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Impact of the COVID-19 pandemic on IT competencies of students

INTRODUCTION

The COVID-19 pandemic has increased the need for computer literacy skills in both personal and professional contexts. Demographic factors, such as age and education level, may impact the level of these competencies.

The aim of this study is to determine the level of computer literacy of the respondents. Various computer literacy competencies were verified, such as using a computer, using a smartphone/phone, technical Internet operation, using new software, using mobile devices, and using mobile applications.

The motivation behind this research was the growing importance of computer literacy skills in the digital era, particularly considering the COVID-19 pandemic and the increasing shift to remote learning and work. The study aims to explore the extent to which people possess these skills and to identify any areas where individuals may need additional support or training.

The main research hypothesis is that the majority of respondents possess basic computer literacy skills, but they may have varying levels of proficiency in specific computer literacy competencies, such as using new software.

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IMPACT OF THE COVID-19 PANDEMIC ON THE FUNCTIONING OF HIGHER EDUCATION INSTITUTIONS IN POLAND

The COVID-19 pandemic has had an impact on the functioning of higher education institutions in Poland. It has affected the organisation of work, the mode of education, and the relationships between academic staff and students (Bao, 2020). As a result of the pandemic, schools and universities in Poland were forced to move their classes to online mode, which required academic staff and students to adapt to new methods of work (Bao, 2020). At the same time, some universities had difficulties in providing adequate sufficient IT infrastructure and Internet access for students (Trust, Whalen, 2020). The pandemic also affected the finances of universities, as many of them experienced a decrease in the number of students and a reduction in funding (Al-Samarrai, Gangwar, Gala, 2020).

During the COVID-19 pandemic, many higher education institutions around the world decided to move their classes to online mode, which required changes in the way academic teachers and students organised their work (Bao, 2020). In Poland, most universities decided to conduct classes online or in a hybrid mode, where some classes were held in-person and some in online mode (Trust, Whalen, 2020). The organisation of classes in online mode required academic teachers to adapt the content and teaching methods to the new conditions and skills in using e-learning platforms (Kukulja Taradi et al., 2005). Students had to adapt to the new mode of work, organise their time and ensure effective remote learning (Kukulja Taradi et al., 2005). At the same time, the transfer of classes to online mode affected the relationships between academic teachers and students, who had to cope with new challenges related to communication and interaction in remote mode (Kukulja Taradi et al., 2005).

COMPETENCIES IN INFORMATION TECHNOLOGY AND COVID-19 PANDEMIC

Digital competencies refer to a set of skills and knowledge related to the use of digital technologies. They include computer literacy, Internet and digital application usage, efficient information retrieval, as well as programming and website creation skills. Digital competencies are essential in modern education and work, as digital technology is present in all aspects of life and the economy. Individuals with strong digital competencies are able to effectively use available digital tools, which in turn allow them to work, learn, and communicate more efficiently.

According to the European Committee for Standardization (CEN), digital competencies are “general and specialist skills related to the use of digital technologies, which include communication and information skills, multimedia usage, problem-solving, Internet use, programming, content creation, and ensuring online safety” (Ferrari, 2013, p. 3).

Research suggests that the COVID-19 pandemic has had an impact on the digital competencies of students worldwide (Bao, 2020; Trust, Whalen, 2020; Daniel, 2020). As a result of the pandemic, students became more interested in digital technologies, including educational applications (Daniel, 2020). Many schools and universities moved their classes online, which required students to develop skills in using various digital tools (Bao, 2020). However, some students from disadvantaged families who did not have access to appropriate equipment or Internet connectivity experienced difficulties in accessing education (Trust, Whalen, 2020).

During the COVID-19 pandemic, students faced many challenges related to digital competencies that were necessary for remote work and online learning. Often, students struggled with access to adequate IT infrastructure, including fast and stable Internet connectivity and appropriate computer equipment (Al-Samarrai, Gangwar, Gala, 2020). Moreover, some students had difficulties using e-learning platforms and applications that were new to them and required them to develop new skills (Kukulja Taradi et al., 2005). Difficulties were also reported in effectively organising their work time and in maintaining motivation for remote learning (Kukulja Taradi et al., 2005).

TOOLS AND PLATFORMS USED IN UNIVERSITIES FOR CONDUCTING ONLINE CLASSES

During the COVID-19 pandemic, many universities around the world decided to switch to remote learning. To enable this, various tools and platforms were used, allowing classes to be conducted online. Among the most commonly used tools were Microsoft Teams, Zoom, Google Meet, Moodle, and e-courses (Trust, Krutka, Carpenter, 2016). Each tool has its own advantages and disadvantages. Microsoft Teams makes it easy to organise online meetings and share materials, but requires a stable Internet connection (Bao, 2020). Zoom supports online meetings with many participants at once, but may be less stable than other tools and requires a fast Internet connection (Bao, 2020). Google Meet is a user-friendly tool, but requires a Google account (Bao, 2020). Moodle makes it easy to share materials and conduct interactive classes, but requires certain technical skills (Trust, Krutka, Carpenter, 2016). E-courses, on the other hand, are easy to use and provide remote learning in an asynchronous mode, but require a lot of work to create content (Trust, Krutka, Carpenter, 2016).

THE PROBLEM OF DIGITAL EXCLUSION IN HIGHER EDUCATION

Digital exclusion is a phenomenon in which individuals who lack digital skills or access to digital technologies are excluded from full participation in social,

cultural, or economic life (Warschauer, 2004). According to other definitions, digital exclusion is inequalities in access and skills in using information and communication technologies that affect the social, economic, and educational situation of individuals (Hargittai, 2002).

Digital exclusion in higher education is a serious problem that has been exacerbated during the COVID-19 pandemic. According to research, many people are experiencing difficulties in using digital technologies, which leads to exclusion from the learning process (Zhang et al., 2020). This problem affects not only students but also academic and administrative staff who, for various reasons, are not proficient with modern tools (Zhang et al., 2020).

According to another study, the problem of digital exclusion in higher education is due, among other things, to a lack of access to appropriate hardware and software, a lack of computer skills, and poor Internet access (Bozkurt, Sharma, Stockdale, 2020). As a result of these difficulties, many people are unable to participate in online classes, which in turn leads to a deterioration in academic performance and limits opportunities for professional development (Bozkurt, Sharma, Stockdale, 2020).

INFORMATION TECHNOLOGY SKILLS REQUIRED OF STUDENTS DURING THE COVID-19 PANDEMIC

The COVID-19 pandemic has somewhat forced students to acquire certain computer skills, including (see Table 1):

- general computer skills,
- smartphone/phone skills,
- technical Internet support skills,
- skills in using new software,
- skills in using mobile devices,
- skills in using mobile applications.

Table 1. IT competencies

Skills	Specification
<i>1</i>	<i>2</i>
Skills in operating a computer	<ul style="list-style-type: none"> – Operating e-learning platforms – Time management – Technical skills – Online communication – Self-education
Skills in operating a smartphone/phone	<ul style="list-style-type: none"> – Ability to use remote education, communication, and time management platforms – Ability to manage the time of using mobile devices to prevent negative consequences of excessive screen exposure

<i>1</i>	<i>2</i>
Skills in technical handling of the Internet	<ul style="list-style-type: none"> – Proficient use of computer and Internet devices – Knowledge of basic terms related to the Internet – Ability to use different Internet browsers and applications – Knowledge of basic functions of office applications – Ability to use e-learning platforms and tools for online communication – Knowledge of basic Internet safety rules
Skills in operating new programs	<ul style="list-style-type: none"> – Ability to install and update software – Knowledge of basic functions of videoconferencing programs – Familiarity with teamwork tools – Knowledge of video and graphic editing software – Knowledge of basic principles of user interface design and website creation – Knowledge of cloud computing technology
Skills in operating mobile devices	<ul style="list-style-type: none"> – Knowledge of basic functions of mobile devices – Familiarity with distance education tools – Familiarity with tools for organising work – Knowledge of applications for creating and editing documents – Familiarity with project management tools – Knowledge of basic principles of digital security and privacy protection
Skills in operating mobile applications	<ul style="list-style-type: none"> – Navigation and usability of mobile interfaces – Mobile application installation and updating – Knowledge of mobile operating systems (Android, iOS) – Ability to customise mobile device settings – Ability to use different types of mobile applications (social media, productivity, entertainment) – Knowledge of mobile security principles – Ability to troubleshoot mobile application issues – Ability to manage and organise mobile applications

Source: own work, based on (Kimmons, Veletsianos, 2020; Hew, Cheung, 2014; Gilster, 1997; Eshet-Alkalai, 2004, pp. 93–106; Ala-Mutka, 2011; Hodges et al., 2020; Zawacki-Richter et al., 2019; Lemola et al., 2015; Wang et al., 2009).

Diverse skills are required from students in the context of remote learning, as well as work and life in the digital era. With the development of technology, technical skills have become essential for people in various aspects of life. Specifically, skills in operating e-learning platforms, online communication, and using mobile devices are necessary in the era of the COVID-19 pandemic, where many activities are carried out remotely (Hsin, Cigas, 2013; Bosch, 2009; Ribble, Bailey, 2007; Lemola et al., 2015, Wang et al., 2009).

Time management is also crucial to ensure effective work and learning in the digital era. This requires self-discipline and planning skills to ensure regular participation in classes, completion of homework, and project implementation (Kirschner, Karpinski, 2010; Jaggars, Xu, 2016).

Knowledge of the basic principles of digital security and privacy protection is also very important, especially in the context of using the Internet and mobile devices. Technology users should know how to protect their data and avoid cybercrime threats (Gallardo-Echenique et al., 2015; Joksimović et al., 2018).

In the digital era, new technologies and tools are constantly evolving, which requires people to continuously learn and improve their skills. The ability to quickly acquire new skills and adapt to changing conditions is crucial for survival and success in today's world of work and learning (Weller, 2020; Pappano, 2012).

PRESENTATION OF EMPIRICAL RESEARCH

This study cites the results of empirical research conducted in February 2021. The aim of the research was to illustrate the computer skills of the individuals surveyed. The research sample consisted of 649 respondents. During the research, the authors obtained the following socio-demographic data:

- gender: 415 females (63.9% of those surveyed) and 234 males (36.1% of those surveyed) participated in the study;
- educational level: most of the respondents had a bachelor's or engineering degree – 367 people (56.5%), while 282 people (43.5%) had a master's degree;
- occupational activity: most of the respondents worked permanently – 511 people (78.7%), 54 people (8.3%) did not work, 46 people (7.1%) worked part-time, and 38 people (5.9%) owned their own business;
- expected form of employment: the majority of the respondents, 451 people (61.3%), expected to be employed in a full-time job. 167 people (22.7%) wanted to run their own business, 85 people (11.5%) expected a contract for specific work or a task, and 33 people (4.5%) planned to work as freelancers;
- current position: most of the respondents, 444 people (68.4%), worked as employees. 56 people (8.6%) held mid-level managerial positions, 54 people (8.3%) held low-level managerial positions, and 33 people (5.1%) held top-level managerial positions. 53 people (8.2%) did not work, and 9 people (1.4%) were completing an internship.

Future workplace: The largest group of the respondents, 196 people (30.2%), planned to run their own business. 154 people (23.7%) wanted to work in a medium-sized company employing up to 100 people, 126 people (19.4%) in an international corporation, and 109 people (16.8%) in a large company employing up to 1000 people. 64 people (9.9%) expected to work in a small family business with up to 10 people. The total number of respondents was 649 people, but the column regarding the expected form of employment yielded a result of 736 people, which indicates that some respondents chose more than one answer to this question.

The research was aimed at determining the computer skills of each individual surveyed. Various computer skills were verified (computer usage, smartphone/telephone usage, technical Internet support, new program usage, mobile device usage, mobile app usage).

The overview of the respondents' answers is optimistic. The vast majority of respondents possess the mentioned skills, although some individuals in the surveyed group have difficulties using new programs. Detailed data on this topic are presented in Table 2.

Table 2. Skill level of IT competencies

Respondents' answers	Skill level					
	In the use of a computer	In the use a smartphone / phone	In technical support of the Internet	In the use of new programs	In the use of mobile devices	In the use of mobile applications
Definitely not	2	1	2	3	1	1
Rather not	3	3	11	33	4	3
I have no opinion	7	5	33	107	33	34
Probably yes	195	103	216	312	242	242
Definitely	442	537	387	194	369	369
Total	649	649	649	649	649	649

Source: own work.

The study shows that the majority of the respondents declared IT competencies in using computers, smartphones/phones, technical Internet support, as well as mobile devices and applications. However, there are people who have difficulties in handling new programs.

In this study, cross-relationships between variables were also determined. To this end, the Pearson correlation coefficient was used, which is a measure of the linear dependence between the following variables. The correlation coefficients obtained are presented in Table 3.

Table 3. Correlation between variables

Variables	No.	1	2	3	4	5	6
In the use of a computer	1	1	0.937	0.738	0.453	0.870	0.870
In the use a smartphone/phone	2	0.937	1	0.750	0.456	0.879	0.879
In technical support of the Internet	3	0.738	0.750	1	0.670	0.823	0.824
In the use of new programs	4	0.453	0.456	0.670	1	0.614	0.615
In the use of mobile devices	5	0.870	0.879	0.823	0.614	1	1.000
In the use of mobile applications	6	0.870	0.879	0.824	0.615	1.000	1

Source: own work.

The correlation matrix shows strong positive correlations between all pairs of skills. The strongest correlations are observed between the use of a computer and the use of a smartphone/phone ($r = 0.937$), as well as between the use of mobile devices and mobile applications ($r = 1.000$). The weakest correlation is observed between the use of new programs and the use of a computer ($r = 0.453$).

Overall, the results suggest that the respondents who reported higher skill levels in one area of IT also tended to report higher skill levels in other areas. This may indicate that IT skills are interrelated and that proficiency in one area can facilitate learning and using other areas of IT. However, the weak correlation between the use of new programs and the use of a computer suggests that some respondents may need additional training to improve their proficiency in using new programs.

CONCLUSIONS

The literature reviews conducted indicated that, in the digital era, technology development requires a variety of skills that are essential in the context of remote learning, work, and everyday life. In particular, technical skills, such as operating e-learning platforms, online communication, and using mobile devices, are vital in the era of the COVID-19 pandemic. Time management is also key to ensure effective work and learning in the digital age. This requires self-discipline and planning skills. Familiarity with the basic principles of digital security and privacy protection is also very important. Continuous learning and improving one's skills are crucial for survival and success in today's world of work and education.

The empirical studies conducted focused on a group of students, indicating that computer skills are essential for effective participation in remote learning processes and for conducting projects, research, and analysis online. In the times of the COVID-19 pandemic, when many classes and projects had to be moved to the virtual world, computer skills became key for students and academic staff. Possessing these skills can also increase the chances of finding employment and professional career development in the digital era.

Finally, it should be noted that while these results mainly concern students, most people realise that ICT competencies are increasingly necessary in today's world and strive to develop their skills. Nevertheless, there is a group of people who still need help learning new technologies.

The recommendation for people, especially students, who have difficulty using new programs is to seek help on the Internet, where you can find plenty of tutorials and online courses. It is also worth taking advantage of training and workshops that are organised in various places, including online.

A good practice for everyone, especially young people, is to regularly update their skills and follow new trends and technologies. In today's times, changes in the field of computing are very fast and it is important to stay up-to-date.

The results of the empirical study conducted among students show that most of them have ICT competencies, but it is worth continuing to develop their skills and to use available resources. People who have difficulty operating new programs should seek help on the Internet and take advantage of various trainings and workshops.

However, it should be remembered that these conclusions may not necessarily apply to all age and occupational groups. Therefore, the interpretation of the results should be limited to the studied group, i.e. students, and not generalised to the whole society. In the context of further research, it would be worth expanding the research group and comparing results between different age and occupational categories, in order to better understand how ICT skills affect different social groups.

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Summary

In the current COVID-19 pandemic era, computer skills have become essential for students and academic staff who participate in remote learning or work on online projects, research, and analysis. Due to the need to shift many activities and projects to the virtual world, having computer skills has become critical for effective functioning in the current situation. The aim of the article was to investigate the level of computer competencies of students in the context of the COVID-19 pandemic. The hypothesis was that most respondents have basic computer skills, but they may have varying levels of proficiency in specific computer competencies, such as the use of new software. To achieve this goal, the authors presented empirical research results conducted in February 2021. The study sample included 649 respondents.

The research show that the majority of the respondents declared possessing computer competencies such as the use of computers, smartphones/phones, technical internet support, and mobile devices and applications. However, there were some individuals who faced difficulties in operating new software. Therefore, it was recommended to focus on developing computer competencies in the area of new software use through training or courses that will assist those who have difficulty in this area. It is also important to continue monitoring progress and the effectiveness of such actions. This will increase the level of computer competencies in the whole group of respondents, which may contribute to improving work efficiency and increasing job market opportunities. The conducted Pearson correlation allowed us to draw the following conclusions: there are strong positive correlations between all pairs of IT skills, which suggests a mutual relationship.

Keywords: IT skills, COVID-19 pandemic, students.

Wpływ pandemii COVID-19 na kompetencje informatyczne studentów w świetle badań własnych

Streszczenie

W obecnych czasach pandemii COVID-19, umiejętności informatyczne stały się niezbędne dla studentów i pracowników naukowych, którzy uczestniczą w procesie nauczania zdalnego lub pracują nad projektami, badaniami i analizami w trybie online. Wiele zajęć i projektów musiało zostać przeniesionych do świata wirtualnego, co sprawiło, że posiadanie umiejętności informatycznych stało się kluczowe dla skutecznego funkcjonowania w obecnej sytuacji. Celem artykułu było zbadanie poziomu kompetencji informatycznych studentów w kontekście pandemii COVID-19. Postawiono hipotezę, iż większość badanych posiada podstawowe umiejętności informatyczne, jednak mogą oni mieć zróżnicowany poziom w poszczególnych kompetencjach informatycznych, takich

jak posługiwanie się nowymi programami. W tym celu przedstawiono autorskie wyniki badań empirycznych, przeprowadzonych w lutym 2021 r. Ich celem było przedstawienie obrazu kompetencji informatycznych osób, objętych badaniem. Próbę badawczą stanowiło 649 respondentów.

Badania pokazały, że większość respondentów posiada kompetencje informatyczne w zakresie posługiwania się komputerem, smartfonem/telefonem, techniczną obsługą Internetu oraz mobilnymi urządzeniami i aplikacjami. Jednakże, istnieją osoby, które mają trudności w obsłudze nowych programów. Z tego powodu wysunięto rekomendację, iż istotne jest skupienie się na rozwijaniu kompetencji informatycznych w zakresie posługiwania się nowymi programami. Można to zrobić poprzez szkolenia lub kursy, które pomogą osobom, które mają trudności w tym obszarze. Ważne jest również kontynuowanie badania, aby monitorować postęp i skuteczność takich działań. W ten sposób można zwiększyć poziom kompetencji informatycznych w całej grupie badanych, co może przyczynić się do poprawy efektywności pracy oraz zwiększenia ich szans na rynku pracy. Przeprowadzona analiza korelacji Pearsona pozwoliła na wyciągnięcie następujących wniosków: Istnieją silne dodatnie korelacje między wszystkimi parami umiejętności IT, co sugeruje ich wzajemne powiązanie.

Słowa kluczowe: kompetencje informatyczne, pandemia COVID-19, studenci.

JEL: M210.