Information and Communication Technologies in Education
(Current Issues and Challenges)

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Abstract
The paper deals with the changes in online education, which became common practice during the COVID-19 pandemic at all levels of the education system. Another trend in the period was the hybrid education model used in the temporary reopening of schools. The management of schools and universities immediately introduced measures to ensure the continuity of education and its transition to the online environment and defined the rules for the implementation of work activities in the home environment, i.e. home office. The decisive factor in the optimal "setting" of new conditions of education and work is their digitization and wide application of information and communication technologies and Internet services. After two years, it can be stated that the pandemic “contributed” and accelerated the processes of digital transformation of classical education systems and traditional forms of work. Benefits of the period are from the perspective of the individual/society increasing the level of information literacy and digital competencies, increasing the use of online learning platforms and digital learning resources (content), new opportunities for self-development and self-education of individuals and shaping their digital competencies for living and working in society. On the other side can be observed negative effects of education and work in the online environment associated with long-term social distance of people in several areas of personal/working life. The author is a member of the working team for the creation distance learning methodologies at FEM and participates in the formulation of procedures and practical implementation of emergency distance learning (ERL) tools. For a comprehensive view of the issue of emergency remote learning, he used his pedagogical and work experience (teacher of IT subjects; administrator of ICT and IT support), but also the results of a controlled interview with participants in emergency remote learning (teachers/students FEM, their experiences, problems and attitudes) in comparison with domestic and foreign research and studies.

Keywords: digital transformation, information technologies, online education platforms, human capital

JEL Classification: I25, J24, L86, O33

1. Introduction
The onset of the Covid 19 pandemic in March 2020 radically changed the functioning of human society worldwide, affected all areas of its economic and social life and changed many social activities to eliminate social contacts and protection of human life and health. In almost all areas of the functioning of human society was the significant phenomenon the unpreparedness and the need for an immediate response to ensure the operation of basic activities in the new conditions was a significant phenomenon. Arquilla & Guzdial (2020) state that the pandemic has demonstrated great vulnerability in social and economic systems and has led to huge economic costs and serious psychological damage inflicted by the virus. On the other hand, the adoption of anti-pandemic measures and social distances have accelerated the processes of digital transformation in sectors where it has stagnated, resp. lagged behind for various
reasons. The result is changes in the functioning of companies, schools, organizations and the implementation of basic activities in the virtual environment of the Internet, e-services and large-scale implementations of information and communication technologies (ICT). The Internet and Web, videoconferencing, collaboration tools, email, and social media are now primary avenues for business, social interaction, and entertainment (Cerf, 2020).

1.1 Education and its changes during a pandemic

Education was one of the areas where the virus pandemic led to a sharp shift forward and accelerated the digital transformation of existing traditional education systems and practices. However, according to Arquilla & Guzdial (2020), the response of the education sector was less developed, but the use of networking systems has shown there is a way to continue to educate via distance learning. They see its advantages especially for high school, college-level and postgraduate education, where in some ways it provides a deeper tutorial quality than like in traditional formal classroom learning. In the context of conventional remote learning methods, Tulaskar & Turunen (2021) define six different forms of remote learning based on their main characteristics: the place of teaching (physical/remote), participant interaction (synchronous/asynchronous) and educational intention. In a more detailed description, they can be supplemented by other characteristics: contact of the participants (direct/indirect), the way of their mutual communication (interpersonal/impersonal) and the forms/tools of the educational content used.

During the pandemic, three basic forms of learning were used: full-time, online and part-time, referred to as hybrid. While in the first year of the pandemic, full-time learning was almost eliminated and replaced by online learning, in the following period hybrid learning prevailed (combination of full-time and online form) depending on the government measures taken and the health situation of individual countries. Hybrid learning combines conventional classroom experiences and online courses; students have the opportunity to choose online or class lectures. Most used learning tools are video conferencing, LMS systems, online exercises, discussion forums, pre-recorded video instruction (Neelakandan, 2021).

1.2 Information and communication technologies and challenges for education

Vardi (2020) argues that computing is today the "operating system" of human civilization. The amazing world of the Internet and the web that we have created over the last 50 years now provides us with the tools that allow us to work and socialize. Vardi's "enthusiasm" confirms how ICTs affect the lives of individuals and society. In recent years development of ICT have been accelerating and bringing many innovations in the form of various technological solutions and services (cloud computing, IoT, augmented/virtual reality, artificial intelligence (AI). For individuals, the acquisition of sufficient digital skills and competencies is not only a prerequisite for their use, but also a prerequisite for successful participation in society. This requires the adaptation and digital transformation of education and education training systems. The aim of the education transformation is to improve it in the context of the demands that are placed on the current generation of students after completing formal education ITakadémia (2020). The challenging and complexity of the process of modern, digital education Evans (2020) explains, “today, schools need to prepare students for rapid economic and social change than ever before, for jobs that have not yet been created, to use technologies that have not yet been invented, and to solve social problems we do not yet know will arise". The importance versatility of a worker as an ability “to work in the mode of so-called multitasking and multiskilling” is growing (ICTC in Oláhová, 2010). Fadel et al. (2015) uses the term versatile expert (abbreviated versatilist), who is able to apply the depth of skills
to a number of situations and experiences, acquire new competencies and take on new roles. He is able to constantly adapt and also to constantly learn and grow, to move in a rapidly changing world.

2. Data and Methods

The COVID-19 pandemic has created the largest disruption of education systems in history, affecting nearly 1.6 billion learners in more than 190 countries and all continents. Closures of schools and other learning spaces have impacted 94% of the world’s student population (United Nations, 2020). The main form of providing educational activities has become "emergency" online education implemented at a distance using information and telecommunications networks and with direct/indirect interaction between students and teachers. From the teacher's/student's point of view, their digital skills and competences, personal approach and objective preconditions for "learning and learning from home" have become decisive. Personal experience with the provision of teaching for two years, the author of the article also has a university teacher, but also as an IT specialist responsible for the operation of ICT and IT support for teachers, students and staff. The information obtained from controlled interviews with the participants of the educational process during the pandemic for the period March 2020 - December 2021 is also used, which brought a number of interesting observations of the user community. Furthermore, for the purposes of this article and the objective evaluation of the information obtained (their generalization), we used freely available outputs of domestic/foreign professional research and studies. The documents analyze and evaluate education and its problem areas from different perspectives. At the same time, they emphasize the need for the necessary modification and "redesign" of existing education systems for the future, with an emphasis on the participants in the educational process. The article used documents:

- Results obtained from interviews of ERL participants at FEM (teachers, students)
- Published research results of foreign authors
- Student Council of Higher Education Institutions of the Slovak Republic: Survey - Impact of COVID-19 on students
- International Association of Universities (IAU): survey The impact of COVID-19 on higher education around the world
- OECD: survey The State of Higher Education One Year into the COVID-19 Pandemic

The aim was to evaluate the emergency distance learning implemented at FEM for two years. Based on the analysis of the initial state of the ERL in the immediate "switchover" from the traditional form to the remote and monitoring of gradual changes in a two-year interval, it was possible to assess progress, but also point out problem areas. We focused on different areas of ERL education: organizational security, technological security (hardware and software), quality of the educational process (forms and content), digital readiness of participants (IT skills, IT support for end users) and psychological aspects of ERL (negative impacts on mental health). To obtain the data, we used a structured interview with questions according to these areas, for example, the participants also evaluated their two-year experience with ERL, i.e. a state "what I knew at the beginning" and a state after two years "how I progressed, what I learned". We chose the form of a personal interview because the interview participants were already “oversaturated” with work and presence in the online environment (reluctance to answer e-questionnaires). In addition, a number of responses were obtained through online training or IT support, remote troubleshooting (online consulting, emails, chat, meetings in MS
Teams, remote PC management tools). To compare and generalize our findings, we used methods of synthesis and comparison of our findings with other published research and studies.

3. Results and Discussion

The Covid-19 pandemic has generally accelerated the digital transformation processes of many industries by at least five years. Significant shifts were in the field of artificial intelligence, cloud services, communication platforms (Lacko, 2021). Digital transformation replaces traditional processes with digital technologies in order to improve or streamline ways of working (AirFocus, n.d.). The reorganization of work changes the way people work (Anderson-Connolly et al., 2002). Digital work is characterized by the use of new technologies and the possibility of working remotely, and it is essential that individuals adopt new technologies as part of their daily work routine (Momani & Jamous, 2017). The current advancement of digitization of routine activities presupposes the ability of the end user to master new technologies. Being digitally literate is one of the prerequisites for successful employment. Digital literacy includes a large number of complex cognitive, motor, sociological and emotional skills that users need to function in a digital environment (Mnyanda & Mbelani in Oláhová, 2020). Digital technologies, e-services and the virtual world of the Internet are an integral part of the life and implementation of many activities. A key 21st century skill "to succeed in the AI world" is versatility. Fadel emphasizes the role of education by saying, "We must help prepare our students to be versatile enough to succeed no matter how our unpredictable world changes around us" (Fadel et al., 2015; Ferrari, 2018). Fadel's framework Four-Dimensional Education focuses at four key areas of modern education:

- Knowledge: the individual is a specialist in his field of study and also an expert with general knowledge from other fields i.e. has interdisciplinary knowledge.
- Skills: creativity, communication, collaboration and critical thinking. While the first three are commonly used, critical thinking often becomes a "hard nut to crack."
- Character: mindfulness, curiosity, courage, resilience, leadership, ethics are a prerequisite for shaping a better world.
- Meta-learning/meta-cognition as a motivation for lifelong learning and self-reflection of the individual in relation to his educational goals, professional growth and development.

The last two years of global change in the economic and social life of the countries have not escaped even the education system. The introduction of anti-pandemic measures, together with the order of the social distance, unexpectedly moved teaching to the online environment of the Internet and participants in the learning process to the home environment. From a practical point of view, distance learning has been a challenge and "test" for the community of students, educators and school staff to test the versatility of their skills in adopting new technologies and adapting to the virtual environment. However, the forced transfer of full-time teaching in March 2020 to the online environment pointed to unpreparedness on the part of schools and universities. In generally, the feasibility and quality of the transition to distance education was conditioned the synergy of three interconnected dimensions, namely: technical infrastructure and accessibility, distance learning competences and pedagogies and the field of study. (Marinoni et al., 2020). In assessing the readiness of higher education institutions to move online, according to a study by the Lumina Foundation (OECD, 2021), institutions were not fully prepared for a sudden shift to distance learning (Table 1). Monroy-Goméz-Franco et al. (2021) present a lack of available resources to scale up distance learning, and a lack of experience from the school system and teachers of operating entirely through distance
platforms. In a survey of online/distance learning in Europe 67% of educators say this is their first experience with this form (School Education Gateway, 2020).

Table 1: Readiness of higher education institutions to move online

<table>
<thead>
<tr>
<th>Factors of readiness</th>
<th>High-income countries</th>
<th>Middle-income countries</th>
<th>Low-income countries</th>
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Source: OECD (2021)

Our experience and knowledge from the provision of the educational process at the Faculty of Economics and Management (FEM) of SUA Nitra are comparable with the results of domestic/foreign surveys. Important information were also attitudes opinions and answers obtained from interviews with teachers and students of the faculty. Together, they can be a starting point for the development of plans or methodologies, the so-called crisis education for future use. Over the past period, we have identified the following problem areas of the educational process:

Organizational support

The absence of a unified approach (methodology) of education was a common feature of the education system at all levels. A survey by the Student Council of Higher Education Institutions and the Slovak Accreditation Agency for Higher Education found that the use of inconsistent solutions indicates a lack of quality management at universities and faculties in ensuring the transition to distance learning and coordinating teaching quality (Bílik, 2020). Similarly, the OECD TALIS survey of 2018 stated that Slovak education is not built or ready for long-term teaching through remote access (Schwabe, 2019). Even FEM has not developed a comprehensive distance learning methodology; the methodology is developed for e-learning (LMS Moodle, e-courses). After the transition to online teaching in March 2020, the basic documents to guide teachers to its organization and implementation were missing. According to educators, there were no uniform instructions for the implementation of basic or specific educational activities (for example, teaching subjects requiring individual work and immediate student response, teaching using licensed software available only in university PC labs, tools and forms of online/offline study materials). Therefore, the FEM management created a working group for the operational solution of remote learning, formulation of procedures and IT support.
Technical support

In 2018, almost 25% of Slovak schools stated that they did not have sufficient digital teaching technologies (Schwabe, 2018). FEM has sufficient equipment for workplaces, auditoriums and training facilities with ICT, as well as the equipment of teachers with equipment for working from home (laptops/tablets). In March 2020, the missing equipment was audiovisual technology (webcams, headphones, microphones, speakers) and a comprehensive video conferencing solution. At present, the given technology includes PC equipment at teachers' workplaces, 16 exercise rooms, 2 auditoriums (possibility of hybrid teaching), and a video conferencing solution for the meeting room is available. The question in our interview was the quality and methods of internet connection during the lessons. A minimum of teachers had problems with insufficient internet connectivity and accessibility, and more frequent failures and delays were reported on the part of students. This was mainly related to their geographical location, connection technology (Ethernet, wifi), outages were more frequent when participating in mass online meetings. The students stated that in the environment of MS Teams they therefore often used a combined approach (internet and mobile networks).

Software support

In the area of software, according to the CIT workplace, the most significant problems in March 2020 were due to the inconsistent approach and use of software solutions for online meetings, team collaboration and real-time communication and the lack of knowledge of their use by end users. Although the Office365 platform includes the MS Teams solution, some educators used Skype or the free Zoom application, which CIT did not recommend using due to lot of security vulnerabilities. The lack of skills to control MS Teams and its functionalities was on the side of teachers, as applications MS Teams (and Zoom too) did not use in the past. They also lacked skills in processing lectures/exercises in the form of video recordings, recording the desktop, creating tests, assigning tasks, etc. The use of MS Teams by students was smoother and seamless.

Quality of education (forms of education and digital content)

In analyzing and evaluating the quality of education, our findings are similar to the results of other surveys. In our interview, FEM students stated that at the beginning (March 2020) the offline form of education prevailed (sending materials / tasks by email, LMS Moodle courses, materials on the UIS server), gradually replaced by online meetings in MS Teams using integrated application functionalities (OneNote, assigned tasks, Forms, Stream, etc.). Students were particularly critical of the application of the passive form of teaching by some educators (Hall et al., 2019), until 28 % of them had to supplement their knowledge from extracurricular sources in order to successfully master most subjects (Bílik, 2020). Figure 1 represents SUA students' responses to the forms of education used in the first year of the pandemic. On the other hand, according to teachers, it was quite difficult to maintain the attention and especially the activity of students who attended "screens" not only lectures and exercises, but also other independent work (elaboration of assignments, seminar papers). The students' negative experiences were: the lack of feedback from teachers (41.7 % of students), which "takes too long and therefore the learning process is very slow and boring"; as well as contacts with teachers (38.7 % of students) “most teachers are not available in case of unscheduled questions” that students encounter in the process of self-study (Bílik, 2020; Malkawi & Khayrullina, 2020). In distance learning, the responsibility for the study is transferred to the student, so communication and quality feedback from the teacher are
important for its improvement and guidance on how to educate yourself. The teachers perceived negatively the "non-interaction" and the students' lack of interest in participating in the discussion during the online lectures (feedback only based on addressing the student by the teacher).

Figure 9 Teaching methods and forms used during emergency measures at SUA Nitra

Source: Hall et al. (2019)

Other problems were: availability of digital educational content and processed teaching materials, inconsistent procedure of their processing and publishing (faculty repositories: LMS Moodle and Exercises, school-wide repository: document server UIS SUA, internal repository MS Teams, OneDrive, web repository Google disc). Objective obstacles on the part of teachers were mostly the lack of knowledge of processing educational online documents in the form of audiovisual records of work procedures, lectures. The LMS Moodle SUA learning platform also did not see a significant increase in the number of courses. A total of 77 new courses were added (period February 2019 - February 2022). At present, 273 courses have been developed, with 50.2 % being courses of faculty FEM. The transformation of classical materials into an online environment is closely linked to the availability of distance learning resources and the growth of its quality (Jordan et al., 2021). From our point of view, it is necessary to unify and reduce online resources (repositories) of access to educational materials, for example, only in the LMS Moodle and Office365 environment. To provide an attractive environment for teaching, communication and collaboration, we also recommend the OneNote solution, which is an integrated part of MS Teams (Oláhová, 2018).

**IT support and digital skills of end users**

Digital skills of end users are an important factor in the success and mastery of distance learning, but their level varied on the part of students and teachers. According to the TALIS survey, only 44.7 % of Slovak teachers consider themselves very well prepared for the use of IT technologies in teaching (Schwabe, 2019). The critical view is on the part of students, in 2019 only 19.6 % of Slovak students stated that their digital skills were developed during their studies at university. Overall, they considered their development to be significantly undersized. According to Hall et al. (2019) up to 49 % of employers consider them to be key when choosing an employee, but only 8.2 % of graduates master advanced work with PC and 46.9 % simple work with PC (email, MS Office). In March 2020, the level of digital skills of FEM end-users varied. In the interview, they mentioned ignorance or little experience with the control of specific O365 applications used for remote learning (teachers, students). Teachers lacked skills in processing teaching materials in the form of multimedia files (screen recording, video tutorials), using MS Teams functionalities (assigning tasks, preparing tests / quizzes,
etc.). In the given period, these skills were developed in the form of online meetings/webinars in several IT areas (topics: online meetings and communication, teamwork, digital content, LMS Moodle). The activities of the CIT workplace, which provided extensive IT support to teachers and students, can be summarized in several points:

- implementation of online workshops / training in MS Teams,
- offline support via e-mail communication,
- creation of a freely available question and answer database (FAQ) in the team of employees,
- individual consultations and problem solving (HW/SW) of users "remotely" using remote management tools (TeamViewer, Quick Assist, or MS Teams),
- creation of the website Manual for the improvement of online teaching with topics for distance education (instructions, materials).

At the same time, the workplace emphasized the need to continue training employees in various areas of digital technology.

**Mental health and psychological aspects of distance learning**

They represent areas that are closely related to the personality and character traits of the individual. Although the facts given are the results of published researches, in our interview the participants (especially students) made the same statements. The multiplication of time spent on monitors during teaching time and at other times (preparation of further curriculum by teachers, or elaboration of student assignments) leads to "oversaturation" of the online environment. Digital fatigue is accompanied by feelings of mental and physical exhaustion in 52% of respondents (Douglas, 2021). The causes of digital fatigue are excessive close contact, reduced mobility during a video call, constant camera involvement and the need for constant "monitoring" of the conversation, constant virtual meetings and digital work processes, etc. (Bailenson, 2020). In connection with learning, students cited self-regulation as a problem for a huge amount of self-study materials, which "increased so much that I don't know how to manage my time efficiently" (Malkawi & Khayrullina, 2020). This can lead to the procrastination of study tasks and responsibilities, loss of motivation and student frustration, and ultimately loss of learning ability (Maldonado & De Witte, 2020). FEM students in the second year of remote learning considered social isolation, lack of personal meetings with classmates and learning behind the screen to be the biggest negatives, which "will not replace their joint meeting in the classroom/lecture room or boarding school life". In virtual teams/classes, the teacher is a moderator and consultant as well, and feedback from students is important to him. As a frustrating experience FEM educators reported students' reluctance to use cameras in lectures/exercises and passivity in engaging in discussion.

**4. Conclusion**

The Covid-19 pandemic has hit hard education systems around the world, pointed to the existing "gaps" and problems of online education. In order to ensure continuity of education, a new alternative form of distance learning, called Emergency Remote Learning (ERL), has been created for unplanned and sudden shifts from traditional to remote learning in the event of emergencies. The past two years have confirmed that ICT and the internet are strongly influencing the learning environment. ICTs have enabled the transition from the physical classroom to the virtual classroom, changing the way we learn and communicate through new features. The paper summarizes the experience gained, identifies problem areas from the period of emergency education at FEM SUA, and can be a starting point for the development of a comprehensive methodology of distance education. In general, the challenge for education
systems and schools is to further develop modern digital education (with ICT support) so that they are prepared and able to respond flexibly to similar, unexpected situations in the future.

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References


