

E-learning: technology in teaching logistics

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Abstract *The impact of data, information, and knowledge on teaching and learning is more important than ever. The dynamic development of technology based on digitization, robotization, and networking is transforming the world of business and science, and universities play an extremely important role in this process. The digitization of the socioeconomic environment forces changes towards technologization. The educational process should be substantive and organized in such a way that students not only learn about technological solutions but also have the skills and competences to apply knowledge in practice. An example of such activity is the teaching and learning of logistics with the use of distance learning methods and techniques. The aim of this article is to identify the possibilities of using e-learning in teaching logistics to face the challenges of the future. The information is based on secondary and primary sources. This article uses qualitative and quantitative mixed research methods. On the one hand, books and reports, scientific articles, and Internet sources were examined during the desk research phase. On the other hand, the use of e-learning in teaching logistics at selected universities in Poland was tested using the diagnostic survey method, which involved computer-assisted web interviewing (CAWI). The collected material showed the need for using e-learning in teaching logistics. Logistics companies need employees with digital competences and skills. Therefore, using new technologies already in the education process is justified. Learning with the use of remote methods and techniques represents the essential components of the requirements of the university's technological ecosystem. The analysis of the material leads to the conclusion that the implementation of technology into the didactic process as such is not sufficient. Adoption of modern methods and technologies requires a comprehensive approach to managing educational units. It is important that the propagation of modern forms of teaching has the understanding and support of users who are an inherent component of the educational ecosystem structure.*

Keywords university management, higher education, logistics, technology, e-learning

JEL Codes: I2, M15

INTRODUCTION

Our reality is becoming computerized, and it seems that nothing can oppose this trend (Kruk, 2015). The digital economy is becoming a significant contributor to the development of societies and the economic growth of states. The contemporary fate of organizations operating on domestic and global markets is shaped by the forces and achievements of science, knowledge, and technology. Smartphone, computer, and Internet access have become almost first-order goods. "Divine technologies" with sensors, electronics, software, and a communication network have entered the life of every person and every organization for good. What used to be only the domain of futurologists such as S. Lem, W. Gibson, K. Kelly, R. Kurzweil, and A. Webb, and the makers of fantasy films such as *AI*, *RoboCop*, *Johnny Mnemonic*, *Ghost in the Shell*, and *The Matrix* series and cartoons such as *The Jetsons* is becoming reality.

The countdown has already begun. It was initiated in 1729 by the first industrial revolution (1.0) with a steam pump. The next step (2.0) was electricity and the production line in 1870. The third evolutionary step (3.0) was the first programmable controller in 1969. Currently, as a result of the development of "technological disruptions" with the dominant feature of cloud computing and automation, we can talk about the fourth industrial revolution—4.0 (Głomb et al., 2019). It is represented in logistics by intelligent supply chains, in which cyberphysical systems are used, such as the Internet of Things (IoT), ubiquitous connectivity (hyperconnectivity), applications and services based on cloud computing, Big Data Analytics (BDA), automation and robotization, and omni-channel models of product and service distribution. On the other hand, the communication layer includes standards

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and protocols for data transmission and automatic identification—WiFi, Bluetooth, GSM, 3G, LTE, WiMaX, IPv4, IPv6, MQTT, DDS, EDI, RFID, and NFC—which redefine human interface to machine and machine to machine communication processes. Such a technological march makes remote work (home office), video calls, and remote learning possible.

The technological possibilities were verified during the COVID-19 virus pandemic that broke out in March 2020. The pandemic forced employees to work differently. To keep a safe social distance and to follow government orders, the only possible formula for working in these difficult conditions was remote work. According to data from the Central Statistical Office of Poland, at the end of March 2020, 11.0% of people worked remotely. In various departments and industries, due to the specificity of the activities performed, a different amount of people could work remotely. Generally, however, one may be tempted to say that the pandemic contributed to the redefinition of the labor market by becoming an accelerator of technological adoption, confirming the thesis that virtualization is inevitable.

Virtual [Latin: *virtualis*] means effective, theoretically possible, that it can exist, or electronic, geographically independent (Szpringer, 2008). And virtualization can be referred to as “new possibilities and ways of operating, transforming and transferring the possibilities of functioning to a virtual environment” (Kisperska-Moroń, 2009). The basis of this process is information. The same information may have a different value depending on the context and take on meaning in values when combined with other information (Krzysztofek & Szczepański, 2002). The diffusion of information—that is, getting infected with information—is a specific feature of the contemporary hypermedia and digitized world (Kolasińska-Morawska & Pytel, 2017). From an enterprise perspective, there is a problem related to the management and processing of knowledge. Technique alone is not enough. People are needed in this process. Managers, especially, interacting with other employees often perform tasks that are difficult to standardize and automate. Therefore, it is important to properly prepare middle and senior management who will meet the expectations of entrepreneurs, because technologization is not only hardware and software but also, and perhaps above all, people creating humanware. The use of robots, artificial intelligence, and digital technologies is changing the characteristics of the tasks performed by employees (Schwab & Davis, 2018). Managing modern entities in which, among others, logistics processes that are so important for the smooth operation of operations are implemented (Christopher, 2016; Bozarth & Handfield, 2007; Handfield & Nichols, 1999; Branch, 2009; Bowersox et al., 2012) require that employees have a certain level of strategic and operational knowledge in the application of modern management concepts and methods (human resources management, total quality management, controlling, business process reengineering, lean management, time-based management, innovations management, efficient consumer response, and agile manufacturing), which will allow them to plan, implement, and control processes and projects efficiently and effectively. It is also important that, in addition to knowledge, employees have communication and analytical skills regarding the use of IT systems, the ability to work on a team, and social competences that allow them to work in a multilingual environment (Cygler, 2013; Ellen MacArthur Foundation & McKinsey & Co., 2014). Such an approach does not require the introduction of modern technologies into the educational process as much as it is a necessary condition. It takes time to develop skills and competences. That is why it is so important to not only introduce subjects that will allow students to learn about the technology operation but also “immerse” them in the digital environment. After all, educational units should prepare not so much employees of the present but, above all, employees of the future. Functioning in a technologized world focused on knowledge, digitization, mechanization, and robotization means the coexistence of people and devices (Kurzweil, 2016). This means an increased demand for highly qualified employees and a requirement of continuous improvement of digital skills and competences. As predicted by the World Bank (World Bank, 2019), intelligent work ecosystems will require employees to have problem-solving skills, teamwork management, adaptability, and advanced reasoning skills (Fundacja Digital Poland, 2020; OECD, 2018; Głomb, 2020).

Therefore, equipping students with the right set of skills and competences is crucial for their proper functioning in the labor market (Jarosz et al., 2020). One study shows that despite the fact that millennials know that technology will redefine employment formulas, they feel unprepared (Deloitte, 2018). And revolution 4.0 has already made the performance requirements of employers completely different than they were until recently. Some professions die, others redefine their requirements, and still other new professions are created and their requirements are only subject to quantification. It is a university's responsibility to prepare future employees so that they have not only knowledge but also, and perhaps above all, competences that allow them to function effectively in the digital environment. Therefore, it is worth reviewing the digitization process that universities are currently undergoing.

Considering two main stakeholders of universities' teaching and learning processes (students and teachers), the authors of this article propose two main research questions:

1. How do logistics students rate the transition to the total distance learning formula?
2. How do logistics teachers rate this process?

FUNCTIONING OF THE UNIVERSITY IN CONSIDERATION OF TECHNOLOGICAL CHALLENGES

The current economy, also known as the e-economy, requires the use of information technology and computer networks. The transformation from an analogue world to a digital one involves a sequence of events that cannot turn back. When we consider the coronavirus pandemic, even pessimists see the advantages of a bit of evolution. The priority in this new reality is and will always be people, which in the case of higher education means the necessity to adapt to the needs and expectations of students and academic teachers. It is also important to revise processes, procedures, methods, and techniques. Digital education will not be the only path, but it certainly cannot be ignored or applied. This process of integrating higher education institutions into a digital environment requires long-term change and an openness to continuous prioritization. During the COVID-19 pandemic, the approach to distance learning has changed dramatically, and the question of *whether* to educate remotely has changed to *how* to do it effectively. There are many indications that after a period of a kind of forced transition to online education, the basic form of academic didactics will be a hybrid education, which will combine the values of contact classes with the benefits of online classes. It may turn out that for some fields of study, especially those prone to remote teaching, the online form will be dominant. Moreover, online academic learning may have two more side effects, namely tough competition in the education industry and the natural elimination of weak actors. This will happen because, like in e-commerce, there will be no justification for the existence of too many sellers offering the same products (here: educational services), because in the virtual space all students (clients) will have access to the best suppliers (universities). This is the hard-to-predict dimension of the virtualization of a university's teaching process, the effects of which will be revealed in the coming years.

Of course without information and communication technology (ICT), there is no way to make a digital transformation. On the one hand, it forces this transformation, and on the other hand, it enables it. However, in the digitization process, we should especially remember the most important stakeholders: customers (students) and university employees. This is confirmed by members of the Digital Academy, who believe that when carrying out digital transformation, we should focus primarily on customer-centricity (Kolasińska-Morawska & Pytel, 2017). And here we have another reference to the business that treats the customer as the most important person. The same trend will apply to universities, which in the era of virtualization and strong competition from other universities, training companies and strongly developing forms of informal education (e.g., massive open online courses [MOOC], social learning) will have to redefine the role of the student-client in their strategy of operation. Teaching as a process has undergone many changes—from the classic direct teacher-student work to support distance learning (d-learning) to the current form of e-learning. The modern world of education uses a e-learning network environment (Virtual Learning Environment [VLE]), applications, and the Internet enabling access to knowledge anywhere and anytime without the need for personal contact with the teacher. Solutions such as Bluetooth, Wireless Application Protocol (WAP), General Packet Radio System (GPRS), Universal Mobile Telecommunications System (UMTS), LTE, and the currently implemented fifth-generation 5G mobile communication technology have triggered m-learning (mobile learning) formula teaching, which allows people participating in the educational process to use smartphones as communication transmitters.

Multimedia education is also assigned a special role in this process. The following years will be marked by an intensive use of Learning Management Systems (LMS), which will integrate the online and offline experiences of participants of the educational process within one system. By definition, LMS is a web application supporting the learning process remotely, usually via the Internet. LMS helps manage training activity and competences in an organization (particularly schools, universities, and enterprises, with emphasis on training companies). From an end-user perspective, the LMS provides tracking of individual skill and competency progress, simple methods for locating training activities, and registering for courses. For instructors, LMS is a tool for creating educational content, presenting it, and verifying students' knowledge. LMS class IT systems have long supported lecturers in academic teaching with the use of distance learning methods and techniques. The current standard is the functioning of these solutions in the cloud computing model as software—Software as a Service (SaaS). The most popular commercial LMS educational platforms include Asseco, Adobe Captive Prime, Blackboard, Canvas, Litmos, OpenLMS, and Universality. The undisputed leader of opensource solutions in LMS is Moodle, widely used all over the world. In Poland, two organizations contribute greatly to the development of academic e-Learning: SEA (Association of Academic E-learning; sea.edu.pl) and PTNEI (Polish Scientific Society for Internet Education; ptnei.pl).

Digitization with the possibility of continuous access to aggregated data at any place and time allows you to manage research and teaching processes in an organized and complete manner. University managers do not think about the implementation of technology but rather about which solutions to choose: single or comprehensive. There are paperless solutions on the market that ensure flexibility, scalability, and low costs by storing documentation in the cloud. In this way, they support the environment while improving the availability of information and the efficiency of its use. In addition, an interesting and expected solution is Electronic Customer Relationship Management (e-CRM) systems, allowing for the care of relations with students. It is also

important to care for cybersecurity, and there are also many solutions to choose from (Kolasińska-Morawska et al., 2019). In light of the current digital challenges, some of the most desired professions on the Polish labor market are logisticians, project managers, translators, administrators, social media specialists, programmers, webmasters, computer graphic designers, career advisors, and biotechnologists. Logisticians are needed in almost every area of the economy. Employers are looking for employees who think analytically, have excellent organizational and communication skills, speak foreign languages, and have a passion for applying new technologies. In this spirit, logistics studies that use distance learning methods and techniques have an additional advantage, because they prepare specialists who work virtually. Moreover, according to research (Mikalef et al., 2018), higher-education graduates are not adequately trained to fill jobs relating to data science. They learn and use modern communication systems and tools during their studies, work in dispersed project teams, and use various sources of information and knowledge. That is exactly what awaits them in the near future during their professional career, because if we assume that academic education after the pandemic will be hybrid to some extent, it is likely that teleworking will become a canon in the coming years. A logistics graduate who has largely completed his studies virtually will be ready for the challenges of the modern labor market. What's more, elite education in the best universities, in Poland and elsewhere, will be widely available thanks to online studies.

E-LEARNING IN LOGISTICS - METHOD AND RESULTS

Digital reality has transformed the world. The education sector, preparing future generations of logistics professionals, has redefined the teaching and learning processes. In the implementation of educational programs, universities are increasingly taking into account the possibility of conducting classes using distance learning methods and techniques. The pandemic that began in the first quarter of 2020 only intensified this process. In Poland, in accordance with the regulation of Jarosław Gowin, minister of science and higher education, per an act of March 2, 2020, on the prevention of the spread of the COVID-19 virus, universities have completely changed their mode of operation from stationary and mixed to completely virtual. Such action turned out to be a considerable challenge but also a test of organizational and didactic possibilities for many universities in various fields of study. Such a transformation may be exemplified by the implementation of the course in the field of logistics. Until March 2020, most logistics students participated in classrooms. Only a few universities used e-learning as a method complementing contact classes. In view of the change in the teaching formula caused by the pandemic, universities and students were obliged to teach and learn in virtual reality. The de-reality of the place and time of classes' meetings resulted in implications that have been noticed by scientists and journalists.

In this trend, the authors of this article undertook research on the consequences of the forced transformation from real to digital didactics. Particularly interesting has been the didactics that may be part of permanent changes in teaching, especially in practical courses such as management, quality sciences, and logistics. For this purpose, the researchers sought the opinions of students and teachers who became participants in a diametrical didactic transformation. Following research questions mentioned above, the authors asked the following questions: Will distance learning methods and techniques remain in Polish universities for good, including in the field of logistics? Or will e-learning be only a supplement to classes conducted face to face?

Authors of this article are aware of the fact that it will be possible to obtain full and comprehensive answers to such questions only after the end of the pandemic. However, thanks to the implementation of the first stage of the research program on the adoption of distance learning methods and techniques, it will be possible to provide the first indications for issues that should be taken into account when shaping didactic guidelines for the implementation of educational programs in the field of logistics. As part of the program, fragmentary research was carried out on representative populations of the student population (people with an index number and participating in logistics classes) and teachers (employed as lecturers/academic teachers for 2019–2020) in Poland. When determining the minimum sample size, the following formula was used:

$n_{\min} = NP(\alpha^2 \cdot f(1-f)) / NP \cdot e^2 + \alpha^2 \cdot f(1-f)$, where:

$n_{\min}$: the minimum sample size

N : the size of the studied population

α : the confidence level for the results, the value of the Z score in the normal distribution for the assumed significance level

f : fraction size

e : assumed maximum error

The study among the student population was conducted at the turn of March and April 2020. The research method used was the CAWI online survey. The number of students from selected universities in Poland was $n = 904$. The selection of the university was based on the method of selecting typical units (leading the field of logistics), while the selection of students was made using the snowball method. The accepted error was at the level of 5%. In turn, the survey among academic teachers was conducted at the turn of May and June 2020. The CAWI online survey was also used as the research method; the size of the sample was calculated at the level of $n = 626$, which was collected based on the method of selecting typical units (a teacher teaching in the field of logistics). The accepted error was at the level of 5%. In both cases, the tool used was a standardized questionnaire.

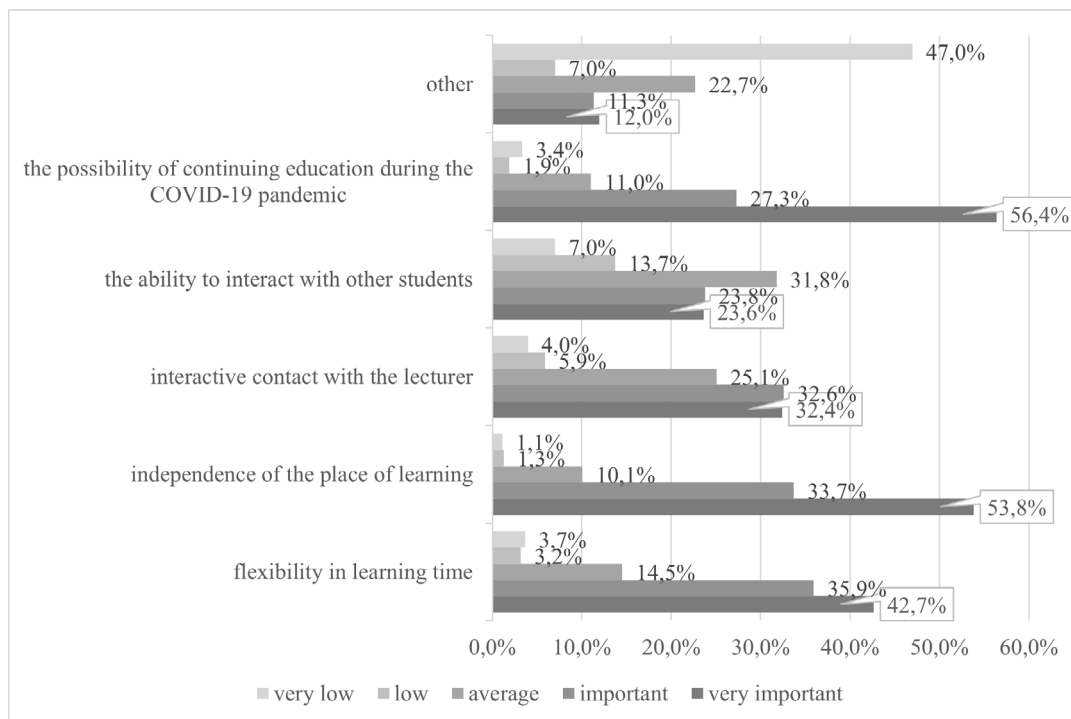


Figure 1. The importance of e-learning in the education process (own research).

Students believed that very important factors relating to e-learning were the possibility of maintaining continuity of education at the time of danger (56.4%), independence of the place of learning from the seat of the university (53.4%), freedom of time in learning (42.7%), and interactive contact with the lecturer (32.4%). Unfortunately, according to students, the use of distance learning offered the least possibility of interaction with other students (23.6%), as shown in Figure 1. In addition to the importance of e-learning during the pandemic, students were concerned about the dangers of barriers to their further education. Most often, students participating in the study were concerned about the quality of the classes (29.4%), the lack of information resources (materials, books) enabling an effective way of conducting didactic classes (17.7%), the lack of teachers' skills in using educational platforms (16.5%), and poor Internet access (bandwidth) (16.3%), as shown in Figure 2.

On the other hand, academic teachers believe that the use of remote forms of teaching definitely offers improvements in the flow of information between organizational units (40.1%), ensures easy access to materials by the student (35.5%), allows the expansion of knowledge resources (material) (26.7%), allows for flexible adaptation of materials in relation to the level of knowledge (26.7%), and allows for integral contact with the student (23.7%), as shown in Figure 3.

In addition to the advantages of e-learning in the pandemic process, academic teachers also noticed the obstacles hindering the implementation of the education process. According to the respondents, lack of infrastructure (computer) and a link enabling participation in e-learning activities (41.4%), lack of direct contact –and social problems with other group members (36.8%), lack of skills to use e-learning platforms (33.6%), and the lack of knowledge of this educational method (28.3%) may significantly contribute to the reluctance to use remote forms of learning, as shown in Figure 4.

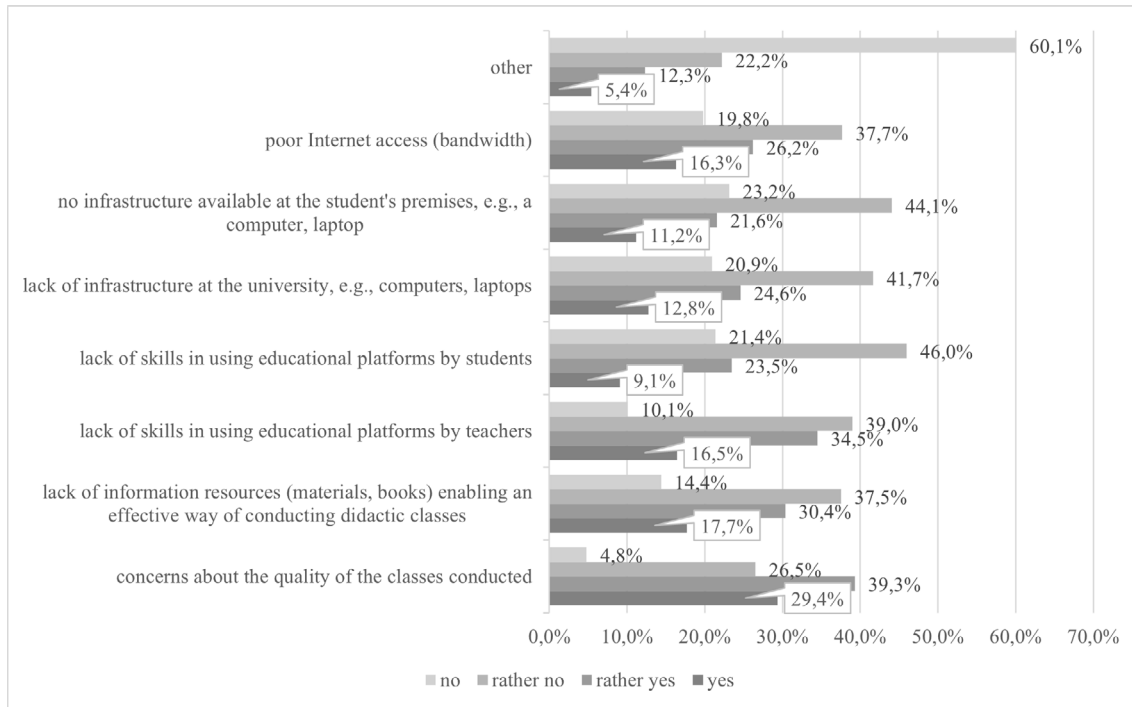


Figure 2. E-learning barriers in the education process (own research).

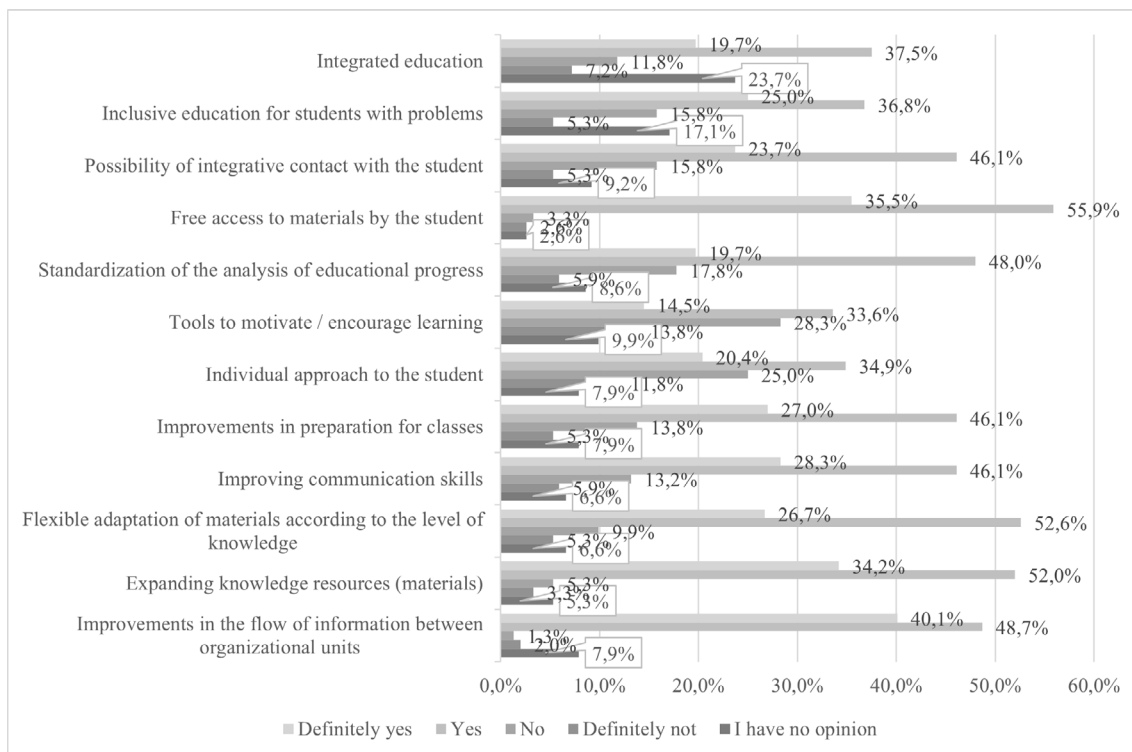


Figure 3. Advantages of using remote forms of learning (own research).

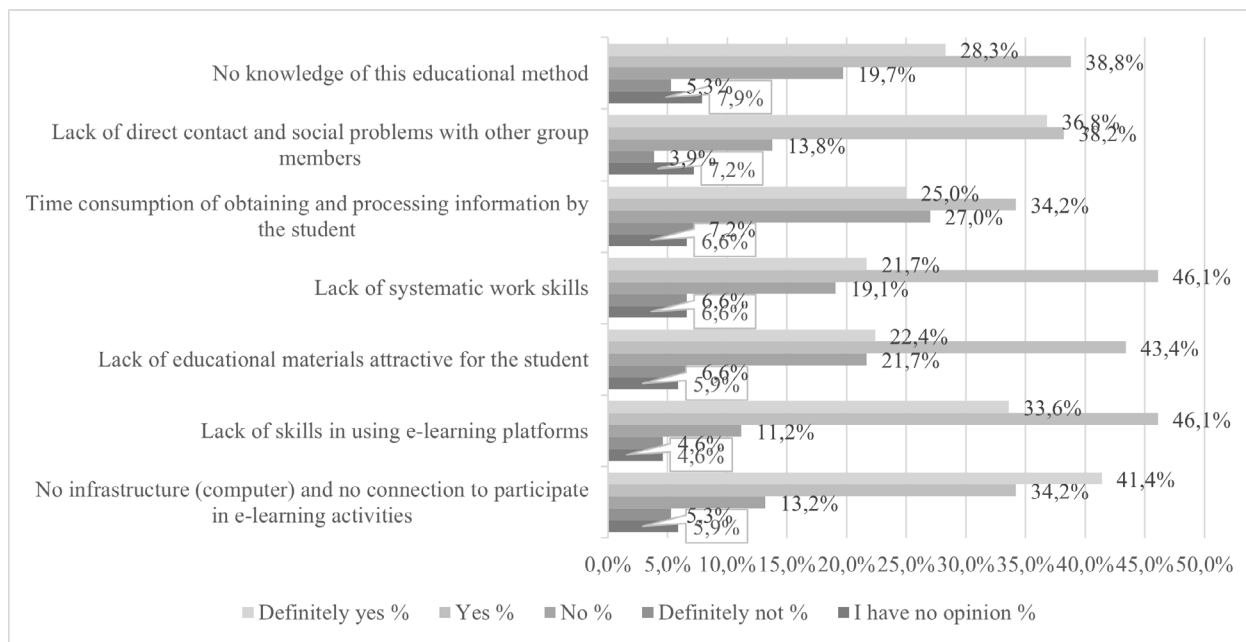


Figure 4. Limitations of remote forms of learning (own research).

Comparing the results obtained from these two studies, one can notice the existing convergences in the importance and advantages of e-learning as a teaching method, and the barriers that may appear, hindering the process of adopting a technologized education system. The surveyed groups appreciate the freedom of place and time of learning offered by digital reality. However, both groups see the lack of opportunities for direct analogue interactions within the academic community. For e-learning to be fully accepted, greater emphasis should be placed on didactic training in order to ensure the quality of education. Moreover, training resources should be available so that students have no problem with reaching the sources of knowledge. It is also important to ensure infrastructure and communication availability, including access to the Internet. While universities can influence and improve some of these guidelines, others they unfortunately cannot, such as ensuring Internet access. This is where the state is indispensable as an investor in the future of education. Providing broadband access to the Internet and the 5G network in the future will allow the ambitious goals of remote education to be achieved while maintaining social relationality, that is, the possibility of direct contact between academic teachers and students.

DISCUSSION AND CONCLUSIONS

To summarize, in the face of the insertion of technology into all manifestations of human activity, it is impossible to remain passive. According to the theory of connectivism, modernity means the necessity of human coexistence with new technologies. Modern education should encourage activities aimed at digitization. Logistics companies already report the need for employees with digital skills and competences. Therefore, teaching and learning using new technologies are most welcome. Students can immerse themselves in technology. It is important not only to teach new technologies but also to apply them. Learning by doing is the most valuable.

Apart from already mentioned theoretical implications, implementation of e-learning as a teaching method at the higher education level will also have a number of practical implications. The post-Covid-19 world will set new challenges and requirements for higher education. Potential opportunities cannot be wasted. Since almost everyone has undergone hyper-fast education in the use of digital tools, it would be worth using them to a greater or lesser extent. One might even be tempted to say that distance learning is now the first “must have” component of the university's technological ecosystem. We live in a digital, golden age in which students (Y2K+) are digital natives for whom new technologies (cloud, VR, AI, etc.) are no longer just empty slogans, and digital skills are simply necessary (e.g., working remotely). The crisis situation brought on by the COVID-19 pandemic, starting

in March 2020, has accelerated the combination of technologies and didactics. There is no escape from digitization. You can only go with its current. How the process of teaching and teaching logistics will be implemented in the future—whether hybrid (e-learning as a support for traditional education, a mixed formula combining digital and analog, or a digital formula supported by traditional education) or only digitally—depends on the degree of technology adoption.

In conclusion, according to the authors, the adoption of methods and technologies in the process of teaching and learning logistics requires a comprehensive approach to the management of the educational process (Sułkowski & Woźniak, 2020). According to Mikalef & Krogstie, 2019, there is great debate over whether higher education institutions are better equipped and more knowledgeable about best practices for teaching such skills, as well as what supporting learning technologies can be applied in each case to support efficient and effective learning outcomes. Moreover, the findings from Alqahtani & Rajkhan, 2020 also indicated that students must understand their role during social distancing measures, build their own attitude and commitment, and find ways to self-motivate in order to gain successful learning outcomes. It is not enough that only e-learning enthusiasts use it in their educational enclave. Propagation of modern forms of teaching should be systemic and process-based and be an inherent component of the didactic construct. It is possible only when the suggestions from participants of the educational process are taken into account. It is important that all system users have the ability to seamlessly use this learning formula to be, know, and act.

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