Possible Changes in Academic Teaching as a Consequence of the COVID-19 Pandemic: International Findings and a Case Study from Croatia

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Abstract. *After the first lockdown at universities in March and April 2020 due to the onset of the COVID-19 pandemic numerous studies have been conducted to investigate the effects of the pandemic circumstances on teaching and learning at higher education institutions (HEIs), as well as on their students and teachers. This paper briefly outlines the results of international studies that were performed during the pandemic, as well as some findings from surveys performed at the national level in Croatia, and at the level of one HEI in Croatia. The main focus of this paper is on students' satisfaction with online and hybrid instruction, their evaluation of various replacements for on-site (face to face) teaching, their preference for on-site, online and hybrid (partly on-site, partly online) teaching, the obstacles/barriers to online teaching, as well as on its advantages during the COVID-19 pandemic. An empirical pilot study was performed with students enrolled in two university courses (N=70) that investigated in more detail the effects of hybrid instruction on students' satisfaction, preferences for online content delivery, flexibility in course attendance (on-site vs. online), and possible reasons for students' inclination toward online teaching and learning. The main finding of the pilot study was that students' preference for online delivery of instruction during the COVID-19 pandemic may have been predominantly grounded on practical and pragmatic reasons.*

Keywords. distance education, e-learning, COVID-19 pandemic, hybrid learning, flexible learning, pilot study, survey

1 Introduction

It was in the period from mid-March to April 1st, 2020 that most countries in the world imposed a national lockdown due to the onset of the COVID-19 pandemic of the SARS-CoV-2 virus, including school closures, as can be seen from the interactive chart map for April 1st, 2020 that is presented in *Figure 1* (source: Our World in Data, 2022; for more popular reminders of the first closure/lockdown period, see BBC, 2020; DW, 2020). According to the United Nations report published in August 2020 (UN, 2020), the COVID-19 pandemic "has caused the largest disruption of education in history", primarily because by mid-April 2020 as many as 94 per cent of learners in 200 countries worldwide were affected, including approximately 1.58 billion children and youth from pre-primary to higher education.
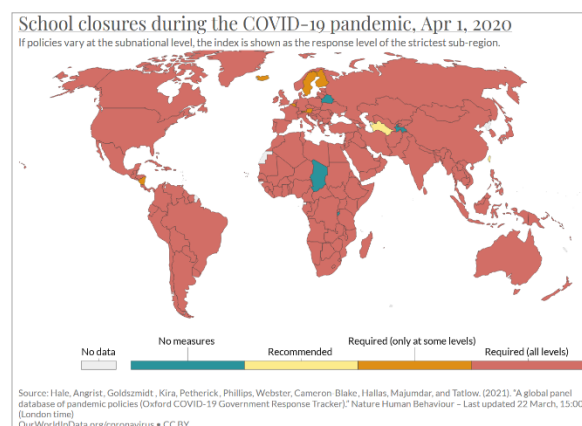

Figure 1. A global map of school closures during the COVID-19 pandemic on April 1st 2020

Shortly after the onset of the COVID-19 pandemic the expression "emergency remote teaching" became widespread in the education community to describe the sudden shift to fully online teaching and learning. In one of the most cited scholarly articles on e-learning (published on March 27th, 2020 in the *EDUCAUSE Review* and mentioned in more than 4000 publications by mid-June 2022 (according to *Google Scholar*), Hodges et al. (2020) state that "emergency remote teaching (ERT) is a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances".

Bond et al. (2021) conducted a review of 282 primary empirical studies published between January 2020 and October 2020 on how teachers, students and academic institutions adapted to delivery of education in fully remote and online formats during the summer semester of the 2019/2020 academic year. They found that most of the research papers in that period were focused on (a) the experiences of students during the pandemic, (b) quality of online teaching and learning, (c) support to students by use of digital technology and (d) assessment issues.

Another review study was performed by Stewart (2021) that included 38 studies specifically about *emergency remote teaching* (ERT) that were published in the same period from January 2020 to October 2020. This review study was more focused on ERT and indicated that the major related empirical research themes in that period were (a) the diverse ERT experiences, (b) digital divide and vast educational / socioeconomic inequalities, (c) commonly experienced ERT problems, and (d) frequently performed adjustments in response to ERT.

1.1 Large-scale surveys at the beginning and during the COVID-19 pandemic

Several large-scale surveys were performed in Europe, USA and globally in the period after the onset of the COVID-19 pandemic and during the summer semester of the 2019/2020 academic year. A study conducted in 41 European country (Doolan et al., 2021) found that 93% of the surveyed higher education students (N=9,180) had their on-site (face-to-face) classes cancelled before or during the survey period. At that time, most of the substitutions for on-site teaching were online real time video lecturing (74.61%), delivering of lecturers' presentations to students (44.51%), asynchronous online video recordings of the lectures (32.10%) and asynchronous online audio recordings of the lecturer (20.58%). In USA, a survey was conducted among students who attended nine public research universities (Chirikov et al., 2020). One specific question in this survey asked the students how well they had adapted to remote instruction. As many as 49.7% (total N=22,974) of undergraduate students responded with *"Well"* and *"Very well"* to this question, and the same responses were given by 66.6% (total N=12,214) of graduate and professional students. Another report at an earlier phase of this survey performed at five universities in the USA (Soria et al., 2020) revealed that the most important obstacles to transitioning to online learning for graduate / professional (N=7,690) and undergraduate (N=22,519) students were (a) lack of motivation for online learning, (b) lack of interaction with other students, (c) inability to learn effectively in an online format, (d) distracting home environments or lack of access to appropriate study spaces, as well as (e) course content that was not appropriate for online delivery.

A very large global survey (Aristovnik et al., 2020) performed in the period from May 5th until June 15th, 2020 among higher education students from 6 continents and 62 countries (final sample N=30,383) revealed that 86.7% of students experienced cancellation of onsite classes before or during the survey because of the COVID-19 pandemic. The findings of this survey were that onsite teaching was primarily substituted with online lecturing in the form of (a) real-time video conferencing, (b) sending of lecturers' presentations to students and (c) asynchronous video recordings of teaching.

A more recent review study on the responses of education institutions at the beginning and in the later phases of the COVID-19 pandemic (Anthony & Noel, 2021) indicated that educational institutions have benefited from their adaptation to the emergency remote teaching (ERT) situation and adoption of virtual learning (VL). The findings of this study suggested that the institutions were adopting platforms like Zoom, Google Classroom and Microsoft Teams, as well as specialized e-learning platforms like Moodle and Blackboard. It can be concluded that the crisis related to the COVID-19 pandemic has accelerated a more widespread acceptance of such platforms.

From the beginning of the COVID-19 pandemic the American Council on Education (ACE) has repeatedly performed "Puls Point Surveys" with a brief set of standard questions to collect data from college and university leaders about the actions, insights and opinions regarding decisions and challenges that were faced by their higher education institutions (HEIs) due to the COVID-19 pandemic. In fact, eight survey reports were published by ACE in the period from April 2020 to October 2021. In the latest Fall 2021 survey (Melidona et al., 2021), which was performed about 19 months after the first lockdown, the respondents were 230 presidents of private, public and for-profit HEIs. In this survey, interesting responses were given regarding the mode of instruction that best described what their institution would be offering at the beginning of the 2021 fall semester. It was planned that (a) "predominantly in-person, with some online instruction" would be delivered by 59% of HEIs, (b) "exclusively in-person" instruction would be offered by 21% of HEIs, (c) "predominantly online, with some in-person instruction" by 17% of HEIs, and (d) "exclusively online instruction" was planned by 4% of HEIs. When compared to previous ACE surveys for Fall 2020 and Fall 2019 (Turk et al., 2020), a gradual shift back to more dominant in-person instruction and less dominant online instruction can be observed (see *Figure 2*).

Interestingly, even though 80% of the surveyed presidents in the Fall 2021 survey reported that their HEIs planned "predominantly in-person, with some online instruction" or "exclusively in-person" instruction, as many as 90% of them also stated that their institution had a contingency plan that would enable a transition to online teaching and learning if the pandemic conditions worsened.

The *Connected Student Report* (Anft, 2021) surveyed 1,128 students and 1,076 staff from 10 countries (USA and Australia, as well as 8 countries from Europe). This study was conducted in the period from February 18th to March 25th, 2021. Among the most interesting findings of this survey was that (a) campus officials plan to increase institutional efficiency with the use of digital technology and that (b) a large percentage of students (40% of them)

consider having more *flexible* learning options as an important policy their institutions could adopt to increase the level of students' wellbeing. This study also found that 43% of global respondents preferred hybrid courses, in comparison to 21% of them who preferred taking all of their classes online. The study also found that 50% of respondents expected their courses to be online at the end of the pandemic.
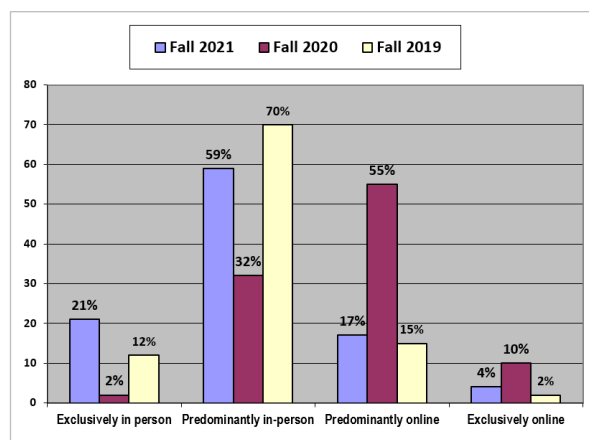

Figure 2. Planned modes of instruction for 1999, 2000 and 2021 fall terms according to ACE surveys (source: Melidona et al. 2021; Turk et al., 2020)

1.2 Motivation for our study

The first aim of the empirical study that is presented in our paper is to *collect and present representative research results of other authors* on the impact of the COVID-19 pandemic on various aspects of teaching and learning at HEIs. Those aspects were predominantly related to student satisfaction regarding online learning during the pandemic, as well as to obstacles/barriers to and advantages of that mode of instruction, and their preference for diverse modes of teaching and learning (fully on-site, hybrid, or fully online) during the pandemic. The second aim was to perform an empirical *pilot study* among students at one higher education institution in Croatia to investigate their interest in (a) on-site, (b) partly on-site and partly online, (c) fully online, and (d) flexible learning options, after the students have experienced more than two years of variable formats of delivery of teaching (fully online, partly online and partly on-site, fully on-site) since the beginning of the COVID-19 pandemic and first lockdown of Croatian HEIs in March 2020. Furthermore, perceived problems/obstacles and advantages of online learning were also in the focus of interest of our pilot study. It is hoped that the findings of our study will contribute to adaptive changes at HEIs to make those institutions more resilient to challenges during the forthcoming waves of the COVID-19 pandemic, as well as more flexible in meeting the actual and future expectations of students after they have gained experience with diverse teaching modes and acquired greater competence for online learning. Finally, additional importance of our study is

associated with the demand for teleworking at HEIs, which is more widespread among education professionals than before the pandemic, as well as with the fact that digital "ecosystems" are being accepted and further advanced at primary, secondary and tertiary level of education.

Before presenting the results of the empirical part of our study, it must be noted that there are some limitations to our pilot study. First, the sample of respondents (students) that were included in our survey was rather small (N=70). Second, only students enrolled in two courses at the same higher education institution were included in our convenience sample which makes our *pilot study* close to the term *case study*. Finally, the results of our survey are at least partly reflective of a certain period during the COVID-19 pandemic, i.e. of the attributes of the higher education environment in Croatia during the summer semester of the 2021/2022 academic year when most of the teaching was performed fully online or in hybrid form (as a combination of online and on-site instruction).

2 Theoretical background

Most of the large-scale international and national survey studies related to the effects of the COVID-19 pandemic on higher education that are briefly reviewed in this paper (e.g.: Doolan et al., 2021; Aristovnik et al., 2020; Anft, 2021; Bezjak et al., 2020; Đorđević et al., 2021) were not designed according to a specific theoretical or pedagogical model. However, in these studies it was possible to apply concepts like *blended learning* and *hybrid learning* that are associated with distance education in general and, more specifically, e-learning.

It must be noted that during the COVID-19 pandemic higher education institutions were first closed and then reopened for *on-site* teaching or some *combination of on-site and online* instruction was utilized according to varying epidemiological measures. In the early phases of the COVID-19 pandemic, the previously discussed (in the *Introduction*) concept of *Emergency Remote Teaching* (Hodges, 2020) gained much popularity amongst researchers who were investigating the effects of the pandemic on teaching at HEIs. The terms *flexible learning* and *HyFlex* (for a practical example see Kelly, 2020) were much less used in academic literature in relation to the response of HEIs and their teachers to the COVID-19 pandemic, but they are still addressed in the continuation of our paper.

2.1 Blended learning

Even though the use of the *blended learning* concept in research on educational technology has received certain critique (most recently by Cronje, 2020), it was extensively utilized at the time of the COVID-19

pandemic, mostly in a plethora of papers reporting empirical research findings related to education in various fields like physics (Rizaldi et al., 2021), medicine (Bolatov et al., 2022) and sports science (Finlay et al., 2022), as well as in analytical work to provide recommendation during the pandemic circumstances (see: Kumar et al., 2021; Singh et al., 2021).

It must be emphasized that numerous studies have been performed to investigate the possible advantages of *blended learning* in comparison to *traditional teaching* that have yielded mixed results. For instance, the findings of a recent meta-analysis performed by Müller & Mildenberger (2021) were inconclusive on this issue. As a contrast, it must also be mentioned that a recent *systematic review of systematic reviews* on blended learning (Ashraf et al., 2021) revealed that most blended learning studies were based on students as subjects and discussed blended learning as a generic construct. Furthermore, the results of this study revealed that students' self-regulation toward learning, satisfaction and engagement, as well as academic performance were the most frequently mentioned positive effects of introducing blended learning. A review regarding online and blended learning in schools (from primary to higher) after the onset of the COVID-19 pandemic was recently conducted by Topping et al. (2022). The findings were that, in general, use of digital technology was better in comparison to regular instruction in 85% of studies, but that blended learning was also better than fully online learning, with computer-assisted instruction (CAI) as the most effective approach.

Various definitions of *blended learning* can be found in literature, but the most general view is that blended learning refers to teaching courses both on-site in the classroom (face to face) and online (remotely) with a possibility to combine various pedagogical strategies. Some scholarly papers that address the *blended learning pedagogical approach* imply the notion of blended learning as the use of *face to face* teaching and learning, on the one side, and *online* teaching and learning with the use of specific technology, on the other side, being *optimally combined* or *integrated* to maximize their conjoint benefits. Still, it must be noted that in the most recent COVID-19-related literature the term *blended learning* is predominantly used exclusively to denote teaching that combines on-site and online instructional activities within a single course. One example of a specific use of blended learning in the discipline of *Computer-Aided Language Learning* (CALL) at one HEI in Croatia was well described in a paper by Seljan et al. (2006).

2.2 Hybrid learning

The term *hybrid learning* has traditionally been used as a synonym for *blended learning*. This terminological equivalence is still relevant for most scholarly authors (see Eyal & Gill, 2022) even though taxonomies have

been used to discern between the two (see Margulieux at al., 2016). However, more recently some other attributes have been added to the concept of *hybrid learning* in scholarly papers, especially after the onset of the COVID-19 pandemic: (1) at least half of the attendance to instruction has to be online, (2) the teaching in the classroom is broadcast in parallel online and students can choose between attending the instruction *on-site* in the classroom or *remotely* from home via synchronous videoconferencing. When discussing *hybrid learning* the notion of an "optimal blend" or a "combination of best of both worlds" (face to face and online) is less frequently mentioned than when the term *blended learning* is concerned.

3 Research problems and goals

The COVID-19 pandemic has forced higher education institutions (HEIs), students and their instructors to adapt to distant teaching and learning modes, technologies and models. The impacts of these changes on higher education (HE) have been extensively tracked and interpreted. In this paper the selected effects of the pandemic on HE are being reviewed having in mind the *research of other authors* and they are also investigated in an empirical *pilot study* performed at one HEI in Croatia. Therefore, the goals of our study were to (1) identify the effects of the COVID-19 pandemic on students' preferences for particular teaching modes, as well as to (2) determine their satisfaction with teaching that was delivered online at the beginning and later into the pandemic. Furthermore, the goals were to (3) identify the most frequent potential barriers/obstacles to online instruction, and also (4) the perceived advantages of online teaching and learning. Finally, the goals were also to (5) assess students' preferences for flexible learning, in other words, for greater choice of modality of attendance to instruction (on-site vs. online), as well as to (6) examine the potential benefits of online instruction that were not frequently mentioned in literature but which could further support the introduction of flexible learning.

According to the previously mentioned goals, the following research questions were defined for the empirical *pilot study*:

RQ1: What are the preferences for specific modes of instruction and their combinations (on-site, online, hybrid, synchronous, asynchronous) of the students included in our pilot study?

RQ2: How satisfied were the students in our pilot study with hybrid and fully online instruction, respectively?

RQ3: What are the most frequent problems (obstacles/barriers) to online teaching that can be identified in our pilot study, as well as those that were observed by other researchers during the pandemic?

RQ4: What are the greatest potential advantages of online teaching that can be identified in our pilot study,

as well as those that were observed by other researchers during the pandemic?

RQ5: What is the preference for flexible learning in possible continuation of the pandemic (or the post-pandemic period) among the students in our pilot study?

RQ6: Are there some other potential advantages of online instruction which are rarely mentioned in literature but can provide additional explanation of the students' preference for online instruction in our pilot study?

4 Methodology

In our study a combination of a brief literature review and an *empirical pilot study* is used to investigate and illustrate some of the effects of the COVID-19 pandemic on teaching at the higher education level. Also, in the continuation of this paper some of the results of our *pilot study* are discussed in comparison to similar findings of other researchers.

4.1 Data collection instrument

For our pilot study a paper-and-pencil survey was developed with the following thematic sections:

- general evaluation of teaching in a specific course;
- evaluation of online instruction in the course;
- comparison of on-site with online teaching;
- problems and advantages of online instruction;
- evaluation of synchronous vs. asynchronous instruction;
- preferences for various teaching modes and ratios of on-site and online instruction;
- preferences regarding the characteristics of the video image of the teacher during synchronous videoconferencing.

4.2 Respondents and data collection

In our pilot study a convenience sample was used that consisted of 70 students enrolled in two different university courses in the summer semester of the 2021/2022 academic year. There were 23 male and 47 female subjects in this convenience sample and they were between 19 and 24 years of age. Among them, 28 were enrolled in an *undergraduate* course related to computer-mediated communication and were in their 2nd study year, and the other 42 students were enrolled in a *graduate* course related to leadership that is delivered in the 1st study year. All of the students in our pilot study had experienced at least 2 years of teaching and learning in their tertiary education during the COVID-19 pandemic before the survey was conducted. Also, all of them had satisfactory ICT equipment and necessary skills to participate in online instruction.

The data were collected with a paper-and-pencil survey at the end of the summer semester of the 2021/2022 academic year. Students' participation in the survey was anonymous and on a voluntary basis. The survey was approved by the *Ethics Committee* of their higher education institution.

4.3 The educational context of our pilot study

It must be noted that most of the students in higher education in Croatia have experienced a variety of situations from the beginning of the COVID-19 pandemic until the end of the summer semester of the 2021/2022 academic year. As was presented at the beginning of our paper (in *Introduction*), at the beginning of the pandemic there was a lockdown of classes at academic institutions in Croatia for a period of 2-3 months. This was followed with periods of partly on-site and partly online (hybrid) teaching, as well as fully on-site teaching according to the epidemiological conditions at a certain point in time during the pandemic, which was mostly associated with the pandemic "waves". Therefore, the experiences of students who participated in our pilot study during the pandemic led us to define research questions from RQ1 to RQ4. However, RQ5 addresses *flexible teaching and learning* and a specific modification was therefore introduced for our pilot study in the delivery formats of lectures in two university courses that the respondents in the survey were enrolled in. This was done in form of a *parallel delivery* of all lectures (1) on-site in the classroom at college, as well as (2) online as synchronous videoconferencing via Zoom and, post festum, (3) as pre-recordings of the delivered lectures that were made available to the students online two weeks before mid-term exams. In fact, the students were able to freely choose on a weekly basis between attending a certain lecture on-site in the classroom, or online as a Zoom videoconference. Furthermore, for both courses two lectures during the semester were delivered exclusively as *asynchronous* pre-recorded voice over PowerPoint video webcasts. By contrast, less than 1/2 of the practical instruction in form of seminars or laboratory exercises were performed in parallel on-site and online, or as an asynchronous activity. In other words, more than 50% of the aforementioned practical types of instructional activities were delivered on-site in a college classroom/laboratory.

Finally, for both courses a Moodle learning management system was used with course material and links to Zoom web conferencing synchronous broadcast of on-site lectures, as well as asynchronous pre-recorded video webcasts of the lectures on equal topics. When the seminars and laboratory exercises were performed parallelly on-site in the classroom and online the link to BigBlueButton videoconferencing system was provided in Moodle.

4.4 Other unpublished survey results that were included in our study

The Agency for Higher Education in Croatia presented online the results of their two national surveys conducted during the COVID-19 pandemic that have not been published in scholarly papers (Bezjak et al., 2020; Đorđević et al., 2021). Some of the results of these surveys are presented and interpreted in parts of this paper. Also, several of their survey questions were repeated in our pilot study with slightly modified wording.

The other source of previously unpublished data in our study was the survey implemented by the higher education institution (University of Zagreb, 2022) at which our pilot study was also performed that has been repeatedly conducted in the second half of the winter semesters of 2020/2021 and 2021/2022 academic year.

5 Results and discussion

5.1 Students' preferences for various teaching modes

To investigate which mode of teaching delivery was most preferred by the students (N=70) in our pilot study, the following question was asked in the survey *"Which mode of teaching in this course do you prefer (choose only one of the answers)?"* Students' responses are presented in *Figure 3*. According to the data presented in *Figure 3*, most of the students (39%) stated that they preferred *hybrid teaching with synchronous online lecturing and seminars or laboratory exercises performed on-site in the classroom*. Interestingly, the second most frequent choice was *fully online teaching and predominantly synchronous lecturing* (20%). Only about 1/6 of the students (17%) preferred all the teaching *being performed in the traditional on-site manner*. The least preferred modes of teaching were *fully online asynchronous teaching* (14%) and *hybrid (online lecturing and the rest on-site) with predominantly asynchronous lecturing* (10%).

When the data collected by the survey in our pilot study at the end of the summer semester of the 2021/2022 academic year is compared with the data collected earlier in the pandemic (freely accessible online survey data provided by: University of Zagreb, 2022), in the period from late November to the beginning of December 2021 for all the studies, years of study and courses at the same HEI in Croatia (with a total of 1,595 responses to an equal survey question as in our pilot study), there is a considerable difference since the main students' preference at the level of our HEI at that earlier time of data collection was for *fully online teaching and predominantly synchronous teaching* (56%). In comparison, preference for *hybrid teaching with synchronous online lecturing and other activities performed on-site* was at that time reported by only 16% of surveyed students. However, the

results of our survey conducted at the end of the summer semester of the 2021/2022 academic year are in greater correspondence to the results of a national survey in Croatia (Đorđević et al., 2021) performed at the beginning of September 2021 (N=4,273), which indicated that 29% of Croatian students would prefer *fully online teaching* in the forthcoming 2021/2022 academic year while 36% of them would prefer *a combination of online and on-site teaching*.
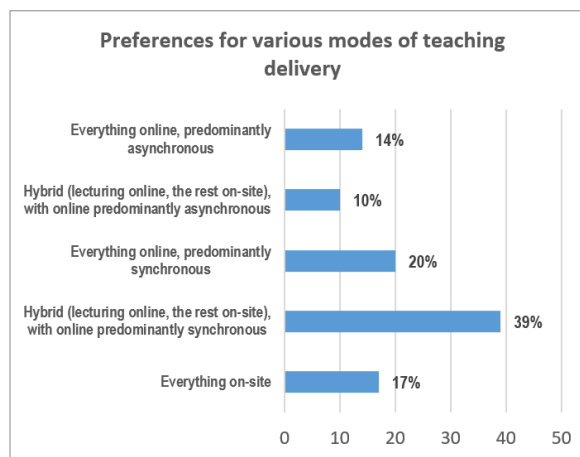

Figure 3. Students' preferences for various modes of teaching delivery in our pilot study (N=70)

5.2 Student satisfaction with online teaching

When the students in our pilot study (N=70) were asked *"To what degree are you satisfied with the performed <u>hybrid</u> mode of teaching in this course?"* as many as 64% responded with *"Totally satisfied"* and 29% with *"Mostly satisfied"* (see *Figure 4*).
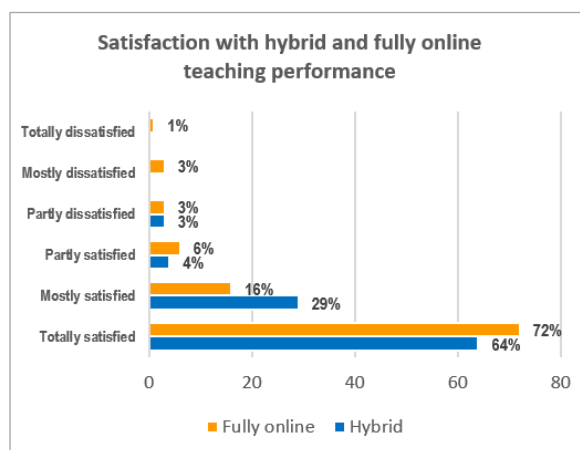

Figure 4. Students' satisfaction with hybrid and fully online teaching performance according to the survey in out pilot study (N=70)

Furthermore, as can also be seen in *Figure 4*, their responses to the question *"To what degree are you satisfied with the performed <u>online</u> part of teaching in this course?"* were also favourable, with 72% of the

subjects who chose the response *"Totally satisfied"* and 16% of them who chose the response *"Mostly satisfied"*. It must be noted that these findings of our pilot study at the level of two courses at the end of summer semester of the 2021/2022 academic year were considerably better for *hybrid teaching* and the *online part of teaching* when compared with responses to similar questions of the survey performed at the level of all courses of our HEI (N=427) in the winter semester (i.e. the previous semester) of the 2021/2022 academic year (freely accessible online survey data provided by: University of Zagreb, 2022).

The large-scale international survey performed for the European Students' Union (ESU) in 41 European countries (N=9,180) in the period from April 21st to May 3rd, 2020 (Doolan et al., 2020), as well as a more global survey performed on students from 62 countries (N=30,383) and conducted from May 5th until June 15th, 2020 (Aristovnik et al., 2020) both revealed a rather positive evaluation of organization of online lectures and specific types of online teaching like real-time video conferences and asynchronous video recordings. However, it must be emphasized that numerous other research papers were identified which revealed mixed results of surveys conducted in the corresponding period at a more specific level and with lesser number of participants. Actually, results of other studies were in the range from *dissatisfaction* of students with their online learning experiences (e.g. Maqableh & Alia, 2021), through *moderate satisfaction* with online teaching (e.g. Reed at al., 2022) and rather *high satisfaction* with online course delivery during the pandemic (e.g. Alturki et al., 2022).

The change of students' perception and evaluation of online teaching after the onset of the COVID-19 pandemic was well detected by the *two surveys* performed by the Agency for Science and Higher Education in Croatia. The *first* national survey (Bezjak et al., 2021), conducted immediately after the lockdown at Croatian HEIs in the period from June to July 2020 (N=1,114), revealed that (at the time of that survey) as many as 50% of the surveyed students evaluated online lectures as *"worse than before the quarantine"* or *"much worse than before the quarantine"*. However, the *second* national survey in Croatia (Đorđević et al., 2021) performed by the Agency for Science and Higher Education at the beginning of September 2021 (N=4,273) indicated that the satisfaction with online teaching had improved since at this later phase of the pandemic as many as 57% of the respondents stated that they were *"satisfied"* or *"very satisfied"* with the quality of *online lecturing* that they received at their HEI. Also, 43% of the respondents declared that they were *"satisfied"* or *"very satisfied"* with the quality of *practical and field work education*.

5.3 Perception of barriers/obstacles to online learning during the pandemic

Barriers to online learning have been investigated for more than two decades (for an example, see Fabry &

Higgs, 1997). Two most comprehensive reports on research on barriers to online learning perceived by students were co-authored by Muilenburg & Berge (2004; 2005). These authors identified as many as 45 potential student barriers that were grouped into the following 8 categories as a result of factor analysis: (1) administrative/instructor issues, (2) social interactions, (3) academic skills, (4) technical skills, (5) learner motivation, (6) time and support for study, (7) cost and access to the Internet, and (8) technical problems. However, despite numerous studies that investigated barriers to online learning during the pandemic performed by researchers worldwide, no recent review studies were found so far that were performed across diverse disciplines and addressed the pandemic period.

Let us mention again the large global study (Aristovnik et al., 2020; Aristovnik et al., 2021) that was performed immediately after the pandemic outbreak, with respondents from HEIs in 62 countries (N=30,383), which identified some possible challenges to students at the beginning of the COVID-19 pandemic. When the students in this study were asked to compare their workload before the on-site classes were cancelled due to the first lockdown during the COVID-19 pandemic, 42.6% of them reported that their workload had become larger or significantly larger with online instruction after the first lockdown. The share of students who reported the same workload was 26.6% and, interestingly, 30.8% of students reported that their study workload had become smaller or significantly smaller. According to this large-scale survey, adequate access to course study material (e.g. compulsory and recommended literature) was available to only 50% of respondents, a quiet place to study at home to 55% of them, and a good internet connection to 59%. Some students reported that they had at least some more difficulty staying focused during the online teaching in comparison to onsite teaching, and that their study performance had weakened since the onsite classes had been cancelled. Finally, the most prevailing negative emotions among students were boredom, frustration and anxiety. The authors of this study also warned that since students may face a lack of self-discipline while studying in isolation at home during the lockdown, the lecturers should be careful not to overload students with study materials and assignments.

A similar set of problems was reported in a study by Doolan et al. (2021) regarding students in European countries. This study revealed that common problems related to online learning after the onset of the pandemic were related to inadequate infrastructure for studying from home (not having a quiet place to study, poor internet connection, or poor access to study materials), not being able to have practical classes, lack of face-to-face interaction with teachers and colleagues, monotony of everyday life at home, lack of motivation and increased procrastination, difficulty to concentrate at home and distractions from family members, challenges of studying on their own without the possibility to immediately clarify open questions that emerge during instruction with teachers, and

difficulty with learning complex subject matter in an online environment.

A more specific focus on obstacles to online learning at the beginning of the COVID-19 pandemic was made in a survey performed in the USA by Soria et al. (2020). As mentioned earlier, according to their findings, the most frequent obstacles reported by undergraduate (N=22,519) and graduate and professional students (N=7,690), ordered by their frequency, were: lack of motivation for online learning, lack of interaction with other students, inability to learn effectively in an online format, distracting home environments or lack of access to appropriate study spaces, course content that is not appropriate for online learning, lack of clear expectations for online learning from instructor(s). A separate report from their survey (Chirikov et al., 2020) revealed an increase in the prevalence of major depressive disorder and generalized anxiety disorder after the beginning of the pandemic in 2020 (in comparison to the pre-pandemic 2019). It must be emphasized that the prevalence of those mental health problems was higher among students who did not adapt well to remote instruction.

The Agency for Science and Higher Education of Croatia (Bezjak et al., 2020) performed a survey among Croatian higher education students at the national level in June and July 2020 (N=1114). The findings of this survey revealed that 56% of respondents perceived a higher or much higher work load than before the quarantine and 51% stated that their motivation for performing student's obligations was *lesser* or *much lesser* than before the quarantine.

In our *pilot study* (N=70) conducted at the end of the summer semester of the 2021/2022 academic year the students in two courses were asked *what they considered as greatest problems in online teaching of those courses*. In *Figure 5* their responses are presented in percentages in comparison to the results of the institutional survey at the same HEI (N=640) that was performed in the winter semester of the 2021/2022 academic year (University of Zagreb, 2022), in which an almost identical question was included regarding *problems in online teaching at that institution* in general. The students had to select up to 3 perceived problems from a predefined list of responses. As can be observed from the data presented in *Figure 5*, after five semesters of experience with fully online and hybrid teaching during the pandemic, the most frequently perceived problems in online teaching were associated with the *aggravated communication with the teacher* and *need for equipment for teaching and learning*. Other problems were related to online teaching *being boring* or *not adapted for online delivery*, as well as with *no instruction previously provided to students regarding how to learn in the online environment*. From the data displayed in *Figure 5* it can be concluded that specific problems in online teaching in two subsequent semesters were identified with similar percentages of responses from the students in our survey (N=70) as from the participants in the institutional survey (N=640) performed at the same HEI in the previous semester.
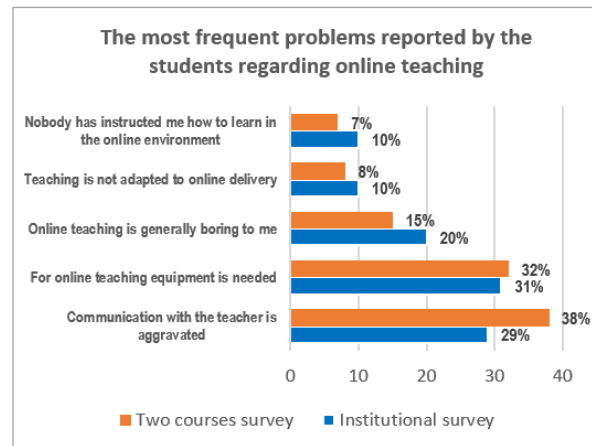

Figure 5. The most frequent problems in online teaching reported by the students at the level of two courses in our pilot study (N=70) and at the institutional level for all courses and all study years (N=640)

5.4 Advantages of online teaching and learning during the pandemic

A systematic review of literature by Saikat et al. (2021) revealed several potential benefits of mobile learning during the COVID-19 pandemic: it (1) enables learning despite social distancing measures, (2) helps in preventing the spread of COVID-19, (3) allows learners and educators to continue the education process from any location, (4) saves time because students do not have to commute to campus for lectures, (5) makes the lessons and class materials available online and offline via a variety of platforms, (6) enables a large number students to attend a course at the same time while attendance in offline courses is limited by the number of seats in the lecture room, (7) reduces cost of utilities and transportation costs, etc.

A survey study performed by Muthuprasad et al. (2021) identified some other benefits of online learning during the pandemic: (1) flexible schedule, (2) opportunity to study at one's own pace and time of convenience, (3) more comfortable environment, (4) enhancement of technical skills of learners, and (5) greater ability to concentrate. Similar findings regarding IT students were made in a survey by Akuratiya & Meddage (2021) in which respondents agreed with the following characteristics of online learning: the ability to learn at one's own pace (63.8%), comfortable surrounding (53%), and online learning being fun / enjoyable (50.7%). An extensive list of benefits of online classes was identified in a study by Li (2022): creating a digital community where students can post questions and inquires, and share materials; enhancing students' familiarity with digital learning technologies and allowing access to further learning materials; making students feel connected with others during the pandemic and creating a sense of community; offering an escape from daily pressures and reduced exposure to the massive amount of

negative news; flexibility, convenience, and more control over the learning process; strengthening self-learning skills and self-discipline; bridging the education gap and enabling continuity during the pandemic; enabling watching playbacks and repeated access to recorded materials.

Several benefits of online learning during the COVID-19 pandemic were also identified in a national survey in Croatia (the sample consisted of 4,273 higher education students) conducted in September 2021 by the Agency for Science and Higher Education (Bezjak et al., 2020). For instance, as many as 60% of the respondents in this survey stated that because of online teaching they had saved on their travel expenses and 56% of respondents stated that during the 2020/2021 academic year they had an opportunity to better organize their time (percentages represent joint responses *"Totally agree"* and *"Mostly agree"* for each of the two questions).

The results of the survey in our pilot study regarding the advantages of online teaching of specific courses (N=70) are presented in *Figure 6*. The greatest advantages were (a) that the students did not have to come to the college but were able to do everything from home, (b) the students were able to manage the process of learning by themselves, and (c) the students were able to choose the time to learn.

Again, similar responses were collected from the students in the institutional survey at the same HEI (N=640) that was performed in the period from November 29th to December 8th, 2021 (University of Zagreb, 2021) with the same three greatest advantages identified.
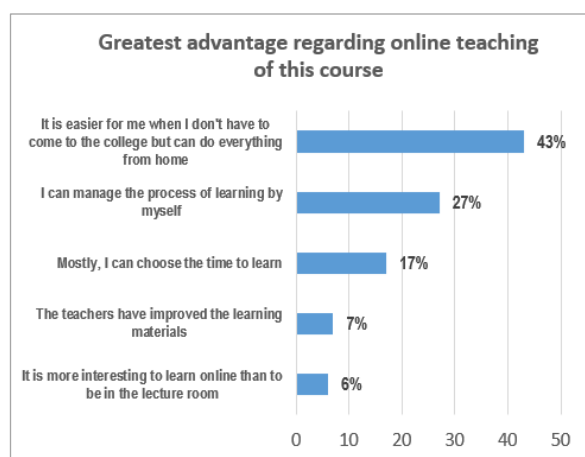

Figure 6. Greatest advantage of online teaching that was perceived by the students in our survey (N=70)

5.5 Preference for flexible learning in possible continuation of the pandemic (or the post-pandemic period)

In an exploratory study aimed at predicting educational approaches and practices in the post-pandemic world, Singh et al. (2021) recognized *flexibility of learning* as one of the important topics emphasized by teachers,

students, university administrators and instructional designers. The assumptions were that online learning environments should be *flexible and adaptable*, with greater students' opportunity to manage their own time, as well as with the faculty offering *hybrid* and *blended* options that better fit students' learning styles. In fact, due to the COVID-19 pandemic, there has been an *increasing interest in the expectations of students regarding flexible learning* and how to manage the factors which facilitate the implementation of flexible learning at the level of individual courses and education institutions (see Reginaldo and Ching, 2021).

Even before the COVID-19 pandemic, researchers identified *flexibility* and consideration of unique life situations of students, with the possibility of learning at one's own pace, as an important component of a university learning environment (for an example, see Valtonen et al., 2021). It must be mentioned that the interesting concept of *"HyFlex"*, introduced by Beatty (2007), has been gaining popularity after the onset of the COVID-19 pandemic (for an example see Verrecchia & McGlinchey, 2021). According to Beatty, *HyFlex* is (1) <u>hybrid</u> because it combines online and face-to-face teaching and learning activities, and (2) <u>flexible</u> because students can choose to attend or not to attend face-to-face course sessions without negative effects on their learning. In other words, at any given week of the course the students can participate either in *face-to-face* sessions or in *online* activities, depending on what their needs and desires are in that week. Pressley (2022) elaborated the difference between *hybrid* learning and *HyFlex* by emphasizing that in the latter format the students can choose the way in which to participate in the course on a session-by-session basis. They can engage with the course material in a format that works best for them at any given time: (1) synchronously in-person, (2) synchronously online or (3) asynchronously online. Simply stated, in a single weekly session three students could each participate in the course in a different format. For a thorough example of an implementation of *HyFlex* during the pandemic regarding teaching of seminars see Detyna et al. (2022).

While investigating the students' preferences for returning to college during the COVID-19 pandemic, Steimle et al. (2022) revealed that the surveyed students expressed different levels of concern regarding the risk of infection due to participation in on-site (face to face) classes. There was also a difference among students regarding their preference for on-campus versus online classes in case of a possible COVID-19 outbreak during the current (or forthcoming) semester. This implies that the *flexible* approach could be the best instructors (or institutional) response regarding the diversity of related students' concerns and interests. Furthermore, the results of a national survey in Croatia (Đorđević et al., 2021) that were mentioned earlier in this paper, like the results of the survey from our pilot study that are presented in *Figure 3*, revealed the variety of students' interest regarding the mixture of instruction delivery formats, from (a) fully online and (b) different ratios of hybrid

(online versus on-site) teaching, to (c) fully on-site course attendance. Another survey (Bagarić et al. 2021) performed among students enrolled in 20 higher education institutions at the beginning of the COVID-19 pandemic in Croatia (N=249) revealed that "flexibility of work" was one of their most frequently mentioned positive personal experiences regarding online learning in that period.

To further investigate the students' interest for *flexibility in course delivery,* two related questions were included in the survey in our pilot study (N=70). In *Figure 7* the responses to the first survey question *("If you had been given a choice at the beginning of the summer semester of the 2021/2022 academic year, how would you have mostly preferred /provide an approximate estimate/ that the teaching in this course be delivered to you?")* are presented.
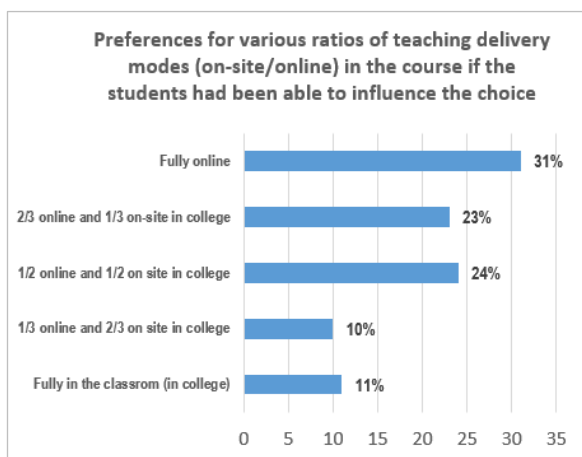
Figure 7. Most preferred ratio of on-site (in the classroom) and online teaching in the course in case the students had been given a choice at the beginning of the summer semester of the 2021/2022 academic year (N=70)

To examine the preferences of participants in our pilot study for more *flexibility* in their choice of mode of teaching, the following survey question was used: *"Do you believe that the teacher of this course should enable that in the future the students can independently choose to attend online teaching of this course instead of on-site teaching in college for any lecture or seminar / laboratory exercise in which they wish to do so?"* Even though the results of data analysis presented in *Figure 8* were derived from the responses of a relatively small convenience sample of students, it is interesting that as many as 76% of students (who responded with *"Certainly yes"* and *"Probably yes"* to the previous question) indicated that they would *prefer to have a choice between attending teaching on-site or online on a weekly basis*. Only 4% (who responded with *"Certainly not"* and *"Probably not"*) stated the opposite. These results should be observed as a possible trend in students' expectations in relation to the ongoing COVID-19 pandemic (and, perhaps, also the forthcoming *post-pandemic* period).
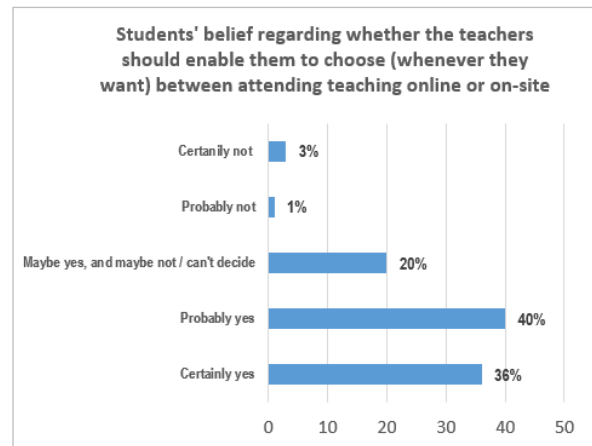
Figure 8. Percentage of students who believe that the teachers should give them the opportunity to choose to attend on-site or on-line teaching on a weekly basis (N=70)

However, it must be emphasized that, especially when a large number of students is enrolled in a specific course, enabling such flexibility to the students would require more time for the preparation of teaching materials and administrative work (i.e. grading of on-site and online assignments) from the instructor(s). In a popularly written article related to the use of *HyFle*x during the COVID-19 pandemic, Kelly (2020) lists the following possible negative aspects of *HyFlex*: fewer students participating in on-site lecturing; greater need for planning by teachers; more administrative work performed for tracking students who participate in different teaching modalities; greater difficulty with engaging students in asynchronous learning; more responsibility required from students for successful learning.

It is important to investigate if the *flexible approach* to teaching and learning results in *inferior learning outcomes* in comparison to *traditional on-site teaching*, as was done in one study during the COVID-19 pandemic by Verrecchia & McGlinchey (2021), and also in other studies conducted immediately before the pandemic (e.g. Feldhammer-Kahret al., 2021), or those performed even earlier (for a list of earlier studies see the review essay by Beatty, 2019).

5.6 Some additional advantages of online versus on-site teaching

It is unmistakable that in our pilot study most of the students preferred *fully online* delivery or *hybrid* delivery of instruction. As can be observed in the data presented in *Figure 7*, if the students had been given the opportunity to determine the preferred ratio of online and on-site teaching (in the classroom) at the beginning of the course they attended in the summer semester of the 2021/2022 academic year, the greatest percentage of students would have chosen fully online delivery (34% of students), followed by 1/2 online and 1/2 on-site delivery (24% of students), and 2/3 online

and 1/3 on-site delivery (23% of students). Also, according to the data presented in *Figure 4*, 88% of the students in our pilot study were *"mostly satisfied"* or *"fully satisfied"* with *fully online* teaching performance, and 93% of them were equally satisfied with *hybrid* teaching performance. Finally, the data displayed in *Figure 3* revealed that 59% of students in our pilot study stated that they preferred either (a) *hybrid* teaching with synchronous online lecturing and seminars or laboratory exercises performed on-site in the classroom, or (b) *fully online* teaching and predominantly synchronous lecturing.

A question arises as to what are the reasons for such preference for online or hybrid teaching, other than those presented in *Figure 6*: (a) the students do not have to come to the college but can do everything from home, (b) the students can manage the process of learning by themselves, and (c) the students can choose the time to learn. To investigate this issue in our pilot study several items that are not commonly found in related literature were also included in the survey. The first of such items was the evaluation of *"Strain and fatigue because of sitting at the desk in the classroom in college versus learning at home"*. The students had to choose one of the following responses: *"There is no advantage with online instruction"*, *"There is a minor advantage with online instruction"*, and *"There is great advantage with online instruction"*. The students' responses (N=70) are presented in *Figure 9*.

As can be concluded from the data displayed in *Figure 9*, most of the students (54%) stated that there was a *great advantage* of online instruction regarding their experience of strain and fatigue when sitting at the desk in the classroom during on-site lectures in college.
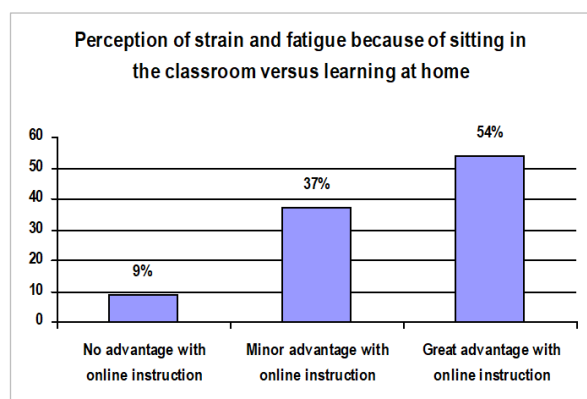

Figure 9. Evaluation of strain and fatigue because of sitting at the desk in the classroom in college versus learning at home (N=70)

The second item in our pilot study was associated with the evaluation of the *"possibility to avoid a feeling of hunger or thirst during lectures, seminars of laboratory exercises in college versus synchronous videoconferencing that is watched and listened to at home."* The students' responses (N=70) are presented in *Figure 10*. Clearly, online instruction, with students at home, is a means for avoiding students being hungry

or thirsty during their participation in the process of teaching and learning.

Finally, one more potential advantage of online instruction was investigated in our pilot study (N=70) with the use of a survey item related to *"visibility / sharpness of presentation on the projector screen in college versus the computer screen at home"*. In this case as many as 57% of the students responded with *"There is great advantage with online instruction"*. This means that the visibility of the teaching content is greater if the students use their home computers to attend videoconferencing lectures in comparison to them viewing the projection of teaching materials in lecture halls, classrooms and laboratories on-site in college.
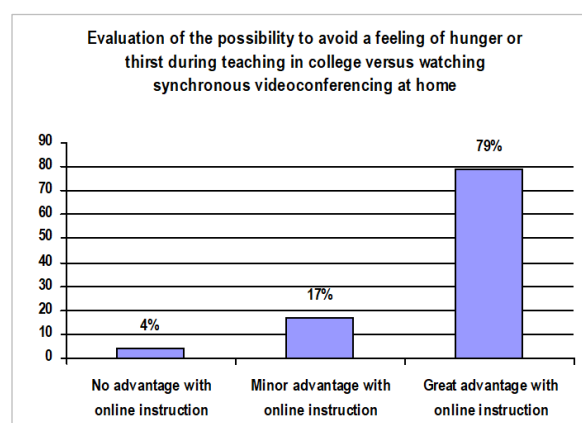

Figure 10. Students' evaluation of the possibility to avoid a feeling of hunger or thirst during teaching in college versus watching synchronous videoconferencing at home (N=70)

When the data presented in *Figure 9* and *Figure 10* are supplemented with those in *Figure 5*, it can be noticed that, according to our pilot study, *the students' perceptions of the <u>advantages</u> of online instruction can be to a considerable degree of <u>practical</u> and not of pedagogical nature*: they feel less strain related to sitting in the classroom, they can have a snack at home instead of feeling hungry in college, they do not have to travel to the college but can do everything from home, they can manage the process of learning by themselves, and can also choose the time to learn.

To briefly conclude the comparison of *on-site* (in the classroom) instruction with *online* instruction, we also emphasize that the analysis of students' responses to several other survey items in our pilot study indicated the following:

- Most of the students stated that it was *more interesting to them to attend online instruction* (71% of them *partly*, *mostly* or *fully agreed* with the corresponding statement).
- Most of the students *did <u>not</u> agree* that it was *easier for them to follow face to face teaching* of the course on-site in college (live) than online teaching (56% of them *partly*, *mostly* or *fully disagreed* with such a notion).

- Most of the students *did not agree* that with the *same amount of used time* during face to face teaching of the course on-site in college (live) they *learn more* than with the use of online synchronous teaching (i.e. with the use of videoconferencing lectures).

The previously listed findings of our pilot study contradict stereotyped assumptions that online learning (a) is less interesting, (b) more difficult to follow, and (c) uses more of students' time in comparison to on-site learning in the classroom. However, this is probably more applicable to *synchronous* teaching via videoconference than a*synchronous* learning activities.

Since *synchronous videoconferencing* was one of the most preferred forms of online delivery of instruction in our pilot study (see *Figure 3*), several additional survey items were devoted to the *use of the streaming of the video image of the instructor*. The students' responses to such survey items indicated that the synchronous projection of *voice over PowerPoint* slides with a *small* or *moderately large* video image of the instructor is on the average best evaluated. This is in concordance with the findings by Korving et al. (2016) that the *visibility of the lecturer* increased attention in web lectures and that the *size of the image* of the lecturer also had a positive effect on attention. Wermeskerken and van Gog (2017) also found that the instructor's face in video lecturing affected the attention in demonstration videos.

6 Conclusion

The COVID-19 pandemic has created the first and only opportunity so far to investigate a global replacement of traditional teaching with fully online and/or hybrid instruction at higher education institutions. As was documented in the Fall 2021 survey of the American Council on Education (Melidona et al., 2021), and is visible in the data displayed in *Figure 2*, by October 2021 the situation at HEIs in the USA appeared to be close to the pre-pandemic fall term of year 2019 in relation to the planned proportion of on-site versus online instruction. That means that the *optimal time frame* for in-depth investigations of massive transitions from traditional to fully online or hybrid instruction due to the pandemic may have elapsed. However, what remains in practical terms is the more advanced skills of teaching staff at HEIs to deliver online education, as well as greater competence and motivation of students to participate in and make use of online instruction delivery. For instance, a recent study by Kovacs et al. (2022) documented that the Austrian students' desired use of e-exams (e-assessment), audiovisual tools (audio, video and online tutorials) and interactive tools (Zoom, MS Teams) after the COVID-19 pandemic was greater in comparison to the self-reported intensity of their use of those media before the first lockdown in the COVID-19 pandemic. Furthermore, HEIs have upgraded their ICT infrastructure and procedures for more effective distance education and have increased their readiness to utilize various communication and collaboration tools in case of potential deterioration of the epidemiological situation.

In this paper we have outlined some of the important findings of other researchers regarding teaching at HEIs from the beginning of the COVID-19 pandemic to the period more than 2 years after it started to affect academic education. In the brief literature review and in our pilot study we have supported the popular claim that the COVID-19 pandemic has changed the average student's preferences toward hybrid and fully online teaching modes. In fact, according to most studies, the students' *satisfaction with teaching* that was delivered online was of acceptable level at the beginning of the COVID-19 pandemic and it even increased in later phases of the pandemic. Numerous studies, including our pilot study, have identified diverse *barriers (obstacles)* to online instruction as well as potential *advantages* of online teaching and learning. In our pilot study we have also determined considerable interest of students in *flexible learning* (i.e. in their greater choice of modality of attendance in instruction – on-site vs. online) and uncovered some potential benefits of online instruction that had not been frequently mentioned in literature.

In terms of a more specific response to the research questions (RQ1-RQ6), the following conclusions could be drawn from the previously presented results of our pilot study (N=70):

RQ1: As many as 78% of the students in our *pilot study* jointly stated that if they had a choice they would prefer one of the following instruction delivery modes: (a) fully online, (b) 2/3 online and 1/3 on-site or (c) 1/2 online and 1/2 on-site instruction. More specifically, the form of predominantly *synchronous* online instruction, that is (a) hybrid or (b) fully online, was preferred by 59% of the students in our pilot study.

RQ2: As many as 64% of the students in our *pilot study* were *"Totally satisfied"* or *"Mostly satisfied"* with *hybrid* part of instruction and 72% were equally satisfied with the *online* part of teaching.

RQ3: The most frequent problems (obstacles/barriers) to online teaching that were identified in our *pilot study* were *aggravated communication with the teacher, need for equipment for teaching and learning, online teaching being boring and teaching not being adapted for online delivery*. A more detailed list of barriers/obstacles can also be derived from large-scale international studies: lack of motivation for online learning, lack of interaction with teachers and other students, inability to learn effectively in an online format, difficulty to concentrate at home, distracting home environments or lack of access to appropriate study spaces, and course content that is not appropriate for online learning.

RQ4: The greatest potential advantages of online teaching that were identified in our *pilot study* were mostly of *practical nature* and included: no need to commute to college and possibility to do everything from home, possibility to manage the process of learning by the students themselves and more potential to choose the time to learn. Similar findings were also

most frequently mentioned in research performed by other authors. However, in our *pilot study* we also noticed that a substantial proportion of students identified several other potential *conveniences of online learning*: less strain or fatigue can be associated with online learning in comparison to sitting at a desk in the classroom; online learning from home implies that students can avoid feeling hunger or thirst while attending lectures; the visibility of the teaching content can be greater if the students use their home computers to attend videoconferencing lectures in comparison to viewing the image on the projector screen on-site in classrooms.

RQ5: The results of our *pilot study* indicate that in possible continuation of the pandemic (or the post-pandemic period) most of the students would probably prefer *flexible* teaching and learning that enables them to choose between (a) attending instruction on-site or (b) attending synchronous videoconferencing lecturing that is in parallel broadcasted online.

RQ6: The "common sense" additional findings obtained by the students in our *pilot study* (and previously discussed in relation to RQ4) include their perception of more strain or fatigue when sitting at a table in the classroom than in online learning from home, as well as of greater possibility of avoiding feeling hunger or thirst while attending lectures from home. Together with other identified advantages of online teaching and learning, such findings highlight the predominantly *practical* (or *convenience*) nature of most of the advantages of studying *fully online* or in a predominantly *hybrid* format that were identified in literature, as well as in our *pilot study*. However, these simple *utilitarian benefits* may in fact have a significant positive impact on the students' prevalent perception of and preference for *fully online* and *hybrid* instruction. In fact, saving *time* that would be otherwise spent on commuting between home and campus and also on waiting between traditional classes attended on-site at college is perhaps the greatest advantage of *fully online* or *hybrid* modality of delivering education. As a support to the notion that *time* is an issue in online versus traditional on-site instruction let us mention that Barbera et al. (2014) have tried to draw attention to the "paradox" of time in the implementation of technologically mediated pedagogy.

The term "paradox" has been used by researchers for various aspects of e-learning and one such "contradiction" can be located in occasional findings that the average students' satisfaction with online instruction may be in discord with the potential demand for more study time and increased effort in this type of instruction (in comparison to traditional teaching and learning). It is the opinion of the authors of this paper that this problem should be particularly dealt with in case of *asynchronous* teaching and learning. In the continuation of our research after this *pilot study* it would be opportune to address such issues in more depth with an advanced survey instrument, more sophisticated methodology and a greater number of subjects selected across diverse courses and higher education institutions.

To conclude (as was mention earlier in this paper), the findings of our study could contribute to greater *resilience* of HEIs in the continuation and after the COVID-19 pandemic, as well as to their *flexibility* in meeting expectations of students. In addition, our findings could motivate HEIs to responding to the growing interest for *telework* among education professionals, especially as *digital learning "ecosystems"* are advanced worldwide at the tertiary level of education.

7 Limitations of our study

The limitations of our *pilot study* are predominantly related to the number of respondents (N=70) and limited number of courses at only one HEI that were included in the survey. However, comparative results of statistical analyses from other surveys were presented in this paper wherever possible. Furthermore, some items in our survey were carefully articulated to better correspond to items from similar earlier studies performed by other researchers.

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