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Wroclaw Review
of Law, Administration & Economics
Vol 12:1, 2022
DOI: 10.2478/wrlae-2022-0004

Selected Economic and Social Aspects Resulting from Online Education at the Higher Level

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Keywords

COVID-19, online education, economic aspect of online education, social aspects of online education, high school

Abstract

The COVID-19 epidemic undoubtedly affected methods and results of teaching, posed many challenges, and changed approaches to education. With the aim of verifying these changes in the context of distance learning in selected social, health, psychological and economic aspects, a survey was conducted among economics students in Poland.

The article aims to present the results of this survey and to verify the main research hypotheses: that students put less work into distance education than in-class education during the semester; they were less active and focused; the economic benefits increased; and social relations deteriorated.

Due to the type of variables studied, statistical methods such as parametric and non-parametric tests, descriptive statistics, correlations measures, and generalized multinomial linear models were used.

From the survey analysis, it can be concluded that distance learning is more complicated, as it requires more work and an above-average commitment. During

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distance learning, students are reluctant to speak up and be active, but they can contact a teacher more easily. The negative effects of this learning are the increasing health and psychological problems and minimal social relations. A positive impact is an economic aspect in the form of saved time, funds, and the possibility of earning money. IT competencies were improved and the possibility of additional education and participating in many workshops increased. The research results show that most students prefer lectures online vs. classes and labs in person.

JEL Classifications

C1, C6, G0, G5, I1, I2

I. Introduction

The global COVID-19 epidemic, having been present since March 2020, has undoubtedly affected the methods and results of teaching. This pandemic has successfully forced a global shutdown of several activities, including educational activities. Universities worldwide suspended face-to-face teaching, and they rapidly replaced it with online digital formats as the educational platform[1].

In many countries, a digital transformation is not a novel phenomenon. It has been accompanying in-person learning in higher education institutions for some years[2]. The COVID-19 pandemic initiated a digital transformation of higher education, and as a result of the crisis brought on by the pandemic, novelties in higher education that would typically take many years because of differing managerial regulations were introduced quickly within a limited number of days[3]. Most universities initially lacked infrastructure and strategies[4]. In Poland, online learning was not popular prior to the pandemic, and only now has e-learning begun to take place. Before the pandemic, teachers had basic or intermediate

1 O.B. Adedoyin, E. Soykan, *Covid-19 pandemic and online learning: the challenges and opportunities. Interactive Learning Environments*, „Interactive Learning Environments", 2020

2 M. Kopp, O. Gröblinger, S. Adams, *Five common assumptions that prevent digital transformation at higher education institutions*, "INTED2019 Proceedings", 2019, 1448–1457

3 W. Strielkowski, COVID-19 pandemic and the digital revolution in academia and higher education, "Preprints, 2020040290", 2020

4 W. Zhang, Y. Wang, L. Yang, C. Wang, *Suspending Classes Without Stopping Learning: China's Education Emergency Management Policy in the COVID-19 Outbreak*. "Journal of Risk and Financial Management", 2020, 13 (3), 55

skills in using and applying IT, but during the pandemic their skills have increased[5]. Now, online classes have become widespread, and the government is supporting many innovative initiatives. Microsoft Office's Teams platform has become very popular in Poland, especially in economic universities. Many online learning platforms have also started offering free access to their services in response to significant demand.

Universities in many regions of the world have been able to manage online teaching. The World Bank's Edtech team collected information during the initial response of education systems to school closings due to the COVID-19 pandemic[6]. This page contained resources, initiatives, programs, and events from March 2020 to June 2020. However, questions about the preparedness, design, and effectiveness of online learning are still unresolved.

Scientists worldwide are conducting various types of research about the effects of a pandemic in various economic fields and education. These analyses concern methods, types, and qualities of education. Much of this research is focused on the opinions of students as well as academic teachers. Muthuprasad et al.[7] indicated that most of the students in India (70%) have been ready to opt for online classes during the COVID-19 pandemic. Most of the responders preferred to use a smartphone. They preferred pre-recorded classes with quizzes at the end of each class to improve the effectiveness of learning. The students expressed that the flexibility and convenience of online courses make it an attractive option.

In Poland, the broadband connectivity issues in rural areas make it a challenge to use online learning initiatives. Several studies suggest that online education can be as effective as traditional education. Butnaru et al.[8] conducted studies in Romania, focusing on learner satisfaction with online instruction, particularly in the transition to online learning from traditional approaches. Their results

5 Cf. M.W. Romaniuk Łukasiewicz, J. Wielba, 2021, *Zdalna edukacja kryzysowa w APS w okresie COVID-19. Z perspektywy rocznych doświadczeń*, 2021, Warszawa; N. Demeshkant, *Future Academic Teachers' Digital Skills: Polish Case-Study*, „Universal Journal of Educational Research" 8(7), 2020; P. Peneszko (ed.), *Raport Ewaluacja ex-post rządowego programu rozwijania kompetencji uczniów i nauczycieli w zakresie stosowania technologii informacyjno-komunikacyjnych – „Cyfrowa szkoła"*, 2012, Warszawa; D. Batorski, J. Jasiewicz, M. Kisielowska, M. Luterek, A. Mierzecka-Szczepańska, *Nowe media w polskiej szkole. Wyniki badań*, 2013; K. Błaszczyński, Ł. Tomczyk, Ł. Srokowski, *Kompetencje cyfrowe w zakresie bezpieczeństwa cyfrowego w polskiej szkole. Raport z badań*, 2016, 2017, 2018, Tarnów.

6 https://www.worldbank.org/en/topic/edutech/brief/how-countries-are-using-edtech-to-support-remote-learning-during-the-covid-19-pandemic

7 T. Muthuprasad, S. Aiswarya, K.S. Aditya, K. Jha Grish, *Students' perception and preference for online education in India during COVID-19 pandemic*, "Social Science & Humanities Open", 2021, 3 (1), 1-11

8 G. I. Butnaru, V. Nită, A. Anichiti, G. Brînză, *The effectiveness of online education Covid 19 pandemic – a comparative analysis between the perceptions of academic students and high school students from Romania*, "Sustainability", 2021, 13, 5311, 1-20

indicated that students have varied reactions to online education, determining their proficiency in online tools, their ability to access online courses technically, and the lecturer's manner in conducting learning activities. An analysis of the results of various studies also shows that the use of information technology related to knowledge transfer and communication, and practices to develop critical use of IT, highly positively affected student achievement[9].

In another study, students indicated that professors had improved their online teaching skills since the beginning of the pandemic (68.1%), and that online education is practical right now (77.9%)[10]. They appreciated the software and online study materials being used to support distance learning. However, the respondents felt that online education is stressful and affecting their health and social life. Similar observations can be noticed in Poland, as seen in results from the research conducted at economic universities. The pandemic posed many challenges, changed the approach to education and its methods, and at the same time hindered direct social contact, negatively affecting mental health and well-being. At the same time, it made it possible to save time and funds and also made it possible to increase competency. The COVID-19 pandemic also "brought a new perspective to the possibilities and impossibilities of global citizenship within higher education"[11], [12].

The article aims to present a survey conducted among students, mainly from economics universities, all over Poland on distance learning. The purpose is to identify the consequences of distance studies across economic, social, health and psychological aspects. The following research hypotheses are verified:

1. The students put less work into distance education than in-class education during the semester.
2. The students were less active.
3. The students were less focused.
4. The students increased their IT skills.
5. The economic benefits increased.
6. The social relations deteriorated.

9 S. Comi, G. Argentin, M. Gui, F. Origo, L. Pagani, *Is it the way they use it? Teacher, ICT and student achievement*, "Economics of Education Review", 2017, vol. 56, 24-39.

10 P. Chakraborty, P. Mittal, M.S. Gupta, S. Yadav, A. Arora, *Opinion of students on online education during the COVID-19 pandemic*, "Human Behavior and Emerging Technology", 2021, Volume 3, Issue 3, 357-365

11 F.F Guimarães., K.R. Finardi, *Global citizen education (GCE) in internationalisation: COIL as alternative Thirdspace*, "Globalisation, Societies and Educations", 2021, Volume 19, Issue 5

12 G.L. Blanco, *Global citizen education as a pedagogy of dwelling: re-tracing (mis)steps in practice during challenging Times*, "Globalisation, Societies and Educations", 2021, Volume 19, Issue 4

The students' comments and remarks are also analysed in this article. The research uses widely understood statistical methods.

This article presents the results of research on socio-economic, psycho-health, and effectiveness aspects of distance learning conducted among university students in Poland during the COVID-19 pandemic. The next part of the article presents the research material and the statistical methods applied, and then the results of the analysis of this research by individual aspects, culminating in the conclusions.

II. Material and methods

The subject of the study was a survey that began on November 4, 2020 and lasted until March 31, 2021. The questionnaire was sent to the nine largest economic universities in Poland, which provided their students with a link to the survey via email. They were asked to distribute the questionnaire to students of economics. All questions were obligatory in the survey. The size of the overall population was unknown, but 604 students took part in the study. The study assessed the economic majors, mainly Finance and Accounting, Economics, Economic Analytics, Administration, and IT in Business. Women constituted 59.44% of the responders, and men 40.56%. Almost 70% of the students were full-time students. Bachelors and Masters students accounted for 93.38% and 6.62%, respectively. Due to the enormous disproportion between the number of Bachelors and Masters students, the study analyses did not compare these groups. First-year Bachelors students accounted for 12.1% of the respondents. Because they had just started their studies during the surveyed period and could not compare studying to the time before the pandemic, they were not included in the questions about these aspects. During the COVID-19 pandemic, 29.1% of students lived in the countryside, 17.5% in a small town (up to 50,000 inhabitants), 8.1% in a medium-sized town (50,000-100,000 inhabitants), 8.6% in a big city (from 100,000 to 500,000 inhabitants) and 36.6% in the biggest city (over 500,000 inhabitants). Nearly 300 students provided their own comments.

Data analysis was based on descriptive measures, parametric tests for quantitative variables (means and standard deviations), and nonparametric tests for qualitative variables (the Kolmogorov-Smirnov test, the Wilcoxon test, and the Kruskal Wallis test). Adequate dependency coefficients were used to determine the strength of the relationship between the variables. For qualitative variables, we used the Kendall tau (at the test significance level lower than 5%) and the V-Cramer correlation coefficients and for quantitative variables measures like the V-Cramer, Pearson's and Spearman's correlation coefficients, as well as significance tests for these measures. For parametric tests, p-value is given only

if it did not result in rejection of the null hypothesis, and a significance level of 5% was assumed. Additionally, a generalized linear multinomial model was used to test the relationship.

III. Social Aspect

This chapter considers social relations, contacts with lecturers and fellow students, and student social life. The hypothesis about the deterioration of social relations is proved, which is observed in Figure 1.

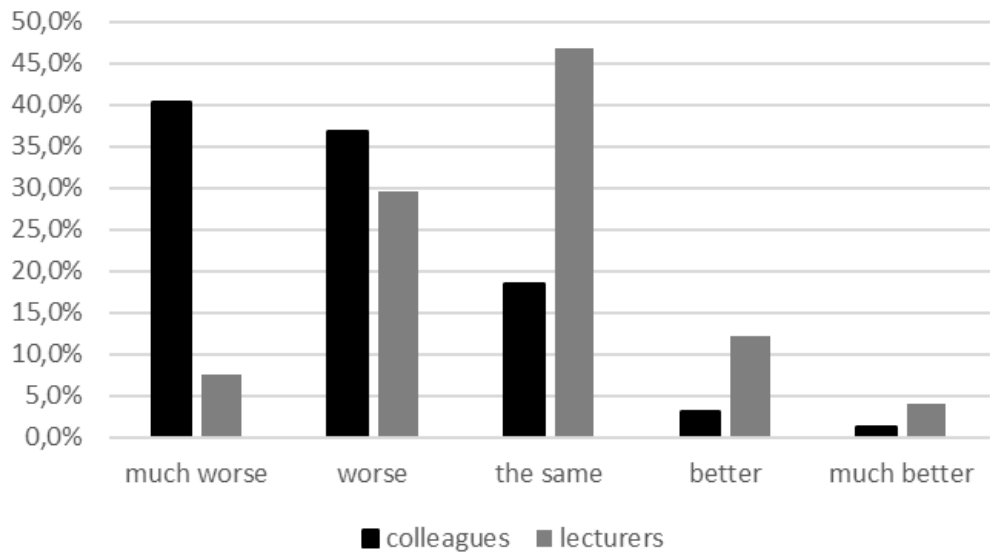


Figure 1: The distribution of responses regarding with relationship with fellow students and lecturers
Sources: own elaboration

Table 1 shows the distribution of responses regarding the relationship of contact with lecturers in relation to communications with fellow students. The survey shows that 35% of students have seen relationships deteriorate with both their lecturers and fellow students. One in ten students did not feel any changes in these relations. On the other hand, every thirteenth student has a worse social relationship with fellow students and better with lecturers. Relationships with fellow students deteriorated much more with junior students, as well as with full-time students. The first-year students also had a much worse relationship with their lecturers. However, almost one in six students experienced an improvement in their relationship with lecturers.

Table 1: The distribution of responses regarding the relationship of contacts with lecturers in relation to communications with fellow students

	Relationship with fellow students		
Relationship with lecturers	worse	the same	better
worse	35.3%	1.5%	0.3%
the same	1.5%	11.4%	1.2%
better	7.6%	5.6%	2.8%

Sources: own elaboration.

In general, students indicated that contact with lecturers became more accessible. Lecturers respond faster and are available for a longer time. Employees of economic universities are very involved; they are competent people who are sensitive to the needs of others. Therefore, students save time through contacting them online. As a negative aspect, students emphasized that remote communication interferes with the assessment of commitment, as students' efforts are not visible, primarily when the evaluation of their learning is carried out based on one test.

The study established relationships between features. Deterioration of contacts (both with lecturers and fellow students) increases fatigue and lack of concentration during classes. It also reduces activity during courses (tau[13] = -0.44 and tau = -0.38 for lecturers and fellow students, respectively). The better-prepared materials by lecturers caused a reduced need to contact them (tau = -0.19). In other words, there is no need for connection as the materials are very well prepared (indicated by 32.3% of people) and well organized (53% of people) by the lecturers. The more significant the contribution of students' work is to distance learning, the better their online contact with lecturers is.

Many respondents indicated that their social contact was significantly impeded and communication with friends deteriorated. Students emphasized that remote communication lowers motivation and peer support, and that it is also not possible to work in a group in a library or cafe. Online learning promotes social isolation. The study of the relationship between contact with lecturers and other students gave a Kendal tau correlation coefficient at the level of -0.43, which can be interpreted as a moderate negative relationship, indicating that worse contact with lecturers also led to worse relationships with fellow students. Relationships with fellow students depended on gender ($V^{14} = 0.12$, $p = 0.037$). Moreover, it was women who indicated exacerbation of bad relations more often.

13 tau always means Kendall's tau correlation coefficient

14 V always means Cramer's V-dependency coefficient

It is a significant task for many young people to leave their family homes during their studies and start a new, independent life. During the pandemic, most of them stayed at home, especially in the countryside. It resulted in a lack of social life, especially student life. Young people point out that the pandemic has resulted in the inability to make new, authentic, and, above all, real relationships.

Below are some quotes from respondents' comments:

- "E-learning takes away the opportunity to integrate and lead the student life."
- "I don't like it, and honestly, I would prefer to have all courses stationary because I don't feel like studying in remote classes."
- "I miss contact with my friends in real-life - then it is easier to motivate yourself to systematic learning. Then there is more willingness."
- "I feel much more comfortable remotely, but I miss convenient access to the library, and most lacking is contact with my friends from the university."
- "The lack of contact with lecturers and fellow students from the university is very noticeable. Mutual motivation gave me a lot. At this point, the biggest disadvantage is the lack of support for each other at the university, ordinary conversations on the campus."
- "Contact with the lecturers is much better and faster."
- "There is no real contact with friends from studies, but most of all with the University staff who teach us. I also believe that despite the lack of full-time classes, contact with lecturers is excellent. They always answer, and in a short time."

IV. Health and Psychological Aspect

The survey analysis shows that fatigue affects the effectiveness of classes. The more weary students are, the less effective their courses are (tau = 0.45). Fatigue also affects concentration during online classes. The greater attention causes more significant fatigue (tau = 0.38). These are moderate dependencies.

Moreover, students who often used to contact their lecturers at university, or less frequently used online communications, usually indicated that online classes were more tiring than classroom ones. Similarly, students who prefer stationary lectures often said that online courses were more tiring than classroom ones. The more tiring the online classes were, the more often students indicated that they prefer classroom classes of any type (i.e., lecture, classes, laboratories, consultations, seminars). In addition, fatigue, efficiency, and concentration during online courses did not affect activity during these classes.

The analysis of these comments shows that, on the one hand, online classes are more stressful for some people. There is a growing sense of uncertainty

among these students. They feel improperly appreciated and judged. There is often an erroneous assumption among the lecturers that "everyone cheats." Additionally, concerns about social evaluation are growing. One student wrote that he "has a much greater uncertainty in reporting to answer, even though [he] knows the correct answer. Then there is a doubt as to whether to turn on the microphone." Another said, "I am fragile in social relations and have a hard time reporting any problems - probably because I feel uncomfortable to admit ignorance in front of other students. I can see my fellow students have a similar feeling, but probably to a lesser extent."

On the other hand, online classes are less stressful for some people who have low self-esteem or problems related to public speaking or functioning in the community. Also, logistical reasons (time, transport, parking, etc.) support that these are less stressful activities.

The health and psychological aspects also include disturbed interpersonal relationships, which were considered in the previous paragraph. The psychological aspect also includes the lack of a distinction between student/professional/personal life. While listening to lectures, students make breakfast, and lecturers answer student e-mails at dinner.

Physical health also deteriorates during distance learning. 10% of respondents reported headaches, problems with the spine, and worsening vision. Difficulties with concentration and focus increase, and weariness also grows (30% of respondents). People also get depressed.

V. Financial and Time Aspect

Distance learning has a very positive impact on the home budget of both full-time and part-time students. The respondents are students of universities located in cities of more than 500,000 inhabitants. The data analysis shows that 29.1% of students during the COVID-19 pandemic lived in the countryside, 17.5% in small towns, almost 8.5% in medium and the same in big cities, and just over 36% in the biggest city. The pandemic allows students to save money allotted to renting a flat, boarding house, or hotel (by part-time students). Students do not have to be at their university, so many do not want to rent an apartment in their academic city. Of course, it is a disadvantage for apartment owners. In large cities, housing prices dropped significantly during the pandemic[15]. Online learning resulted in a significant reduction in commuting costs to universities and reduced

[15] https://www.money.pl/gospodarka/wynajem-mieszkan-tak-tanio-nie-bylo-od-dawna-swietny-moment-na-umowe-6636040170265312a.html (retrived: 5.07.2021)

the cost of food. Research showed there is no dependency between the place of residence and the mode of study ($p = 0.178$ for chi-square test of independence).

Distance learning positively affected the possibility of paid work, both in small and large cities. In the comments, students wrote: "Online classes allow me to do additional work, thanks to which, despite full-time studies, I can earn 450-700 euros a month." "Thanks to distance studies, I can start working in the countryside."

Most students indicate that online learning also has a positive effect on saving time and improving work organization. A considerable advantage of remote education is the lack of the need to travel to universities and wait between classes on the campus. It is not necessary to spend time on public transport. Thanks to such teaching, all materials are in one place, which also saves time. "You can also get enough sleep," said one respondent.

VI. Raising Competence Aspect

It was hypothesized that the students improved their IT skills. Research has fully confirmed this. Table 2 shows the overall distribution of skill assessments before and during the pandemic.

Table 2: The distribution of IT skill assessment before and during pandemic

		skill assessment during the pandemic					
		1	2	3	4	5	Sum
pre-pandemic skill assessment	1	0.17%	1.66%	1.16%	0.33%	0.50%	3.81%
	2	0.17%	1.49%	10.76%	3.48%	0.33%	16.23%
	3	0.00%	0.17%	12.42%	17.55%	0.83%	30.96%
	4	0.00%	0.00%	0.17%	23.84%	8.44%	32.45%
	5	0.00%	0.00%	0.00%	0.17%	16.39%	16.56%
	Sum	0.33%	3.31%	24.50%	45.36%	26.49%	100.00%

Source: own elaboration.

Among the responders, 3.81% assessed their skills as 1 before COVID-19. In the pandemic, only 0.33% of people rated their skills as 1. About 16.23% set their IT skills before the pandemic as 2, and only 3.31% during the pandemic. The group of people giving the grade 3 decreased by almost 6.5%. A significant skill jump to 4 and 5 is visible (practically about 23%). Up to 45.36% and 26.49% of respondents rated their IT skills during the pandemic at 4 and 5, respectively,

and before the pandemic, there were 32.45% and 16.56%. It is worth noting, that than 50% of the students assess their skills identically before and during the pandemic. The Kolmogorov-Smirnov test shows that the distribution of skill ratings before and during the pandemic is different ($p < 0.001$). The null hypothesis about the equality of the means' notes before and during the pandemic (paired test) was rejected ($p < 0.001$). Table 3 presents the descriptive parameters of the assessments before and during the pandemic.

Table 3: The descriptive statistics of IT skill assessment before and during pandemic

	Parameters								
Variables	mean	median	mode	number of mode	lower quartile	upper quartile	standard deviation	coefficient of variance [%]	skewness
Pre-pandemic skill assessment	3.417	3	4	196	3	4	1.063	31.096	-0.252
Skill assessment during the pandemic	3.944	4	4	274	3	5	0.819	20.757	-0.405

Source: own elaboration.

The average pre-pandemic skill assessment was 3.41 and 3.94 during the pandemic. The variability coefficient of the ratings decreased from 31% to 21%, and the standard deviation of the ratings decreased from 1.063 to 0.819. Before the pandemic, 50% of persons assessed their skills at a maximum of 3, and 75% of respondents rated them at no more than 4. During the pandemic, the median grade was 4, and the upper quartile was 5. The modal in both cases was 4, but 78 (12.9%) more people assessed their skills at a 4. The distribution of assessments is characterized by left-hand asymmetry, which during a pandemic is much stronger.

Studies have also shown that IT skills at the time of the survey are dependent on gender ($V = 0.14$, $p = 0.009$) and study mode ($V = 0.17$, $p < 0.001$). Women rated their skills more often at 3 and 4, and men at 4 and 5. Almost 50% of full-time students rated their skills as 4, and 21% rated their skills at a 5. Almost 38% of part-time students rated their skills as 4 and 38% at a 5. IT skills before the pandemic were dependent on gender ($V = 0.22$, $p < 0.001$) and study mode ($V = 0.23$, $p < 0.001$) too.

The analysis also shows that fatigue depends on IT competencies. The higher the IT skills, the lower the fatigue (tau = -0.19). The level of skills slightly affects the activity in the classes (tau = 0.18). In particular, those very willing and likely to actively participate in online classes were significantly more likely to indicate a high level of IT skills than a low level of IT skills. Exactly the opposite was true of the indications of students who were not willing to actively participate in classes. Moreover, students whose IT competencies were insufficient and made their education substantially more difficult usually prefer classroom lectures. In contrast, digital competence had no effect on preferences for the format of all other types of courses except lectures.

The respondents gave comments including:

- "Laboratories and computer classes could always be remote because it is much faster and more convenient, it perfects computer skills, as well as MS Office and statistical programs."
- "I have increased my possibilities and skills in working with the computer and using programs (mainly MS Office). I believe that this is a beneficial skill that will pay off in the future at work."
- "We receive a lot of materials, and we do everything on computers, which is how we should do it. Then we practice working at the computer."
- "In terms of statistics and lectures, it is much easier to follow the actions of the tutor. I repeat the activities in my file or take notes - I take notes on a laptop much faster than manually."

In their comments, students pay attention to the aspect of insufficient competencies of lecturers in the field of new technologies. Lecturers try to adapt the old methods of conducting classes to new conditions, not considering the technical aspects and possible problems that arise during the classes. Students wrote: "In most classes, distance learning is preferable, but it is largely a carbon copy of classroom activities rather than making full use of its technical capabilities." "The teaching staff could make more use of the available technology during, for example, lectures. The form of presentation in the form of speaking, work poorly, online studies stigmatize such methods even more." "However, there is a visible difference between junior and senior lecturers." "Theoretical subjects are much more accessible in this form, and the quality of education is much better. Younger lecturers have used completely new possibilities. I consider the greatest benefit to be classes in the form of recordings illuminating the entire material, supplemented with consultations available almost always."

VII. Work effort aspect

The research hypothesis assumed that students input less work into online education than stationary education. The Kolmogorov-Smirnov test indicates that the distributions of time spent on online and stationary learning were different ($p < 0.001$). The result was that 42.55% of students input more work effort into online education. Among students who indicated that they spend more time studying online, the most common indication was that it takes them 0-80% more time than when learning in-person. Among students who indicated that they spend more time study stationary, the most common indication was that it takes them 20-100% more time than when studying online. The distribution of work effort is presented in Figure 2.

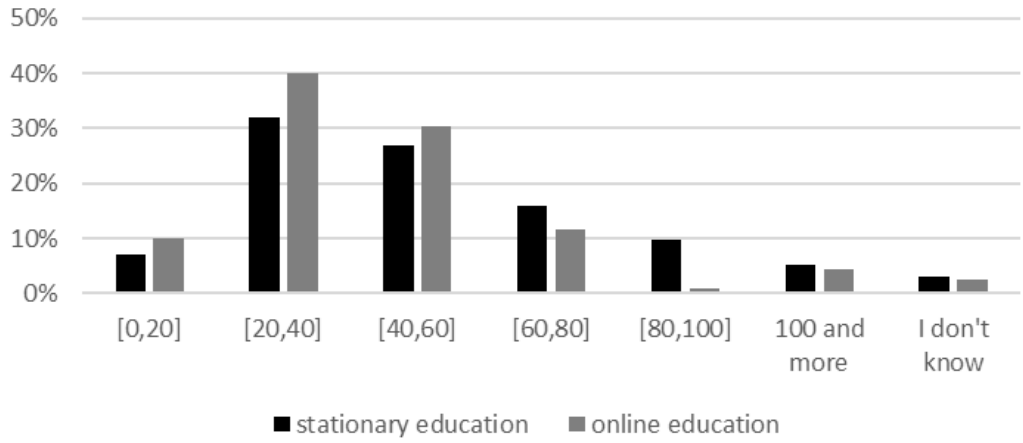


Figure 2: The distribution of work effort
Sources: own elaboration

The null hypothesis of equality of means' time spent on learning was rejected. One average, students put 47.73% more time into stationary education and 41.35% into online. Statistics showed that students who indicated that they spend more time during stationary education spend significantly considerably more time than other students (stationary education: Me = 45%, Q1 = 30% and Q3 = 60% and online education: Me = 30%, Q1 = 20% and Q3 = 50%). Moreover, the survey results indicated that IT skills do not influence which type of classes one puts more work effort. Students who put more work effort into online classes are more likely to indicate better online interactions with their lecturers. In comparison, students who put more work effort into stationary classes were more likely to have deteriorated relationships with their fellow students.

VIII. Concentration and activity aspect

The research hypothesis assumed that students are less active and concentrated in online classes. Nearly 60% of students indicated that they concentrated less during online courses than during in-person courses. The more effective students find the courses, the more concentration they require (tau = 0.38). The necessity of increased concentration during the class causes more fatigue (tau = 0.38).

The results of the statistical analyses showed that activity was influenced by contact with the lecturer, whether in face-to-face classes (tau = 0.42), online in real-time (tau = 0.40), or asynchronously (tau = 0.46). In addition, activity during online classes is influenced by technical conditions (tau = 0.61), environmental conditions (tau = 0.62), and, to a small but statistically significant level, assessing the level of IT competence during online classes. In particular, those very willing and likely to actively participate in online classes were significantly more likely to indicate a high level of IT competence than a low level of IT competence. Exactly the opposite was true of the indications of students who were unwilling to participate in classes actively. The distribution of assessment of IT skills according to willingness to participate in online education is presented in Figure 3.

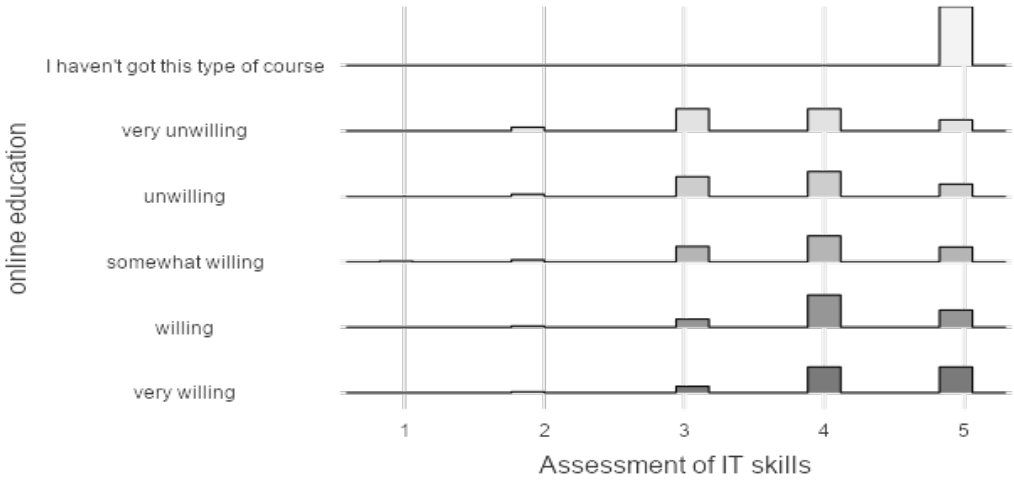


Figure 3: The distribution of assessment of IT skills according to willingness to participate in online education
Sources: own elaboration

However, activity is not influenced by fatigue, concentration, class performance evaluation, or the type of class that students invest more effort. Only students who are very active to a low degree (3%) are likely to find online classes

considerably less effective. The probability of assessment of online courses' effectiveness according to willingness to take courses online is shown in Figure 4.

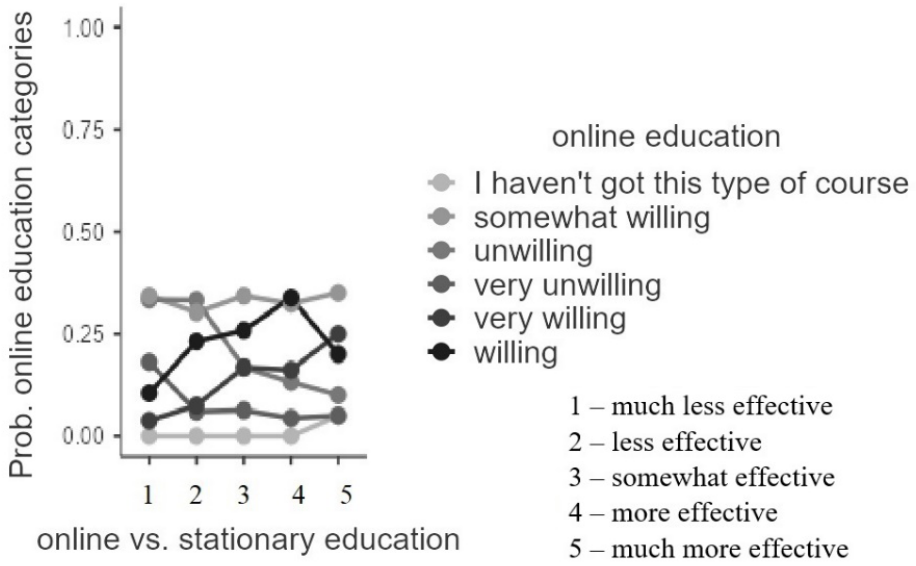


Figure 4: The probability of assessment of online courses' effectiveness according to willingness to take courses online
Sources: own elaboration

The more willing students are to be active in online classes, the more likely they are to indicate a higher rating for faculty preparation for online classes. Those with moderate activity indicate the highest ratings. Those who are inactive rate the lecturers' preparation as very poor. The probability of assessment of lecturers' faculty preparation for online courses according to willingness to take courses online is presented in Figure 5.

Students also indicate that:

- "During online learning it is harder to concentrate because classes are in a row."
- "In the lecture room it is easier to concentrate despite 10 hours of classes (looking at the monitor for 10 hours makes it difficult to concentrate)."
- "The form of online classes is monotonous."
- "There are more things that distract during distance learning."
- "You have to be more focused on the lecture/classes in order not to lose concentration."

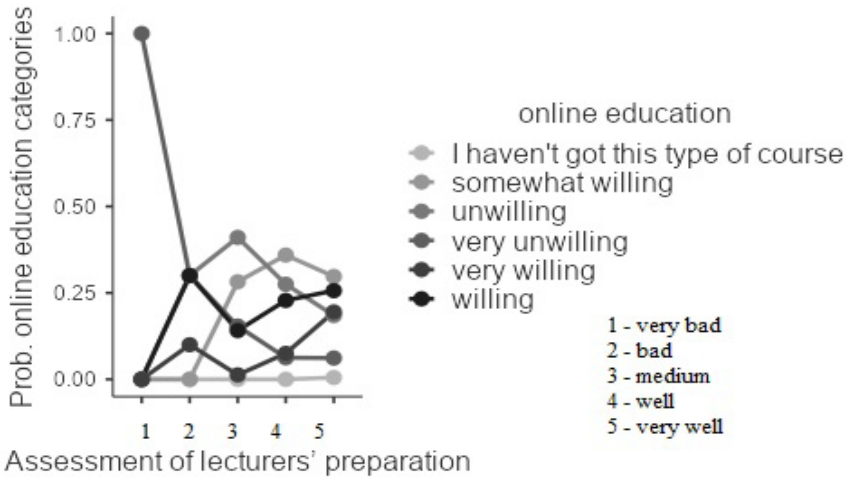


Figure 5: The probability of assessment of lecturers' faculty preparation for online courses according to willingness to take courses online
Sources: own elaboration

IX. Technical and environmental (home) conditions aspect

In general, most students assess their home as good or very good (74%) and their technical conditions as good or very good (70%) for distance learning. Only 3% of students describe their home conditions as bad, and just over 3.5% describe their technology conditions as bad. The distribution of the degree to which the environmental and the technical conditions hinder online learning is shown in Figure 6.

Statistical analysis showed:

- the better the environmental conditions, the less e-learning was hindered (tau = -0.62),
- the better the environmental conditions, the better the technical conditions (tau = 0.45),
- the better the technical conditions, the less e-learning was hindered (tau = -0.61),
- the more environmental conditions facilitate learning, the more technical conditions facilitate learning (tau = 0.49).

Furthermore, it was indicated that environmental conditions are independent of gender and mode of study, but are dependent on residences. Conditions are slightly worse in the countryside and in the small and big cities (see Figure 7). However, online learning is most difficult for residents of big cities (see Figure 8).

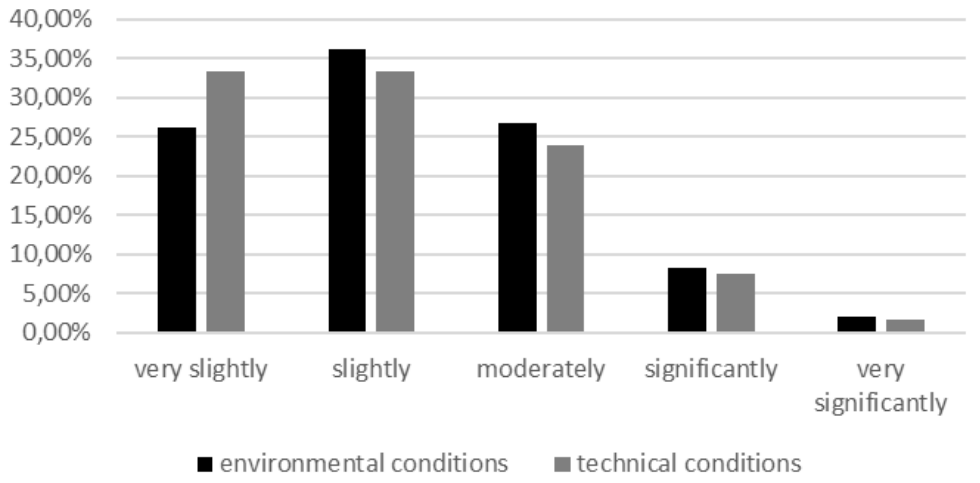


Figure 6: The distribution of the degree to which the environmental and technical conditions hinder online learning
Sources: own elaboration

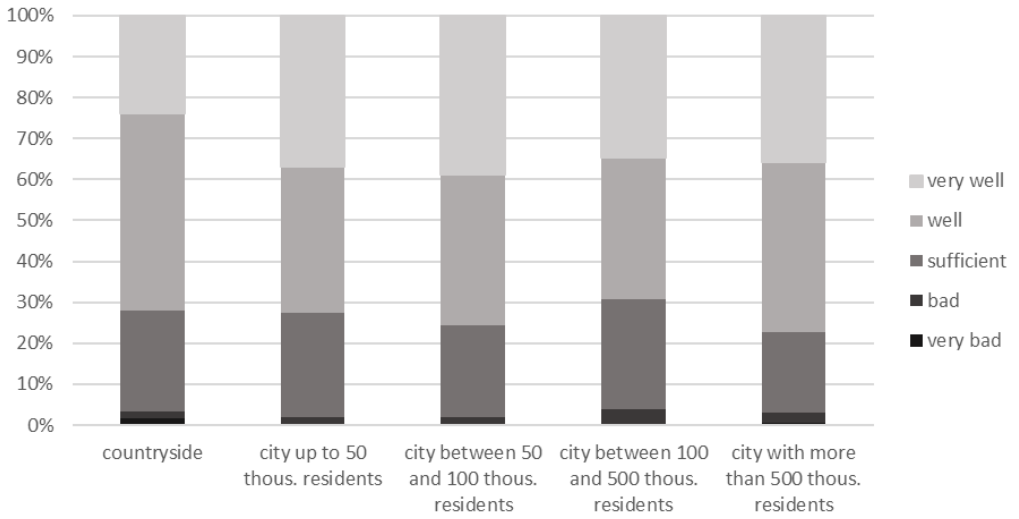


Figure 7: The distribution of environmental conditions according to accommodation
Sources: own elaboration

The technical conditions are dependent on gender (women are more likely to indicate sufficient or bad conditions), mode of study (full-time students are more likely to indicate sufficient or bad conditions), and residences (slightly worse in the countryside and smaller towns). Slightly over 65% women and 77% men, as well as 74% part-time students and 68% full-time students (the difference in this case is not statistically significant $p = 0.139$) have good or very good technical conditions. These conditions make online learning more difficult for women than

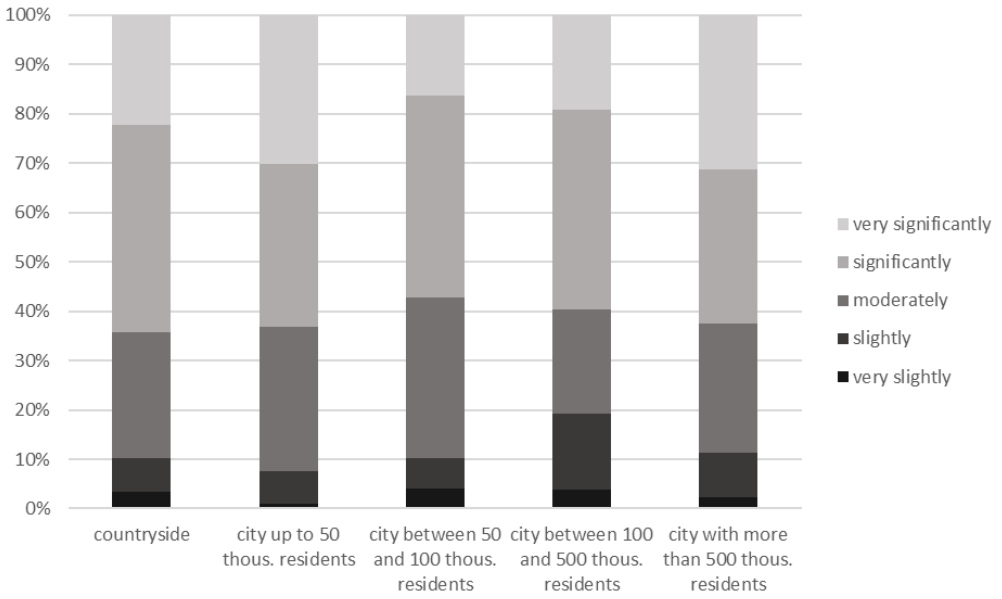


Figure 8: The distribution of the degree to which the environmental conditions hinder online learning according to accommodation
Sources: own elaboration

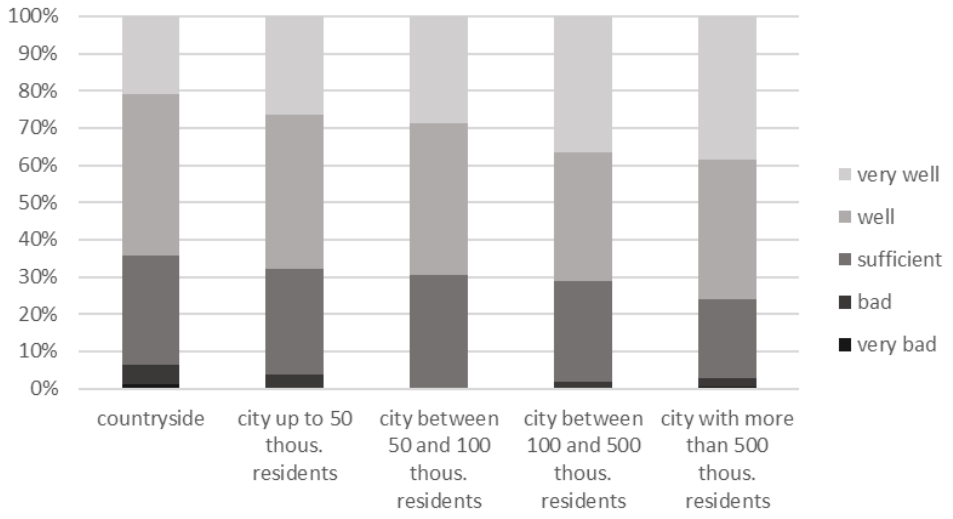


Figure 9: The distribution the technical conditions according to accommodation
Sources: own elaboration

for men, full-time students than part-time students, and residents of the countryside, small towns, and big cities. The technical conditions are slightly worse in the countryside, in the small and the biggest cities (see Figure 9). However, online learning is most difficult for residents of the countryside and big cities (see Figure 10).

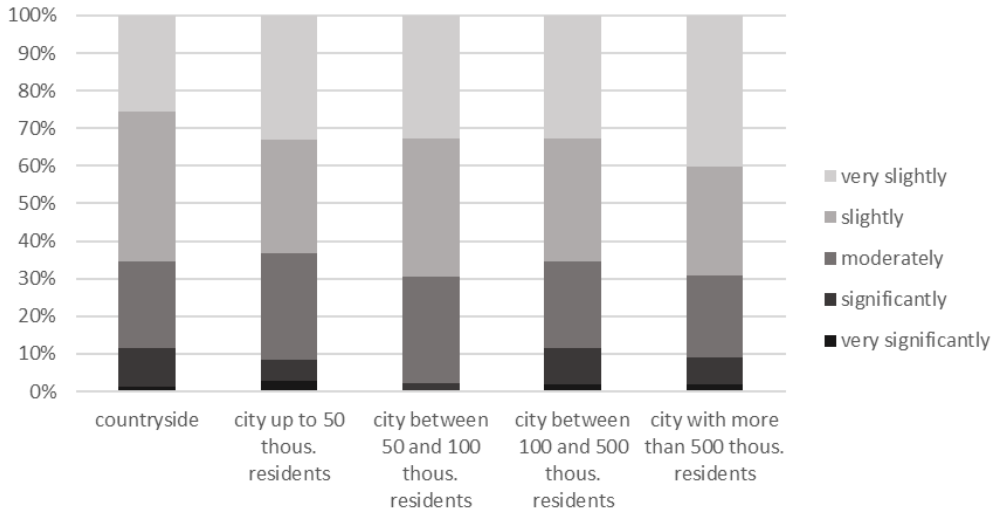


Figure 10: The distribution of the degree to which the technical conditions hinder online learning according to accommodation
Sources: own elaboration

X. Preferences for the forms of all types of courses

Students were asked about preferences for the forms of all types of courses. In general, the conclusion is that most prefer classes and lab stationary (70% of respondents), and lectures online (75%, including 22% asynchronously). In the case of seminars and consultations, it is about 50% online to 50% in-person.

There are differences in responses depending on gender and the mode of study. More women (80%) than men (70%) prefer online lectures. It is the opposite for labs and classes: (women – 26% and men – 38%). There is no gender difference in the case of seminars and consultations.

A few more part-time students (78%) than full-time students (74%) prefer online lectures, but the difference is not statistically significant ($p = 0.295$). It's similar for seminars (part-time students – 59%, full-time students – 42%) and for consultations (part-time students – 64%, full-time students – 48%). And for labs and classes, bigger differences were observed (part-time students – 47% and full-time students – 24%).

Generalized multinomial linear models were built to identify which variables impact preferences for the forms (online synchronically, online asynchronously and stationary) of all types of courses (lectures, classes, labs, seminars, and consultations). To these models, the following independent variables were chosen: the learning effort, the fatigue, the effectiveness, the concentration, and the IT competitions.

For each model, a stepwise elimination was used. After this, we obtain the five models with significant independent variables (Table 4).

Table 4: The results from the generalized multinomial linear models

Dependent variable (MODEL)	Independent variable	Wald's chi-square	df	p-value
1. Lecture forms preferences	IT skills	9.633	2	0.008
	Fatigue stationary vs. online	11.579	4	0.021
	Effectiveness stationary vs. online	47.233	4	0.000
2. Classes forms preferences	Fatigue stationary vs. online	30.396	4	0.000
	Effectiveness stationary vs. online	73.598	4	0.000
	Concentration stationary vs. online	17.386	4	0.002
	Work effort stationary vs. online	12.113	1	0.001
3. Labs forms preferences	Fatigue stationary vs. online	19.187	4	0.001
	Effectiveness stationary vs. online	36.386	4	0.000
	Concentration stationary vs. online	9.672	4	0.046
	Work effort stationary vs. online	13.476	1	0.000
4. Consultations forms preferences	Fatigue stationary vs. online	18.433	4	0.001
	Effectiveness stationary vs. online	33.258	4	0.000
5. Seminars forms preferences	Fatigue stationary vs. online	9.531	4	0.049
	Effectiveness stationary vs. online	37.483	4	0.000

Source: own elaboration using SPSS Statistics 27

After estimation of the model parameters, the following conclusions were obtained.

For the first model: Students whose IT competencies are insufficient and significantly hinder their education are more likely to prefer in-person lectures. Students who prefer in-person lectures were significantly more likely to indicate that online lectures are more tiring than in-person lectures. Students who prefer in-person lectures were significantly more likely to suggest that online lectures are less effective than in-person lectures.

For the second model: Students who indicated that they put more effort into onsite classes were significantly more likely (1.6 times) to show that they preferred onsite classes. The more tiring the online classes were, the more often they indicated they preferred to do the classes stationary. The more online classes were rated as more or equally effective, the more often they stated they preferred online classes. Only students who found online classes required the same concentration were significantly more likely to indicate they favoured online classes.

For the third model: Students who indicated that they put more effort into onsite labs were significantly more likely (1.6 times) to say that they preferred onsite labs. The more tiring the online labs were, the more often they indicated that they favoured doing the labs stationary. The more online labs were rated as more or equally effective, the more often they stated they preferred online labs. Only students who found that online labs required the same amount of concentration indicated equally that they preferred real-time online and in-person labs.

For the fourth model: The more online classes were rated as tiring, the more often they indicated that they preferred in-person consultations. The more online classes were rated as more or equally effective, the more often they stated they preferred online consultations.

For the fifth model: The more that online classes were found as tiring, students indicated that they preferred in-person seminars more often. The more online classes were judged to be more or equally effective, the more often they favoured online seminars.

XI. Summary and conclusions for the future regarding the forms of classes

Remote learning provides many people with greater comfort at work. It gives excellent technical and interpersonal skills and the ability to work in a group. It teaches regularity. The remote form requires more significant involvement in acquiring knowledge of a given material, takes more time and effort, but gives a lot of satisfaction.

From the survey analysis, it can be concluded that distance learning is more complicated and time-consuming. It requires more work and an above-average commitment. During distance learning, important interpersonal contacts and social relations are disturbed and limited. Lack of eye contact causes less focus and creates uncertainty. Students are reluctant to speak up and be active. In addition, there are technical problems that make it difficult to connect, listen, work in groups, solve tasks and issues, and engage in classes.

On the other hand, the possibility of connecting students with their academic teachers increases, even outside the designated consultation time. The negative effect of distance learning, however, is increasing health and psychological problems and minimal social relations. A positive impact of the pandemic is the economic aspect in the form of saved time and funds for commuting and accommodations. In addition, the possibility for students to earn money; improve IT competencies; train in other fields of study, postgraduate studies, and courses; and participate in many conferences and seminars, most of which are free of charge, increases.

The form of online classes, especially for part-time studies, is an excellent solution not only during a pandemic. Creating a solid and uniform infrastructure for all subjects is the future of teaching. For this purpose, one can follow the solutions used by the Open University in Great Britain.

The research results suggest that online lectures could be considered, especially for part-time students and majors where women make up the majority. The majority of students prefer classes and labs in-person. In the case of seminars and consultations, it's not so unambiguous. Students who prefer e-consultations find this solution saves time and is more effective. The results suggest that students are interested in hybrid education. However, it requires further in-depth research.

If one institution decides to provide some type of course online, they also need to increase IT competency for low-level IT students. In addition, teaching staff should receive training to make better use of available technologies, mainly during lectures. Most of the classes are a carbon copy of stationary methods, and online studies stigmatize such schematics even more. The important issue is to care about the communications and contact between teachers and students to increase activity in class and effectiveness of learning.

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