

Article

Evaluating Sustainable Online Education: A Cross-Disciplinary Analysis of IT Device Utilization among Slovakian and Hungarian University Students

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Abstract: By the onset of the 21st century, online presence had become prevalent in higher education, with the COVID-19 pandemic further accelerating this trend. However, the success of online education and its assessment by students can differ significantly from region to region and according to the field of study. This can be influenced by students' habits of using IT devices, but it can also occur the other way around. In this research, experiences related to online education were examined in the fields of Informatics, Agriculture and Pharmacy education at two higher-education institutions in Slovakia and one in Hungary, considering the environmental and social sustainability implications. In the study, in addition to simple statistical methods, a cross-tabulation analysis was carried out using Cramer's V method. The results have shown that the students of the investigated institutions confidently navigate the online world; they are conscious users of IT tools without being addicted. A total of 74% of students in Mosonmagyaróvár believe they possess sufficient information about the risks associated with computers, mobile phones, and the Internet, whereas only 34% of students in Košice share the same sentiment. The reason for the differences between these characteristics can be attributed to the specialties of the different majors, and not to those arising from regional differences, raising important questions about the ecological sustainability of online education practices. A relatively great consistency can be observed in the assessment of online learning among students from the three institutions, with approximately 85% expressing overall satisfaction with the online learning experience. The easier availability of study materials and savings on travel are mentioned as advantages, contributing to economic sustainability. However, separation from their mates and the lack of practical training may be regarded as a disadvantage for them, as they seem to have a preference for face-to-face training. Overall, it may be concluded that purely online training in the fields of Informatics, Agriculture, and Pharmacy training is not feasible for the time being, necessitating a balanced and sustainable approach for the future.

Keywords: online education; IT devices; students' experiences; health effects



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1. Introduction

The digital revolution has reshaped education, with online learning emerging as a pivotal force. Skenderi and Skenderi [1] aptly note that the integration of IT tools initially complemented traditional methods, paving the way for a gradual transition to online education [1]. However, the unforeseen catalyst of the COVID-19 pandemic thrust online education into the forefront, necessitating its implementation worldwide [2].

The impact of online education varies across disciplines, as Safraz et al. [3] contend that professions like architecture and medicine face limitations in transferring knowledge

effectively through online means. Conversely, Deés [4] suggests that more theoretical fields, such as law and economics, find online education a seamless fit.

Examining the success of online education, Razami et al. [2] emphasise the subjective nature of its effectiveness, influenced by factors like instructors' experiences and students' learning environments [2]. Nevertheless, concerns about the long-term consequences and health implications of widespread online learning persist, prompting ongoing discussions among scholars [5].

Beyond academia, the environmental impact of e-learning and remote work remains a topic of debate. According to Luo et al. [6], the COVID-19 restrictions inadvertently demonstrated positive environmental outcomes by removing students from traditional classrooms. However, the broader sustainability of online education prompts a continued exploration of its multifaceted effects [7].

In summary, this introduction, drawn from insights by various authors, underscores the transformative journey of education into the digital realm, shaped by unforeseen global events and ongoing scholarly discourse.

It is essential to underscore the significance of analysing the specific context of Slovakia and Hungary in our study. The limited existing evidence necessitates a closer examination of the unique circumstances in these regions, making these two countries the exclusive focus of our research.

This study aims to address this gap by providing a detailed analysis of the IT usage habits of university students in Mosonmagyaróvár, Komárom, and Košice. Our objectives include elucidating the impact of online education on these students, understanding the sustainability implications, and contributing valuable insights to the existing body of knowledge.

Literature Review

Online education exists in many forms, and its widespread use (and occasionally even its upgrading or expansion) was forced by COVID-19.

According to studies by Dag and Gecer [8], the most popular digital learning forms in many countries in the world include e-learning, Internet learning, distribution learning, network learning, telelearning, virtual learning and PC-controlled learning. Although online education can take place in many ways—frontal, feedback, face-to-face, or as an opportunity for self-research or self-learning—in the view of some researchers, it seems less effective than classroom or onsite education.

Based on the surveys by Zapata-Cuervo et al. [9] in the United States, South Korea, and Columbia, online education was, overall, less effective. However, students' self-efficiency and anxiety have significantly influenced their commitment to online, influencing their online learning results.

Online education has different modalities, including synchronous and asynchronous learning. Synchronous learning involves real-time interaction between instructors and students, fostering immediate engagement. This mode, often facilitated through live lectures, webinars, or virtual classrooms, enhances students' sense of connection and community. On the other hand, asynchronous learning unfolds without real-time interaction, providing flexibility for students to access learning materials and complete tasks at their own pace. Discussion forums, pre-recorded lectures, and self-paced modules characterize asynchronous learning. These modalities have been explored by various researchers, including Lee et al. [10], Razami and Ibrahim [2], and Tam [11], who have discussed ways to enhance the efficiency of online learning with a focus on interaction, application, and self-managed learning [2,10,11]. Lee et al. [10] examined how to make online learning more efficient with questionnaires. They discussed three main topics: interaction, application and self-managed learning. Razami and Ibrahim [2] highlighted interaction, motivation and concentration in a similar survey. Tam [11] claims that taking exams from home improved students' constructive attitudes. They learned more actively, reviewed their notes more frequently, and asked for information and feedback.

Also, the attitude of teachers plays a vital role in the effectiveness of online education. Studies by Kross et al. [12] were conducted among 2260 people in the United States, and Hung et al. [13] also measured the online learning ability in Taiwan with a confirmation factor analysis. Five dimensions were considered in the surveys: self-directed learning, learning motivation, computer/Internet self-efficiency, student control, and online communication self-efficiency. The results have shown that teachers play a significant role in developing two dimensions: self-directed learning and learning control skills. They can help students develop their time and information management. In addition, students with less self-confidence should be encouraged in online communication. Hoang and Hoang [14] had the same opinion in their surveys in Vietnam. Han and Geng [15] also highlighted the same issue in their examination in China. In addition, they noted that, for more efficient learning, teachers should clarify the goals and the course guidelines before the lecture, offer high-quality online materials and immediately respond to students' questions through messaging interfaces. Five dimensions of self-efficiency have been identified by Shen et al. [16] (the same in serial numbering as above): (1) self-efficiency in completing the online course, (2) self-efficiency with classmates, (3) self-efficiency in device management, (4) self-efficiency of interactions with instructors, (5) self-efficiency of communication with students for study purposes.

The efficiency of online learning is significantly influenced by students' using habits of IT devices, the degree of their orientation in online space, and their preparedness. The survey by Akuratiya and Meddage [17], conducted among 130 first- and second-year medical students, is also worth mentioning. According to its findings, switching to online education was much more complicated in Sri Lanka because 62% of higher education students had little or no experience with IT devices. About 54.7% of students preferred printed literature to digital. Smartphones were used mainly during the lectures (43.8%); 37.5% of the students preferred the laptop, while 1.6% used tablets in this activity. A total of 17.1% of students used their laptops and smartphones in the same proportion during their online work. However, after lifting the restrictions, 82.9% of respondents said they could imagine continuing this type of distance education.

Hermanto and Srimulyani [18] received similar results for preferred IT devices in online education. A total of 108 lecturers and 386 students participated in their Indonesian survey. A total of 34.8% of the students preferred the smartphone, while 26.68% preferred the computer, laptop, or a combination of the two. The Internet was mainly used for receiving information during online education, but many people also preferred TV and smart boards.

A survey conducted by Deés [4] at the Edutus University in Hungary established that students who had previously worked less on online interfaces or preferred IT devices in their studies to a lesser extent were uncertain about this new type of assignment. In this case, this was a problem because they enjoyed the greater independence to complete their studies more responsibly. The author points to the fact that, in 2018, it was noticeable that students neglected learning from books. The students opted to browse the Internet to expand their knowledge. She also stated that students who attended an Engineering Programme were more satisfied with the quality of online education than students with a major in Economics.

Sarfraz et al. [3] found that medical students' higher results in online learning were related to their preparedness for online learning on behalf of students and lecturers. Kang's studies at the University of Medicine also showed that higher-grade students used their online space more routinely, spending more time on learning and research than lower-grade students.

Furthermore, the motivation and satisfaction of students play a crucial role in the success of online education. Studies by Brahmasrene and Lee [19], Martin et al. [20], and Dymek et al. [21] highlighted the impact of students' preparedness, satisfaction, and intention to use online learning in the future. Students' satisfaction can lead to the successful application of online education in the future, as suggested by research findings by Cham-

dani et al. [22] in Indonesia. Several surveys were conducted after the pandemic. The research findings by Chamdani et al. [22] in Indonesia show that 50% of students were satisfied with online education, and learning motivation did not influence their views on online lectures.

Online education during the COVID-19 pandemic, various techniques and programmes were used by universities to provide lectures. Students were optimistic about the following online techniques, devices and methods: semi-directional communication, SPADA, Google Meet, WhatsApp interface, study videos, video conferences, theme of lectures, lecture style, and method of presentation. Susila et al. [23] found that Indonesian students preferred visual presentations to auditive methods. The authors' survey revealed that, in the case of lectures, the visual method seemed more preferred than the auditive method. Overall, students had very different opinions about online education. Surveys conducted in several countries have confirmed that students are satisfied with this method of education; therefore, they will participate in online education in the future.

The advantages and disadvantages of online education were studied in many ways by researchers. In Deés' [4] survey, 50% of students' opinions suggest that they were comfortable attending lectures from home to save travel costs and make their time more flexible. The lecturers were maximally helpful, preparing their lessons creatively. In addition, a decrease in stress due to the exam was observed. As a disadvantage, students mentioned the lack of personal contact, some lecturers' insufficient grounding in online education, technical problems, and the adverse effects of all-day sedentary work on health.

Online education significantly contributes to sustainability by minimizing the need for travel to educational institutions, thereby reducing greenhouse gas emissions. Additionally, it saves valuable time and alleviates the traffic congestion, fuel wastage, and noise pollution associated with traditional commuting. Particularly significant savings can be made if students only leave home to take an exam. These examinations can be quickly and easily carried out from home.

Song et al. [24] examined the participants in two groups: those who were satisfied with online education and those who were not. In both groups, it was stated that students liked the evolution of the course. Both groups were satisfied with the comfort of the technology. However, it was more problematic to manage time and keep students motivated. The students' opinions were similar in a similar study by Kazainé Ónódi [25]. She presented her results on a five-grade Likert scale, with a value of 4.5 for satisfaction of seminars. The students positively experienced that the online lessons were convenient, and that new students were in contact with each other and friendships were formed. Peimani and Kamalipour [26] found that eye contact was important for students during online seminars. However, they considered it more important to see their teachers and their companions than to be visible themselves. It was also found that participants preferred online seminars to pre-recorded seminars. Han et al. [27] grouped 317 participants according to their preference for content-oriented or practice-oriented learning. The survey revealed that the practice-oriented strategy was less effective in terms of results and, overall, the students were less satisfied with online education. In a study by Riaz et al. [28] in Saudi Arabia, students were very positive about their home learning. People returning to universities after the closures complained about fatigue (77% of survey participants), demotivation, and unhappiness (63%). Most of the students thought they could study more conveniently in online lessons, were more alert, and had higher exam scores. Also, Nikou [29] stated in a survey that students had a favourable opinion of online education opportunities. A total of 159 students, when asked by Giovannella [30] (95% women), also made the same statement—however, the interaction between lecturers and groupmates needed to remain continuous. Almuraqab [31] included 133 students in his survey in Dubai. The gender distribution of this study comprised 53% female and 47% male participants aged between 18 and 24 years. A total of 62% of the respondents were satisfied with the opportunities offered by online education. A total of 73% of them thought they could do their job much more efficiently because of the flexibility of working from home. The students mentioned

that they could save time by not having to devote time to travel. Looking at the negative and positive aspects, 55% of students liked distance education, while 45% did not. Overall, however, only 25% of them would completely stop online education, while others would continue to use the opportunities offered by online education, either in full or in a hybrid method. Frederick et al. [32] obtained the same result. It is clear from their studies that during both online and hybrid education, young people considered flexibility, autonomy and the diversity of curriculum as positives. However, most of the respondents preferred hybrid education. Almahasees et al. [33] reported the same opinions from their surveys in Jordan, and so did Hegde et al. [34]. Bali and Liu [35] also achieved similar results, as students preferred traditional lectures, but they quickly discovered the potential and positive side of online education (autonomy, time-saving, cost-effectiveness). Van et al. [36] found that online education was positively judged by students. Therefore, they suggest that teacher training colleges should specialize in preparing trainers online, allowing for the opportunity to continue online lectures. A survey by Saeed and Almende [37] in Saudi Arabia concluded that, among the 2030 students surveyed, female respondents had a higher preference for online education than their male counterparts. In addition, lower-year pharmaceutical students found personal lectures more favourable. They seem to be less prepared for online education and have less autonomy in learning. Among the disadvantages of online learning, students mentioned technical problems, an uncomfortable environment at home, and demotivation.

Surveys by Huang et al. [38] in southern China also show the reduced motivation of students, although there were significant differences in students' online learning skills. Gross and Uppsäll [39] obtained similar results in Sweden in the case of IT students. Students were less motivated; it was harder for them to concentrate and maintain their self-discipline.

In addition, in higher-education institutions, students could take exams from home. This option was generally experienced by the students as positive. Luo and Hiang [6] also emphasised that it was important for lecturers to create a motivating online learning environment and service systems for home learning and change students' views on online education. Su et al. [40] believe that this should be formed according to students' needs, which are influenced by their social origin.

Saving energy is a significant concern: universities use lighting, heating, computers, and air conditioning most of the day. Students can control their energy use at home, significantly reducing unnecessary energy use.

In some regions, online education was clearly rejected by students. Hilaria et al. [41] found in their examinations that 62% of students negatively assessed the shift to online education. Students said the interaction was limited or exhibited misunderstandings about the written texts. Nevertheless, they did not experience demotivation or a decline in academic results. Jamil and Tasir [42] also highlighted the importance of lecturers in terms of students' interactions with each other. A survey by Dindar [43] in Turkey supported the same view by pointing out that students are more likely to attend face-to-face seminars than online lectures.

Thus, in the countries mentioned above, online education was carried out relatively smoothly during the pandemic. It should be noted, however, that closures were also imposed in developing countries. In these states, there were many more challenges for both students and lecturers in switching to digital education. [44]

Surahman and Sujarwanto [45] found that students preferred hybrid learning at the University of Siliwang in Indonesia, because of the slow Internet connection. Wang et al. [46] highlighted the need to develop online education platforms. In Malaysia, online education is also in its infancy, which causes a high level of dropout in higher education. Students were asked about enforced home learning because of the COVID-19 pandemic. They evaluated this form of education positively. Therefore, Tan et al. [7] consider improving the quality of this domain. Harefa és Sihombin [47] also mentioned, in their studies, that students living in the countryside faced more difficulties in participating in online education for technical reasons. The lecturers also needed to adapt to this situation.

In a survey, Susila et al. [23] found that although 100% of students had a mobile phone, and 86.8% had access to the Internet, only 52.6% had continuous Internet service, and others were stuck. For this reason, 84.2% of the students do not want online education in the future.

The health effects of online education could primarily be examined during the pandemic. In the Hungarian survey by Szemes et al. [48], the impact of epidemiological measures was examined among students aged between 18 and 25 years during the first period of the pandemic. A total of 54% of them mentioned a reduction in personal relationships in terms of learning, and mentioned working at home as a discommodity. However, 65% believed that their leisure activities did not change during the pandemic. In terms of health, it is a disadvantage that smoking increased by 1.6% during this period, and alcohol consumption by 11.8%. Nevertheless, it can be stated that there was no change in health and risk behaviour. It should be noted that both women and men found a way to complete some sports activities. Women accessed live-streaming workouts and exercises on videos posted on sharing sites. Adverse effects, such as weight gain or increased alcohol consumption, were more common in the case of men. In addition to physical activity, people's psychological status changed a lot during the period of online education and curfew. Rozali et al. [49], in their survey of 127 technical students in Malaysia, investigated the impact of the pandemic on health, looking at gender differences. A study with a quantitative research plan showed that there was no significant difference in psychological well-being related to gender.

E-learning contributes to reducing the food waste and expenses associated with impulse purchases, as students often buy food on campus or on-the-go that goes uneaten. Additionally, home-based learning helps minimize the consumption of single-use PET bottled beverages, promoting cost savings, and address ongoing concerns about PET bottle recycling.

Hayat et al. [50] and Howcroft and Mercer [5] found similar problems with students' mental health at the University of Waterloo Ethics Office. Studies by Puiu et al. [51] in Romania show that the stress experienced by the students stems from additional factors, as well as the lack of social relationships. Students experienced more stress when communication problems occurred during online education. Lecturers played a significant role in reducing stress levels. The following tools were used: brainstorming, games, and quizzes. In addition to communication problems, technical problems also increased students' stress levels. Studies conducted by Lim et al. [52] and Khumya et al. [53] in the Philippines drew attention to the importance of higher-education institutions preserving the mental health of students and meeting their social needs. As a result of the sudden transition to online education, a large number of students experienced depression, anxiety, stress, and fatigue.

Based on the previous literature review, the authors of this study considered it essential to survey two Central European countries, namely Slovakia and Hungary.

The following research questions were defined:

1. How do students' preferences for the devices used in studying and leisure activities in Hungary and Slovakia compare to studies in other (non-European) countries, and what role does their overall experience with IT devices play?
2. What are the commonalities and differences in students' perceptions of online learning, including advantages, disadvantages, and changes in habits during the pandemic, and how do these align with the existing literature?
3. How do correlations between IT device usage, time spent on activities, and perceptions of digital learning materials differ between institutions, and what key factors contribute to the variation in experiences?

2. Materials and Methods

A questionnaire survey was conducted on students' IT device usage habits in 2022 in Slovakia and Hungary at three universities in different regions (Komarno, Kosice and Mosonmagyaróvár) to examine regional differences. Students studying Informatics in

Komarno, Pharmacy in Kosice, and Agricultural and Food Sciences in Mosonmagyaróvár were surveyed, also examining whether there is a difference between the results of students studying different fields of expertise. The questionnaire—in addition to two questions about gender and age—contained a total of 43 questions, which can be grouped into three main themes: on the one hand, the typical IT device usage habits of the students during their period of online education (specifically computer, laptop, tablet, smartphone); on the other hand, the effects of the use of IT devices on health based on the opinions and experiences of the students, and their educational approach to online education. The last two themes (the health impact and the learning perspective) include 11–11 questions. The theme of usage habits contains 21 questions, but the first 10 questions focused on the same area from different perspectives, and were given less weight in the evaluation. Additionally, it is noteworthy that, during the COVID-19 pandemic, students (both full-time and correspondence students) in all three institutions studied entirely online. Following the pandemic, correspondence students had the option to continue their studies in a hybrid, synchronous, or asynchronous mode. In contrast, full-time students could continue their studies in the face-to-face mode only. This contextual information provides insights into the dynamic modes of education necessitated by the pandemic, and the subsequent choices available to students regarding their learning preferences. The questionnaire (Appendix A) contained 23 multiple-choice questions, 15 scaled questions, and 5 open-ended questions.

The questionnaire underwent rigorous testing to ensure both validity and reliability. The instrument was carefully designed to comprehensively understand students' IT device usage habits, their perceptions of the health implications, and their approach to online education.

- **Content Validity:** The survey questions were crafted based on a thorough review of the existing literature on IT device usage, health impacts, and online education. Additionally, experts in the relevant fields provided valuable insights during the questionnaire development phase to enhance content validity.
- **Face Validity:** The clarity and relevance of the questions were assessed through a pilot study with a small group of students, ensuring that the questionnaire was easily comprehensible and aligned with the study's objectives.
- **Construct Validity:** A factor analysis was conducted on a subset of questions related to IT device usage habits and their effects on health to assess the underlying constructs. This analysis confirmed the intended structure and construct validity of the instrument.
- **Reliability:** The internal consistency of the questionnaire was measured using appropriate statistical methods. Cronbach's alpha coefficient was calculated for sections addressing IT device usage, health impacts, and educational approaches, demonstrating a high level of reliability.

The responses obtained from a significant portion of the student population across the three institutions further contribute to the generalizability of the findings. The gender and age distribution of the respondents mirrors the overall demographics of the respective universities, ensuring a representative sample.

The study focused on students enrolled in higher-education institutions in Slovakia and Hungary, specifically in the cities of Komarno, Kosice, and Mosonmagyaróvár. The target population comprised students from diverse academic disciplines, including Informatics in Komarno, Pharmacy in Kosice, and Agricultural and Food Sciences in Mosonmagyaróvár. A stratified sampling method was employed to ensure representation from each field of study and geographical location. The study included both full-time and correspondence students, emphasising capturing the experiences of those who engaged in fully online learning during the COVID-19 pandemic. The respondents were chosen randomly within each stratum to avoid bias. The sample consisted of 233 participants, with 132 students from Komarno, 71 from Mosonmagyaróvár, and 30 from Kosice. The involved students represent more than 10% of the student population across the three institutions. This response rate reinforces the study's credibility and allows for meaningful insights into the IT device usage habits, health perceptions, and educational approaches of the

broader student community. The gender distribution within each university mirrored the respective gender ratios of the student population. In Komarno and Mosonmagyaróvár, the gender distribution was approximately equal, while at the University of Kosice, most respondents were women, representing the university's gender ratio accurately. The age distribution of the respondents was proportionally representative, mainly falling within the age group ranging from 20 to 23. This distribution ensures that perspectives from various academic years are adequately captured, enhancing the generalizability of the study's findings. This comprehensive approach to population definition, sample selection, and sample characterization establishes the groundwork for a robust and representative examination of students' experiences in online education.

Statistical Analysis

The general evaluation of the questionnaires was carried out using simple statistical methods (average, standard deviation, distribution, table, graphical display) with the statistical program SPSS. Cramer's V was used to examine the correlations between the questions. This method is suitable for measuring the correlation between two quality criteria for which the number of criteria variables is arbitrary. In the case of a correlation, there is an association, and in the absence of a correlation, an association is absent. To detect the association, the elements of the population are arranged in a contingency table, and then Cramer's V is applied. The significance level (p) for the Cramer's V was also calculated, which was under 5% in each case.

3. Results

In the first part of the results, the findings from the three main topics of the questionnaire are described, while in the second part, the correlations between each question are presented. (The open-ended questions did not receive sufficient meaningful responses, so this chapter does not include results for these.) The results of the study illuminate cross-cultural patterns in students' device preferences, unveil nuanced perceptions of online learning, and unravel correlations between IT device usage and digital learning experiences in diverse educational institutions.

3.1. IT Device Usage Habits

The study sought to answer the question of what kind of electrotechnical equipment young people prefer using in their free time and during their learning activities. This question can be analysed using the answers to the first 21 questions of the questionnaire. The answers show that students in all three institutions mainly use laptops for study purposes. In contrast, they prefer using their mobile phones for leisure activities. However, it should be noted that those who like to browse the Internet for a more extended period or use other software and games would rather use their laptops for these activities.

The answers to the questions show that 100% of the respondents, i.e., all the students surveyed, used some kind of electronic device during the period of online education at both Hungarian and Slovak universities. Students at all three institutions preferred laptops, probably because of their ease of use and mobility. In addition to laptops, students also preferred using their mobile phones for learning purposes. Tablets were used by very few students, possibly due to their inconvenient size or difficulties using them.

The study examined the time young people spent online, their online activities, their habits of using IT devices, and their feelings and preferences in this regard (Table 1).

The research shows that 58% of students from Mosonmagyaróvár, 54% of students from Komárno and 41% of students from Košice use the Internet for leisure. Two-thirds (76%) of the students at the University of Košice, almost half (49%) of the students in Hungary, and one-third (35%) of the students in Komárno spend time on social networks. Different software and PC games are used less often at both Hungarian and Slovak universities.

Table 1. Students preferences regarding the use of IT devices.

Questions about Preference	Answers	Distribution of Answers (%)		
		Komárno	Košice	Mosonmagyaróvár
Do you tend to get nervous without using IT devices?	Yes	3	3	3
	No	72	76	86
	Sometimes	25	21	11
Do you prefer online activities to offline activities?	Yes	17	3	10
	No	53	76	59
	Sometimes	30	21	31
Have you ever preferred your IT device to your social connections?	Yes	12	0	0
	No	77	90	91
	Sometimes	11	10	9
Do you often think of your IT device while doing other activities?	Yes	22	7	7
	No	49	76	81
	Sometimes	29	17	11
Do you have enough information about the risks associated with IT devices and/or the Internet?	Yes	69	41	74
	No	13	21	10
	Sometimes	18	38	16
Have anyone informed you of the potential risks associated with IT devices and/or the Internet?	Yes	42	9	41
	No	54	76	52
	Sometimes	4	15	7

The majority of respondents in Hungary and Komárno would mainly prefer to spend their time browsing the Internet. However, in Košice, 36% of the respondents also enjoy using online platforms for learning.

At the same time, it must be noted that a significant proportion of respondents (86% in Mosonmagyaróvár, 76% in Košice and 72% in Komárno) do not feel frustrated if they do not have access to any digital device, including the Internet. Most respondents said that they do not or only sometimes prefer technical devices to social relationships, with only students from Komárno showing a higher proportion of preferring a computer or mobile phone for social contact, with 17% answering yes to this question. The majority of respondents, on the other hand, would prefer to use a computer or the Internet in certain cases. However, the question was open, so it was not clear whether they would prefer to use their electronic device mainly for work-related or leisure activities.

While completing the questionnaires, 90% of respondents in Mosonmagyaróvár did not use mobile phones or the Internet at all. In comparison, slightly more than half of the students in Košice (48%) and 66% of students in Komárno acted similarly.

In addition to all of this, it is worth mentioning that the study showed that, after studying at the computer, the students preferred to spend their free time in nature or playing sports. Since they were no longer home, this also resulted in energy savings. Many people like gardening, which is also beneficial in terms of sustainability.

A total of 74% of the students in Mosonmagyaróvár who completed the questionnaire believe they have sufficient information about the risks related to computers, mobile phones and the Internet. A total of 44% of the students had received information about the dangers related to digital devices. Most of them received this information from their parents and their previous school. Respondents in Košice are less confident about this issue. Only 41% of them answered yes to the question of whether they had enough information about working with electronic devices, as almost 90% had not been informed about these facts

at all. A total of 69% of students in Komárno think that they are aware of the risks of working with computers, even though 56% of them answered that they had not obtained information on this before. Of course, this is not necessarily a contradiction, as the digital generation is mainly informed from online spaces.

When examining the students' computer, mobile, internet and social media usage patterns, specifically the time spent on them, it can be seen that, in all three institutions, there was a significant increase in online education during the pandemic compared to the offline education period before the pandemic (Table 2). In addition, both the time spent studying and the time spent on online leisure activities increased during the pandemic, although to a lesser extent compared to the time spent studying. One reason for this may have been the curfew during the pandemic, when people spent most of their free time using their IT devices and/or conducting some online activities. In all three institutions, the time spent studying on the computer increased to the greatest extent on working days, by an average of more than one hour in Komárno and Mosonmagyaróvár (more than three hours in Košice). There was also a significant increase in time spent on the Internet for studying on working days, with an average increase of almost one hour in Komárno and Mosonmagyaróvár and more than three hours in Košice. The reason for this could be explained by the fact that the lessons were held via video-sharing portals. Of the three institutions, in all respects, the online presence increased the most in Košice and the least in Mosonmagyaróvár. Moreover, the time spent on online leisure activities in the latter institution also stagnated or slightly decreased. This is mainly due to the differences in the professions studied by students at the universities. In Mosonmagyaróvár, a significant proportion of agricultural students work on farms, including during the pandemic, so they could not spend much more time on these devices. In Komárno, computer science students spend much of their time on IT devices anyway, so the closures due to the pandemic increased this activity by only one hour, the same proportion as agricultural students. However, pharmacy students spent a significant amount of time using IT devices due to the effect of the lockdown. In terms of weekend leisure activities, students from each institution tended to spend more time on their mobile phones.

Table 2. Students' computer, mobile, internet and social network usage time during the online education period during the pandemic (2020–2021) and before (–2019).

		Komárno			Moson-Magyaróvár			Košice		
		Period before Online Educ.	Online Educ. Period	Avg. Change	Period before Online Educ.	Online Educ. Period	Avg. Change	Period before Online Educ.	Online Educ. Period	Avg. Change
Workdays	Learning									
	Computer	2.4 ± 1.9	3.9 ± 2.2	+1.5	1.5 ± 0.9	2.5 ± 1.6	+1.0	1.9 ± 1.4	5.0 ± 2.5	+3.1
	Mobile	2.0 ± 1.5	2.5 ± 1.8	+0.5	1.3 ± 1.0	1.6 ± 1.0	+0.3	1.9 ± 1.5	3.7 ± 2.5	+1.8
	Internet	2.6 ± 1.7	3.7 ± 2.0	+1.1	1.8 ± 1.2	2.6 ± 1.7	+0.8	2.6 ± 1.6	6.1 ± 2.5	+3.5
	Social netw.	1.6 ± 1.1	2.0 ± 1.6	+0.4	1.2 ± 0.6	1.4 ± 1.3	+0.2	1.7 ± 1.6	1.8 ± 1.3	+1.1
	Leisure activity									
	Computer	2.4 ± 2.0	2.5 ± 2.1	+0.1	1.5 ± 0.9	1.5 ± 1.0	0.0	1.1 ± 0.8	1.1 ± 1.2	0.0
	Mobile	2.6 ± 2.0	3.0 ± 2.1	+0.4	2.1 ± 1.4	2.2 ± 1.7	+0.1	2.1 ± 1.4	2.6 ± 1.2	+0.5
	Internet	3.0 ± 2.3	3.3 ± 2.3	+0.3	2.3 ± 1.5	2.0 ± 1.4	−0.3	2.3 ± 1.3	2.6 ± 1.4	+0.3
	Social netw.	1.8 ± 1.4	2.2 ± 1.6	+0.4	1.9 ± 1.4	1.9 ± 1.5	0.0	1.9 ± 1.4	2.3 ± 1.7	+0.4

Table 2. Cont.

		Komárno			Moson-Magyaróvár			Košice		
		Period before Online Educ.	Online Educ. Period	Avg. Change	Period before Online Educ.	Online Educ. Period	Avg. Change	Period before Online Educ.	Online Educ. Period	Avg. Change
Weekends and holidays	Learning									
	Computer	1.9 ± 1.6	2.6 ± 1.9	+0.7	1.3 ± 0.8	1.5 ± 0.9	+0.2	2.4 ± 1.6	3.5 ± 2.1	+1.1
	Mobile	1.7 ± 1.4	2.0 ± 1.7	+0.3	1.2 ± 0.9	1.4 ± 1.1	+0.2	1.7 ± 1.4	2.5 ± 1.8	+0.8
	Internet	2.2 ± 1.7	2.7 ± 2.0	+0.5	1.4 ± 0.9	1.7 ± 1.3	+0.3	2.9 ± 1.9	4.2 ± 2.3	+1.3
	Social netw.	1.4 ± 1.1	1.8 ± 1.5	+0.4	1.1 ± 0.8	1.2 ± 1.0	+0.1	1.2 ± 0.9	1.8 ± 1.6	+0.6
	Leisure activity									
	Computer	2.6 ± 2.4	2.6 ± 2.1	0.0	1.5 ± 1.4	1.7 ± 1.3	+0.2	1.4 ± 1.2	1.2 ± 1.1	−0.2
	Mobile	2.6 ± 1.9	3.0 ± 2.0	+0.4	2.2 ± 1.5	2.2 ± 1.6	0.0	2.6 ± 1.3	2.7 ± 1.5	+1.1
	Internet	3.2 ± 2.4	3.4 ± 2.4	+0.2	2.4 ± 1.7	2.2 ± 1.5	−0.2	2.6 ± 1.3	3.0 ± 1.8	+0.4
	Social netw.	1.8 ± 1.6	2.2 ± 1.7	+0.4	2.2 ± 1.5	1.9 ± 1.3	−0.3	2.0 ± 1.4	2.2 ± 1.7	+0.2

3.2. The Impact of Online Learning and IT Devices on Health

The COVID pandemic has taken a heavy toll on society in terms of both physical and mental health. The number of cases of depression multiplied, the situation regarding the use of addictive substances worsened, and aggression within families became more common. This issue can be analysed from the answers to the second 11 questions of the questionnaire. Most of the young people surveyed in Mosonmagyaróvár (61%) did not experience any adverse effects of isolation; in contrast, only 24% of the respondents in Košice said the same. However, 23% of the respondents in Mosonmagyaróvár experienced a feeling of loneliness, and many also experienced increased stress. An even higher proportion of students in Košice, around 70%, experienced the same thing, as well as more than a third of the students (37%) in Komárno. To overcome these adverse effects, 47% of students in Mosonmagyaróvár participated in some physical activity or sport. Similarly, 42% of students from Komárno answered the same. As the students from Košice were more likely (66% of them) to experience reduced physical activity during online learning, they participated in more sports or other forms of physical activity as a recreational activity. Others preferred some form of passive recreation in their free time. A total of 17% of Hungarian students either relaxed in front of the television or read a book.

The same number of students chose to use the Internet and their mobile phone to relax between online work.

Although they had to use electrotechnical devices for a long time during their studies, the students in Komárno preferred using the Internet and mobile phones in their free time (33% of them). However, a relatively high percentage of respondents in Mosonmagyaróvár completed physical or mental work in their free time during the study period. This may be due to the fact that a large number of students had previously worked on farms, where there was no downtime during the COVID-19 pandemic. A total of 24% of the respondents in Košice tried to relax while watching television or reading a book.

Students' views on excessive IT device use and overwhelming online presence are summarised in Figure 1. This shows that a relatively high proportion of respondents think that long-term Internet use and working on a computer or mobile phone, i.e., regularly for more than one hour without interruption, can damage people's health. A total of 74% of students in Mosonmagyaróvár held this view, similar to 76% of students in Košice, while only 46% of respondents in Komárno thought the same. While slightly more than 10% of respondents in Hungary and Komárno were not aware of the fact that working for long

periods on electronic devices is harmful, this percentage was only 3% at the University of Košice. This could be due to the students' educational background, as students studying to become health professionals were asked at the University of Košice, while these students were not asked at the other two institutions. However, only slightly more than half (59%) of the Hungarian respondents are aware of the basic principles of computer work. At the University of Košice, this proportion is 34%, while in Komárno it is 66%. It can be assumed that students studying informatics are more aware of the basic principles of computer work than students studying health.

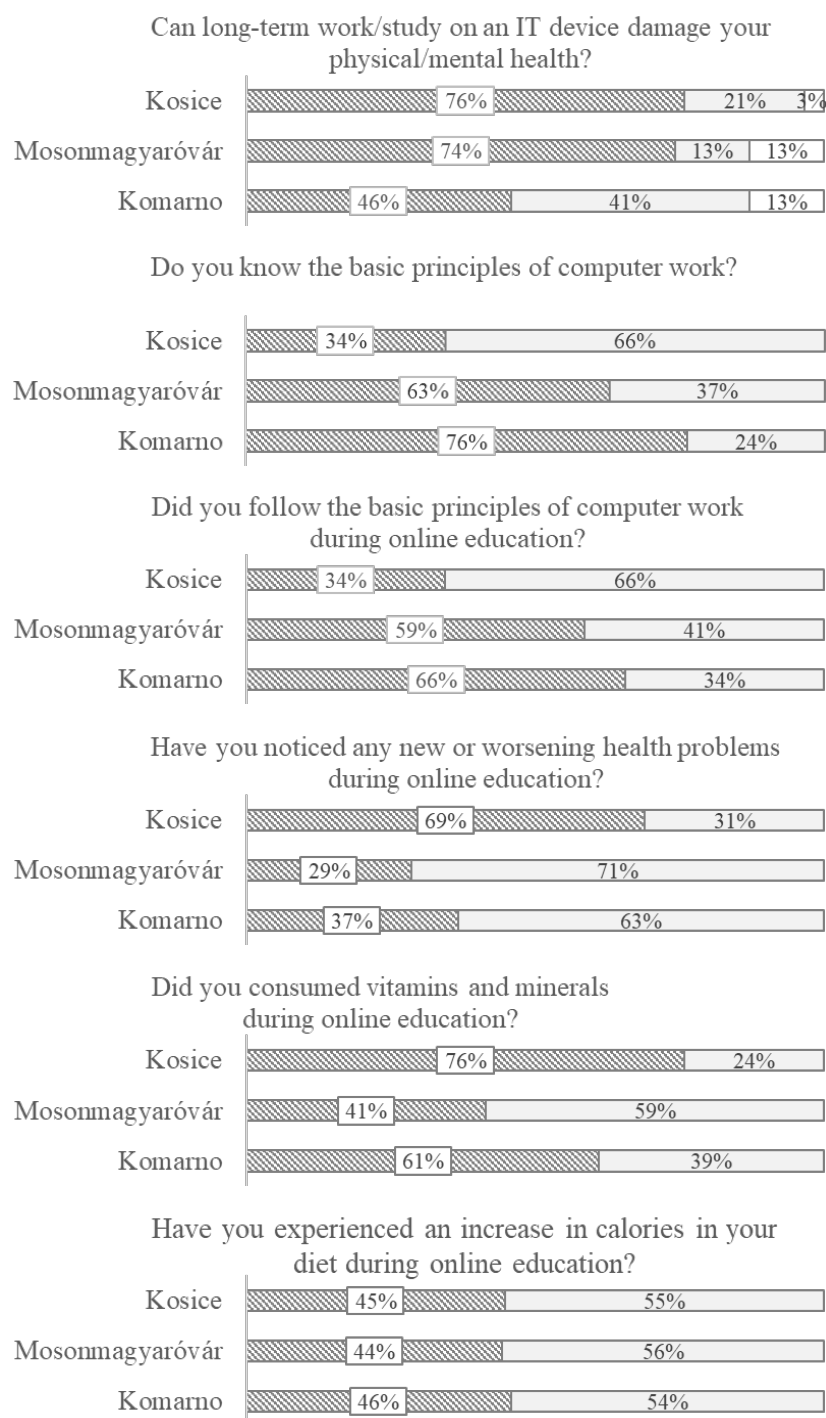


Figure 1. Cont.

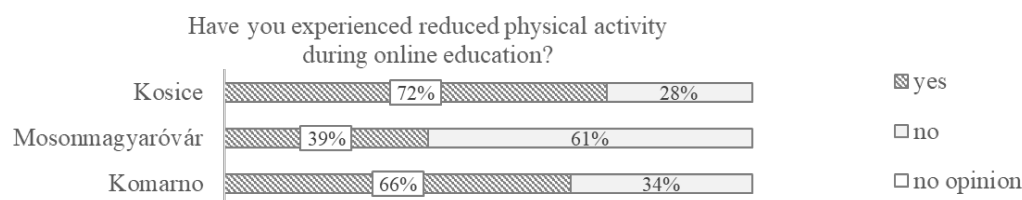


Figure 1. Health issues experienced by students in connection with the use of IT devices.

Less than a third of students (29%) in Mosonmagyaróvár, just over a third of students (37%) in Komárno and more than two-thirds of students (69%) in Košice experienced any health problems while studying online, even though that the survey participants are younger and in their early twenties. A recurring problem during the COVID pandemic was that people were less likely to leave their homes due to curfew restrictions and fear of illness. As a result, they were less physically active, and their need for exercise and sport was reduced. However, some people complained about increasing appetite when working from home. The proportion was perhaps better for the students surveyed in both of the above-mentioned cases. More than half of students at all three institutions (52–54%) did not notice any increase in calorie intake, and 61% of students in Hungary did not experience any decrease in physical activity. This indicator was much less favourable at the universities of Komárno and Košice, where 66% of students at the former and 72% at the latter institution said they were less active during the period of online education compared to the previous period.

3.3. Online Education from the Learning Perspective

The study examined how students evaluate the success or failure of online education. This question can be analysed using the answers to the third part of the questionnaire. According to most respondents in all three institutions, the main difficulty of online education was coping with being isolated from classmates and peers. It was also problematic for them that the practical training was sidelined, although this would have been a great help in all areas of study, especially for full-time students. Concentration problems were the least problematic.

In all three institutions, the most significant advantage of online education was the easy accessibility of course materials; 90% of students in Košice, 80% of students in Komárno and 77% of students in Mosonmagyaróvár considered this beneficial. Compared with only 34% of the students in Mosonmagyaróvár, most of the students in Komárno (80%) and Košice (76%) felt that the possibility taking their exams from home was a positive factor. Only a tiny proportion of the respondents regarded the elimination of daily commuting as a further benefit of online learning as they could use the time saved in this way for studying or relaxing.

Over 90% of the respondents said that online learning materials were more accessible than printed literature. The questionnaires show that 86% of the students from Komárno, 70% of students from Mosonmagyaróvár and 62% of students from Košice used digital resources to a more significant extent for online learning. In comparison, only 60% of the respondents preferred learning materials or additional literature that was available on the computer. However, a large proportion of students still prefer using books or handwritten or printed notes.

Whether online or printed literature, in both cases, students prefer university textbooks, notes, or course materials and guides compiled by teachers. Searchable professional articles, lectures and videos on other platforms are less popular. Unlike students in Mosonmagyaróvár, students at the University of Košice prefer learning from handwritten notes, but they were even less likely to consult professional journals during their studies.

3.4. Correlation (Cramer's V)

3.4.1. Komárno

In the results of the survey conducted in all three institutions, in addition to more dispersed correlations, the answers to the questions related to the two main topics show a correlation with each other and with other answers. One of these questions referred to the devices most commonly used by students for learning and leisure activities, while the other concerned the average number of hours spent on various devices for learning and leisure activities by students before and during the pandemic. The results show that there is no difference in the correlations between these two periods (pre-pandemic and amid-pandemic periods); therefore, IT use in general terms will be discussed. The correlations between the themes for the institution of Komárno are presented in Table 3, in which the value of a moderately solid or strong correlation is indicated in bold. This shows a moderately strong correlation between the devices used for learning and leisure activities, for the computer and laptop, which can be explained by the fact that someone either has a computer or a laptop and uses the same device for both leisure and learning activities. In addition, it is also observed that the device is not only used in general but was also applied during the online learning period.

Table 3. Correlations between students' habits of using IT devices in Komárno.

Cramer's V ($p < 0.05$)		Computer Use	Laptop Use	Perceived Health Problems	Time Spent on Computer, Mobile, Internet and/or Social Networks			
					Workdays		Weekends and Holidays	
					Learning	Leisure	Learning	Leisure
	Computer use	1.00	0.65	0.03	0.13	0.22	0.15	0.31
	Laptop use	0.65	1.00	0.08	0.07	0.06	0.11	0.18
	Other IT devices' use (other than computer, laptop, tablet and mobile)	0.23	0.41	0.76	0.16	0.62	0.10	0.61
Time spent on computer, mobile, Internet and/or social networks	Workdays	learning	0.13	0.07	0.23	1.00	0.12	0.60
		leisure	0.22	0.06	0.11	0.12	1.00	0.60
	Weekends and holidays	learning	0.15	0.11	0.07	0.60	0.08	1.00
		leisure	0.31	0.18	0.17	0.22	0.60	0.16

Such a correlation is not typical for other devices; thus, it cannot be excluded that a tablet and/or mobile phone is used for this purpose, in addition to a computer or laptop. There is a moderately strong correlation between the time spent on each device (computer, mobile) and the time spent on the Internet and social networking, as well as the time spent on activities (learning, leisure), which indicates that the time spent on each device and platform is often the same for both working days and days off, and for learning and leisure activities. However, the time spent on computer activities is only related to the time spent on the Internet, not to mobile use or social networking.

In addition, there is also a moderately strong correlation between those who used other IT devices for study during the period of online education and those who experienced more health problems. However, it was not clear what these other devices were. This correlation could not be demonstrated in the case of other IT devices.

3.4.2. Mosonmagyaróvár

According to the results of the survey in Mosonmagyaróvár, the answers to the questions related to the two main themes (type of IT device used for learning and leisure activities, and the time spent on these activities) also show correlations with each other and with other answers, with correlation values very similar to the results in Komárno. In addition to these two, the impact of electronic devices on students' perceived health is also correlated with some answers. In the latter case, a moderately strong relationship

is observed between the number of health effects perceived by students and, the positive effects students associated with online education and the proportion of e-learning materials they used. In other words, in general, students who experienced more negative health effects were less likely to associate positive outcomes with the online form of education and were more likely to use printed materials for learning. A moderately strong relationship was also observed between students' calorie intake and reduced physical activity during this period. As for the devices used by students in the leisure and learning process, there is a contrasting relationship between them, especially between the use of computers, laptops and mobile phones, i.e., students do not tend to use a mix of devices, but rather seem to be committed to the use of one for both learning and leisure activities. The moderately strong correlation observed between the daily time spent using devices indicates that, in general, those who spend more time in front of an IT device for learning also spend more time in front of it for leisure activities. Similarly, the time spent on working days and weekends is positively correlated.

3.4.3. Košice

There are several, and in many cases stronger, correlations between the results of the survey in Košice (Table 4). In this case, the first two groups show correlations between the type of IT devices used for learning and leisure activities and the time spent on the two activities. The correlations are very similar to the results of the institution in Komárno, with the difference that the correlations between the different items are slightly more robust. In addition, the type of IT devices used by students shows an additional correlation with other indicators. For instance, it was found that, in general, those who used other devices used more digital learning materials more often than printed ones, and they were less likely to adhere to the principles of computer work, as they were less familiar with them in context. They also experienced more health problems during the online education period. Furthermore, those who used other devices tended to be more irritable when offline, and also used some IT devices for other purposes while completing the questionnaire. This group identified concentration problems as their biggest problem with online education. However, those who used a tablet were more familiar with these principles. Tablet users used more printed resources for their studies, mainly handwritten notes. Almost all device users reported feeling guilty about spending too much time in front of a computer. They also noticed an increase in their calorie intake during their online education or pandemic measures (such as curfews) compared to the pre-pandemic period. In addition, they feel they do not have enough information about the risks associated with computers, mobile phones and/or the Internet in connection with work and study, despite having been informed about the potential risks of computer use from a variety of sources (such as school, parents, friends, articles). The fact that these two groups emerged from those who use tablets or other devices may also be an effect of the random factor, but in any case, it seems that two extreme groups emerged: the well-informed and the less informed.

A further correlation is that those who believe that long-term work/learning on a computer, mobile phone, or the Internet can damage their physical and/or mental health are more likely to experience new or worsening health problems related to online learning. An interesting correlation is that those who knew the basic principles of working with computers adhered to them when learning, and those who adhered to these principles were more likely to use print resources.

In terms of sustainability, an important fact is that, through online lectures, students receive the outline of the course material in an electronic format, which significantly reduces the amount of paper needed. If less paper is used, deforestation can be reduced.

Table 4. Correlations between students’ habits when using IT devices in Košice.

Cramer's V (<i>p</i> < 0.05)	Computer Use	Laptop Use	Tablet Use	Other IT Devices Use (Other than Computer, Laptop, Tablet and Mobile)	Perceived Health Problems	Digital Learning Material	Principles of Computer Work		Guilt for IT Use	
							Know	Adhere		
Computer use	1.00	0.74	−0.91	0.69	0.17	−0.53	0.27	0.23	0.54	
Laptop use	0.74	1.00	−0.63	0.82	0.10	0.15	0.28	0.30	0.13	
Tablet use	−0.91	−0.63	1.00	−0.89	0.29	0.06	0.51	0.18	−0.84	
Other IT devices' use (other than computer, laptop, tablet and mobile)	0.69	0.82	−0.89	1.00	0.55	0.70	−0.52	0.55	0.53	
Perceived health problems	0.17	0.10	0.29	0.55	1.00	0.11	0.14	0.16	0.22	
Digital learning material	−0.53	0.15	0.06	0.70	0.11	1.00	0.19	0.58	0.20	
Principles of computer work	know	0.27	0.28	0.51	−0.52	0.14	0.19	1.00	0.55	0.08
	adhere	0.23	0.30	0.18	0.55	0.16	0.58	0.55	1.00	0.11
Guilt due to IT use	0.54	0.13	−0.84	0.53	0.22	0.20	0.08	0.11	1.00	
Cramer's V (<i>p</i> < 0.05)	Time spent on computer, mobile, Internet and/or social networks									
	Workdays			Weekends and holidays						
	learning		leisure		learning		leisure			
Time spent on computer, mobile, Internet and/or social networks	Workdays	learning		0.90–1.00		0.50–0.68		0.52–0.69		0.62–0.74
		leisure		0.50–0.68		0.84–1.00		0.57–0.58		0.50–0.74
	Weekends and holidays	learning		0.52–0.69		0.57–0.58		0.76–1.00		0.55–0.57
		leisure		0.62–0.74		0.50–0.74		0.55–0.57		0.82–1.00

4. Conclusions

Based on the findings, in all three institutions, the most popular device used by students was the laptop for studying and the mobile phone for leisure activities. This is in contrast to the studies by Akuratiya and Meddage [17] in Sri Lanka, and Hermanto and Srimulyani [18] in Indonesia. However, in these countries, unlike in Hungary and Slovakia, students have less experience in using IT devices.

In considering students' preferences and activities during their free time, the study also delves into a comparison between online and traditional learning modes. Students prefer to browse the Internet in their free time, but more than half of them do not feel frustrated when they are not online and do not neglect their social contacts. By their own admission, far fewer students had received any information about the dangers of using computers than the number that actually knew about these dangers, indicating a potential reliance on online sources for such knowledge. Consequently, highly educated people are less at risk of excessive Internet use. This aspect aligns with the broader discussion on the influence of online platforms on information dissemination.

In accordance with the literature, this study also found that the time students spent on computers, mobile phones, the Internet, and social networking increased during the pandemic. However, the increased time was clearly differentiated according to the speciality of each study programme (Agriculture, IT, Pharmacy); this increase was much lower in the field of agriculture and informatics than among pharmacy students.

In contrast to the literature, due to the peculiarity of the study programmes, agricultural students from Mosonmagyaróvár and informatics students from Komárno experienced adverse effects of isolation, the feeling of loneliness, a lack of exercise or any health problems to a lesser extent compared to the pharmacy students from Košice. Therefore, the latter were more attentive to incorporating healthy eating and some form of sport into their daily lives. This may also be due to the fact that students in Košice are more health-conscious because of their primary health knowledge. This insight suggests that the impact of online learning on students' well-being can vary based on their field of study.

Students' perceptions of online learning were very similar in the three institutions. Isolation from peers was rated as a negative aspect, as mentioned by Deés [4], Dindar et al. [43] and Hilaria et al. [41] in their studies. The other disadvantages mentioned in the literature (technical problems, lack of motivation, concentration problems, difficulty in time management) [4,24,37,39] were not mentioned by the students surveyed, even by the computer science students. However, Gross and Uppsäll [39] included these opinions in the case of computer science students. In contrast to these studies, a lack of practical training, which is particularly important in all three fields, was mentioned. The easier accessibility of learning materials was evaluated as a positive aspect, while Slovak students also prefer remote exams. The time and cost savings from the absence of travel, flexible schedules, and home comfort, which are mentioned in the literature as essential positives [4,24,25,28,31–34], were not mentioned as decisive factors for the students surveyed in this study. Even though the digital generation's use of IT devices and the Internet has recently increased, regardless of the pandemic, university students still use the materials and literature provided or recommended by the lecturer and do not take the trouble to search and develop literature on the subject themselves. This is somewhat contrary to Deés [4] statement, according to which the students surveyed at the Hungarian university were already willing to look up the course material from other online sources before the shift to online education due to the pandemic.

The examination of the correlations between the questions revealed that, in Mosonmagyaróvár and Komárno, questions related to the two main topics show a correlation with each other regarding the type of IT devices used for learning and leisure activities, and the time spent on these activities. In general, it can be observed that students tend to use one type of device for both learning and leisure activities (usually different for learning and leisure: a laptop for the former, mobile for the latter), and those who spend more time on an IT device for learning also use it for leisure activities.

In Košice, there are much more complex and somewhat closer correlations: for example, different perceptions of digital learning materials, the principles of computer work, their knowledge, concentration difficulties, and perceived health problems among users of different devices. Two main groups emerged among the students in Košice: well-informed and less-informed students. These two groups were not observed in the other two institutions. Conducting a more intricate analysis in Košice, the study uncovers complex correlations related to students' perceptions and experiences with online learning. The emergence of distinct groups based on knowledge and device usage suggests a unique dynamic in Košice, emphasizing the need for tailored approaches to understand the impact of online education on students.

Overall, it may be concluded that students' attitude towards the online space strongly depends on their education level and their major. The students at higher-education institutions who participated in the survey do not need a digital presence and online education; moreover, in some cases, they prefer face-to-face education. Health students are more aware of the impact of an online presence on health than their peers in other majors. The students noted the advantages and disadvantages of online education in almost equal proportions. Practical education definitely requires attendance. Consequently, in the field of higher education, it is not advisable to switch to a completely online form of education for the time being, but students are prepared for hybrid education; their digital competence and available tools enable them to implement a hybrid form of education. Teaching theoretical subjects online while teaching practical knowledge offline could be a solution. In addition, despite students' awareness, it would be advisable to more forcefully explain the danger of online space in higher education being too oriented toward online spaces.

It is essential to highlight that taking students out of the traditional classroom has a positive impact on the environment. The first and most important advantage can be related to the absence of means of transport. In this way, the amount of carbon dioxide that is emitted can be reduced. This is essential to spare energy. At home, students can control their energy use. Furthermore, the growing use of green energy sources is worth mentioning. Another important fact is that, through online lectures, students receive the outline of the course material in electronic format, significantly reducing the amount of paper needed. If less paper is used, deforestation can be reduced. Less food was wasted in the online learning period, and students spent more time on sports and outdoor activities, which also resulted in energy savings.

The research has several limitations that warrant consideration. The regional focus on specific universities in Slovakia and Hungary raises questions about the generalizability of findings to a broader context. Additionally, including students from diverse fields introduces variability that may impact the study's applicability to specific disciplines. The reliance on a questionnaire with 45 questions, without a detailed exploration of online education modalities and potential response biases, could limit the depth of understanding. The study's narrow timeframe during the COVID-19 pandemic restricts insights into long-term effects, while the brief mention of the health impacts lacks clarity regarding the methodology that was used. These limitations collectively emphasize the need for a nuanced interpretation of the research findings.

Future studies could delve into refining the balance between the positive aspects and challenges of online education, exploring strategies to enhance social engagement in virtual learning environments and investigating the long-term academic and social impacts of a prolonged reliance on digital education methods. In addition, consideration should be given in the future to expanding the research to include a more diverse sample population, possibly from different countries or regions, to enhance the generalizability of the findings. It is also advisable to design a longitudinal study to track changes in students' IT usage patterns and online education effectiveness over time, which can provide more in-depth insights.

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Appendix A. Questionnaire

The questionnaire covers the period of online education due to the COVID-19 pandemic (2020 and 2021) and the period before.

(Your participation in this questionnaire is voluntary, and by proceeding, you consent to the use of your responses for research purposes. Rest assured that all data collected will be treated anonymously and confidentially, ensuring your privacy throughout the research process.)

Demography:

Your gender?

- ☐ Male
☐ Female

Your age:

- ☐ Under 20
☐ 21
☐ 22
☐ 23
☐ 24
☐ 25 and over

IT device usage habits:

Please rank (most frequent, often, regular, rarely, almost never) which device you most frequently use for study activities. If you did not use a particular device, do not select it.

	Most frequent	Often	Regular	Rarely	Almost never
Computer					
Laptop					
Tablet					
Mobile					
Other					

Please rank (most frequent, often, regular, rarely, almost never) which device you most frequently use for leisure activities. If you did not use a particular device, do not select it.

	Most frequent	Often	Regular	Rarely	Almost never
Computer					
Laptop					
Tablet					
Mobile					
Other					

How many hours per workday did you typically spend on study activities using a computer/mobile/Internet/social networks during online learning?

	Less than 1 h	1–2 h	3–4 h	5–6 h	7–8 h	9–10 h	More than 10 h
Computer							
Mobile							
Internet							
Social networks							

How many hours per workday did you typically spend on leisure activities using a computer/mobile/internet/social networks during online learning?

	Less than 1 h	1–2 h	3–4 h	5–6 h	7–8 h	9–10 h	More than 10 h
Computer							
Mobile							
Internet							
Social networks							

How many hours per weekend did you typically spend on study activities using a computer/mobile/Internet/social networks during online learning?

	Less than 1 h	1–2 h	3–4 h	5–6 h	7–8 h	9–10 h	More than 10 h
Computer							
Mobile							
Internet							
Social networks							

How many hours per weekend did you typically spend on leisure activities using a computer/mobile/Internet/social networks during online learning?

	Less than 1 h	1–2 h	3–4 h	5–6 h	7–8 h	9–10 h	More than 10 h
Computer							
Mobile							
Internet							
Social networks							

How many hours per workday did you typically spend on study activities using a computer/mobile/Internet/social networks before online learning?

	Less than 1 h	1–2 h	3–4 h	5–6 h	7–8 h	9–10 h	More than 10 h
Computer							
Mobile							
Internet							
Social networks							

How many hours per workday did you typically spend on leisure activities using a computer/mobile/Internet/social networks before online learning?

	Less than 1 h	1–2 h	3–4 h	5–6 h	7–8 h	9–10 h	More than 10 h
Computer							
Mobile							
Internet							
Social networks							

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Computer							
Mobile							
Internet							
Social networks							

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	Less than 1 h	1–2 h	3–4 h	5–6 h	7–8 h	9–10 h	More than 10 h
Computer							
Mobile							
Internet							
Social networks							

During your free time, where do you spend most of your time?

- ☐ Computer games
- ☐ Internet
- ☐ Software
- ☐ Social networks

Do you often think about your following activities on a computer, mobile, or the Internet during the day when you are not at the computer?

	Yes	No	Sometimes
Computer games			
Internet			
Software			
Social networks			

If yes, or sometimes, for what purpose? If no, continue to the next question.

- ☐ Leisure activities
- ☐ Study
- ☐ Other

Do you tend to get nervous without using IT devices?

- ☐ Yes
- ☐ No
- ☐ Sometimes

Do you prefer online activities to offline activities?

- ☐ Yes
- ☐ No
- ☐ Sometimes

Have you ever preferred your IT device to your social connections?

- ☐ Yes
- ☐ No
- ☐ Sometimes

Do you often think of your IT device while doing other activities?

- ☐ Yes
- ☐ No
- ☐ Sometimes

Do you have enough information about the risks associated with IT devices and/or the Internet?

- ☐ Yes
- ☐ No
- ☐ I don't know

Has anyone informed you of the potential risks of IT devices and/or the Internet?

- ☐ Yes
- ☐ No

If yes, who and where? If no, continue to the next question.

.....

While completing this survey, did you realize you have developed an excessive relationship with a computer, mobile, or the internet? (Facebook, social networks, etc.)

- ☐ Yes
- ☐ No
- ☐ Maybe

The impact of online learning and IT devices on health

Do you think long-term work/study on an IT device can damage your physical/mental health?

- ☐ Yes
- ☐ No
- ☐ I don't know
- ☐ Long-term work is safe

Do you know the basic principles of computer work?

- ☐ Yes
- ☐ No
- ☐ I have heard of it, but I am not interested

The principles of computer work can be found in the following document: "https://osha.europa.eu/sites/default/files/E-fact_13_-_Office_ergonomics.pdf (accessed on 11 March 2022)"

Did you follow the basic principles of computer work during online education?

- ☐ Yes
- ☐ No

Have you noticed any new or worsening health problems during online education?

- ☐ Yes
- ☐ No

If yes, please specify the health problems. If no, continue to the next question.

- ☐ Fatigue
- ☐ Headaches
- ☐ Lower and cervical spine pain
- ☐ Eye burning, irritation, dry eye syndrome
- ☐ Carpal tunnel
- ☐ Varicose veins
- ☐ Insomnia
- ☐ Other

Did you consume vitamins and minerals during online education?

- ☐ Yes, almost all
- ☐ Some of the above
- ☐ No

Have you experienced an increase in calories in your diet during online education?

- ☐ Yes
- ☐ No

Have you experienced reduced physical activity during online education?

- ☐ Yes
- ☐ No

During online learning or pandemic measures (curfew, Isolation, restriction of outdoor activities, etc.), did you experience:

- ☐ Increased stress
- ☐ Fear of the future
- ☐ Feeling of loneliness
- ☐ I did not notice
- ☐ Other

How did you most often use your free time after completing online learning during a workday?

- ☐ Physical activity (walking, sports, etc.)
- ☐ Passive relaxation (reading a book, watching TV, etc.)
- ☐ Relaxing by PC or mobile, etc.
- ☐ Other

What is your opinion on the impact of computers, mobiles, or the internet on health?
.....

Online education from the learning perspective

What negatives do you associate with online learning?

- ☐ Concentration problems
- ☐ Technical issues (internet outage, computer breakdowns, etc.)
- ☐ Isolation from classmates, teachers
- ☐ Significant absence of practical teaching
- ☐ Other

What positives do you associate with online learning?

- ☐ Better availability of educational materials in online form
- ☐ Improved skills related to working with computers, the internet, etc.
- ☐ Improved ability to search the internet and use relevant information sources
- ☐ The possibility to participate in the educational process, credits, and exams from the comfort of home
- ☐ Other

During online learning, did you use written (printed) or electronic information sources more often for independent study?

- ☐ Printed literature
- ☐ Electronic resources

What percentage of your independent study during online learning involved using written (printed) sources?
.....

What percentage of your independent study during online learning involved using electronic information resources?
.....

From written—printed sources, please rank (most frequent, often, regular, rarely, almost never) what you used for studying.

	Most frequent	Often	Regular	Rarely	Almost never
Printed editions of university textbooks					
Printed materials from lectures and exercises					
Recommended literature for subjects in printed form, e.g., books available in bookstores					
Printed editions of professional and scientific journals					
Handwritten notes					

From electronic information sources, please rank (most frequent, often, regular, rarely, almost never) what you used for studying.

	Most frequent	Often	Regular	Rarely	Almost never
Study materials developed by teachers are available online, e.g., via Moodle					
Recommended educational materials, e.g., electronically available scripts, online books, pdfs					
Electronic scientific publications, such as monographs and scientific journals					
Electronic databases (PubMed, SCOPUS, WOS, etc.)					
Materials available via Google search, etc.					
Educational videos and animations (e.g., YouTube)					
Structured, education-focused websites, online courses, etc.					
Other					

Do you think electronic study materials are more extensively developed than printed materials?

- ☐ Yes
☐ No

Do you prefer electronic study materials or printed materials?

- ☐ I prefer electronic sources (electronic information resources)
☐ I prefer printed sources (written information resources)

What do you think about the impact of computers, mobile phones or the internet on your health?

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Other you would like to share

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