

# COVID-19: Challenges and Opportunities in the Online University Education

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**Abstract**—The COVID-19 pandemic had a very severe impact on the education both in schools and in universities. In the span of several weeks, educators around the world had to transform completely the teaching method and students had to adapt to the new form of learning. The following article reviews the opinions of university students based on three different studies – one before the pandemic and the distance learning, one in the middle of it and one in the end of the distance learning. The goal is to see how students' thinking and perceptions of online learning has changed over the last three years as a result of different conditions.

**Keywords**—*e-Learning; online learning; students' attitude to e-learning; pandemic outbreak; COVID-19*

## I. INTRODUCTION

Undoubtedly, in the last two years, the COVID-19 pandemic has been decisive in the lives of people around the world and has greatly changed their habits and daily lives. The education sector is one of the key sectors that have borne much of the burden of this pandemic. Hospitals, doctors and medical staff were invariably under the greatest strain, as they met directly with the illness. In addition, the COVID-19 pandemic had a very severe impact on education. The Government closed schools and universities to prevent the spread of the infection. This closure was not expected by anyone and was unprecedented, so both students and teachers were not at all prepared for it. Within two weeks, the teaching had to be transferred entirely to the electronic environment, online. These conditions forced the teachers to prepare their lectures and teaching materials in a completely new way. Students should look at e-learning not as a supplement to the standard learning, but as the main and only way. Since this has never happened to neither lecturers, nor students before - both sides faced many challenges and overcame many problems together.

## II. STATE AND RELEVANCE OF THE PROBLEM

Before the spring of 2020, e-learning was seen as an object of research and an opportunity to complement standard education in schools and universities, but since that spring online learning was introduced as a means of ensuring continuing education. The pros and cons of online learning and the comparison of the results of standard and online learning or standard and blended learning [3, 4, 5] are mainly examined before the pandemic, while online learning is the only option after the pandemic and research is addressed mainly to its refinement or improvement [6, 7, 8]. Online learning is a convenient form of distance learning that has developed since

2000. Initially, to provide access to teaching materials and training for students who are far from the place of the school or university, for those who are professionally engaged and cannot afford to attend standard university courses. This form of learning gives access to training and materials to a wide range of people, regardless of their age and previous experience or profession [1]. In addition, education is generally expensive and offering online courses at a lower cost makes them much more accessible to a wider range of learners. Anyone who has access to the Internet and an interest in a field has access to materials from top universities and can study and develop for free or at a relatively low cost [2]. Last but not least, the advantage of online courses is that they are available at a time convenient for the learner. They can watch, listen to or read them as many times as they want.

In order for online learning to be successful, the environment or the learning management system (LMS) that will be used plays a very important role. Before 2020, most of the courses were offered on popular platforms for sharing audio and video materials, the universities themselves used LMS systems [11, 12, 13] or teachers supplemented the systems and communication with students using social networks [9, 10, 13]. After the announcement of the 2020 pandemic and the transition to full online learning, it was necessary to improve and adapt LMS systems to the new conditions very quickly. It was no longer enough for students to have access to structured materials - lectures, exercises, homework, as the LMS had to allow direct communication in real time and the opportunity for direct conversations and meetings [14, 15]. An analysis of the impact of the pandemic on the development of this type of system is described in [16]. Before the pandemic, our university used LMS, which was more of a file management system (file manager) with materials for students in various disciplines in PDF or PPT formats. Therefore, the university management had to make a choice promptly and decide to introduce another system, with more opportunities and, above all, the possibility of synchronous online learning.

## III. STUDY, METHOD, PARTICIPANTS, CONDITIONS AND DURATION OF THE RESEARCH

With the help of Google Forms, we collected the opinions of the students from the department of Computer systems and technologies in the University of Ruse, Bulgaria, regarding their opinion about online learning. Three studies have been conducted - one before the pandemic [18], the second one at

the beginning of the pandemic [17] and the third one recently at the end of the distance learning. Our goal was to see how students' thinking and perceptions of online learning has changed over the last three years as a result of different conditions.

A few months before the COVID-19 pandemic, without even suspecting it, we wanted to see what the students thought about the materials provided by the lecturer. How, in what form and whether there is a need to have access to them, do they think it makes sense to combine traditional with online learning. This questionnaire was completed by 201 participants in the study. It was distributed publicly and filled not only by our current students, but also by former ones, with the idea to see different points of view.

At the beginning of the COVID-19 period (the first online semester for them), we tried to assess students' attitudes and sense of learning during the pandemic. Number of students participated were 109, average age being 22 years. For some of the participants in the survey, this was the only semester online, and for others - this is the second semester of learning and they had no real experience in normal university education.

Our latest study involved 75 students with an average age of 22, mostly men. They studied 4 semesters online, they were also online at the beginning of the current semester and have been in-person for several weeks now. Some of them have been entirely online since the beginning of their university studies and have no experience with standard academic lecturing at the university. Some of these students (about 50%) also participated in the first study.

In Bulgaria, schools were one of the first and very quick to return to normal education, starting with the youngest. Universities had the opportunity to decide what form of education to use independently and at our university we had 2 trials in 2-3 weeks for in-person lecturing and education but came back to online again. We hope that the return to the normal form of study this semester will last at least until its end, if not permanently.

After the two surveys, we wanted to see what the students thought and what their experience of those two years was after almost entirely online education.

#### IV. RESULTS ANALYSIS

After the experience gained in online teaching, we can say that due to the compulsory online training the various IT technologies are widely used in the teaching itself, as well as that this teaching has been the engine for active development of these technologies in the last two years.

Advantages of online learning: Students have the opportunity to study and learn the material at their own pace, thus encouraging engagement, independent thinking and working on problems. There were no problems with technology and information technologies in general, because they are studying such courses, but there were those who did not have good internet connection or suitable devices, for example.

In the meantime, lecturers and students had to face some challenges:

- They had to quickly learn to use different LMS systems with the possibility of online connection in real time with the students.
- In a short time, they had to adapt their materials so that they can be used online. And all this without any special training before that.
- It is inevitably a big challenge to face the use of new technologies and various digital devices.
- Uncertainties about students' readiness for learning, social isolation and participation in online classes.
- The need to develop materials in an attractive and appropriate form.
- Developing and using training strategies tailored to the new conditions.
- The transition from face to face to online learning is related to overcoming communication barriers for both parties.
- Measures and methods for overcoming the lack of interest in both sides of the learning process.
- Ways to organize and conduct online exams and presentation of diploma projects.

At first glance, it may be considered that when teaching is in the field of computer systems and technologies, online teaching is not so complicated. There are indeed courses that may be more appropriate and productive for online rather than standard teaching, but there are many courses that are very difficult to adapt for online use - for example, those that require specific hardware, laboratory facilities or equipment.

Before COVID-19, students said that they found classes in the form of exercises and workshops the most useful for them. They are the most difficult to conduct online if they involve any specialized equipment. For courses related to programming and using a popular, unlicensed environment, conducting it online may be even more useful for the students. In these courses, they are forced to install and configure the various software environments needed to conduct practical exercises in the learning process on their own, under the supervision and assistance of the teacher remotely. Some students said that this was one of the very useful aspects of the teaching, because if they were taught in-person, most of them do not install the used environments at all and do nothing at home. 52% of the respondents said that they had installed all the software products that were necessary for their teaching and 72% performed all the tasks set by the lecturers.

During the long period of online learning, the university improved their chosen platform and the hardware resources, while the lecturers got used to it and did not have a need for the university's LMS at all. The students themselves (73.3%) think that the platform used for online learning is the main issue during teaching (Fig. 1).

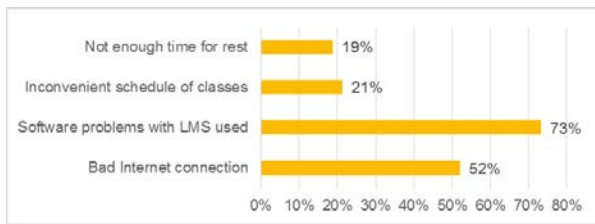


Fig. 1. What are the Main Issues during the Online Learning According to the Students.

Although 89% of students used a computer to participate in lectures and 93% to participate in exercises, there were still students using mobile phones at the end of the pandemic. This means that these students practically only attended, but did not fully participate in the classes. 40% of respondents said that they kept notes, 17.3% that they used specialized recording software (which is not regulated and allowed because teachers are not informed about it) and almost 35% did not need notes because the teachers provided the necessary materials and presentations. 52% attended all the lectures, 28% attended 75% of the lectures and unfortunately there are still students - 13.3% who attended the classes online only because the teachers said it is mandatory to attend and checked attendance. Graphic representation of the attendance of online classes for all respondents, as well as depending on the number of semesters in which they studied online, is shown in Fig. 2.

Given that the surveyed students are studying Computer Science, the use of mobile devices for classes makes virtually no sense. It is assumed that in order to actively participate in the teaching, they must use different programming environments or software products for various engineering research, which is not possible to have on their phones or tablets. Despite the presence of such students who are still using mobile devices, 52% answered that during the exercises they had software installed to perform the tasks and 72% tried to do everything assigned to them by the teacher. However, there are still those who have just joined the online classroom and did not stay in front of the device, did not listen or did not participate in the classes and 19% who have only listened and watched and done nothing. Although a small percentage, this means that about 20% of students have trained as a computer engineer for 4 semesters, but have not tried to program or solve their own tasks. They do not even participate in discussions during the classes.

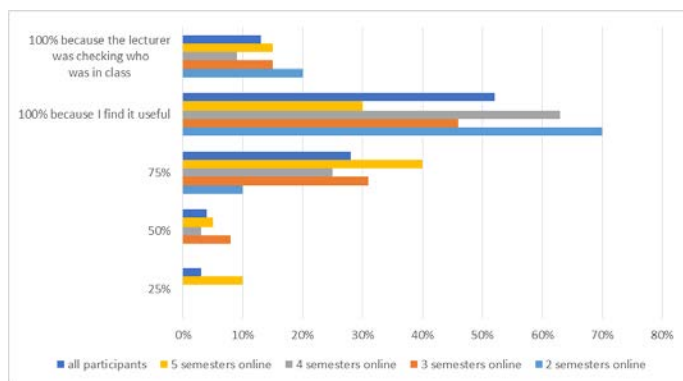


Fig. 2. Graphic Representation of the Attendance of Online Classes Depending on the Number of Semesters in which they Studied Online.

What do students think about their lecturers? Only 9.3% of students think that very few lecturers have provided materials, 40% thinks most teachers have had and have provided materials and 50.7% say that all teachers have provided their materials. The differences probably come from the different courses, as in the first 2 semesters of their education they study only basic and general courses: mathematics, physics, foreign languages, etc. which are not so suitable for providing materials and online learning. From the third semester onwards, they are taught mainly by the specialized department and the courses are more appropriate for online teaching. 56% answered that by studying online they were able to learn and understand the material better because they were provided with materials by the teacher and the teachers themselves spent more time and attention and answered additional questions and organized online consultations if necessary.

Students are almost equally divided in their assessment of workload during online learning. 53.4% of all participants think that it is not burdensome for them since 34.7% of them think that they can just start their online classroom and do other things while 18.7% definitely do not find this form of training stressful and work loading.

For the other half of the participants, this form of training was more stressful since for 33% of them it was more difficult due to the lack or limitation of social contacts with other students. For 21% the workload felt hard due to longer duration, and for 16% it was stressful because they had to work alone, while in face to face education they work in teams and they are not active during classes.

Unlike the traditional way of teaching, where students use laboratories and computer rooms with installed software environments and applications with no commitment to install and configure, online teaching requires additional commitments from the students to install and configure everything on their computers. The students themselves shared that for some of them these were the first encounters with this type of problem. Although the lecturers helped, this process was long and complicated for some students, and some did not manage to cope, mostly due to lack of interest on their part. This moment of online training was burdensome for lecturers as well, because they had to prepare a step-by-step description of the installation itself, and some of them had to find and replace their prepared materials for another environment that is free and does not require licenses. Unfortunately, we did not have opportunities for remote access to the university resources for each of the students. Despite the difficulties for both parties, this part of the learning process and the opportunity for everyone to work independently on their own computer (in traditional learning we do not provide a separate computer for each student, usually 2 students are working together on one computer) were very useful. The students were able to try to solve their tasks on their own, to share their screen with the teacher and others and to get quick and adequate answers to their questions. They saw that they could do much more on their own than they expected, and that made them more confident and more willing to work. 25.3% believe that they have learned more online than they would have learned in-person, for 54.7% this way of learning was quite acceptable given the circumstances, 9.3% cannot judge. Unfortunately,

there are those who think that they have not learned anything more and even that was a complete waste of time. For 65.3%, online learning has helped them become more confident and independent in solving various practical tasks, and 34.7% do not think that there has been an impact.

The answers to the question about the understanding of the taught material, shown in Fig. 3, are optimistic. It can be seen that for 56% of the respondents the assimilation and understanding of the material was easier, because they had materials provided by the teachers and the latter spent more time for additional explanations of the material or to discuss with students' various problems. 19% answered that they spent a lot more effort and time and thanks to this they were able to understand and learn the material. A quarter of them failed to understand and master the material taught and believe that the teachers did not devote the necessary time and effort or that the problems with LMS did not allow them to cope.

As can be seen from the graph in Fig. 4, the best part of the online teaching according to the students was that they were provided with all the materials and did not have to take notes, write or look for specific books or materials to prepare for classes or for the exam. It is impressive as well that according to 44% the good thing about online learning were the easy exams.

During the pandemic, not only teaching but also exams had to be conducted online. We had written rules of procedure for online exams, most teachers tried to adapt to the conditions and took advantage of the opportunities provided by Google to create online tests, but there were some that remained on the classic type of exams with writing on selected topics. The system used was quite limited and did not provide opportunities to conduct tests or exams online, so we had to look for other options. Students are generally satisfied with the online exams, but unfortunately admit that they have used unregulated materials to take the exam easily (have copied from their colleagues or from the Internet, used pre-prepared materials or used someone else's help, which is not allowed, according to the rules). 26.7% did not take advantage of the situation, 24% used unregulated materials for all exams, and the rest for at least one or several exams. Fig. 5 shows how many of the exams students have taken using unregulated materials, according to the number of semesters taught online (2, 3, 4 or 5).

An interesting fact is that students prefer to take exams in the form of an online test (85%). They don't like exams that involve writing on some questions and solving problems (Fig. 6).

50.7% said that during the online teaching they lacked communication with other students, 42.7% missed on the environment and conditions of study at the university, and 26.7% missed on direct communication with lecturers and professors. For communication with each other they mostly used social networks, such as Facebook - messenger and Facebook groups and Discord. It is noteworthy that information about the learning process and related messages

were received not only through their university e-mail addresses (86.7% indicated this option) but also from social networks, mainly Facebook pages (56%) and groups in various courses (82,7%).

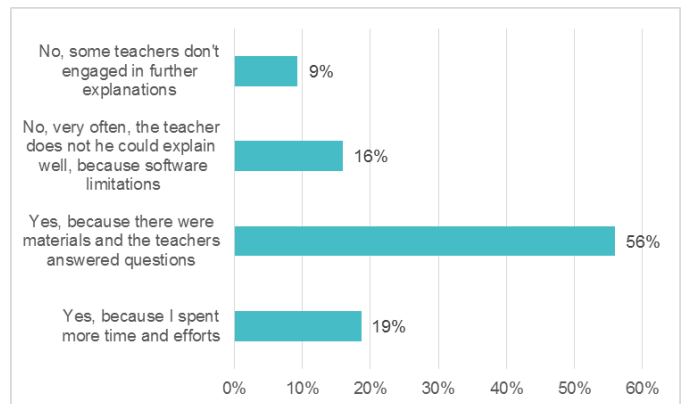


Fig. 3. Were you Able to Understand the Material Taught Better?

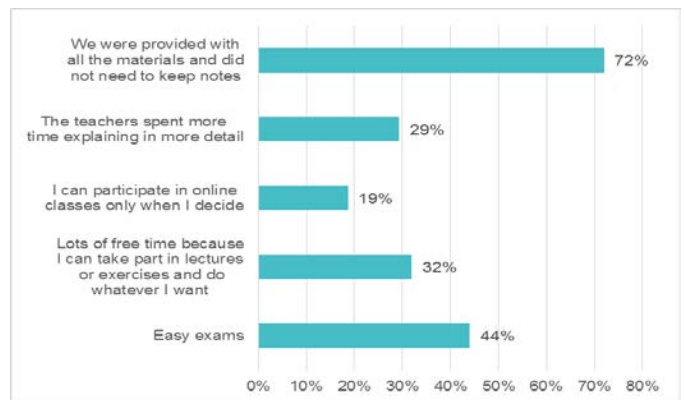


Fig. 4. What was the Best thing about Online Learning?

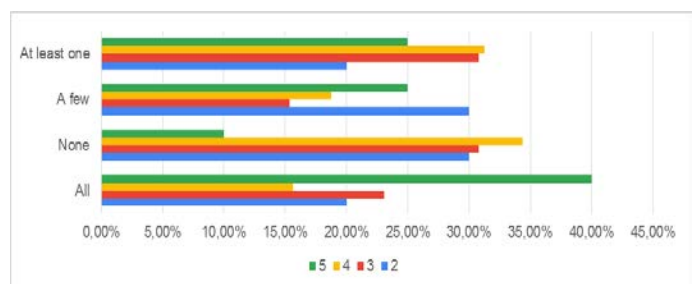


Fig. 5. How Often and Whether Students use Unregulated materials during the Online Exams.

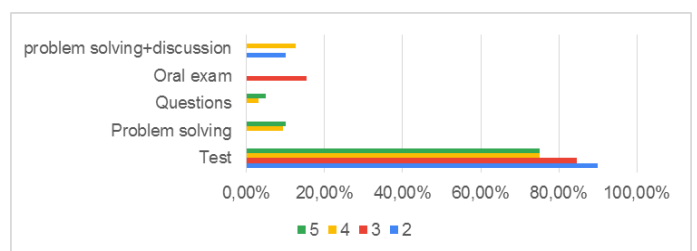


Fig. 6. Preferable Exam Type According to the Students' Answers.

During the first few months of the pandemic most lecturers were using Facebook groups to organize their online teaching. This method proved quite useful for communication with the students, instead of exchanging emails. One of the reasons for this is that in our university, we do not store information about which students are taking each course and no record of their university email address. Even now, when we have gone back to in-person teaching, the Facebook groups are still used to exchange information and for discussions.

Communication between the students has been a useful channel of information (75%), as well as communication with the lecturers (55%) (Fig. 7). It is worth noting that despite the online teaching, a positive tendency was that some students would take a leadership role and mediate the information between lecturers and students and aid the teaching process. These leaders, typically one or two, were responsible for collecting the materials and messages from the different courses, reminding and organizing their fellow students and quite often to motivate them to be more active in the teaching process.

During the COVID-19 pandemic, although isolated in their homes, students kept in touch with each other (Fig. 8). Messenger was cited as the most popular means of communication (96%), followed by Discord. Young people prefer online communications to telephone calls.

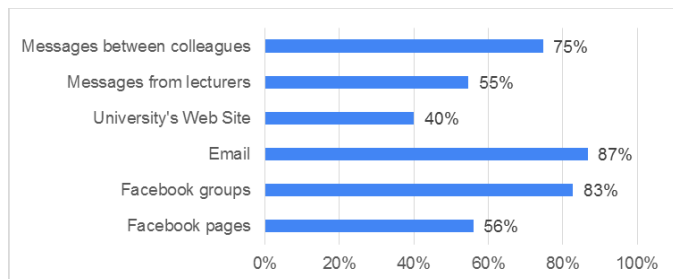


Fig. 7. How and from Where the Students Received Information about the Learning Process?

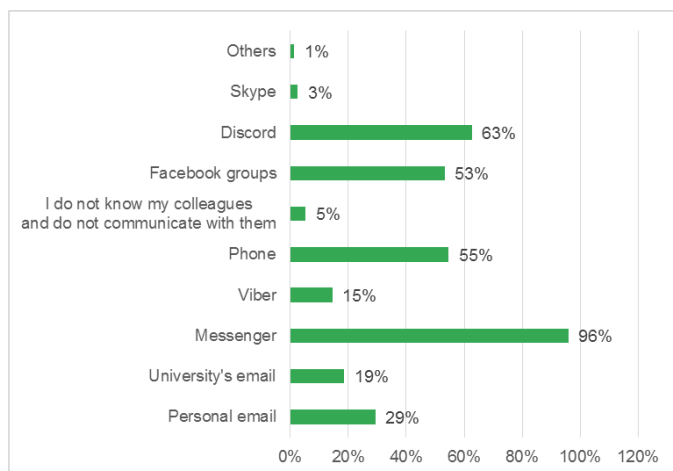


Fig. 8. How you Communicated with each other during Online Learning.

The number of students has significantly dropped in the last two years while the teaching has been almost entirely completed remotely. Each year there are 70-75 new students on average, while at the moment the students are: 1st year - 37, 2nd year - 36, 3rd year - 22 and 4th year - 34. The drop in students is most noticeable in third year and this is due to the fact that these students have only had 1 semester of in-person teaching, did not expect that the teaching would transform to online learning when they enrolled and after 1 semester in university they were not at all used to the different method of teaching compared to high school. They were the most affected by the sudden change in teaching. However, undeniably there has never been such a drop in student numbers within our department. Unfortunately, we are unable to speak directly to the students and we do not have clear information why they chose to drop out. It can only be speculated that these students were forced to go back to their hometowns and families due to the pandemic and were not interested in finishing their education. When asked if they would continue their education if the teaching was entirely online, 86.7% say they would definitely continue or would continue as part-time students. The responses are positive since only 8% would not want to continue their education online, but expect and would go back if the teaching was in-person (Fig. 9).



Fig. 9. Would you Continue your Education if you were Online Again?

## V. CONCLUSIONS

Despite all the negatives of social isolation due to COVID-19 measures and restrictions, there are some positive moments from online education during the last 5 semesters.

Students have become more confident and independent, they have to and manage to solve problems and tasks of the learning process, which in normal conditions in standard education do not arise before them - installing and configuring software environments and products and working independently with them.

Teachers and professors (for the most part) have prepared and provided students with much more materials and resources in the courses they teach. They also manage to spend more time consulting and discussing with students, albeit online.

Students feel much freer to ask questions and discuss learning materials. They admit that online exams are easier, they use unregulated materials and they have even started to prefer online forms of exams. They recommended in the survey that even under normal conditions, lectures and exams should be held online.

Perhaps with a more developed online LMS than the one used by our university, it would be more convenient for lecturers to give online lectures. At the moment, this is not appropriate, because you never know who is actually in class and whether the lecturer is not "teaching to themselves". In all cases, online learning is much more stressful, time consuming and difficult for lecturers (especially for those who have not had prepared materials in an appropriate form for online learning).

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