14.955	***	0.759
COM5	<--	Communication	0.877	0.07	12.613	***	0.632
ED1	<--	Education	1				0.674
ED2	<--	Education	1.075	0.089	12.029	***	0.697
ED3	<--	Education	0.797	0.078	10.213	***	0.564
ED4	<--	Education	1.157	0.096	12.013	***	0.695
OR1	<--	Home office	1				0.865
OR2	<--	Home office	0.987	0.053	18.612	***	0.819
OR3	<--	Home office	0.836	0.051	16.466	***	0.719
DI1	<--	Digitalization	1				0.575
DI2	<--	Digitalization	1.059	0.125	8.457	***	0.646
DI3	<--	Digitalization	1.235	0.148	8.363	***	0.619
IN1	<--	Institution	1				0.705
IN2	<--	Institution	0.78	0.117	6.695	***	0.477
Position	<--	Communication	-0.039	0.059	-0.656	0.512	-0.054
Position	<--	Education	0.059	0.068	0.862	0.388	0.071
Position	<--	Home office	-0.189	0.034	-5.612	***	-0.337
Position	<--	Digitalization	0.216	0.08	2.694	0.007	0.21
Position	<--	Institution	0.018	0.086	0.208	0.835	0.02

Source: authors' own research

The table shows that in two cases a correlation could be identified between the factors studied and the positions. These were the organisation of the home office and digital accessibility. The lack of face-to-face communication, the transfer of education to a digital platform and the difficulties resulting from communication with educational institutions were experienced in a basically comparable way by the participants in the study. Home office and digital access were the most problematic for full professors among the three educational actors. This was also due to the fact that they had relatively fewer compulsory hours than assistant professors and associate professors.

In their own words, the lecturers also expressed what they found really difficult.

Some ideas are summarised in Table 8.

Table 8. Respondents' own opinions on difficulties

Assistant professor	Associate professor	Full professor
'Cancelled practices'	'Having the key during the exams.'	'Lack of student contact.'
'Work-life balance.'	'Preparing video training materials.'	'Lack of students' digital literacy.'
'Lack of frontal	'Preparation took too much	'Attitude of students to the

presentation.'	time.'	lessons.'
'Promoting student activity.'	'The lack of interest of the students.'	'Students and teachers' lack of IT tools.'

Source: authors' own editing

Overall, in the light of the above results, the many difficulties experienced by the trainers were different, and the authors accept their second hypothesis.

Finally, the authors wanted to know how the research participants perceived that online education would be integrated into the structure and content of their teaching. Of the 681 respondents surveyed, less than 1 % of respondents believe that online education will replace traditional classroom-based education in the future. 5 % thought that online education will replace traditional classroom education. 82 % reckoned that online education would be a complement to traditional education, while 12 % were on the opinion that education would return to the way it was. The authors also examined whether there is a correlation between gender, age and position (job title) in terms of future perceptions. The Chi-square tests showed no evidence of a relationship by any of these criteria. Of course, it is important to underline that it was not only disadvantages that respondents perceived in online education. Many of them perceived learning to use the online platform as a positive, realised the hidden skills they had previously had, were able to develop students' creativity, saved time getting to the workplace, and were given opportunities to expand their pedagogical methods. Overall, therefore, it was concluded that, despite the many difficulties and gains, the duality of traditional and online education will be achieved in the future, according to the respondents' opinions, with hybrid education gaining ground. Accordingly, the authors accept their third hypothesis.

5. Discussion

Before the pandemic, the digitisation of education was relatively modest. Around 1 in 10 teachers had integrated digitisation into the content and structure of their teaching, primarily for communication rather than teaching. Prior to the COVID-19 outbreak, the majority of respondents had not even used digitisation opportunities and solutions. This finding is in line with the public consultation on digital education of the European Commission (2020b), according to which approximately 60 % of respondents had not used online learning prior to the pandemic. It underlines the same lack of preparedness the researchers also found in Hungary.

In spring 2020, teachers would have no time at all to make the digital switchover. The results of our survey show that 35.1 % of respondents spent more than 8 hours a day in the digital space after the state of emergency was declared (11 March 2020), compared to 9.8 % before the emergency. As we could also found in literature, the COVID-19 outbreak forced teachers to change their educational practice quickly to guarantee learning continuity (Cabero, 2020; Casado-Aranda et al., 2021; Usher et al., 2021).

The study also analysed the difficulties of online education. In the second hypothesis, the respondents on a 5-point Likert scale. The difficulties were less in institutional communication, while the organisation of home education and the effective involvement of students in education were more limited and required a rapid rethinking of traditional teaching options, while not everyone necessarily had the right digital skills.

The biggest problems were in the provision of institutional tools, online methodological skills and active learner participation. In the literature, we could also find references to the constraints of online teaching, which are frequently related to instructors' lack of expertise or technical abilities (Kim, 2020), lack of access to the internet or the tools and skills to use it (Kovács, 2020) as well as maintaining and enhancing students' academic involvement (Bond, 2020; Campbell et al., 2019).

Respondents were most satisfied with the quality of online learning materials and activities.

The data suggest that the prior digital knowledge of the instructors, as well as the tools and methodological background related to online education, may influence the perception of instructors' success. Those who rated educational outcomes positively felt that the above factors were strong. Those who rated themselves as weaker were more critical of online education. Our results echo the conclusions of Sundqvist et al. (2020), according to whom the higher teachers rate their digital competence, the more likely they are to use ICT in their work but teacher with limited ICT knowledge are hesitant to use it (Arkorful et al., 2021; Huang et al., 2021; Šabić et al., 2021).

However, the quality and availability of the learning materials did not affect the success rate. In view of the above results, the authors only partially accept their first hypothesis.

The authors used the SPSS AMOS 27 programme to test their model, which focused on how each group of teachers perceived the difficulties, as expressed in their own words, in the light of the factors created in the factor analysis.

The results of the study showed that the instructors faced a number of difficulties, which they experienced and judged differently. The second hypothesis can thus be considered to be confirmed.

The authors also asked how the participants assessed the future of online education and its possible integration into the structure and content of education. Less than 1 % of the 681 respondents think that online education will replace traditional classroom education in the future. 5 % think that online education will complement traditional school education, while 82 % think that online education will be a complement to traditional education. 12 % thought that education would return to business as usual. We agree with Engen and Engen (2019) and Winstone et al. (2021) in stating that teachers' digital skills are still critical for optimizing new technologies in the classroom, and also with the fact that the pandemic has led to a review of educational practices to adapt teaching to a digital environment (Sales et al., 2020; Heidari et al., 2020; Murphy, 2020).

In the survey, respondents not only highlighted the drawbacks of online education, but also its positive benefits: they increased their computer, methodological and pedagogical knowledge, became more creative and saved time by avoiding travel.

Overall, the opinions suggest that hybrid education is on the horizon for future education, and the authors accept their third hypothesis. The future significance of online education is also supported by the European Commission's 2020 consultation on digital education, where sixty percent of respondents stated the pandemic enhanced their digital abilities, and 95 percent said the pandemic represented a point of no return in terms of how technology is utilized in education (European Commission, 2020a).

6. Conclusion and recommendations

On the whole, the findings revealed that teachers had been compelled to immediately reschedule to all their classes online due to the strict emergency measures. Consequently, they faced various hardships due to some external (such as digital equipment, platforms provided) and internal (e.g., different level of digital competence) constraints, but online education will still be playing a crucial role in the future. Digital school and digital education in general should also be considered a decisive factor in the long term.

Finally, this research, like any other research, has limitations. Despite the substantial relevance of this issue, it would be beneficial to conduct more in-depth analyses of the statistical information obtained. Another new challenge would be to extend the boundaries abroad and increase the sample with other counties to be able to make some comparison. With the addition of new concepts to the review and an increase in the number of research papers, these constraints may provide an impetus for future study. Another significant path of future research is to look more into the evaluation of teachers' digital competencies, considering that this topic is prevalent in the literature reviewed.

References

Akmal et al., 2021 – *Akmal, A., Fikri, A., Rahmawati, T., Hendri, Z., Sari, N.* (2021). Measuring online learning readiness during coronavirus pandemic: an evaluative survey on history teachers and students. *J. Pajar (Pendidikan dan Pengajaran).* 5: 98-110. DOI: 10.33578/ pjr.v1i1.8169 (date of access: 15.03.2022).

Aristovnik et al., 2020 – *Aristovnik, A., Keržič, D., Ravšelj, D., Tomaževič, N., Umek, L.* (2020). Impacts of the COVID-19 pandemic on life of higher education students: A global perspective. *Sustainability*. 12(20): 8438. DOI: http://dx.doi.org/10.3390/su12208438 (date of access: 15.03.2022).

Arkorful et al., 2021 – *Arkorful, V., Barfi, K.A., Aboagye, I.K.* (2021). Integration of information and communication technology in teaching: initial perspectives of senior high school teachers in Ghana. *Educ. Inform. Technol.* 26: 1-17. DOI: 10.1007/s10639-020-10426-7 (date of access: 14.03.2022).

Awofala et al., 2017 – *Awofala, A.O., Akinoso, S.O., Fatade, A.O.* (2017). Attitudes towards computer and computer self-efficacy as predictors of preservice mathematics teachers' computer

anxiety. *Acta Didactica Napocensia*. 10: 91-108. DOI: 10.24193/adn.10.3.9 7 (date of access: 15.03.2022).

Awofala et al., 2019 – *Awofala, A.O., Olabiyi, O.S., Awofala, A.A., Arigbabu, A.A., Fatade, A.O., Udeani, U.N.* (2019). Attitudes toward computer, computer anxiety, and gender as determinants of pre-service science, technology, and mathematics teachers' computer self-efficacy. *Digital Educ. Rev*. 36: 51-67. DOI: 10.1344/der.2019.36.51-67 (date of access: 16.03.2022).

Bacter et al., 2021 – *Bacter, C., Bălţătescu, S., Marc, C., Săveanu, S., Buhaş, R*. (2021). Correlates of preadolescent emotional health in 18 countries. A study using children's words data. *Child Indic. Res*. 14: 1-20. DOI: 10.1007/s12187-021-09819-y (date of access: 15.03.2022).

Basilotta-Gómez-Pablos et al., 2022 – *Basilotta-Gómez-Pablos, V., Matarranz, M., Casado-Aranda, L-A., Otto, A*. (2022). Teachers' digital competencies in higher education: a systematic literature review. *International Journal of Education Technology in Higher Education*. 19: 1-16. DOI: https://doi.org/10.1186/s41239-021-00312-8 (date of access: 14.03.2022).

Bond, 2020 – *Bond, M*. (2020). Facilitating student engagement through the flipped classroom approach in K-12: A systematic review. *Computers & Education*. 151: 103819. DOI: https://doi.org/10.1016/j.compedu.2020.103819 (date of access: 17.03.2022).

Cabero, 2020 – *Cabero, J*. (2020). Aprendiendo del tiempo de la COVID-19. *Revista Electrónica Educare*. 24(Suppl. 1): 4-6. DOI: https://doi.org/ 10.15359/ree.24-s.2 (date of access: 15.03.2022).

Caena, Redecker, 2019 – *Caena, F., Redecker, C*. (2019). Aligning teacher competence frameworks to 21st century challenges: The case for the European Digital Competence. Framework for Educators (DigCompEdu). *European Journal of Education*. 54(3): 1-14. DOI: https://doi.org/10.1111/ejed.12345 (date of access: 15.03.2022).

Calvani et al., 2012 – *Calvani, A., Fini, A., Ranieri, M., Picci, P*. (2012). Are young generations in secondary school digitally competent? A study on Italian teenagers. *Computers & Education*. 58(2): 797-807. DOI: https://doi.org/10.1016/j.compedu.2011.10.004 (date of access: 13.03.2022).

Campbell et al., 2019 – *Campbell, M., Detres, M., Lucio, R*. (2019). Can a digital whiteboard foster student engagement? *Social Work Education*. 38(6): 735-752. DOI: https://doi.org/ 10.1080/02615479.2018.1556631 (date of access: 15.03.2022).

Cao et al., 2020 – *Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., et al*. (2020) 'The psychological impact of the COVID-19 epidemic on college students in China', *Psychiatry Res*. 287:112934. doi: 10.1016/j.psychres.2020.112934 (Accessed 15 March 2022)

Casado-Aranda et al., 2021 – *Casado-Aranda, L.-A., Sánchez-Fernández, J., Montoro-Ríos, F.J., Horcajadas, M.I.A*. (2021). Evaluation of the work-inte- grated learning methodology: Teaching marketing through practitioner experience in the classroom. *Mathematics*. 9(17): 2164. DOI: https://doi.org/10.3390/math9172164 (date of access: 16.03.2022).

Chang, 2005 – *Chang, S.E*. (2005). Computer anxiety and perception of task complexity in learning programming-related skills. *Comput. Hum. Behav*. 21: 713-728. DOI: 10.1016/j.chb.2004. 02.021 (date of access: 14.03.2022).

Council of the European Union, 2018 – Council of the European Union. Council Recommendation of 22 May 2018 on key competences for lifelong learning. [Electronic resource]. URL: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018H0604(01)&rid=7 (date of access: 28.03.2022).

Drossel et al., 2017 – *Drossel, K., Eickelmann, B., Gerick, J*. (2017). Predictors of teachers' use of ICT in school–the relevance of school characteristics, teachers' attitudes, and teacher collaboration. *Educ. Inform. Technol*. 22: 551-573. DOI: 10.1007/s10639-016-9476-y (date of access: 15.03.2022).

Engen, Engen, 2019 – *Engen, B.K.E., Engen, B.K*. (2019). Understanding social and cultural aspects of teachers' digital competences. *Comunicar. Med. Educ. Res. J*. 27: 2019. DOI: 10.3916/C61-2019-01 (date of access: 11.03.2022).

Erstad et al., 2021 – *Erstad, O., Kjällander, S., Järvelä, S*. (2021). Facing the challenges of 'digital competence' – a Nordic agenda for curriculum development for the 21st century. *Nordic Journal of Digital Literacy*. *16*(2): 77-87. DOI: https://doi.org/10.18261/issn.1891-943x-2021-02-02 (date of access: 15.03.2022).

European Commission, 2021 – European Commission. *DigCompEdu. The European Framework for the Digital Competence of Educators*. [Electronic resource]. URL:

https://ec.europa.eu/jrc/en/digcompedu (date of access: 27.03.2022).

European Commission, 2020a – European Commission. *Digital education action plan (2021–2027). Resetting education and training for the digital age, 2020.* [Electronic resource]. URL: https://ec.europa.eu/education/sites/default/files/document-library-docs/deap-communication-sept 2020_en.pdf (date of access: 27.03.2022).

European Commission, 2020b – European Commission. *Education and training. Education in the EU*, 2020. [Electronic resource]. URL: https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en (date of access: 27.03.2022).

Fernandez-Cruz, Fernandez-Diaz, 2016 – *Fernandez-Cruz, F.-J., Fernandez-Diaz, M.-J.* (2016). Teachers' generation Z and their digital skills. *Comunicar. Media Education Research Journal*. 46: 97-105. (date of access: 15.03.2022).

Gil-Flores et al., 2017 – *Gil-Flores, J., Rodríguez-Santero, J., Torres-Gordillo, J.-J.* (2017) Factors that explain the use of ICT in secondary-education classrooms: the role of teacher characteristics and school infrastructure. *Comput. Hum. Behav*. 68: 441-449. DOI: 10.1016/ j.chb.2016.11.057 (date of access: 15.03.2022).

Grubic et al., 2020 – *Grubic, N., Badovinac, S., Johri, A.M.* (2020). Student mental health in the midst of the COVID-19 pandemic: A call for further research and immediate solutions. *International Journal of Social Psychiatry*. 66(5): 517-518. DI: https://doi.org/10.1177/002076 4020925108 (date of access: 12.03.2022).

Hatos, 2019 – *Hatos, A.* (2019). The Impact of digitalization on educational achievement: a literature review from a sociological perspective. *Quality Life Calitatea Vietii*. 30: 3-16. (date of access: 15.03.2022).

Hatos et al., 2022 – *Hatos, A., Cosma, M. L., Clipa, O.* (2022). Self-Assessed Digital Competences of Romanian Teachers During the COVID-19 Pandemic. *Frontiers in* Psyhcology. 13: 1-19. DOI: https://doi.org/10.3389/fpsyg.2022.810359 (date of access: 12.03.2022).

Heidari et al., 2020 – *Heidari, E., Salimi, G., Mehrvarz, M.* (2020). The influence of online social networks and online social capital on constructing a new graduate students' professional identity. *Interactive Learning Environments*. 1-18. DOI: https://doi.org/10.1080/10494820. 2020.1769682 (date of access: 13.03.2022).

Hrastinski, 2008 – *Hrastinski, S.* (2008). Asynchronous and synchronous e-learning. *EDUCAUSE Quarterly. 4:* 51-55. [Electronic resource]. URL: https://er.educause.edu/-/media/ files/article-downloads/eqm0848.pdf (date of access: 15.03.2022).

Huang et al., 2021 – *Huang, F., Teo, T., Guo, J.* (2021). Understanding English teachers' non-volitional use of online teaching: a Chinese study. *System*. 101: 102574. DOI: 10.1016/j.system.2021.102574 (date of access: 16.03.2022).

Islam et al., 2020 – *Islam, M.A., Barna, S.D., Raihan, H., Khan, M.N.A., Hossain, M.T.* (2020). Depression and anxiety among university students during the COVID-19 pandemic in Bangladesh: A web-based cross-sectional survey. *PLoS One*. 15: e0238162. DOI: 10.1371/journal.pone.0238162 (date of access: 17.03.2022).

Kim, 2020 – *Kim, J.* (2020). Learning and teaching online during Covid-19: Experiences of student teachers in an early childhood education practicum. *International Journal of Early Childhood. 52:* 145-158. DOI: https://doi.org/10.1007/s13158-020-00272-6 (date of access: 17.03.2022).

Kovács, 2020 – *Kovács, S.Zs.* (2020). Az alapvető pénzügyi szolgáltatások online térbe helyezésének korlátai [Limitations of putting of basic financial services on online space]. *Space and Society = Tér és Társadalom*. 34(2): 195-201. DOI: 10.17649/TET.34.2.3264 (date of access: 15.03.2022). [in Hungarian]

Lu et al., 2021 – *Lu, L., Mirpuri, S., Rao, N., & Law, N.* (2021). Conceptualization and measurement of digital citizenship across disciplines. *Educational Research Review*. 33: 1-18. DOI: https://doi.org/10.1016/j.edurev.2021.100379 (date of access: 19.03.2022).

Maderick et al., 2016 – *Maderick, J.A., Zhang, S., Hartley, K., Marchand, G.* (2016). Preservice teachers and self-assessing digital competence. *J. Educ. Comput. Res*. 54: 326-351. DOI: 10.1177/0735633115620432 (date of access: 18.03.2022).

Murphy, 2020 – *Murphy, M.P.* (2020). COVID-19 and emergency eLearning: Consequences of the securitization of higher education for post-pandemic pedagogy. *Contemporary Security Policy*. 41(3): 492-505. DOI: https://doi.org/10.1080/13523260.2020.1761749 (date of access: 11.03.2022).

OECD, 2019a – OECD. OECD Skills Outlook 2019. Paris: Thriving In a Digital World. OECD Publishing, 2019. (date of access: 15.03.2022).

OECD, 2019b – OECD. PISA 2018 Results (Volume I): What Students Know and Can Do. Paris: OECD Publishing, 2019. DOI: 10.1787/5f07c754-en (date of access: 15.03.2022).

OECD, 2019b – OECD. PISA 2018 Results (Volume II): Where All Students Can Succeed. Paris: OECD Publishing, 2019. DOI: 10.1787/b5fd1b8f-en (date of access: 15.03.2022).

OECD, 2019c – OECD. PISA 2018 Results (Volume III): What School Life Means for Students' Lives. Paris: OECD Publishing, 2019. DOI: 10.1787/acd78851-en (date of access: 15.03.2022).

Pavić, Černja, 2019 – *Pavić, D., Černja, I.* (2019). How to measure digital literacy? A case of Croatian adult learners. *Future Inform. Sci.* 222: 222-229. DOI: 10.17234/INFUTURE.2019.27 (date of access: 17.03.2022).

Pohan, 2020 – *Pohan, C.A.* (2020). In support of student learning: Managing cognitive load during emergency remote instruction. Merced, CA: University of California Merced Center for Engaged Teaching and Learning.

Porat et al., 2018 – *Porat, E., Blau, I., Barak, A.* (2018). Measuring digital literacies: junior high-school students' perceived competences versus actual performance. *Comput. Educ.* 126: 23-36. DOI: 10.1016/j.compedu.2018.06.030 (date of access: 17.03.2022).

Røkenes, Krumsvik, 2014 – *Røkenes, F.M., Krumsvik, R.J.* (2014). Development of student teachers' digital competence in teacher education. a literature review. *Nordic J. Digital Literacy.* 9: 250-280. DOI: 10.18261/ISSN1891-943X-2014-04-03 (date of access: 15.03.2022).

Šabić et al., 2021 – *Šabić, J., Baranović, B., Rogošić, S.* (2021). Teachers' self-efficacy for using information and communication technology: the interaction effect of gender and age. *Inform. Educ.* DOI: 10.15388/infedu.2022.11 (date of access: 17.03.2022).

Sales et al., 2020 – *Sales, D., Cuevas-Cerveró, A., Gómez-Hernández, J.A.* (2020). Perspectives on the information and digital competence of social sciences students and faculty before and during lockdown due to Covid-19. *Profesional De La Información*. 29(4): 1-20. DOI: https://doi.org/10.3145/epi.2020.jul.23 (date of access: 15.03.2022).

Sundqvist et al., 2020 – *Sundqvist, K., Korhonen, J., Eklund, G.* (2020). Predicting Finnish subject teachers ICT use in home economics based on teacher-and school-level factors. *Educ. Inquiry*. 12: 1-21. DOI: 10.1080/20004508.2020.1778609 (date of access: 19.03.2022).

Toquero, 2020 – *Toquero, C.M.* (2020). Challenges and opportunities for higher education amid the COVID-19 pandemic: The Philippine context. *Pedagogical Research*. 5(4): 1-5. DOI: https://doi.org/10.29333/pr/7947 (date of access: 15.03.2022).

Triadó, 2020 – *Triadó, X.M.* (2020). Prólogo. In M. Turull (Coord.). Manual de Docencia Universitaria. Octaedro. Pp. 11-21.

Trust, Whalen, 2020 – *Trust, T., Whalen, J.* (2020). Should teachers be trained in emergency remote teaching? Lessons learned from the COVID-19 pandemic. *Journal of Technology and Teacher Education*. 28(2): 189-199. (date of access: 13.03.2022).

Usher et al., 2021 – *Usher, M., Hershkovitz, A., Forkosh-Baruch, A.* (2021). From data to actions: Instructors' refections about learners' data in online emergency remote teaching. *The British Journal of Educational Technology*. 52(4): 1338-1356. DOI: https://doi.org/10.1111/bjet.13108 (date of access: 15.03.2022).

Van Mechelen et al., 2022 – *Van Mechelen, M., Wagner, M.-L., Baykal, G. E., Charlotte Smith, R., Iversen, O.S.* (2021). Digital design literacy in k-9 education: experiences from pioneer teachers. *Int. Design Child.* 32-42. DOI: 10.1145/3459990.3460696 (date of access: 17.03.2022).

Winstone et al., 2021 – *Winstone, N.E., Hepper, E.G., Nash, R.A.* (2021). Individual differences in self-reported use of assessment feedback: the mediating role of feedback beliefs. *Educ. Psychol.* 7: 844-862. DOI: 10.1080/01443410.2019.1693510 (date of access: 18.03.2022).

Yilmaz, 2019 – *Yilmaz, A.B.* (2019). Distance and face-to-face students' perceptions towards distance education: A comparative metaphorical study. *Turkish Online Journal of Distance Education. 20*(1): 1302-6488. [Electronic resource]. URL: https://fles.eric.ed.gov/fulltext/EJ1201959.pdf (date of access: 15.03.2022).