Moving from face-to-face to online learning in a week due to the COVID-19 pandemic: Higher education students' perceptions

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Abstract: Online learning has attracted the interest of researchers and practitioners for decades. Various advantages, challenges and factors affecting the effectiveness of online learning have been reported. However, these findings have been recorded under ideal circumstances and not extraordinary situations, such as the one imposed by the COVID-19 pandemic. In this article, the results of a survey on the perceptions of higher education students regarding the emergent transition to online learning are quantitatively and qualitatively analyzed. Students evaluated positively the quality, organization and presentation of synchronous online courses, but they were divided as to whether their quality is equivalent to that of face-to-face courses. The most prominent problems refer to the quality of Internet connection, lack of appropriate infrastructure especially for online lab courses, lower quality communication and interaction and a difficulty in keeping concentrated on the course. Despite these issues, instructors and students embraced successfully the solution of online learning.

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1 Introduction

Online learning has been thoroughly researched for over two decades. In a contemporary systematic literature review (SLR), Singh and Thurman (2019) reported forty-six definitions and eighteen synonymous terms. The SLR investigated relevant literature in the period 1990-2017 and the five most frequent terms used for defining online learning are: online learning; e-learning; blended-learning; online education; and online course. Other common terms, such as distance education and distance learning were not recorded in the literature published after 2011 and included in the SLR.

As Singh and Thurman (2019) stated, online learning has several meanings, including just the use of a Learning Management System (LMS) for supporting *asynchronous learning*, video conferencing platforms for supporting *synchronous learning*, a combination of the aforementioned approaches, or even a combination of them with face-to-face learning (i.e. *blended learning*). Consequently, a reference to online learning should always clarify its context, the way it is experienced and the role of physical distance, if any. With this in mind, we must note that in the context of the current study:

Online learning is perceived as learning experienced in a virtual classroom where instructors and students interact from any physical location (for students typically their homes) in a *synchronous mode,* while an LMS (Ivanović et al., 2017; Xinogalos et al., 2020) is used for *asynchronously* interacting with instructors and students through discussion forums, delivering educational content, being informed about organizational course issues and assignments, submitting assignments from anywhere and at any time.

The study presented in this article aims to investigate Higher education students' perceptions on the emergent transition from face-to-face to online learning for confining the spread of the COVID-19 pandemic. The sudden lockdown imposed in countries all over the world resulted in closing educational institutions as well. At the end of March 2020 more than 100 countries had applied nationwide closure, while others had applied localized closures and this impacted more than half of world's student population according to the UNESCO (2020a) observatory.

Although a great amount of research has been carried out on online learning, reporting various advantages, success factors (Alhabeeb & Rowley, 2018) and challenges for its adoption and application (Bean, et al., 2019; Sinha & Bagarukayo, 2019; Flavell et al., 2019; Solangi, Shahrani, & Pandhiani, 2018), such research has been carried out in a controlled environment and not as a consequence of an emergency situation. The application of online learning as an emergent solution, or better the only solution, for not stopping the educational process at all levels of education (UNESCO, 2020b) has created a new landscape and has also opened new perspectives in education. Besides the challenges already recorded in the literature for the application of online learning, such as:

- limited or unreliable Internet access (Bean, et al., 2019; Sinha & Bagarukayo, 2019) and infrastructure problems
- instructors' reluctance and/or procrastination to adopt online learning and low instructor and student self-efficacy (Flavell et al., 2019; Solangi, Shahrani, & Pandhiani, 2018)

the new emergent situation, which dictated its use without having enough time and an adequate budget to appropriately organize it, has to be researched. It might be true that new challenges have appeared, but it might also be true that the need to apply it as the only solution for educating and being educated might have shaped new perceptions and behaviors both on instructors and students.

The study presented in this article, as already mentioned, aims to investigate students' perceptions on the sudden transition from face-to-face to online learning due the COVID-19 pandemic. For this purpose a survey containing both closed and open type questions was prepared and filled in anonymously both from undergraduate and postgraduate students from an Applied Informatics Department at a European country, namely Greece. Both quantitative and qualitative results are reported.

The rest of the article is organized as follows. In section 2 relevant studies on various aspects of online learning during the COVID-19 era are briefly reviewed. In section 3, the research questions and the methodology of the

study are presented, while in section 4 the results of the study are analyzed. In section 5 some limitations of the study are presented, while in section 6 the results are discussed and final conclusions are drawn in conjunction with implications for researchers and practitioners.

2 Relevant work

Research on the consequences of the COVID-19 pandemic on education has started to gain great interest, but it is still at an initial stage of maturity. The research so far studies either general issues that refer to managing the application of the emergency remote online learning and its consequences on the society or the instructors' and students' perceptions about the challenges and the perspectives of this new reality.

Hodges et al. (2020) in their article highlight the differences between emergency remote teaching and well-planned online teaching and stress the need for educational institutions to acknowledge these differences and be flexible and adjustable to the extraordinary situation that the educational process takes place. At this spirit, Zhang, Wang, and Yang (2020) present the emergency policy initiative taken in China called "Suspending Classes Without Stopping Learning", analyze measures taken for its implementation and the underlying problems, such as weaknesses in the necessary infrastructure, the inexperience of teachers, the information gap, and the complex environment at home. Beaunoyer, Dupéré, and Guitton (2020) move a step forward and stress the fact that existing digital inequalities are strengthened due to the COVID-19 pandemic and propose strategies for mitigating the consequences.

Almaiah, Al-Khasawneh, and Althunibat (2020) carried out a qualitative study for investigating the critical challenges and the factors that influence the usage of an e-learning system during the COVID-19 pandemic. In the context of the study the authors interviewed 30 students and 31 experts in e-learning systems from six universities from Jordan and Saudi Arabia. Thematic analysis was used for analyzing the data collected. Based on the results the following challenges are connected with the usage of an e-learning system: there is a need for changing management issues; facing various e-learning system technical issues; and granting financial support. The critical factors that affect the usage of the e-learning system refer to: technology; e-learning system quality; cultural aspects; self-efficacy; and trust issues.

Adarkwah (2020) carried out a qualitative study on the perceptions of students on online learning in Ghana and ways to improve it, taking into account poor urban and rural areas. The data collected through interviewing 15 participants were analyzed using a narrative inquiry approach, in a similar way with Almaiah et al. (2020). The study presents results on the effectiveness of the online course, underlying barriers and ICT integration issues and concludes that the traditional teaching approach is preferable since the online learning is accompanied with several challenges in Ghana. However, as the author states, the results cannot be generalized due to the small sample size.

Giovanella (2020) investigated through a questionnaire the perceptions of 101 undergraduate Educational Science students in Italy on the transition from physical to fully virtual education and their opinions on online learning one month after the lockdown imposed due to the COVID-19 pandemic. Although students miss face-to-face educational processes they evaluate positively the emergent transition from face-to-face to online learning.

In another study, positive experiences and perceptions about online learning were recorded by teachers in Italy two months after the COVID-19 pandemic lockdown (Giovannella, Passarelli, & Persico, 2020). After the

analysis of the data collected through a survey with 336 participants the authors concluded that the reactions of educational institutions and the efforts of teachers that faced an increased workload succeeded in keeping the educational process alive and creating a feeling of self-efficacy and positive attitude towards online learning. However, the loss of contact with nearly 6-10% of students and the need for cultivating a digital pedagogy to future teachers are highlighted and require appropriate attention.

3 Study methodology

3.1 Research questions

Extended literature is available for issues related to synchronous and asynchronous online learning (Alhabeeb & Rowley, 2018; Bean, et al., 2019; Flavell et al., 2019; Sinha & Bagarukayo, 2019; Solangi, Shahrani, & Pandhiani, 2018). However, such research has been carried out in the context of courses that are designed from the very beginning to be offered online and both instructors and students are appropriately prepared for offering and attending respectively such courses. Due to the COVID-19 pandemic Higher Education institutions faced an extraordinary situation and had to move from face-to-face to completely synchronous online learning from one day to another, without having time for working on this transition. The study presented in this article aims to investigate the following research question:

> *What are Higher education students' perceptions on the sudden transition from face-to-face to online learning?*

Since there is no much research on this issue yet, this study aims to shed some light on students' perceptions regarding the sudden transition from face-to-face to online learning; investigate potential problems; and bring to surface issues that would be valuable for instructors that will have to continue online teaching and researchers that are carrying out research on the consequences of this emergent situation.

3.2 Context of the study

The study presented in this article took place at the University of Macedonia in Thessaloniki, Greece during the spring semester of the academic year 2019-20 when the lockdown due to the COVID-19 pandemic was imposed. Specifically, at March 10, 2020 the Senate announced the suspension of face-to-face courses due to the COVID-19 pandemic. One week later the University announced being ready to move to online learning both for undergraduate and postgraduate courses. By the end of the month nearly all the courses were offered online. At the Department of Applied Informatics, where this study took place, the instructors started offering online courses just one week after the lockdown.

At this point we must mention that the Institution used prior the pandemic two Learning Management Systems (LMSs) for providing asynchronous education services, such as (Ivanović et al., 2017; Xinogalos et al., 2020): sharing educational material; project assignment and submission; making announcements sent to the academic emails of enrolled students; students' guidance; cooperation and collaboration through discussion forums and so on.

In order to support synchronous online courses two platforms where used, namely Google meet and Zoom, based on the requirements of each course. Specifically, when the courses started there were no licenses for the two platforms and at that time the following restrictions existed:

- Zoom had a restriction of 100 participants and 40 minutes per meeting, which means that the instructor had to restart the meeting and students had to sign in every 40 minutes.
- Google meet had increased the number of participants to 250 and there was no time limit for a meeting.

As already mentioned, based on the number of enrolled students in each course and the nature of the course one of the aforementioned platforms was utilized. Some nice features of Zoom were the ability of organizing breakout-rooms for having groups of students cooperate on a common task, remote control of students' PC for assisting them in dealing with problems (i.e. software installation), and giving a student access to the application shared by the instructor (i.e. for completing an excerpt of source code). No matter what platform was chosen by each instructor, students were typically informed for the link of each course through an email sent from the LMS utilized in the course. The courses were taught based on the predefined timetable announced at the beginning of the semester (17th of February for undergraduate courses & 24th of February for postgraduate courses).

The study presented in this article was based on a survey carried out from April 28th to May 1st of 2020. The motivation for this survey was an open web discussion organized by the University of Macedonia on the COVID-19 pandemic and technology, and more specifically the challenges that emerged for innovation, education and communication.

3.3 Participants

The participants of this study were undergraduate and postgraduate students of an Applied Informatics Department. The demographics of the participants are presented in Table 1 and were recorded in questions Q1-Q4 of the questionnaire (see Table 2).

Table 1 Demographics of participants

Demographic	Data
Program of studies & number of participants (Q1)	Department of Applied Informatics 71 Undergraduate students 39 Postgraduate students
Year of studies (Q2)	1st: 37% (41) 2nd: 32% (35) 3rd: 9% (10) 4th: 22% (24)
Number of courses enrolled (Q3)	Mean: 6, Std. Dev.: 2.5
Number of courses attending (Q4)	Mean: 5, Std. Dev.: 2.4

3.4 Instruments and data analysis

In order to investigate the aforementioned research question, a questionnaire was designed consisting of 5 point Likert scale, yes/no and open-type questions. The questions along with their type are presented in Table 2. The questions on the quality (Q5), the organization and presentation of synchronous online courses (Q8) and the overall performance of instructors (Q15) were based on the typical questionnaire of the Quality Assurance Unit of the institution filled in by students during the final weeks of each course. The questionnaire was anonymous and included at the beginning all the necessary information defined by the Research Ethics Committee of the University, such as: the aim of the research; contact information of the principal investigator; information on the anonymity of the questionnaire; acknowledgment of the chance to leave out of the questionnaire at any time without any consequence; consent to use the responses in the questionnaire for research purposes. The principal investigator informed undergraduate and postgraduate students regarding the aims of the study and the link of

the questionnaire (Google form) through an email sent from the asynchronous education platform and specifically the courses that the investigator had access as an instructor.

Descriptive statistics were used and specifically the frequency and percentage for each possible response, as well as the mean value, standard deviation and median were calculated for the Likert scale questions. A qualitative analysis of the results has also been carried out.

For the open-type questions on the positive and negative aspects of synchronous online courses (Q17 & Q18) and students' concerns about their studies (Q19) a procedure that applied elements of both phenomenographic (Marton, 1981) and content analysis was carried out. Specifically, students' replies were studied applying an iterative and comparative process. During this process, characteristic words and phrases in students' responses were recorded in the text and compared in order to formulate categories of perceptions. As long as the most prominent categories emerged, we revisited students' responses using a similar iterative and comparative process and each perception was recorded under a specific category. It is obvious that some of the students' responses included more than one perception. The perceptions recorded under each category are in fact quotations from students' responses. We have to note, however, that the recorded perceptions and excerpts of students' responses were translated by the author since the participants were all Greek students.

Table 2 The questionnaire of the study

Code	Question	Type
Q1	Programme of studies	Open-type question
Q2	Year of studies	
Q3	Number of courses enrolled	
Q4	Number of courses attending	
Q5	The quality of synchronous online courses is high	5 point Likert-scale statement where: 1= totally disagree 5 = totally agree
Q6	The quality of synchronous online courses is equivalent to that of face-to-face courses	
Q7	The quality of synchronous online lab courses is equivalent to that of face-to-face lab courses	
Q8	The organization and presentation of synchronous online courses is flawless	
Q9	The organization and presentation of synchronous online courses is equivalent to that of face-to-face courses	
Q10	Using synchronous online platforms (Google Meet, Zoom) is easy	
Q11	Using asynchronous online platforms (LMSs) is important for supporting and carrying out courses (sharing educational material, assigning & submitting assignments etc.)	
Q12	I faced problems during course attendance with Zoom	Yes/No question
Q13	I faced problems during course attendance with Google meet	
Q14	I face problems with my Internet connection	
Q15	Instructors' overall performance in synchronous online courses is good	5 point Likert-scale statement where: 1= totally disagree 5 = totally agree
Q16	Instructors' overall performance in synchronous online courses is equivalent to that of face-to-face courses	
Q17	Positive aspects of synchronous online courses	Open-type question
Q18	Negative aspects of synchronous online course	
Q19	What concerns you more about your studies?	

4 Results

4.1 Quality and organization of synchronous online courses

The results of the survey regarding the quality and organization of the synchronous online courses are summarized in Table 3. Specifically, the mean, standard deviation and median for each one of the five questions is presented, as well as percentage and frequency for each possible response for each question.

Table 3 Results on quality, organization and presentation of online courses

Question	Mean	Std	Median	Totally disagree	Disagree	Neither disagree nor agree	Agree	Totally agree
Q5. The quality of synchronous online courses is high.	3.9	0.8	4	1.8% (2)	1.8% (2)	20% (22)	57.3% (63)	19.1% (21)
Q6. The quality of synchronous online courses is equivalent to that of face-to-face courses.	3.2	1.2	3	12.7% (14)	15.5% (17)	27.3% (30)	30.9% (34)	13.6% (15)
Q7. The quality of synchronous online lab courses is equivalent to that of face-to-face lab courses.	3.1	1.4	3	19.1% (21)	15.5% (17)	26.4% (29)	17.3% (19)	21.8% (24)
Q8. The organization and presentation of synchronous online courses is flawless.	4	0.9	4	1.8% (2)	1.8% (2)	18.2% (20)	48.2% (53)	30% (33)
Q9. The organization and presentation of synchronous online courses is equivalent to that of face-to-face courses.	3.7	1.1	4	2.7% (3)	11.8% (13)	21.8% (24)	37.3% (41)	26.4% (29)

The vast majority of students agree that the *quality* of synchronous online courses is high (median 4). More specifically, more than three out of four students agree (57.3%) or totally agree (19.1%) that the quality of online courses is high, while one out of five students is neutral (Table 3: Q5).

However, it is clear that students are divided as to whether the quality of online courses is *equivalent* to that of face-to-face courses (median 3 – neither agree nor disagree). A little more than four out of ten students agree (30.9%) or totally agree (13.6%) that online courses are of equivalent quality with face-to-face courses, while more than one fourth of students (27.3%) are neutral and another one fourth of students (28.2%) consider face-to-face courses to be of better quality in comparison with online courses (Table 3: Q6).

In an attempt to investigate the potential reasons for the perception that the quality of synchronous online courses is not equivalent to that of face-to-face courses, we further analyzed the responses of students that disagree (15.5%) or totally disagree (12.7%) on quality equivalence in conjunction with question Q14 on Internet connection problems and Q18 on the perceived negative aspects of synchronous online courses. Based on this analysis, it becomes clear that 55% of these students faced problem with the quality of their Internet connection, while 45% of them faced problems while attending courses using synchronous online learning platforms. Although the problems faced during synchronous online courses will be analyzed in a subsequent section, we must mention at this point that these problems are not connected to the usability of the underlying platforms that were considered by the vast majority of students (Q10: 92.7%) as easy to use. Finally, an interesting observation is that nearly half the students (14 out of the 31 – 45%) that do not consider online courses to be of the same quality with face-to-face courses are first year students. In other words, one third of - first year students (14 out of 41 students – 34%) clearly prefer face-to face courses.

Since the study was carried out at an Informatics Department, many courses contain labs in addition to lectures, while several courses are exclusively based on labs. In a typical lab course students carry out assignments in a desktop personal computer either in person or in pairs using one or more software packages, while the instructor presents various use cases with the software and guides students during problem solving using a computer and a projector. In some cases lab assistants or the instructor help students deal with various problems by inspecting their computer and explaining them personally what their error is and how they will solve it. It is clear that a synchronous online lab is much more demanding both for instructors and students. When it comes to students, they have to use their own infrastructure, setup and configure the necessary software and use their own screen

both for watching the instructor and carrying out assignments using one or more software packages. In the case of not having two screens or at least a wide screen, this is rather difficult and tiring. So, it was not surprising that than one third of the students disagree (15.5%) or totally disagree (19.1%) that the quality of online lab courses is equivalent to that of face-to-face lab courses (Table 3: Q7), while another one fourth of them (26.4%) is neutral. Half of the students (52%) that do not agree that online labs are of the same quality with face-to-face labs stated that face problems with the quality of their Internet connection or/and participating in the lab using synchronous online learning platforms. As was the case with lectures these problems do not refer to the usability of the platforms. The problems highlighted by students in the relevant open type question will be analyzed in detail in a subsequent section. Finally, an interesting observation is that nearly half the students (18 out of the 38 – 47%) that do not consider online lab courses to be of the same quality with face-to-face lab courses are first year students. Consequently, even more first year students (18 out of 41 students – 44%) clearly prefer face-to-face lab courses, since the same percentage for lectures is 34%.

Since the participants of the study comprised of both undergraduate (64.5%) and postgraduate students (35.5%), their responses in the questions that refer to the quality of online and face-to-face courses were further analyzed. As shown in Figure 1, although both undergraduate (median 4) and postgraduate students (median 4) evaluate positively the quality of synchronous online courses, their perceptions regarding the quality equivalence of the two types of courses differ. Specifically, undergraduate students agree that online courses (median 4) and labs (median 4) are of equal quality with face-to-face courses, while postgraduate students are divided (median both for online courses and labs: 3). One problem faced by one third of undergraduate (31%) and postgraduate students (33%) is problems with Internet connection (Q14). Moreover, nearly half the postgraduate students (44%) faced problems in attending courses with at least one of the two online learning platforms used (Zoom, Google meet), while less than one fifth (17%) of undergraduate students reported such problems (Q12, Q13). Specific problems were reported and will be analyzed in the context of the open type question on the negative aspects of online courses (Q18).

**Figure 1** Perceived quality of synchronous online courses (mean value)
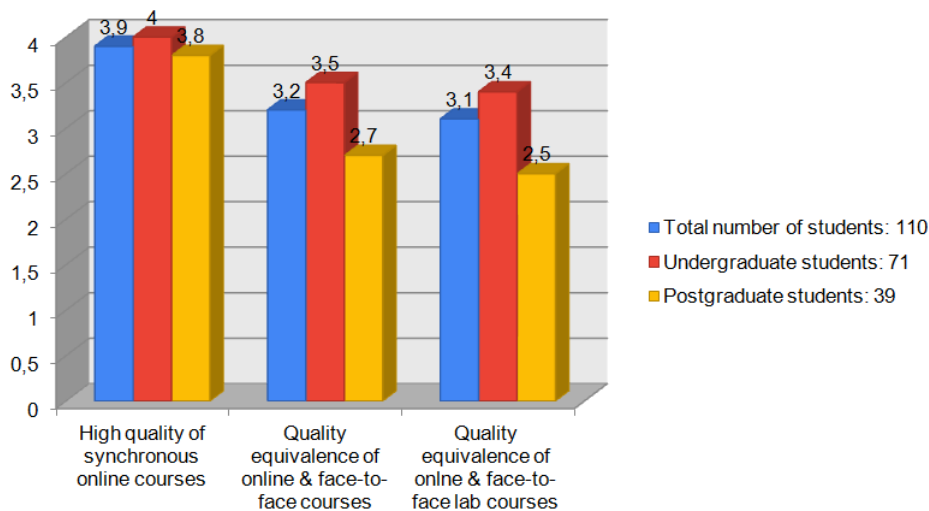
When it comes to the organization and presentation of synchronous online courses, students agree that it is flawless (median 4) and at a high degree equivalent to that of face-to-face courses. Specifically, more than 3 out

of 4 students agree (48.2%) or totally agree (30%) that the organization and presentation of synchronous online courses is flawless (Table 3: Q8), and 3 out of five students consider it to be of equivalent quality to that of face-to-face courses (Table 3: Q9).

As shown in Figure 2, undergraduate students are more positive than postgraduate students regarding the organization and presentation of synchronous online courses and its quality equivalence with face-to-face courses. However, the differences are not as big as those concerning the questions that are relevant to the quality of the courses per se (Figure 2).

Figure 2 Perceived organization and presentation of courses (mean value)
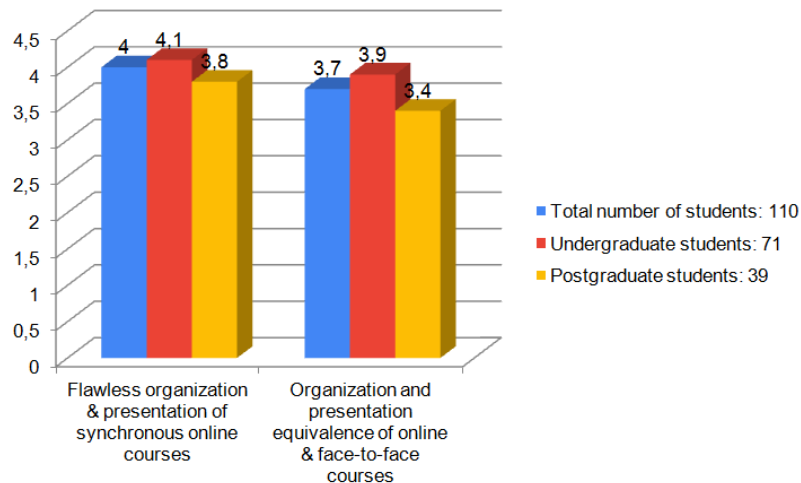
4.2 Online learning platforms

As already mentioned the University of Macedonia utilizes two asynchronous online learning platforms, which students considered important for supporting and carrying out courses (median 5) as shown in Table 4. The results were also positive regarding the platforms of Google meet and Zoom that were utilized for carrying out the synchronous online courses.

Table 4 Results regarding online platforms

Question	Mean	Std	Median	Totally disagree	Disagree	Neither disagree nor agree	Agree	Totally agree
Q10. Using synchronous online learning platforms (Google Meet, Zoom) is easy	4.6	0.7	5	0.9% (1)	0.9% (1)	5.5% (6)	21.8% (24)	70.9% (78)
Q11. Using asynchronous online learning platforms (CoMPUs, eClass) is important for supporting and carrying out courses (sharing educational material, assigning & submitting assignments etc.)	4.7	0.7	5	0.9% (1)	1.8% (2)	3.6% (4)	16.4% (18)	77.3% (85)

In Table 5 students' responses on the closed type questions regarding course attendance with the online learning platforms are presented. Nearly one out of three students stated that faced problems with their Internet connection (Q14). Moreover, 12.7% of students stated that faced problems during course attendance with Google meet and nearly twice as many (24.5%) with Zoom. Various problems, not directly connected with the

online learning platforms, were reported in the relevant open type question (Q18) and will be presented in section 4.5.

Table 5 Results regarding problems with online learning platforms

Question	Yes	No	I don't use it
Q12. I faced problems during course attendance with Zoom	24.5% (27)	73.6% (81)	1.8% (2)
Q13. I faced problems during course attendance with Google meet	12.7% (14)	82.7% (91)	4.5% (5)
Q14. I face problems with my Internet connection	31.8% (35)	68.2% (75)	

4.3 Instructors' performance in synchronous online learning courses

In Table 6 students' responses on the instructors' overall performance in synchronous online courses and the degree that it is equivalent with their performance in face-to-face courses are presented.

Table 6 Results regarding instructors overall performance

Question	Mean	Std	Median	Totally disagree	Disagree	Neither disagree nor agree	Agree	Totally agree
Q15. Instructors overall performance in synchronous online courses is good	4.2	0.8	4	0.9% (1)	1.8% (2)	12.7% (14)	48.2% (53)	36.4% (40)
Q16. Instructors overall performance in synchronous online courses is equivalent that of face to face courses	3.9	1	4	1.8% (2)	8.2% (9)	18.2% (20)	40% (44)	31.8% (35)

Generally, students agree that the instructors' performance in online courses is good and equivalent to that of face-to-face courses (median 4). The corresponding percentages are 84.6% regarding the performance in online courses (Table 6: Q15) and 71.8% for its equivalence with face-to-face courses (Table 6: Q16).

In Figure 3 the results on instructors' performance are presented separately for undergraduate and postgraduate students. The majority of the instructors in the undergraduate and postgraduate programmes are the same and their overall performance in online courses was uniformly evaluated by all students. A small difference was recorded regarding the equivalence of performance in online and face-to-face courses with undergraduate students being once again more positive.

Figure 3 Perceived instructors' overall performance (mean value)
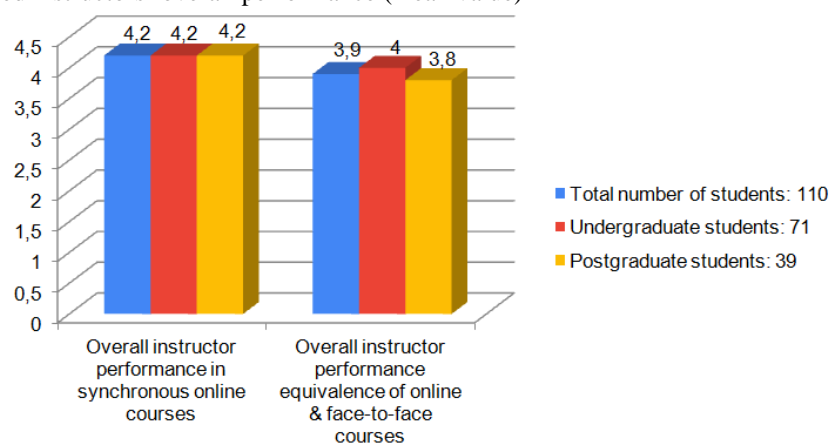
4.4 Positive aspects of online learning

In Table 7 students' responses in the open-type question on the positive aspects of synchronous online courses as experienced during the COVID-19 lockdown are summarized.

Seventy four percent of the students answered this question and the three most prominent positive aspects of online learning according to them are:

- There is *no need for transportation*, which is not easy for Universities located in big cities with lots of traffic.

- As a consequence of the previous fact students *save time*. Moreover, students can exploit more effectively the time between courses.

- *Attending classes from the comfort of their homes* is also considered important by students.

Table 7 Positive aspects of synchronous online courses (Q17)

Code	Positive aspect	Frequency	Percentage out of 110 participants	Percentage out of 81 participants that reported positive aspects
T7-1	No need for transportation	30	27%	37%
T7-2	Saving time	19	17%	23%
T7-3	Attending classes from the comfort of my home	17	15%	21%
T7-4	Guaranteed seat in the class/lab	13	12%	16%
T7-5	Reduced cost	7	6%	9%
T7-6	There is no noise in the class	6	5%	7%
T7-7	Opens new perspectives in education	6	5%	7%
T7-8	Offers possibilities for asynchronous attendance	4	4%	5%
T7-9	Watching a lecture is easier	2	2%	2%
	No answer	29	26%	

Besides the aforementioned widely known advantages of distance education, as well as the *reduced cost* (transportation costs, living costs), students noticed that they were glad that had a *guaranteed seat in classes and labs* which is a major problem in overcrowded institutions with limited building facilities (Giovanella, 2020). Some students stated that distance education "*opens new perspectives in education*" to use their own words, such as "*possibilities for asynchronous attendance*" in the case that lectures are recorded and made available to students.

4.5. Negative aspects of online learning

In Table 8 students' responses in the open-type question on the negative aspects of synchronous online courses as experienced during the COVID-19 lockdown are summarized.

Sixty nine percent of the students answered this question and their responses were analyzed using content analysis. The major negative aspects, or else problems, that were reported by students were grouped in the following main categories:

- Infrastructure and technical problems

- Interaction and communication

- Concentration - flow of the course

- Readiness of instructors for synchronous online courses

Specific problems reported by students under each one of these categories are presented in the following paragraphs using excerpts of students' responses (translated from Greek). It is clear that these categories are not independent and several interrelations exist. Several students reported problems falling in more than one of the aforementioned categories.

Table 8 Negative aspects of synchronous online courses (Q18)

Code	Negative aspect	Frequency	Percentage out of 110 participants	Percentage out of 76 participants that reported negative aspects
T8-1	Problems with Internet connection	18	16%	24%
T8-2	The immediacy and ease of communication of face-to-face education is lost	15	14%	20%
T8-3	Lack of infrastructure – technical problems	12	11%	16%
T8-4	Face-to-face labs are more comprehensible	9	8%	12%
T8-5	Some instructors are not accustomed to distance education	8	7%	11%
T8-6	Courses are more tiring – more difficult to concentrate	6	5%	8%
T8-7	Lack of socialization	4	4%	5%
T8-8	Lack of whiteboard	4	4%	5%
T8-9	Some students use their microphones or use the chat tool without reason and distract the instructor and students	2	2%	3%
T8-10	Decreased participation of students in the course	2	2%	3%
T8-11	There is no disadvantage	3	3%	4%
	No answer	34		31%

4.5.1 Infrastructure & technical problems

Having the appropriate infrastructure and a stable Internet connection is a prerequisite for the seamless attendance of online courses. Problems with Internet access affect the quality of online learning and the motivation for applying it (Bean, et al., 2019; Sinha & Bagarukayo, 2019), and was referenced by students as one of the major challenges in a study carried out during the COVID-19 pandemic by Adarkwah (2020).

Having *problems with the Internet connection* (T8-1: 18 students) was the most frequent problem referenced by students in our study. We would like to remind that nearly one third of students stated that had problems with the quality of their Internet connection (Q14). As students stated "*when the Internet connection is lost I attend the course with gaps*" and this makes it "*difficult to follow the flow of the course*", while sometimes it is even "*impossible to attend the course*". During the lockdown imposed by the COVID-19 pandemic several students moved back to their family homes and as a result students, their brothers and sisters also attending online school or University courses, as well as their parents working from home had to share the same Internet connection, which in some areas is problematic. The problem seems to be even more severe for some students. As one of the students mentioned "*Unfortunately, based on communication with classmates, it turned out that there are some students that do not have access to a computer or an Internet connection and as a consequence attending lectures is not possible. Free education has to take care of all students and especially the most vulnerable ones*". Several students mentioned as a solution to this problem recording lectures and labs and making them available, which however raises concerns due to the General Data Protection Regulation (GDPR) that is applicable since the 25th of May 2018 across all member states in Europe.

Lack of infrastructure and/or technical problems (T8-3) was mentioned by 12 students. In some cases the problems are trivial, such as "*lack of a microphone*" and could be solved if it weren't for the extreme situations we experienced due to the pandemic lockdown. What is worse is that some students stated that do not have a computer or "*in the same house there are more than one students and just one computer making the attendance of lectures difficult when they are carried out at the same time. The solution of the mobile phone is not good, because objectively speaking you cannot watch the lecture appropriately*". The lack of a computer is quite unexpected for a student studying Informatics, but as mentioned "*some students have a desktop computer and did not manage to take it with them when returning to their parents' home*". Of course no one imagined what would follow when the Universities suspended the courses due to the pandemic at the first place. Another problem lies in the fact that "*for lab courses a big size screen or a second one is necessary*" which of course is not always available.

4.5.2 Interaction & communication

The educational process requires interaction between teachers and students in order to be effective. According to students *the immediacy and ease of communication of face-to-face education is lost* in online courses (T8-2: 15 students). "*In face to face education there is immediacy and easy communication*", while in online learning some students "*find it difficult to make questions*". "*Several questions and problems that would be a matter of a few seconds in a face to face course, now require too much time and as an effect the quantitative and qualitative duration of the course is reduced!!*" and this is even more severe in lab courses. Another student mentioned that "*lectures are tedious and there should be more interaction of teachers and students*". Moreover, as one of the students stated "*face to face contact with teachers and colleagues is lost, and in my opinion it is important and it cultivates academic and communicational skills as well*".

There is definitely "*less interaction between teacher – student*" in online courses and what is also important is that "*there is no socialization and interpersonal communication*" as mentioned by students (T8-7: 4 students). All these result in the *decreased participation of students in online courses* (T8-10: 2 students).

The lack of interaction and intercommunication between lecturers and students was perceived to be poor in the study by Adarkwah (2020) as well, with a negative impact on the effectiveness of the course during the pandemic lockdown.

4.5.3 Concentration – flow of the course

The decreased interaction and communication may also be a reason for making *online courses more tiring and difficult for students to concentrate* (T8-6: 6 students). In online courses "*attention is easily lost*" and one reason for this is the fact that "*there are more distractions during the course (Internet, music etc.)*". Some students seem to become tired earlier during online courses in comparison with face-to-face courses. One student mentioned that there is a problem in courses that are too theoretical, but the problem is more severe in online lab courses. *Face-to-face labs are more comprehensible* according to some students (T8-4: 9 students). The following statement by one of the students summarizes one of the most common problems with online labs: "*Many times lab courses become incomprehensible and more difficult because it is hard to follow the instructor from home, since I have to constantly change screens. On the contrary, at the University we watch the course on the projector screen and the flow of the lesson is smoother for the students but also for the instructor*".

4.5.4 Readiness of instructors for synchronous online courses

As already mentioned students evaluated positively the overall performance of instructors in synchronous online courses in the context of Q15 (see Table 5) and at a high degree analogous to their performance in face-to-face courses. However, in the context of the open-type question Q18, some students commented on the readiness of some instructors for synchronous distance education courses (T8-5: 8 students). Students mentioned that "*some instructors have not adjusted their teaching to distance education*" and one of them states in addition that "*this results in the negative stance of some of the instructors that affects the level of the course*". As one of the students stated "*maybe a more specialized training of instructors on distance education is needed",* which is of course important but could not be realized on the emergency of the covid-19 pandemic.

4.5.5 Students' concerns about their studies

Although this survey took place during the second month of the COVID-19 lockdown, Q19 on students' concerns about their studies was not connected somehow with the specific period in students' studies.

One issue that was raised by both undergraduate (30%) and postgraduate (21%) students referred to the final exams of the spring semester. Specifically, students raised questions such as:

"Will the exams be realized?"

"In what way will the exams be realized?"

"When will the exams take place?"

Another issue that was raised by 18% of postgraduate students and just 3% of undergraduate students refers to the quality of studies:

"Will the continuation of online learning affect the quality of studies?"

This is definitely an important concern that disserves to be further researched.

5 Limitations

The study presented in this article was carried out during the second month of the lockdown due to the COVID-19 pandemic with the participation of 110 undergraduate and postgraduate students from an Applied Informatics department. It is clear that the participation of more students would have provided more reliable results. However, we must note that the qualitative analysis of the data collected from open type questions is time consuming and it would be difficult to be carried out with a larger sample. Another limitation of the study lies in the fact that all the participants were studying Informatics, which means that they were expected to have the available infrastructure (laptop or desktop computer, Internet access), as well as a positive attitude and a good knowledge towards the use of technology. The same is true about the instructors as well. It is quite certain that the results might be different with students from other fields and this requires further research.

6 Discussion and conclusions

The study presented in this article aimed to investigate undergraduate and postgraduate students' perceptions on the emergent transition from face-to-face to online learning with the aim of preventing the spread of the COVID-19 pandemic. Although this transition was implemented just in a few days and was mainly based on the hard work of the instructors and the cooperation of students, the outcomes were rather positive and provide several implications for researchers and practitioners. In alignment with the results of the study by Giovannella

(2020), this study also confirms that a large part of Higher education students has a positive attitude towards online learning, although they miss features of face-to-face learning.

The students agree that the synchronous online courses are of high quality, and are perfectly organized and presented. Moreover, students totally agree that the asynchronous online platforms support the learning process. However, students are divided as to whether online courses and labs are of equivalent quality with face-to-face courses and labs. Especially labs are more difficult to attend online and require infrastructure (such as a second screen) and a good quality Internet access that cannot be taken for granted (Adarkwah, 2020; Almaiah, Al-Khasawneh, Althunibat, 2020). Moreover, the immediacy and ease of face-to-face communication and interaction is considered by several students to be lost (Adarkwah, 2020) and this hampers mainly online labs. A direct implication of the aforementioned results is that instructors or even Higher education institutions should be more flexible with specific learning requirements and student responsibilities (Hodges et al., 2020), and this is even more important for the case of online labs. Appropriately adjusting the educational material of a lab course, providing more support through asynchronous discussion forums, finding ways to motivate students to more actively participate in online labs, extra lab hours for discussing students' difficulties are just some ideas for achieving a better learning experience.

Online platforms for synchronous and asynchronous learning were positively evaluated by students and no quality issues were raised (Almaiah, Al-Khasawneh, & Althunibat, 2020). Specifically, students totally agree that the platforms (Google meet and Zoom) utilized for synchronous online learning are easy to use, while the asynchronous online learning platforms support the courses. Besides this, some students reported that faced problems during course attendance with Zoom and at a smaller degree with Google meet, but as it turned out in the open-type question on negative aspects (Q17) of online learning the problems recorded were not directly connected with the online platforms. This is certainly a topic that should be further studied in subsequent studies.

When it comes to the instructors the students agree that their overall performance on online courses is good and moreover it is equivalent to that of face-to-face courses. However, a few students believe that some instructors are not accustomed to online teaching and/or have not adjusted their teaching strategies. Of course this is not surprising since there was practically no time for the transition from face-to-face to online teaching. At this point we have to note that the reluctance to adopt online learning or low self-efficacy recorded in the literature (Flavell et al., 2019; Solangi, Shahrani, & Pandhiani, 2018) were not confirmed in our study, but the result might be different for instructors of another knowledge area than Computer Science. In any case it is clear that fostering a digital pedagogy (Giovanella, 2020) and educating instructors, no matter what the level of education is, on the effective application of online teaching is important.

Concluding, it turned out that both undergraduate and postgraduate students viewed positively the transition from face-to-face to online learning, but at the same time they highlighted aspects of the educational process that are far more effective in a face-to-face context. Proposing and empirically investigating ways for dealing with troublesome aspects of online learning is important for delivering more effectively online courses. Finally, an interesting finding of this study was the indication that postgraduate students seem to be much more thoughtful than undergraduate students for the degree that the quality of online courses and even more online labs can be considered equivalent to the quality of face-to-face courses and labs. Since, we were not able to locate any study with postgraduate students carried out in the COVID-19 era and the sample of our study was

not that big to generalize results, this finding should be further researched. We consider this important since at the time of writing this article several educational institutions worldwide are partially open (UNESCO, 2020a) and have to make informed decisions as to who should be given priority for face-to-face courses (i.e. freshmen, undergraduate or postgraduate students).

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