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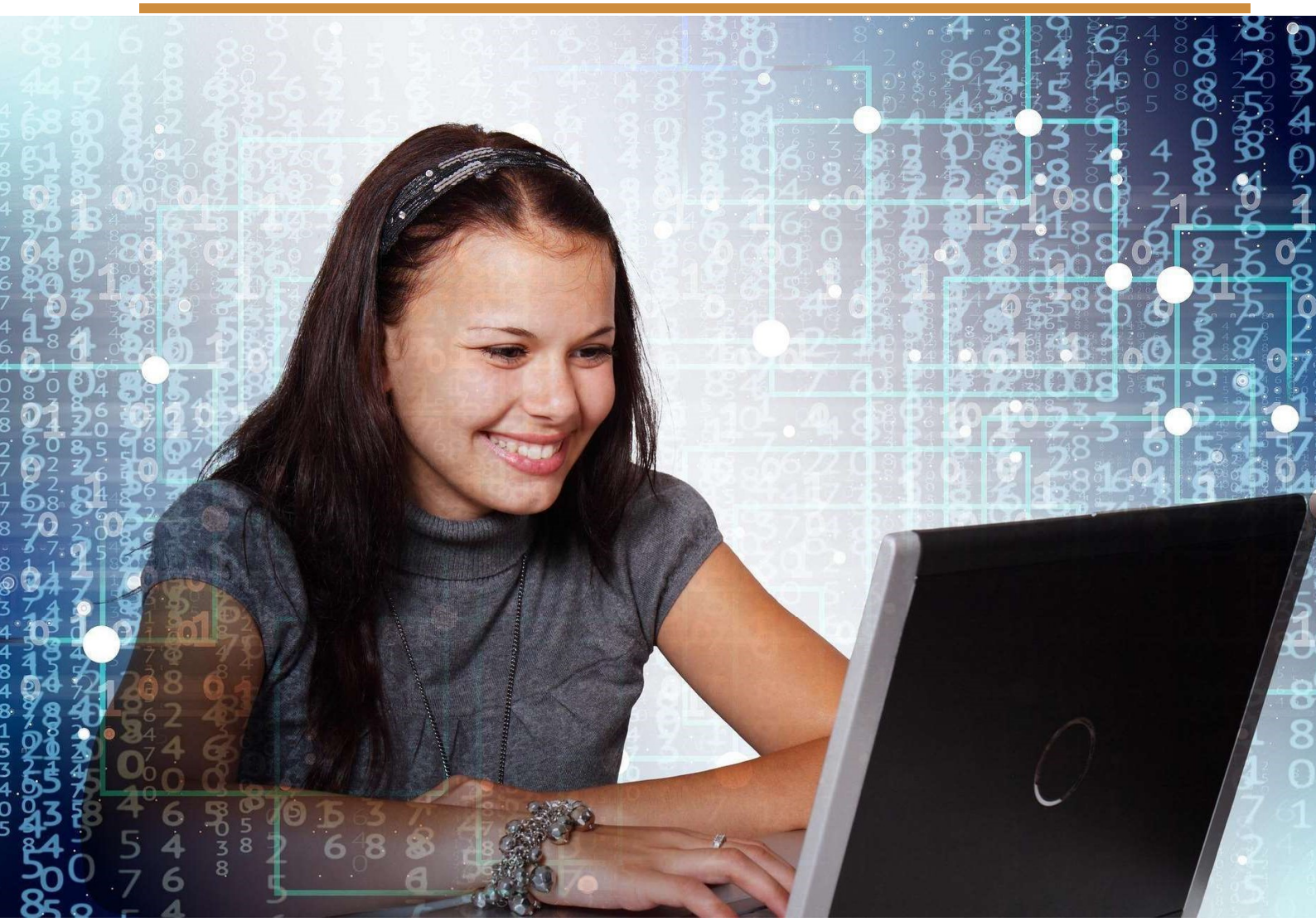

Local Partner Report on the Impact of COVID-19 on University Teaching

JANUARY 14, 2022

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University of Aveiro, Portugal

e-CLOSE

Contents

Introduction

The COVID-19 outbreak has had a significant impact on higher education all over the world. In Portugal, the pandemic situation was more relevant after March 2020, where the first lockdown was declared by the Portuguese government. In one week, the traditional face-to-face teaching and learning process was substituted by an emergency distance learning. Universities faced an enormous effort to adapt to online teaching and learning in a very short period.

The University of Aveiro (UA) identified Information and Communication Technology (ICT) tools that could be used to provide online education and has organised several workshops on new teaching and learning methodologies using innovative tools. UA made a great effort to identify all students who did not have a computer. For these students, the university lent a computer and provided internet access. A Reflection Scientific-Pedagogical Support Group was created to follow all the process and produce recommendations on distance assessment.

The teachers faced a giant challenge to adapt to a new way of teaching because almost all the teachers had no experience in online education. In fact, UA had very few online courses before the COVID-19 pandemic.

In one week, a new paradigm of education was implemented. Teachers made a remarkable effort to quickly transform their study programs to be taught online and to keep students motivated. The adjustment, however, came with significant challenges not only in relation to the technical aspects of handling simultaneously a large number of online sessions by the same videoconference platform, but also to the methodology of the teaching process and the teacher-student interaction. The technological development and wide availability of several ICT tools facilitated the shift to online education. The real challenge was to consciously choose available collaboration tools and engagement methods to raise students' interest and provoke a response for a more efficient and effective communication and learning experience while away from a traditional classroom. To face that challenge, the universities involved in the e-CLOSE project decided to join forces for the development, implementation and dissemination of innovative and comprehensive teaching and learning solutions, supported by advanced ICT technologies and tools, to increase the level of student-teacher interaction during online education.

The purpose of this report is to analyse activities performed during the period of COVID-19 pandemic related to the mass transition to online education, taking into account all the stages of the distance learning/teaching process.

General information on the survey

Objectives

The main objective is to conduct research in the area of distance education on Science, Technology, Engineering, and Mathematics (STEM) courses that was boosted by the COVID-19 pandemic due to the lockdown initiated in March 2020. More precisely, this study covers:

- the identification of challenges and good practices of methodologies and platforms used in asynchronous and synchronous interactive online STEM education;
- the development of innovative solutions that promote the increase of the interaction between teachers and students, as well as between students during distance learning, which reinforce the engagement and motivation of students and teachers.

In this study, we focus our attention on the following four phases of the teaching and learning process: preparation, delivery, assessment, and evaluation.

Means and time

This study is based on two online questionnaires, one to students and the other to teachers, both delivered by email sent by the Communication Services of the University of Aveiro.

The students' survey was at students' disposal from June 26th to July 9th and the teachers' survey was open for answers from October 19th to November 7th, 2021.

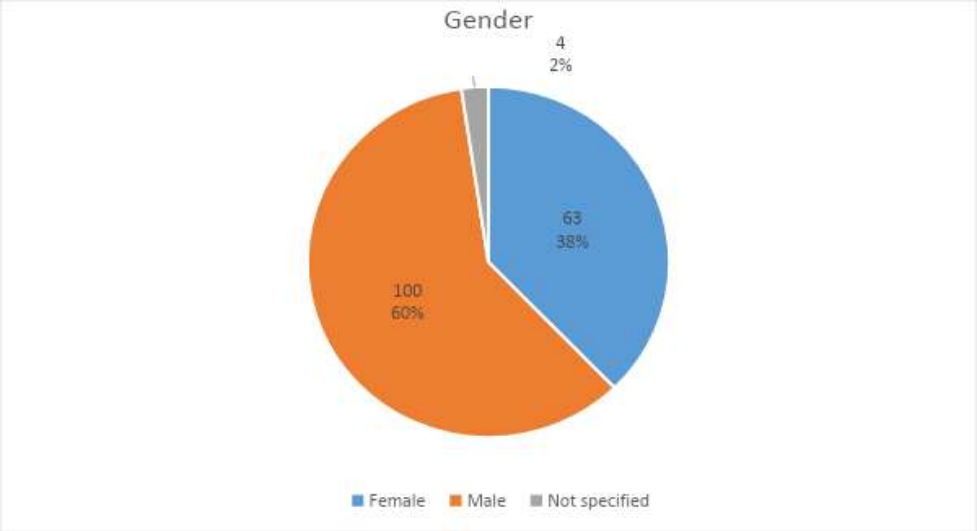
Respondents profile

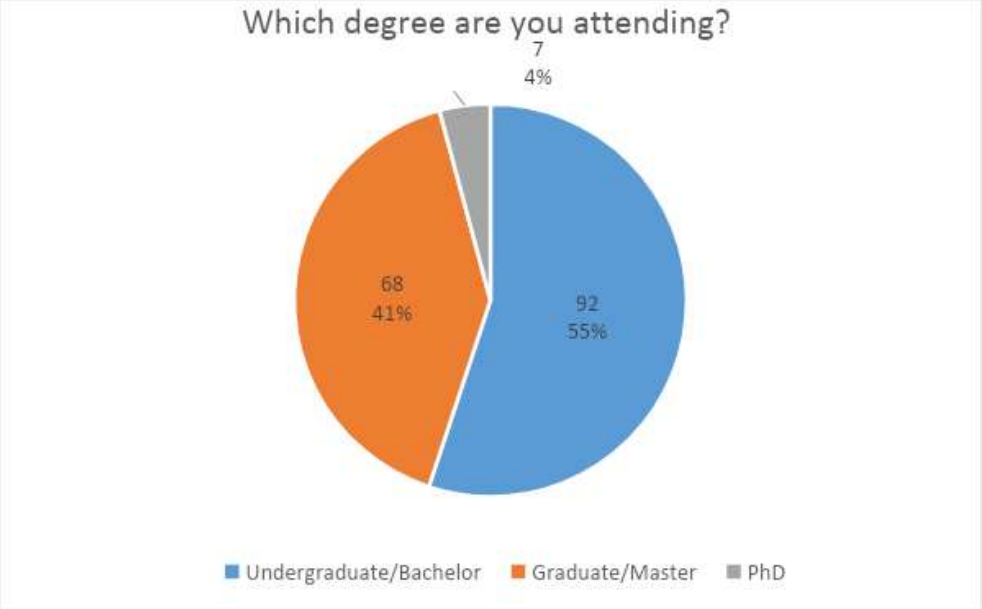
We begin this section with the profile of the students who answered the questionnaire.

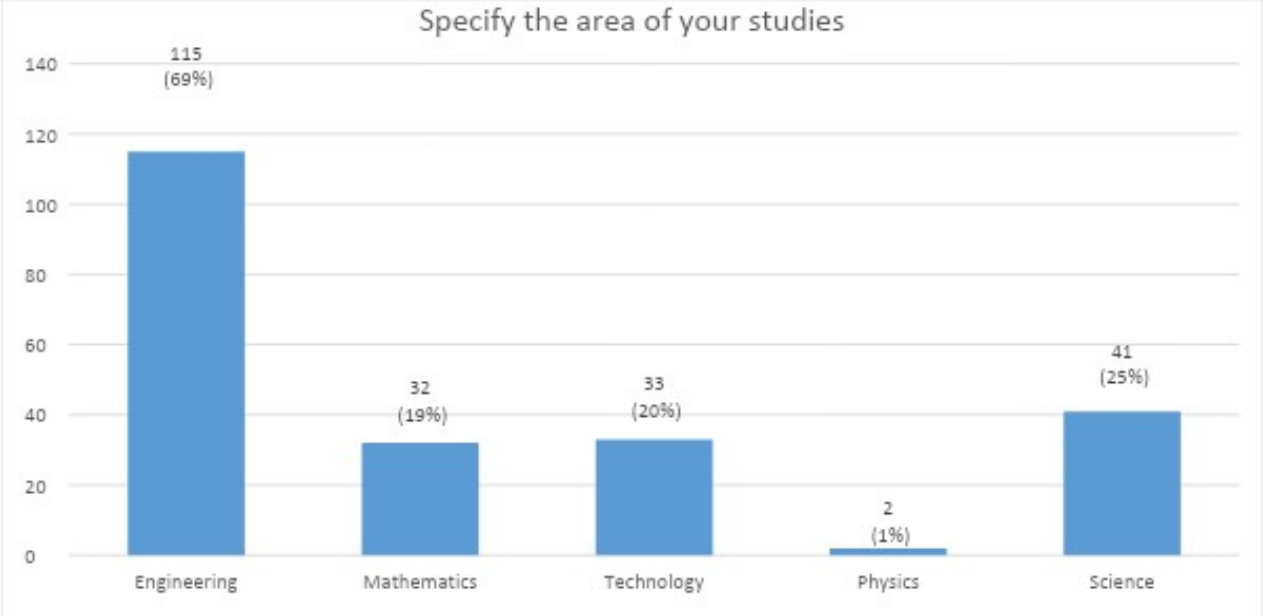
Students: Totally 172 answers have been received from the students of UA. From the survey results we decided to remove answers from study areas not directly related to STEM. The remaining 167 answers have been considered for further analysis.

From the 167 answers from STEM courses, 100 are male, 63 female, and 4 not specified. 55% are undergraduate/bachelor students, 41% are graduate/masters students, and 4% are doctoral

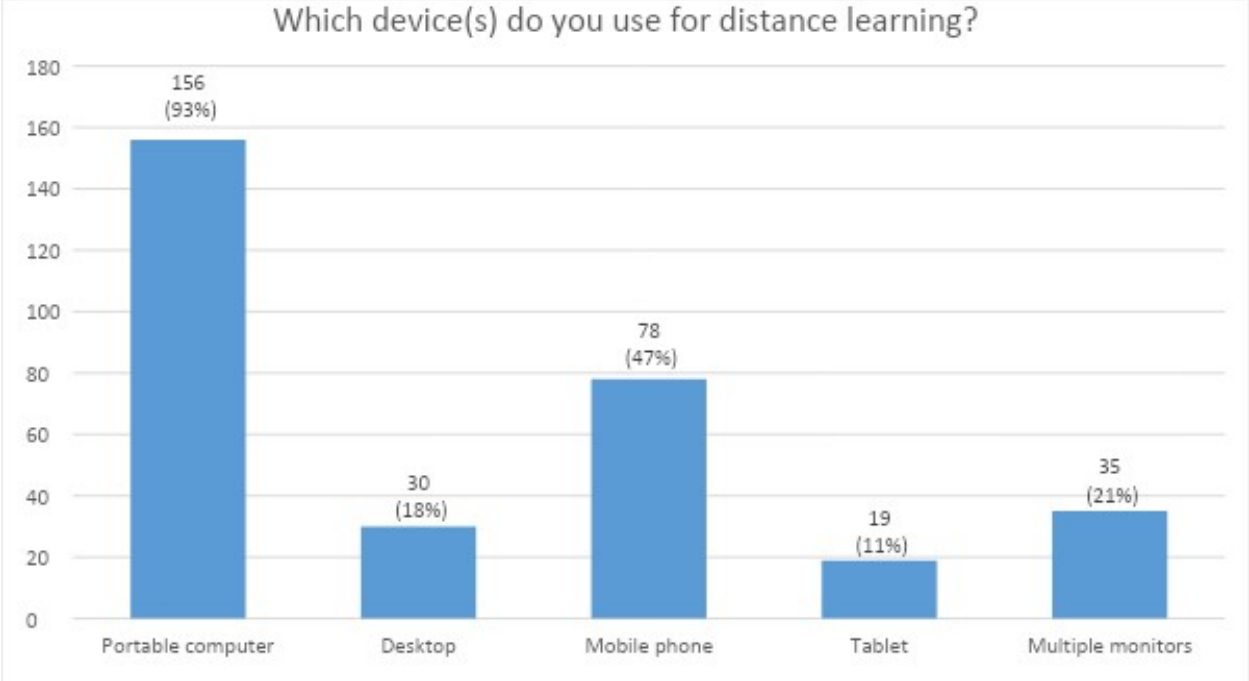
students. Concerning the areas of studies, 69% are Engineering students, 25% Science, 20% Technology, 19% Mathematics and 1% Physics.





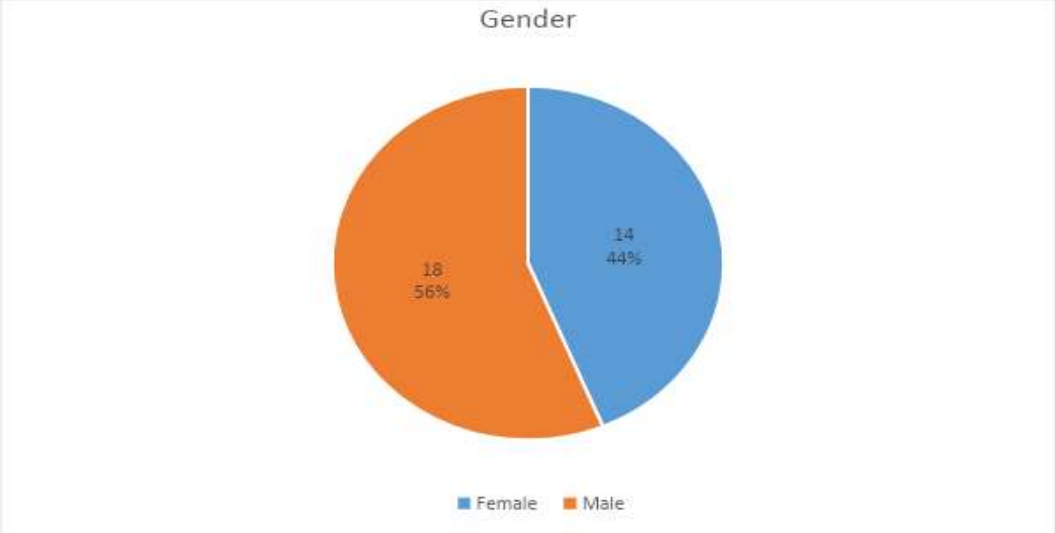


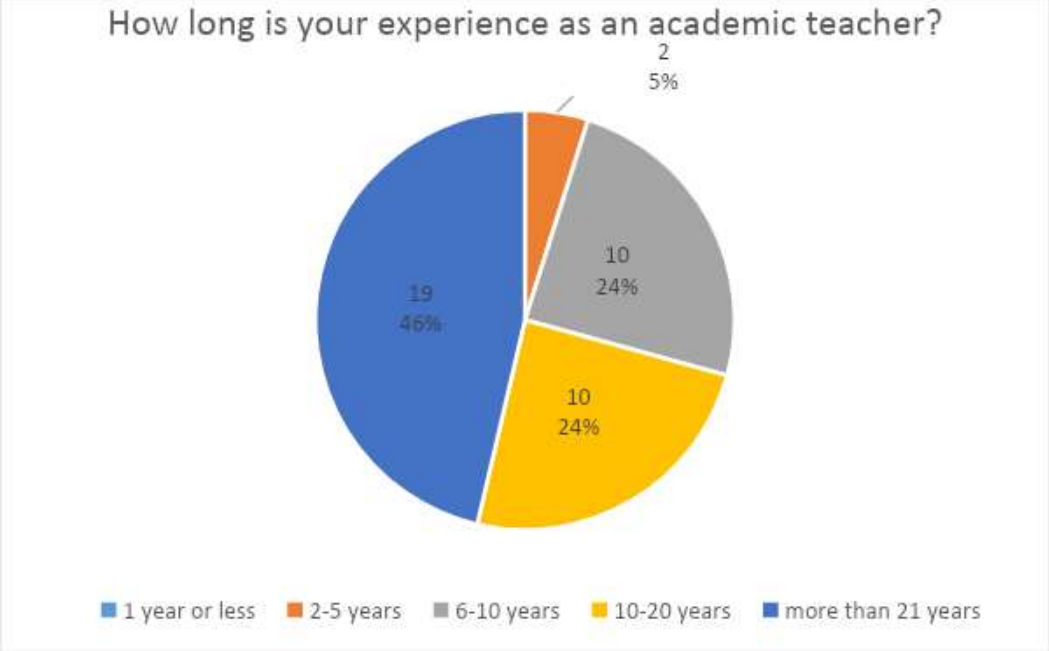
Regarding distance learning devices, almost all students worked with a portable computer, although other devices were also used, as shown in the graphic below.



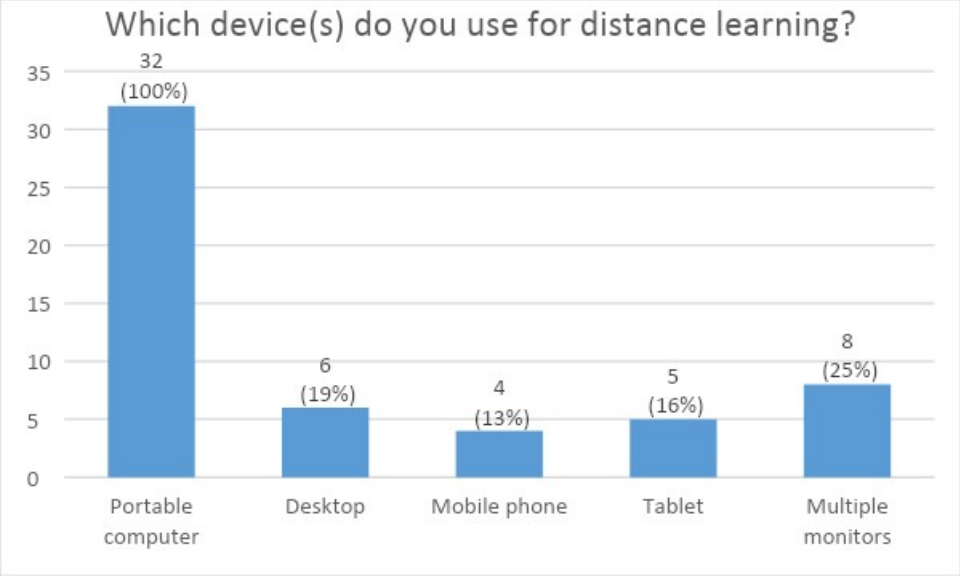
Next, we present the profile of the teachers.

Teachers: Totally, 32 answers have been received from UA teachers. All these answers have been considered for further analysis. 14 are women and 18 are men. Regarding experience as an academic teacher, 19 have more than 21 years, 10 between 10-20 years, 10 between 6-10 years and 2 between 2-5 years.

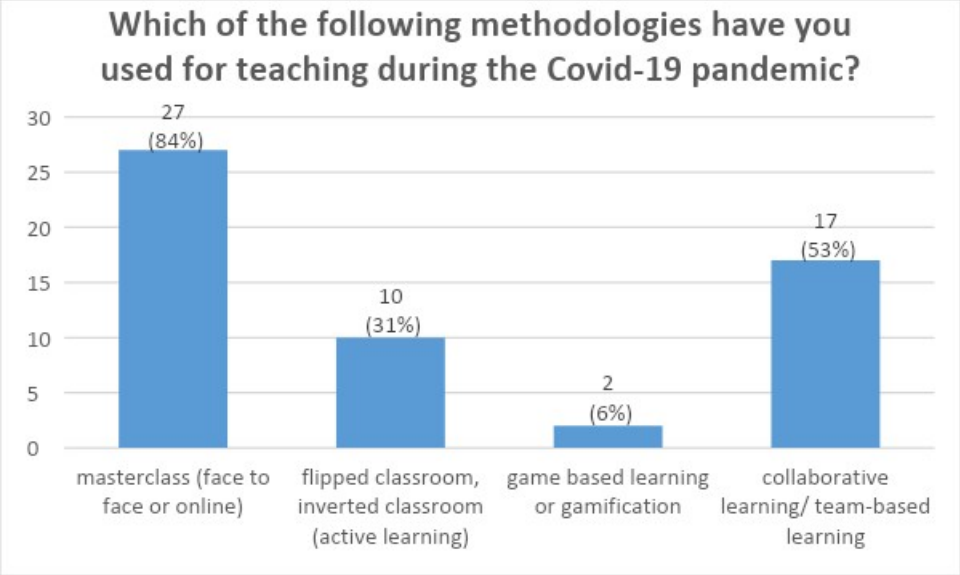




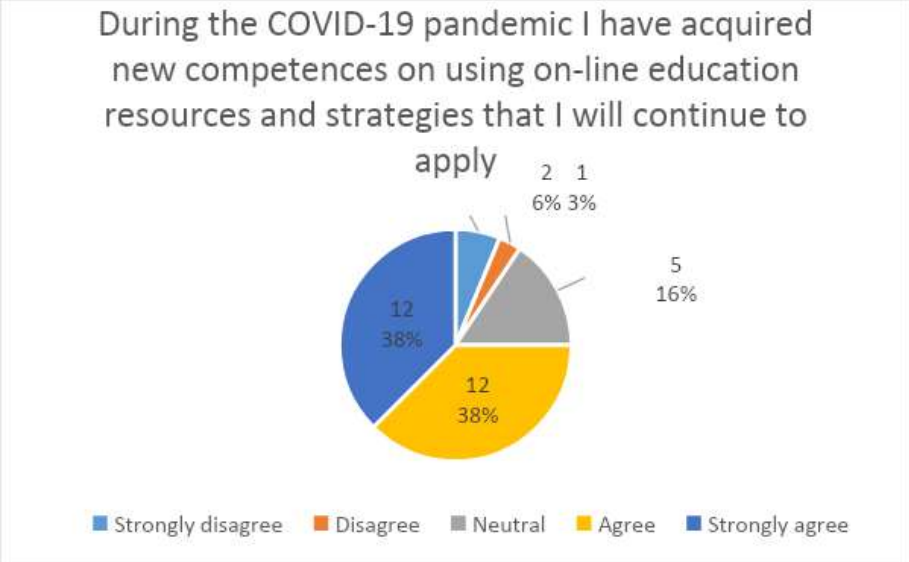
Regarding devices for distance teaching, all respondents used portable computers, complemented with other devices, as shown in the graphic below. Additionally, 3 respondents reported using a digital table/graphic drawing board.



In terms of the used teaching methodologies, the following have been applied in UA:



To complete the profile of teachers, we present the results of the question: "During the COVID-19 pandemic I have acquired new competences on using on-line education resources and strategies that I will continue to apply".



COVID-19 Impact on Teaching and Learning

National framework for distance education

The Council of Ministers of Portugal decided the closure of the institutions of higher education on March 13, 2020. In the case of the University of Aveiro, this closure happened one day before, by rectoral decision. Classes were suspended for 11 days following the closing, giving teachers time to adapt to a new reality of distance learning. The classes were delivered in online mode until the end of the second semester, June 12th, 2020. The assessments for the second semester of 2019/2020 took place mostly in the remote modality.

The Portuguese government levied restrictions on July 1st, 2020, keeping teleworking mandatory whenever possible. From that day, business trips within the country were already allowed and for foreigner countries, the trips were subject to the opening of borders and the sanitary conditions at the destination.

In the first semester of the academic year 2020/2021, the classes took place in the hybrid modality. However, due to the worsening of the pandemic situation that occurred after Christmas 2020, the Portuguese government, on January 22nd, 2021, ordered the suspension of in-person teaching and non-teaching activities of higher education institutions, without prejudice to the ongoing assessments periods. Given this determination, the Rector of the University of Aveiro decided to postpone the starting date of the exam period to February 8th

instead of January 22nd previously scheduled, and the corresponding reprogramming of the respective academic calendar.

The second semester of 2020/2021 took place in the hybrid mode, as the pandemic situation became more controlled due to the massive vaccination that began in April 2021. The assessments occurred in in-person mode.

The government has not provided any additional financial aid to higher education institutions to support the switch to online education.

Internal policy development

On March 10th, 2020, UA provided the COVID-19 Prevention and Action Plan, giving guidelines and description of the evolution of the COVID-19 outbreak to the academic community. This plan was regularly reassessed in accordance with the pandemic evolution.

During the first days of the lockdown, from March 12th to March 20th, there was a massive effort by UA to provide training in the use of communication platforms that could be employed in online classes that took place thereafter. This effort was continued throughout the semester, and various pedagogical methodologies appropriate to online teaching were also made known by several online workshops.

On May 8th, 2020, UA published the Prevention and Action Plan for the Progressive Lifting of Containment Measures, which contains the general guidelines to be taken in resuming face-to-face activity in the university. We highlight that the classes were delivered in online mode until the end of the second semester, June 12th, 2020, by decision of the Rector of UA.

The face-to-face activities at the university were allowed provided that the rules contained in the updated version of the university's Prevention and Action Plan against COVID-19 were observed, namely: a) the minimum distance recommended by the Directorate-General of Health; b) the mandatory use of a face mask indoors and in all buildings of the University; c) the provision of personal protective equipment; d) the rules that limit the number of attendees, including the number of participants per event, seating capacity for amphitheaters, auditoriums, meeting rooms and other spaces for joint use, just to name a few of these rules.

It is noteworthy that the administration of UA communicated regularly with the academic community, disclosing the daily bulletin of cases of infection with COVID-19, as well as regulations regarding the teaching and evaluation activities.

The examination period of the second semester of 2019/2020 ran from June 17th to July 24th and, following the administration guidelines, most exams were performed using the remote modality. In exceptional cases, the Pedagogical Council was asked for authorization to carry out face-to-face examinations, which occurred in a very small number of cases.

As already mentioned, at UA, the classes for the first semester of the academic year 2020/2021 took place in the hybrid modality. However, due to the worsening of the pandemic situation in Portugal in January 2021, the assessments of the first semester were carried out online. The second semester of 2020/2021 took place in the hybrid modality and the assessments took place in person.

We conclude this section stating that, at UA, teachers have complete freedom to choose the communication platforms for conducting online classes and for assessments.

Survey results

Preparation

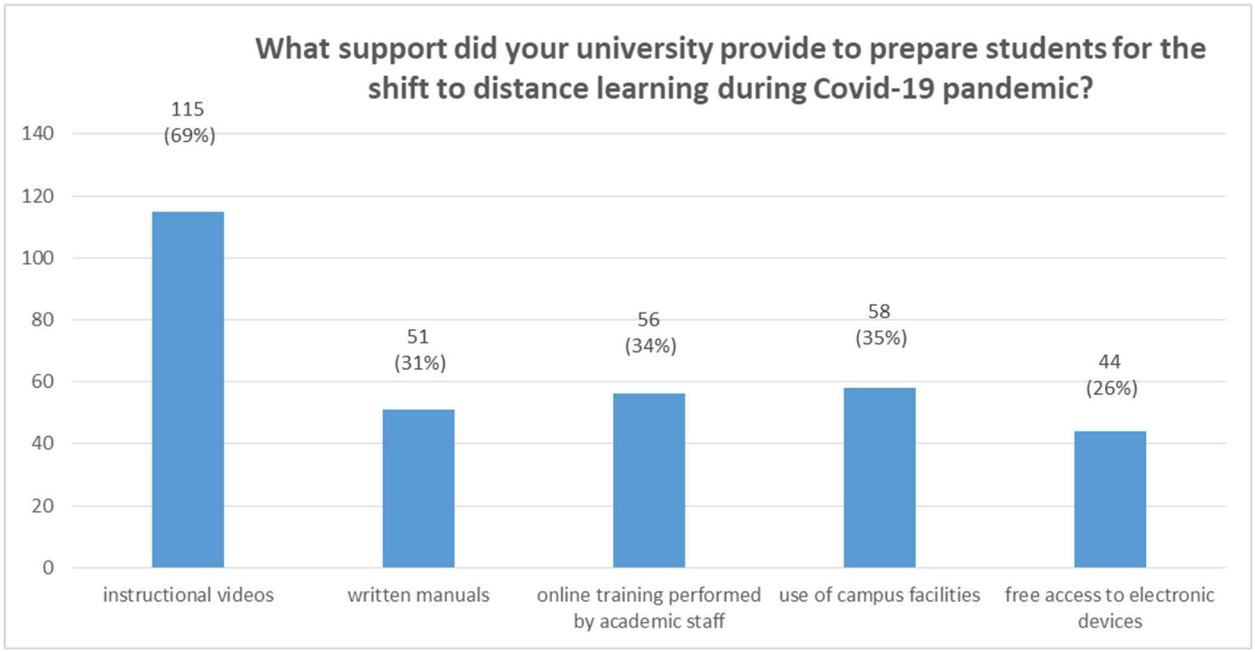
University perspective

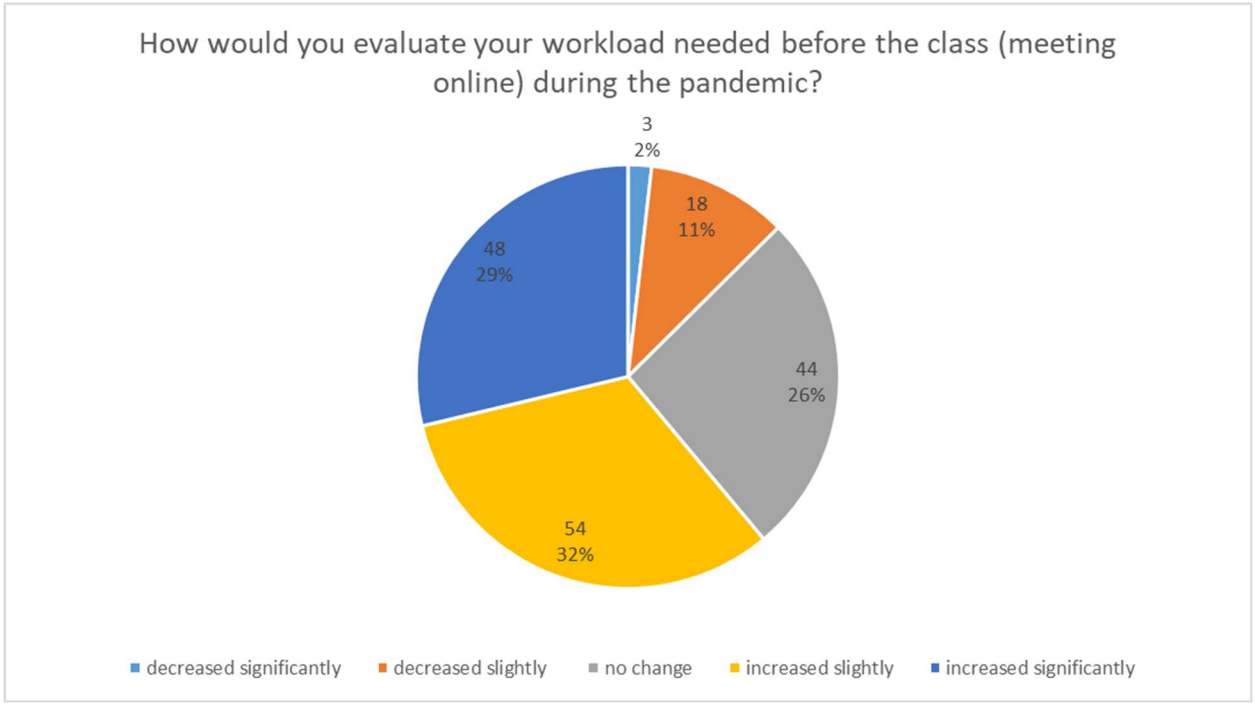
During the first months after the closure of the university, UA made available to teachers, weekly, several online workshops on ICT tools and innovative teaching and learning methodologies aimed at distance education. Meanwhile, UA identified all students who did not have a personal computer, and, for those, UA lent a computer and provided access to the Internet.

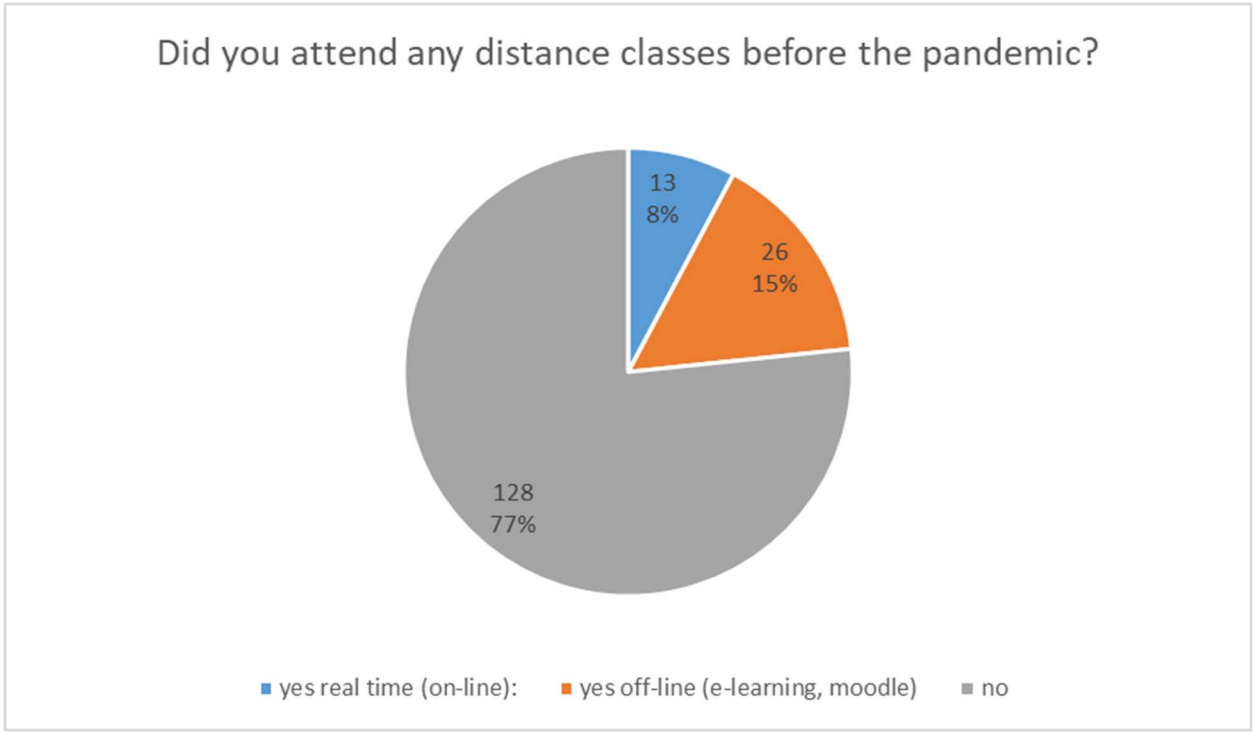
In relation to the psychological support and well-being of students, UA has an integrated service called LUA ("Linha Universidade de Aveiro") that guarantees emotional and psychological support and counselling for students at night. Support is provided by volunteer students (peer counselling) who are trained by psychologists and doctors, who are available for urgent cases and consultations.

Student perspective

In this section the students' answers which deal with the preparation of classes are analysed based on distance learning tools and techniques. Totally, three student survey questions fall in the "preparation" category. The respective results are summarised in the figures below.

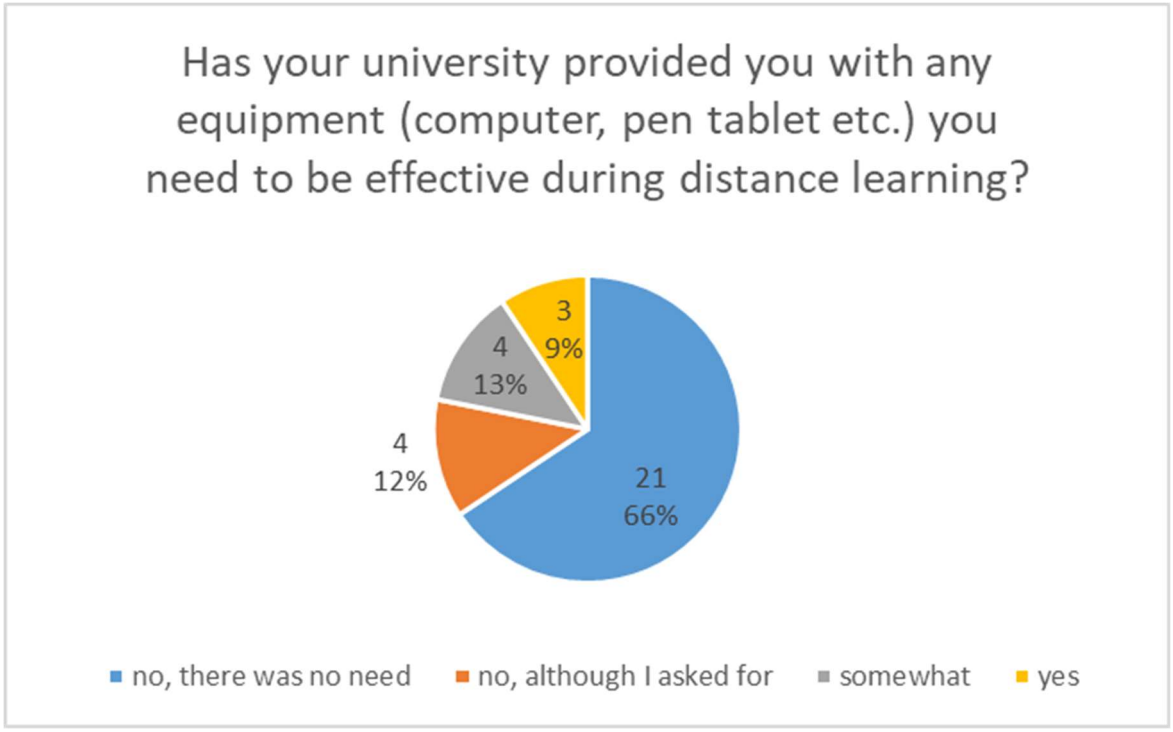

What support did your university provide to prepare students for the shift to distance learning during Covid-19 pandemic?
140
120
100
80
60
40
20
0
115
(69%)
51
(31%)
56
(34%)
58
(35%)
44
(26%)
instructional videos
written manuals
online training performed by academic staff
use of campus facilities
free access to electronic devices

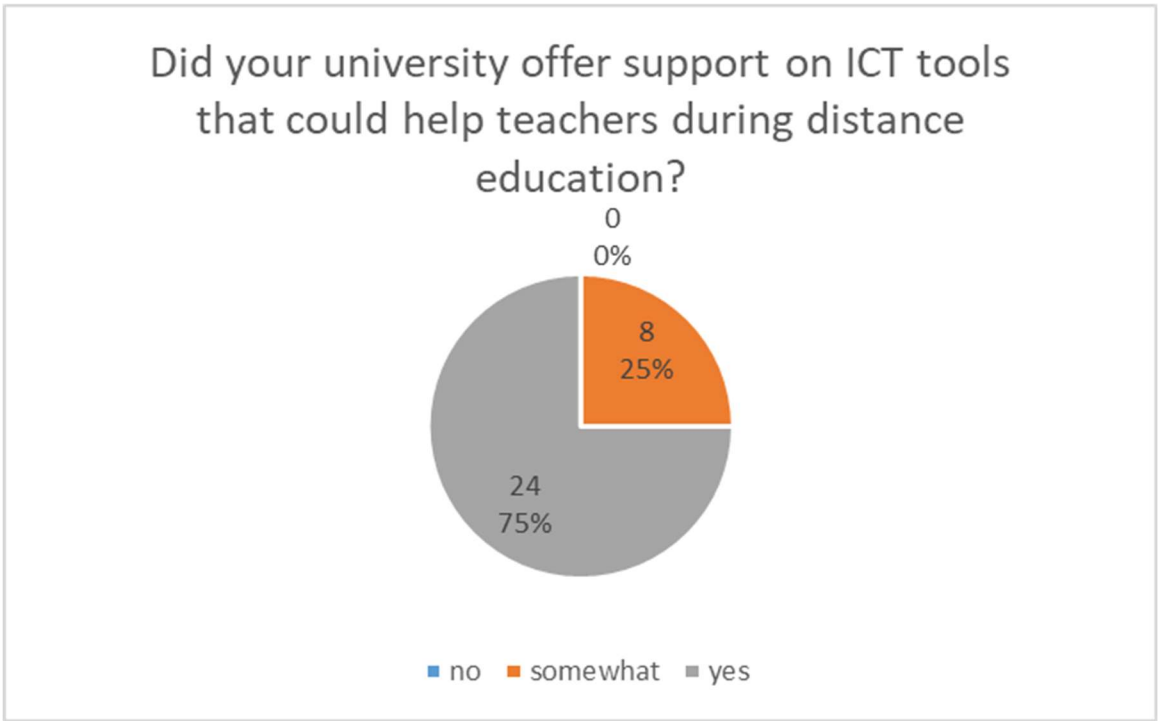

How would you evaluate your workload needed before the class (meeting online) during the pandemic?
3
2%
18
11%
44
26%
54
32%
48
29%
decreased significantly
decreased slightly
no change
increased slightly
increased significantly

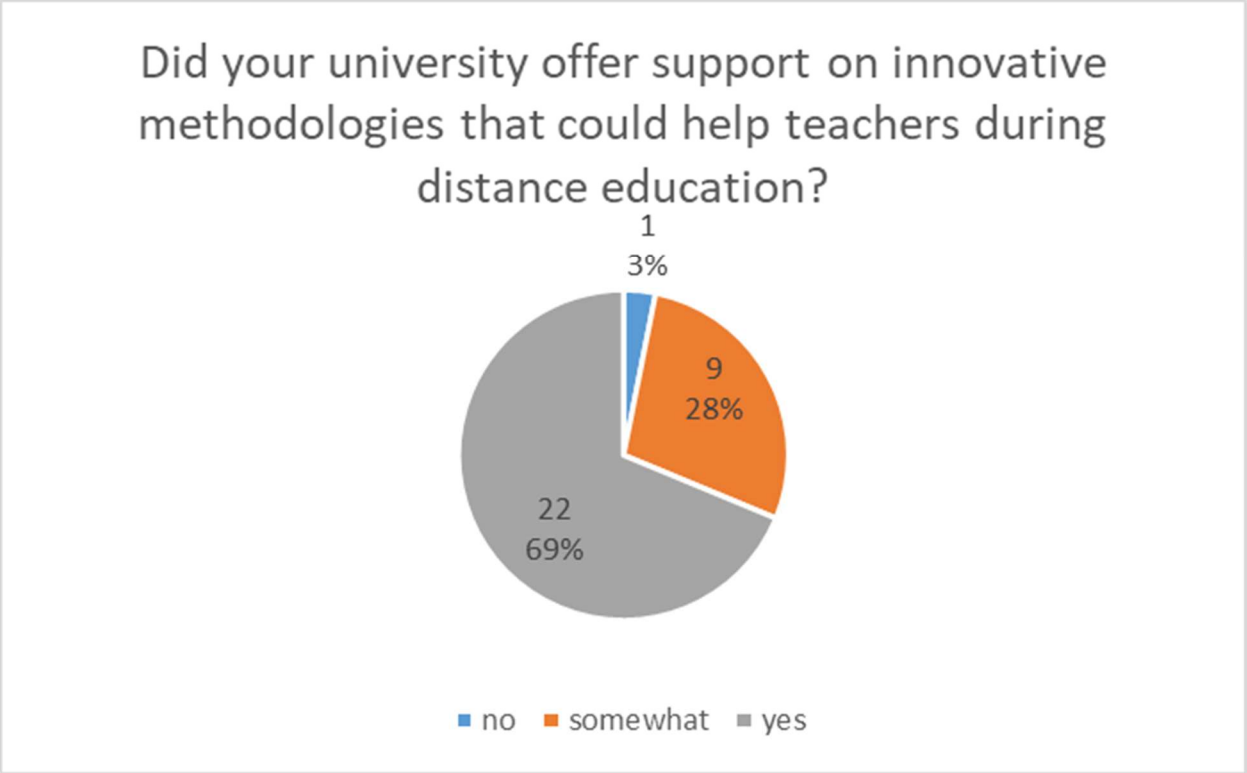


Teacher perspective

The questionnaire included three questions connected with the equipment, ICT tools/software, and innovative methodologies provided by the university to support the work of teachers in the situation of lockdown. It should be mentioned that all teachers have computers/laptops/tablets and other equipment that permit their research and teaching work from home. On the other hand, the need for some specific devices (such as, for example, the graphic tables) has appeared only at the time of lockdown. The survey results are summarised below.


Has your university provided you with any equipment (computer, pen tablet etc.) you need to be effective during distance learning?
3
9%
4
13%
4
12%
21
66%
no, there was no need
no, although I asked for
somewhat
yes


Did your university offer support on ICT tools that could help teachers during distance education?
0
0%
8
25%
24
75%
no
somewhat
yes



Conclusions

As can be seen from the students' answers, the great majority of students (92%) has never attended a real distance class before the pandemic, but the University provided quite a broad support including instructional videos, manuals, and online training. The majority of students (61%) reported that their preparation workload has increased when compared to traditional face-to-face classes.

From the answers of the teachers of the University of Aveiro it can be seen that the great majority of teachers were provided with quite a broad support from the University. The main demand of the teachers was the ICT support and the information/instruction about modern and innovative methodologies and these needs were promptly satisfied by the institution.

Delivery

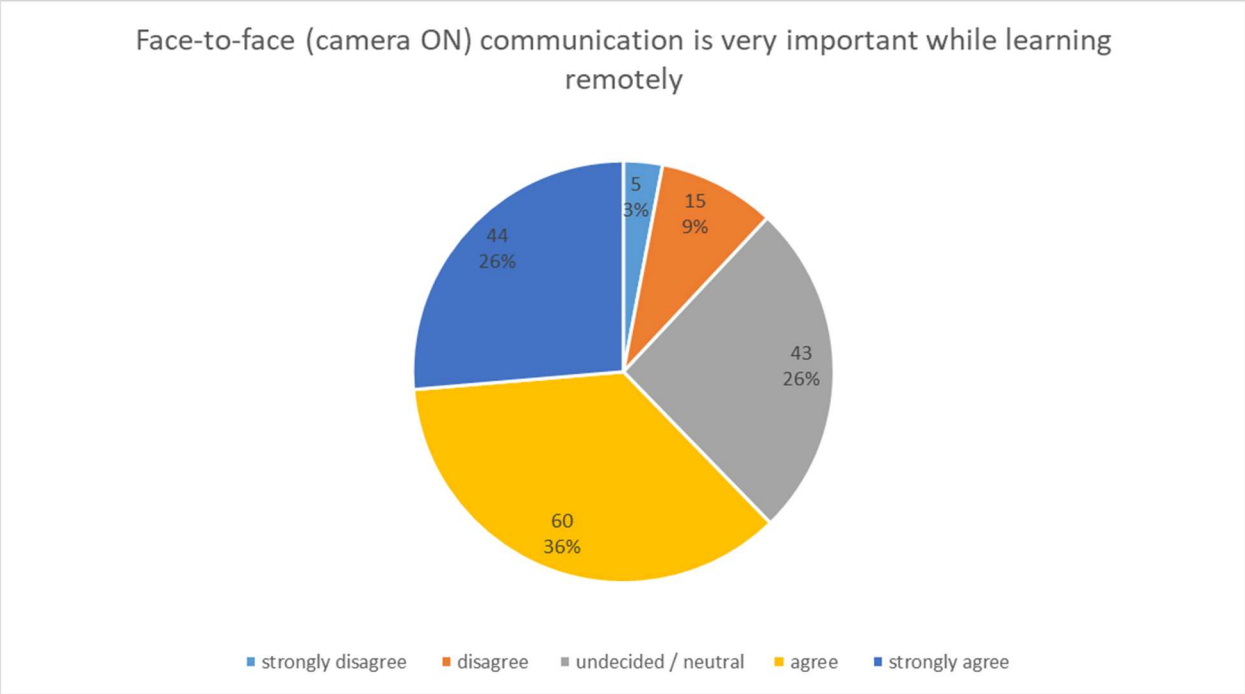
University perspective

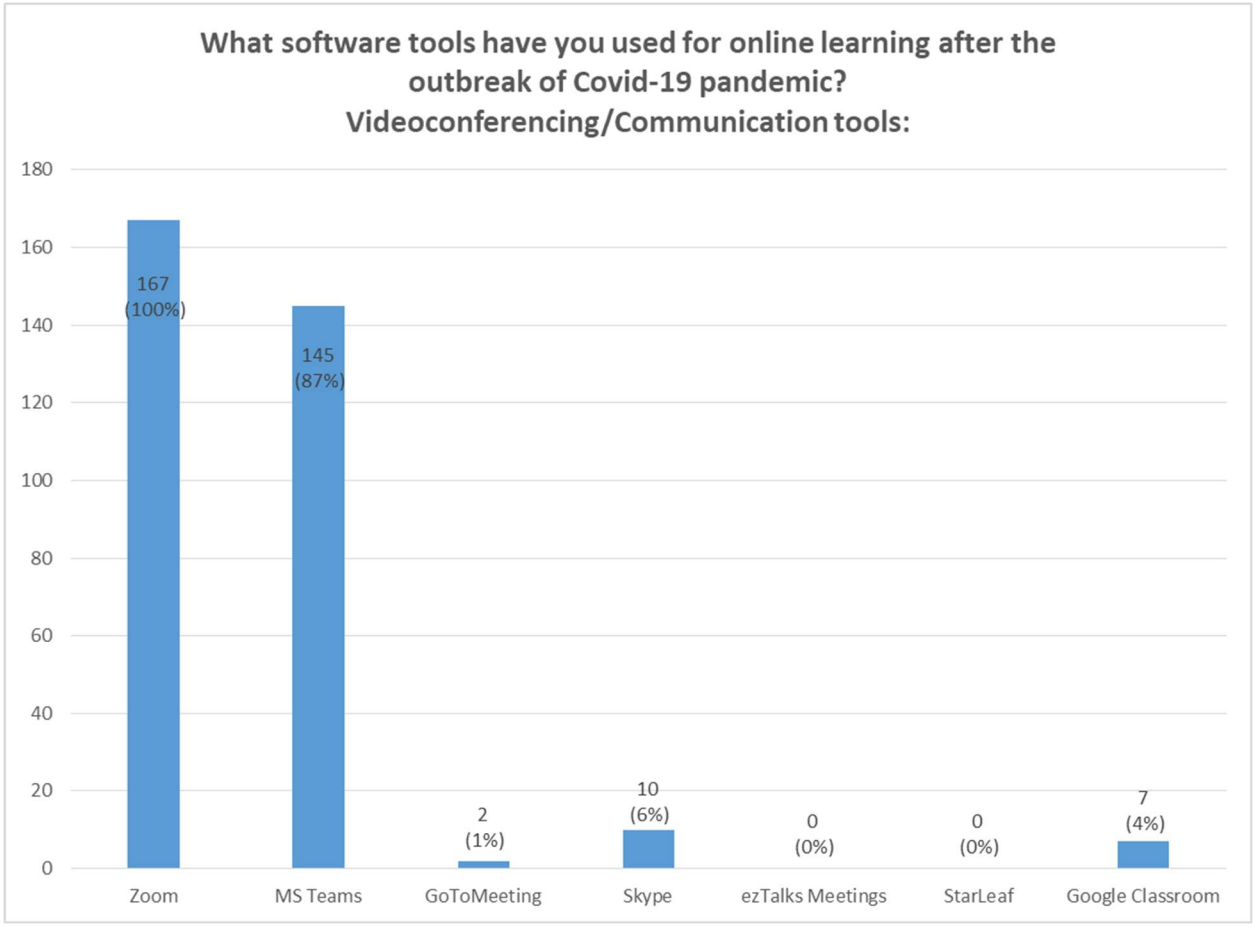
By Rector's decision, the timetables of all UA courses were kept during distance learning classes. Teachers were free to choose the teaching methodology as well as the communication tools. During online classes, cameras on/off was a teacher's decision. With regard to self-study and real-

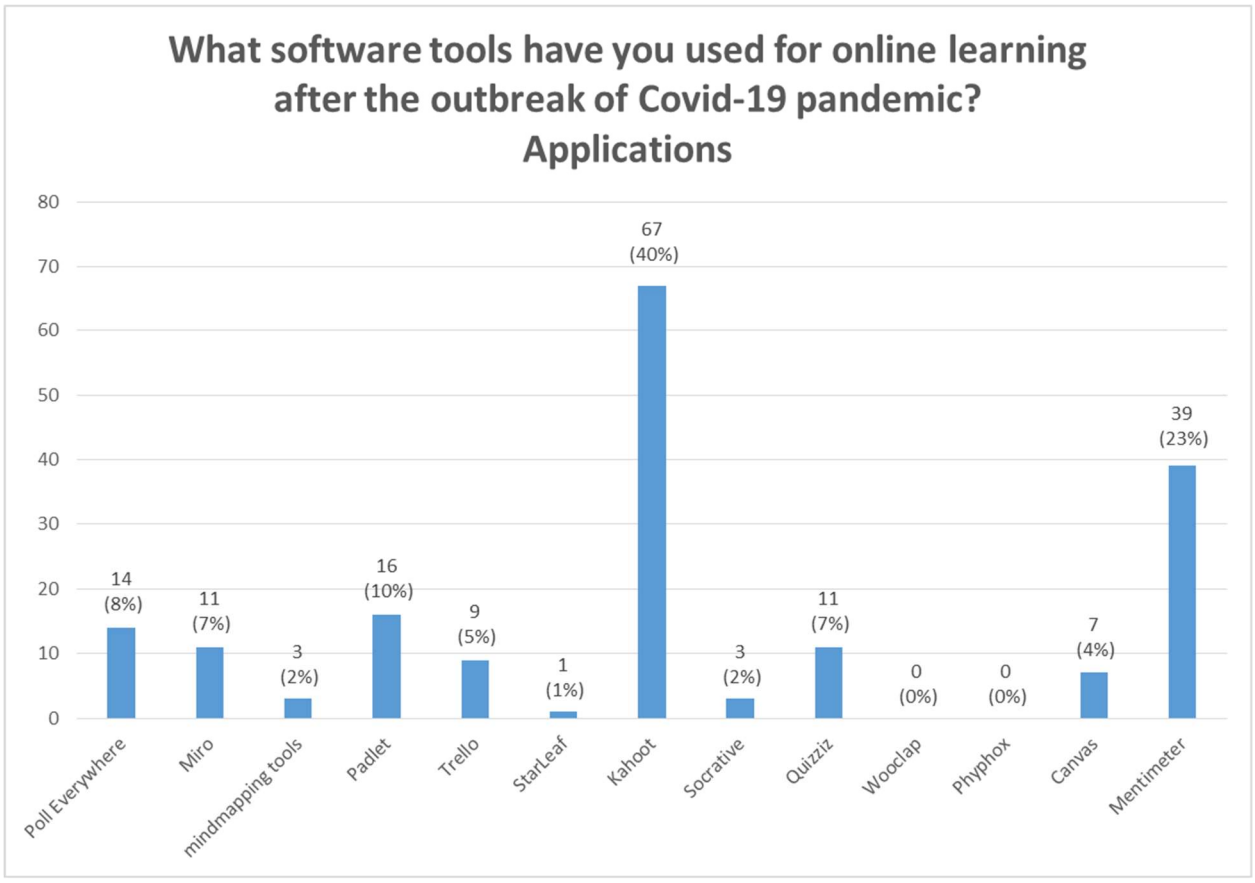
time group work, both forms were used, depending on the methodology implemented by the teacher.

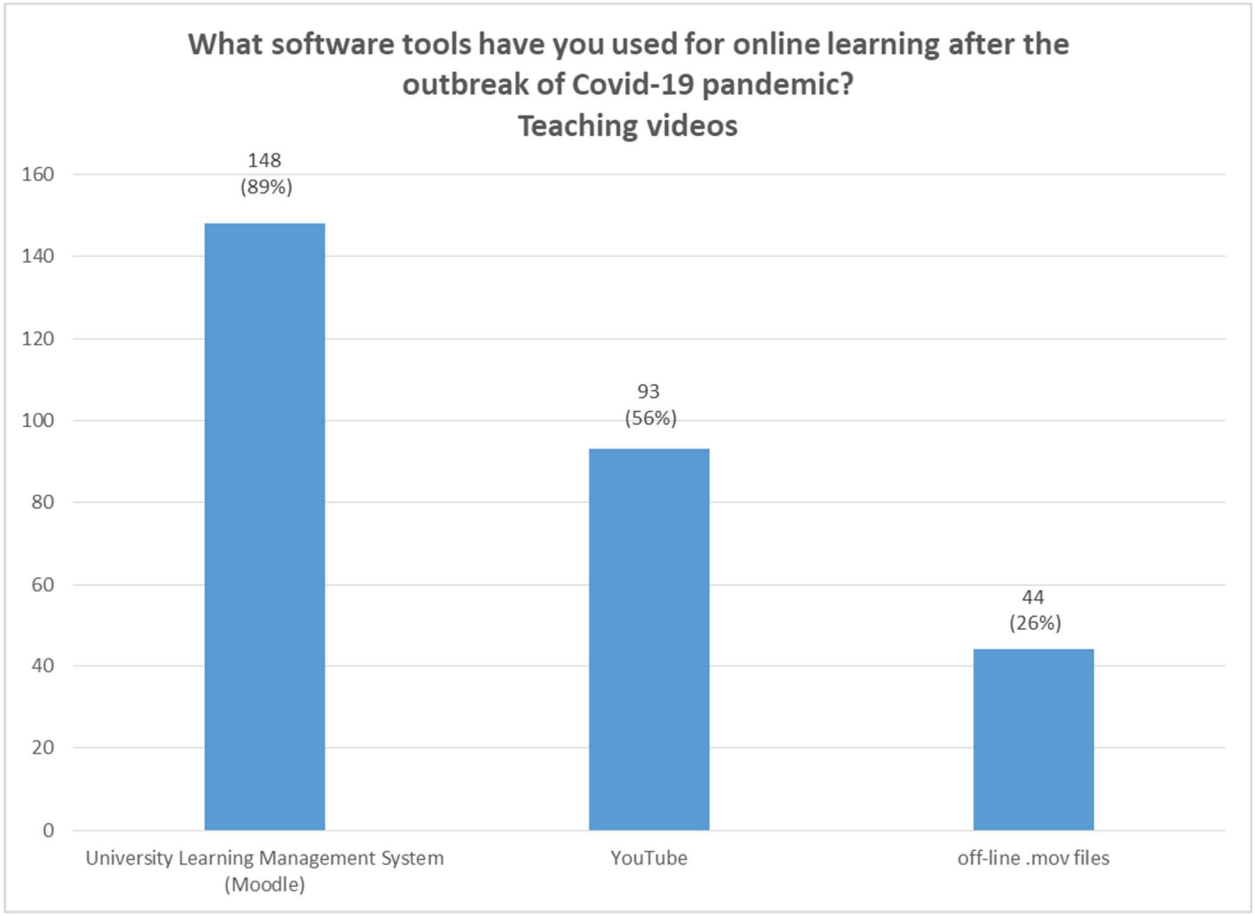
Student perspective

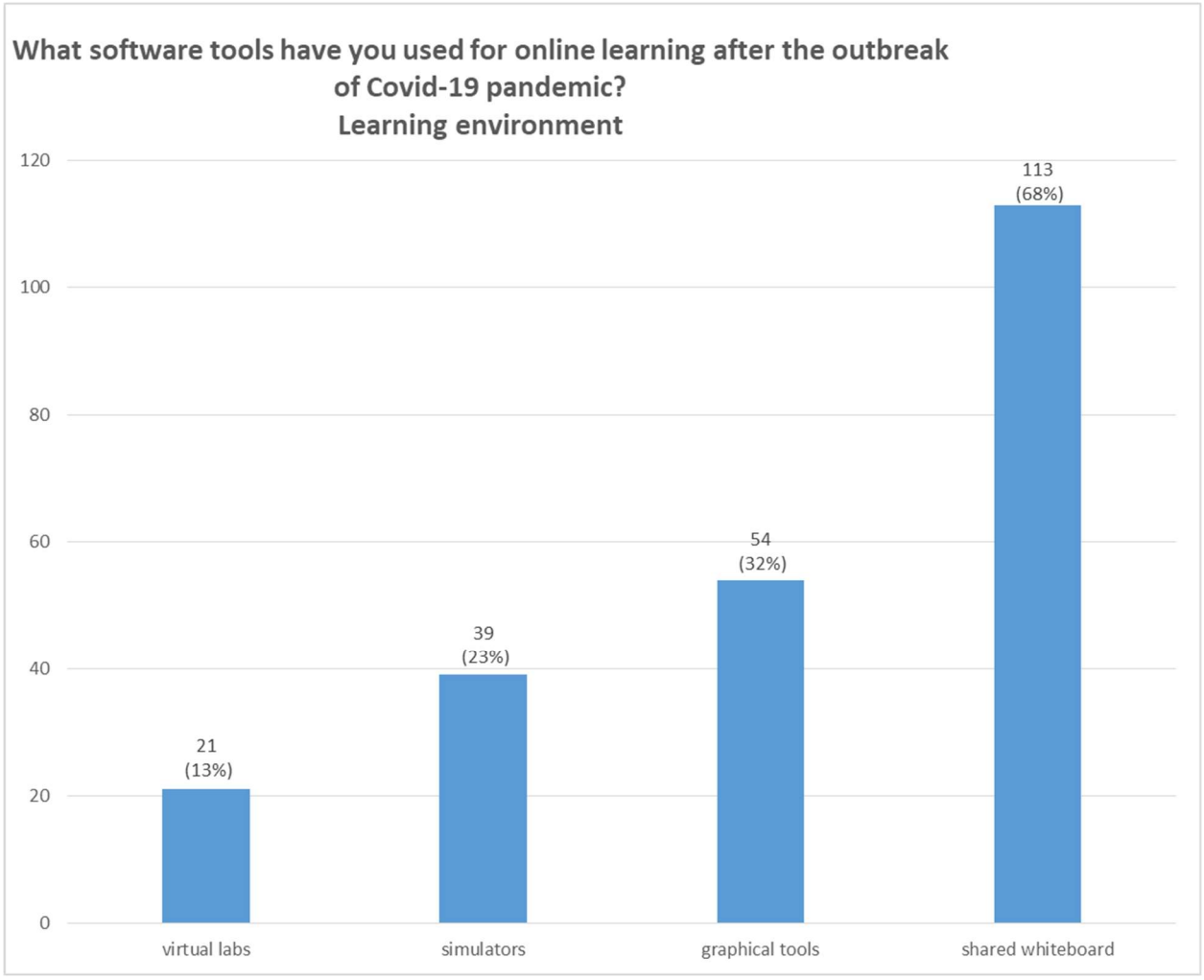
In this section the students' answers that deal with the delivery of classes are analysed based on distance learning tools and techniques. Totally, ten students' survey questions fall in the "delivery" category. The respective results are summarised in the figures below.

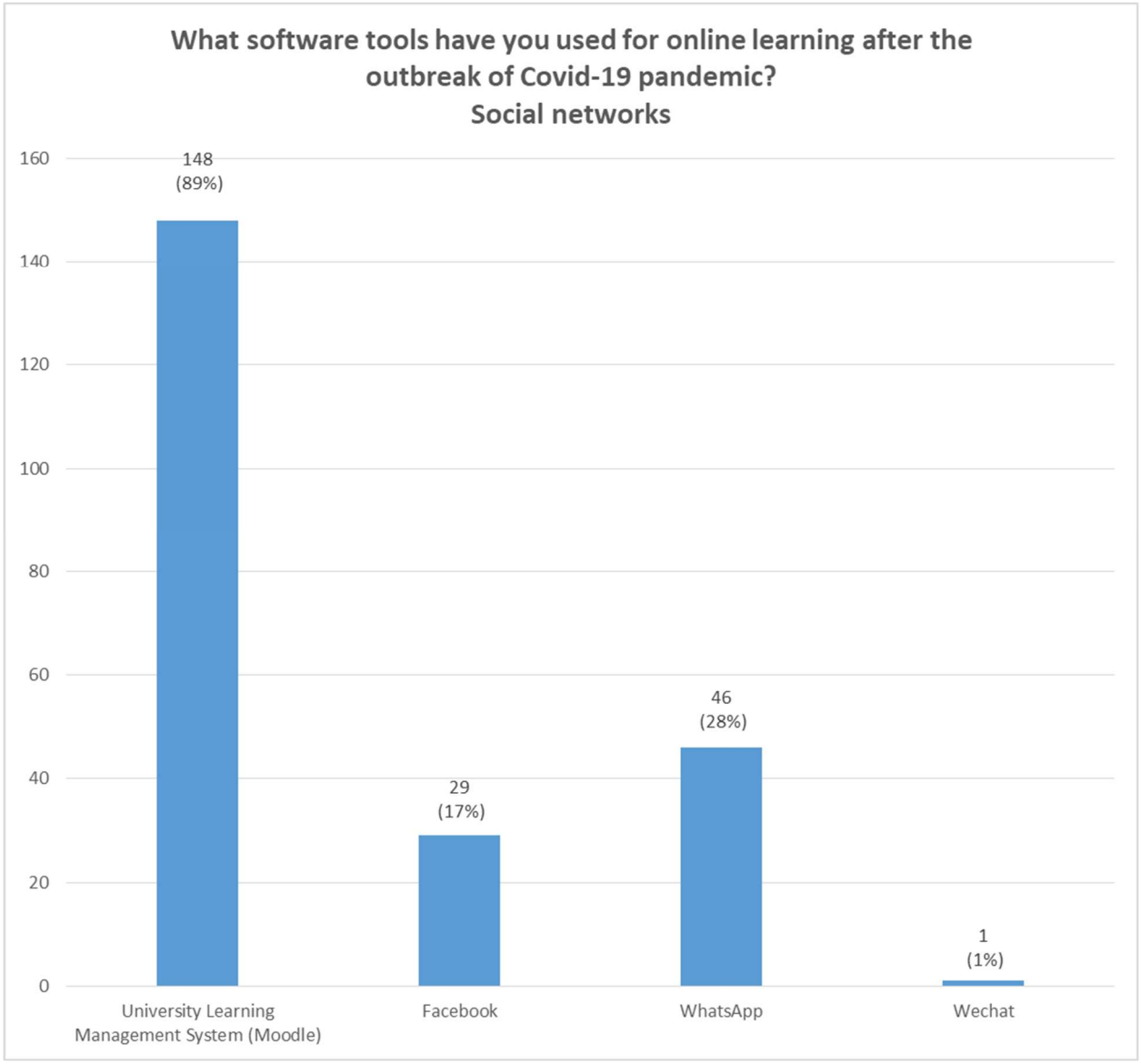


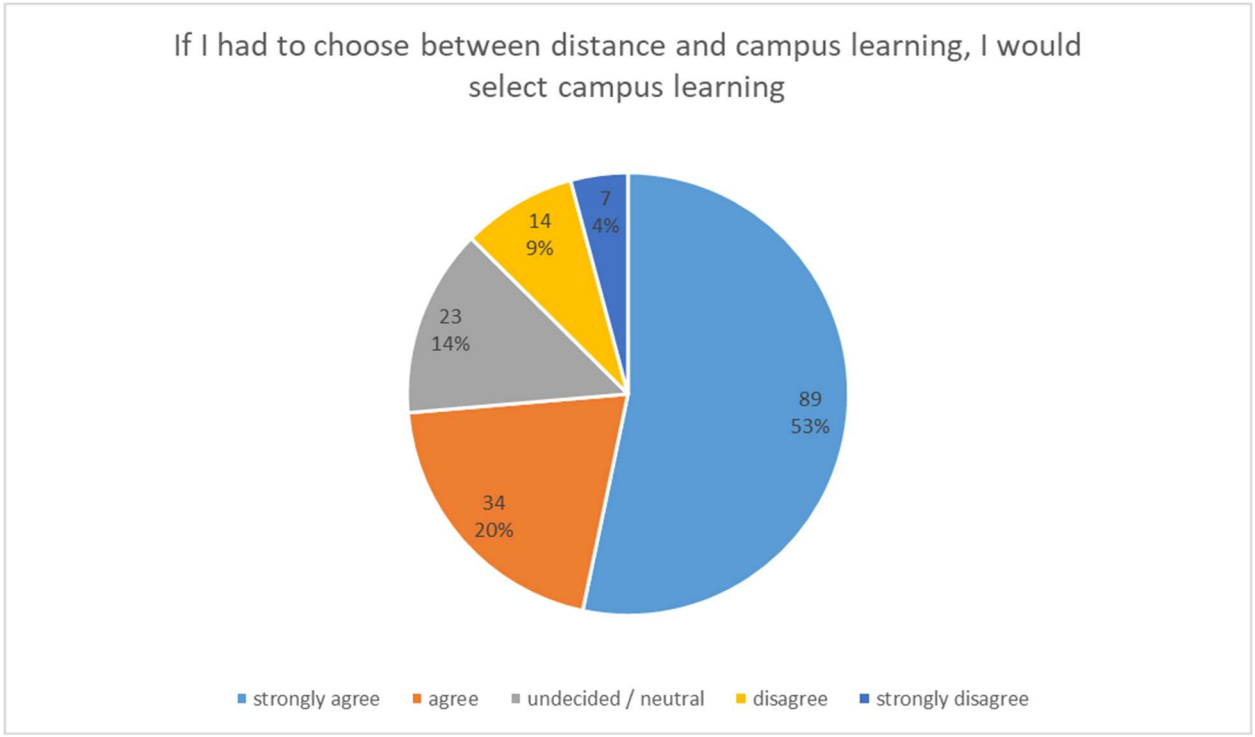

What software tools have you used for online learning after the outbreak of Covid-19 pandemic?
Videoconferencing/Communication tools:
180
160
140
120
100
80
60
40
20
0
167 (100%)
145 (87%)
2 (1%)
10 (6%)
0 (0%)
0 (0%)
7 (4%)
Zoom
MS Teams
GoToMeeting
Skype
ezTalks Meetings
StarLeaf
Google Classroom

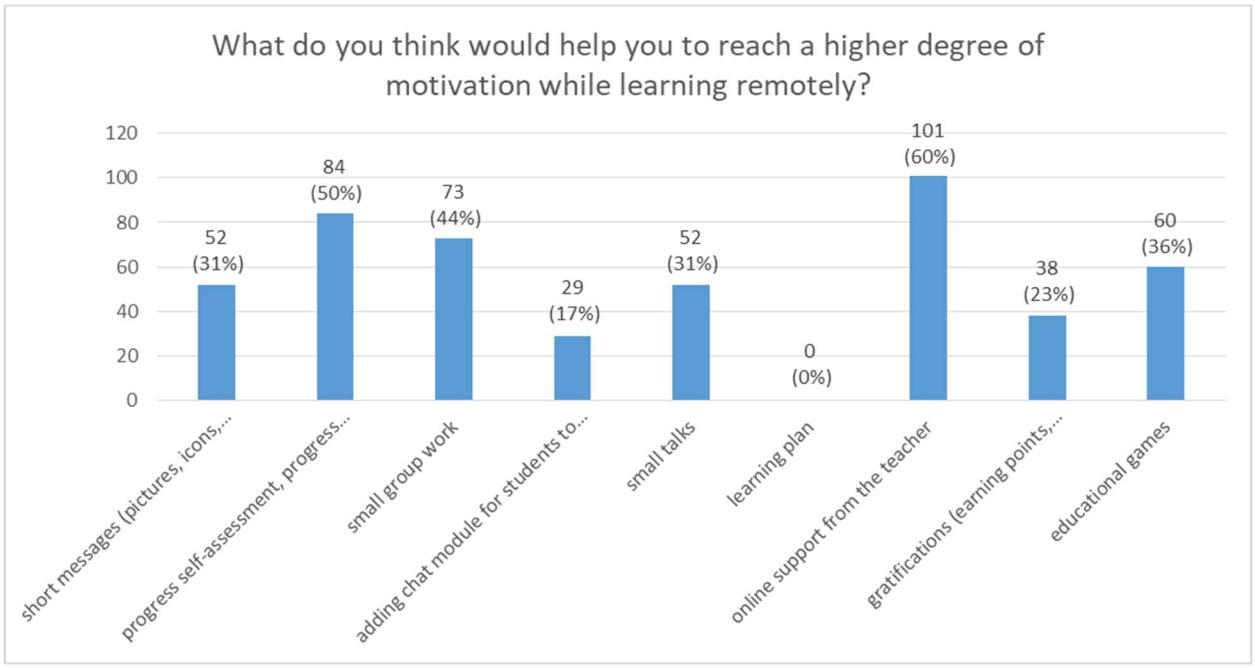

What software tools have you used for online learning after the outbreak of Covid-19 pandemic?
Applications
80
70
60
50
40
30
20
10
0
14 (8%)
11 (7%)
3 (2%)
16 (10%)
9 (5%)
1 (1%)
67 (40%)
3 (2%)
11 (7%)
0 (0%)
0 (0%)
7 (4%)
39 (23%)
Poll Everywhere
Miro
mindmapping tools
Padlet
Trello
StarLeaf
Kahoot
Socrative
Quizziz
Wooclap
Phyphox
Canvas
Mentimeter

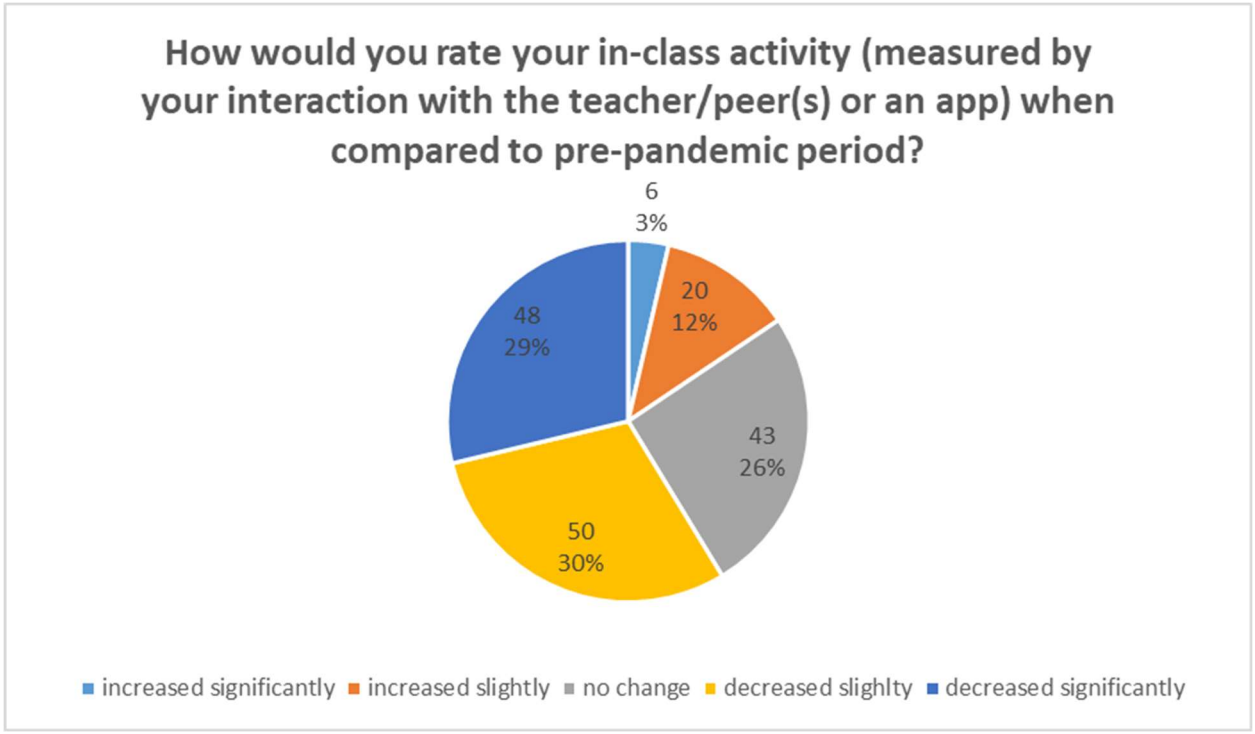

What software tools have you used for online learning after the outbreak of Covid-19 pandemic?
Teaching videos
160
140
120
100
80
60
40
20
0
148
(89%)
93
(56%)
44
(26%)
University Learning Management System (Moodle)
YouTube
off-line .mov files

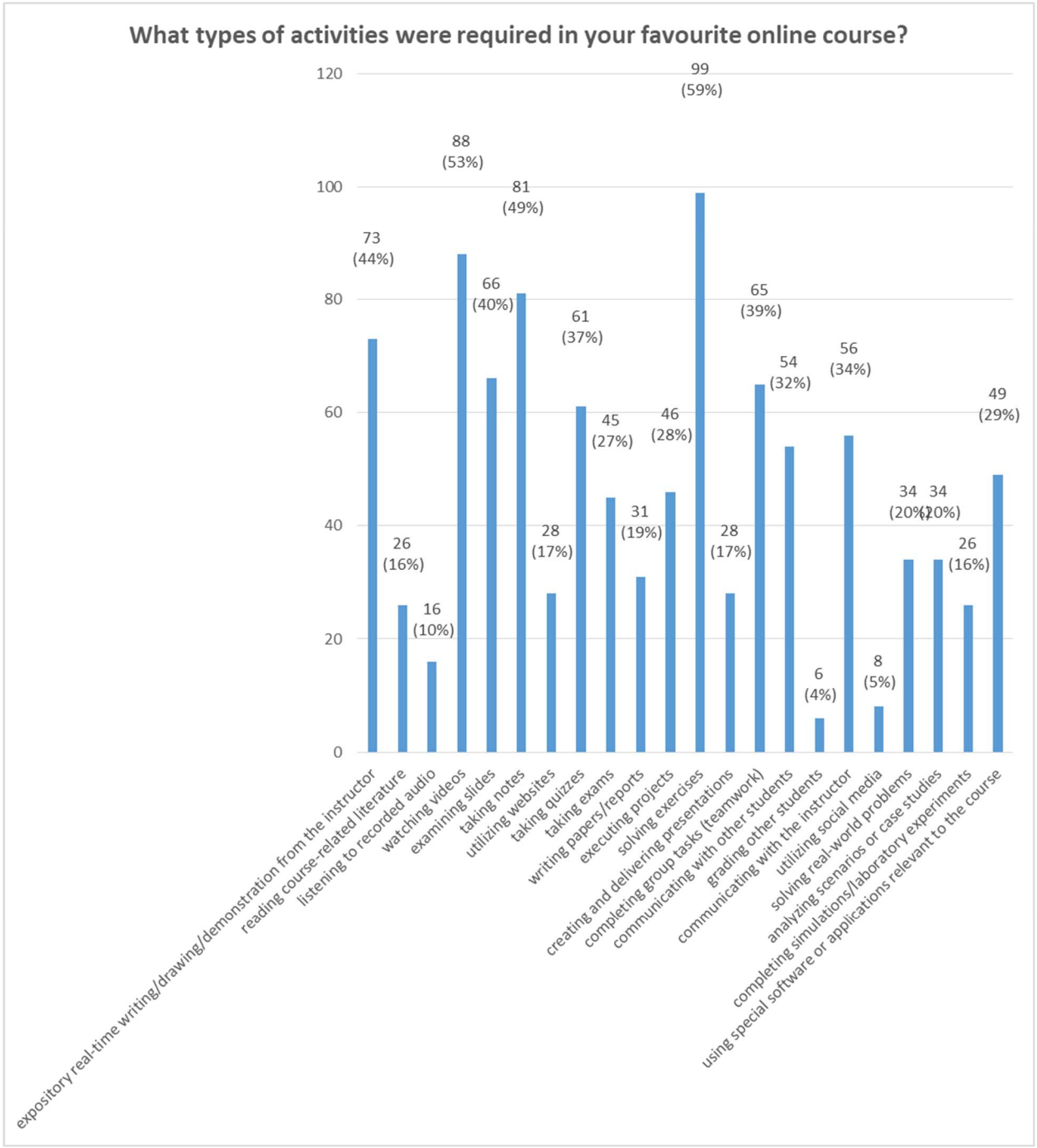

What software tools have you used for online learning after the outbreak of Covid-19 pandemic?
Learning environment
120
100
80
60
40
20
0
21
(13%)
39
(23%)
54
(32%)
113
(68%)
virtual labs
simulators
graphical tools
shared whiteboard

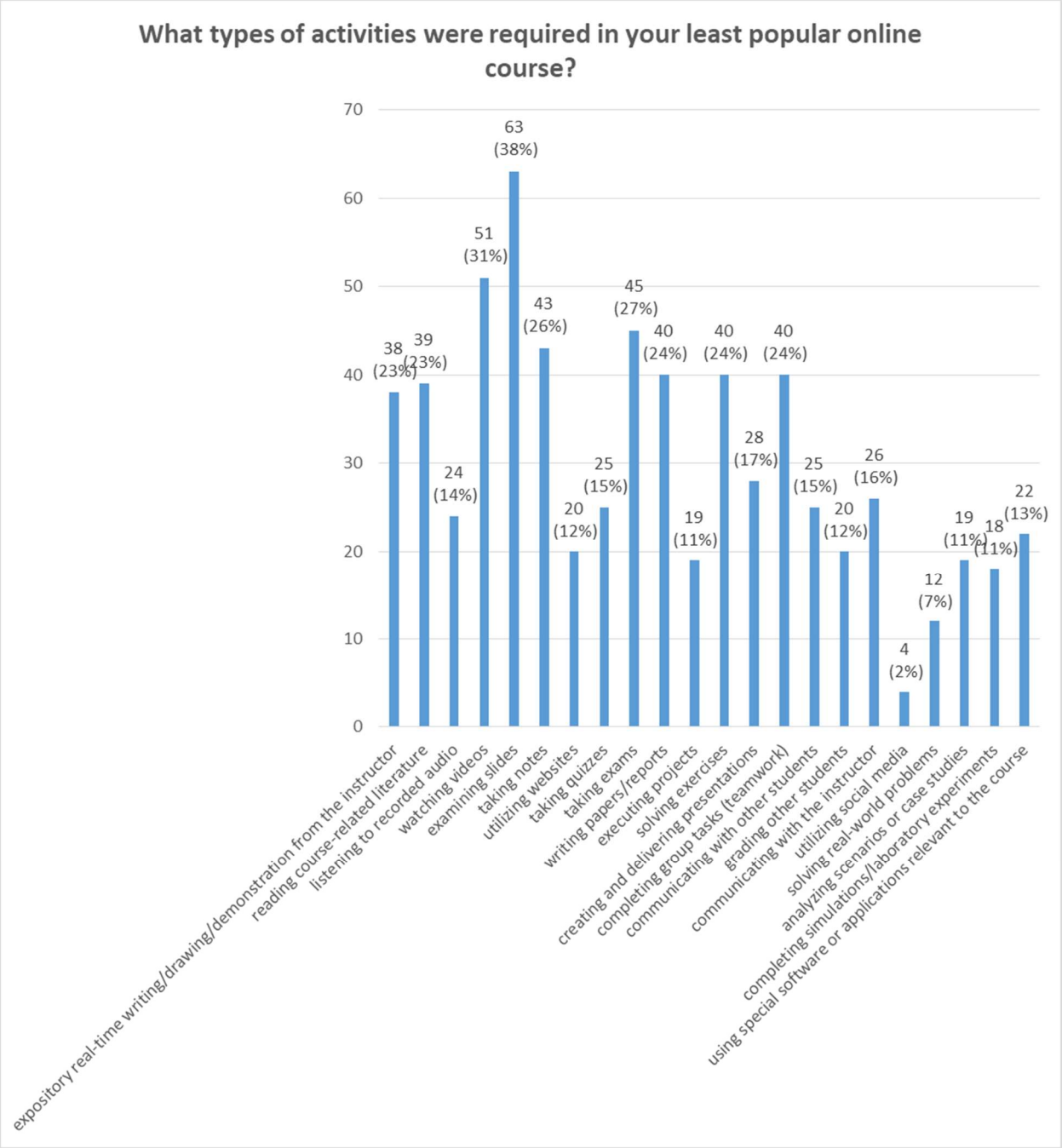

What software tools have you used for online learning after the outbreak of Covid-19 pandemic?
Social networks
160
140
120
100
80
60
40
20
0
148
(89%)
29
(17%)
46
(28%)
1
(1%)
University Learning Management System (Moodle)
Facebook
WhatsApp
Wechat


If I had to choose between distance and campus learning, I would select campus learning
89
53%
34
20%
23
14%
14
9%
7
4%
strongly agree
agree
undecided / neutral
disagree
strongly disagree


What do you think would help you to reach a higher degree of motivation while learning remotely?
120
100
80
60
40
20
0
52 (31%)
84 (50%)
73 (44%)
29 (17%)
52 (31%)
0 (0%)
101 (60%)
38 (23%)
60 (36%)
short messages (pictures, icons,...
progress self-assessment, progress...
small group work
adding chat module for students to...
small talks
learning plan
online support from the teacher
gratifications (earning points,...
educational games

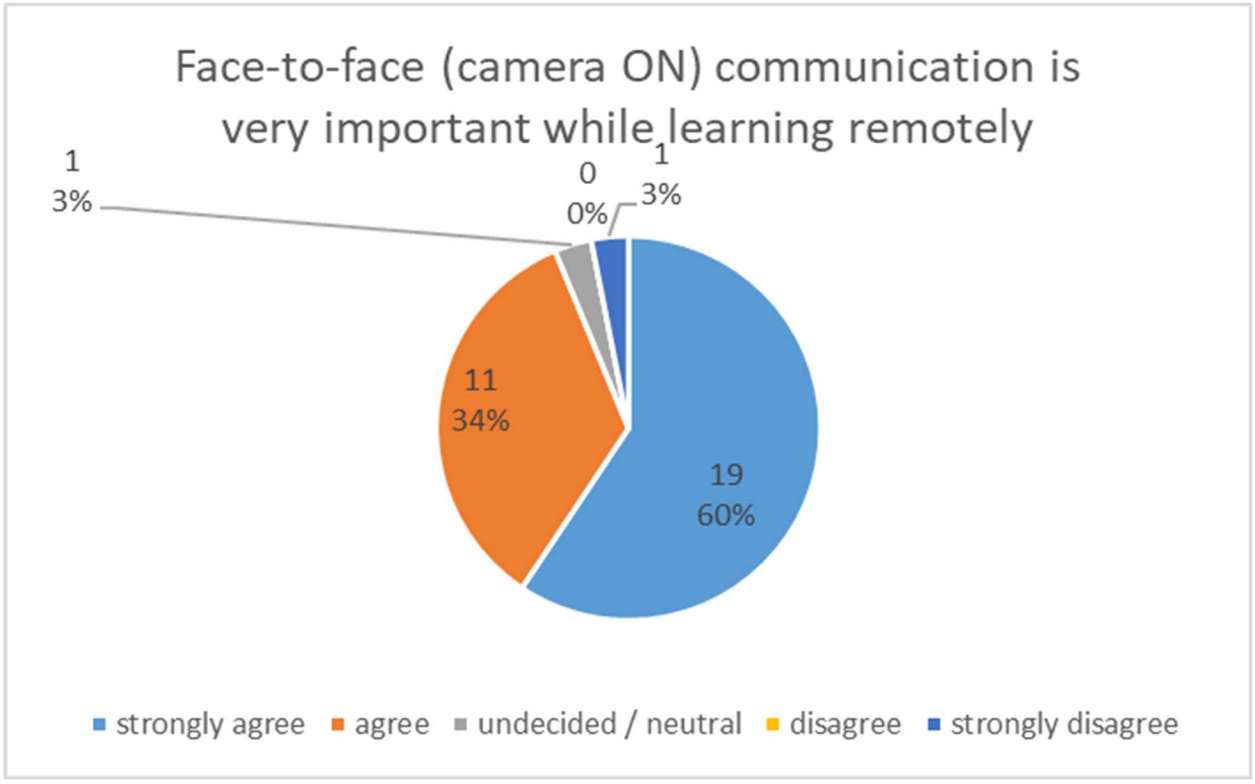

How would you rate your in-class activity (measured by your interaction with the teacher/peer(s) or an app) when compared to pre-pandemic period?
6
3%
20
12%
43
26%
50
30%
48
29%
increased significantly
increased slightly
no change
decreased slighlty
decreased significantly

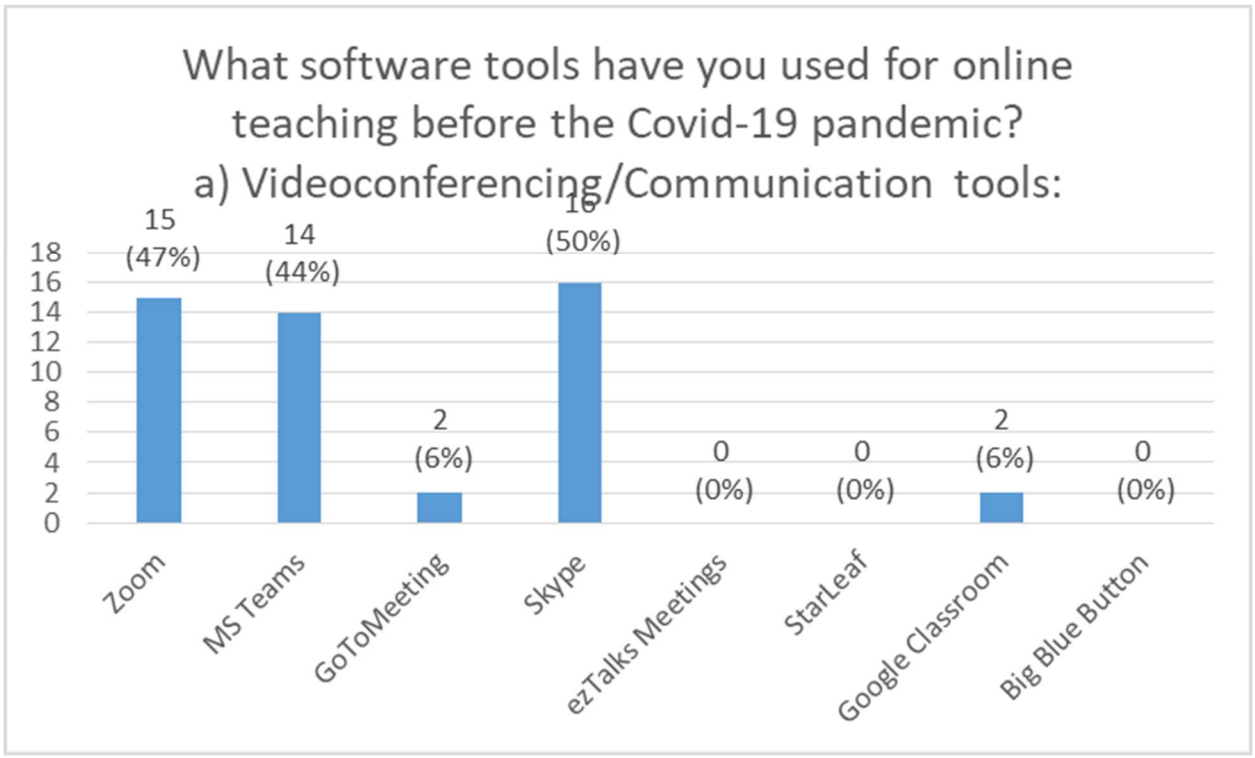

What types of activities were required in your favourite online course?
120
100
80
60
40
20
0
73 (44%)
26 (16%)
16 (10%)
88 (53%)
66 (40%)
81 (49%)
28 (17%)
61 (37%)
45 (27%)
31 (19%)
46 (28%)
99 (59%)
28 (17%)
65 (39%)
54 (32%)
6 (4%)
56 (34%)
8 (5%)
34 (20%)
34 (20%)
26 (16%)
49 (29%)
expository real-time writing/drawing/demonstration from the instructor
reading course-related literature
listening to recorded audio
watching videos
examining slides
taking notes
utilizing websites
taking quizzes
taking exams
writing papers/reports
executing projects
solving exercises
creating and delivering presentations
completing group tasks (teamwork)
communicating with other students
grading other students
communicating with the instructor
utilizing social media
solving real-world problems
analyzing scenarios or case studies
completing simulations/laboratory experiments
using special software or applications relevant to the course

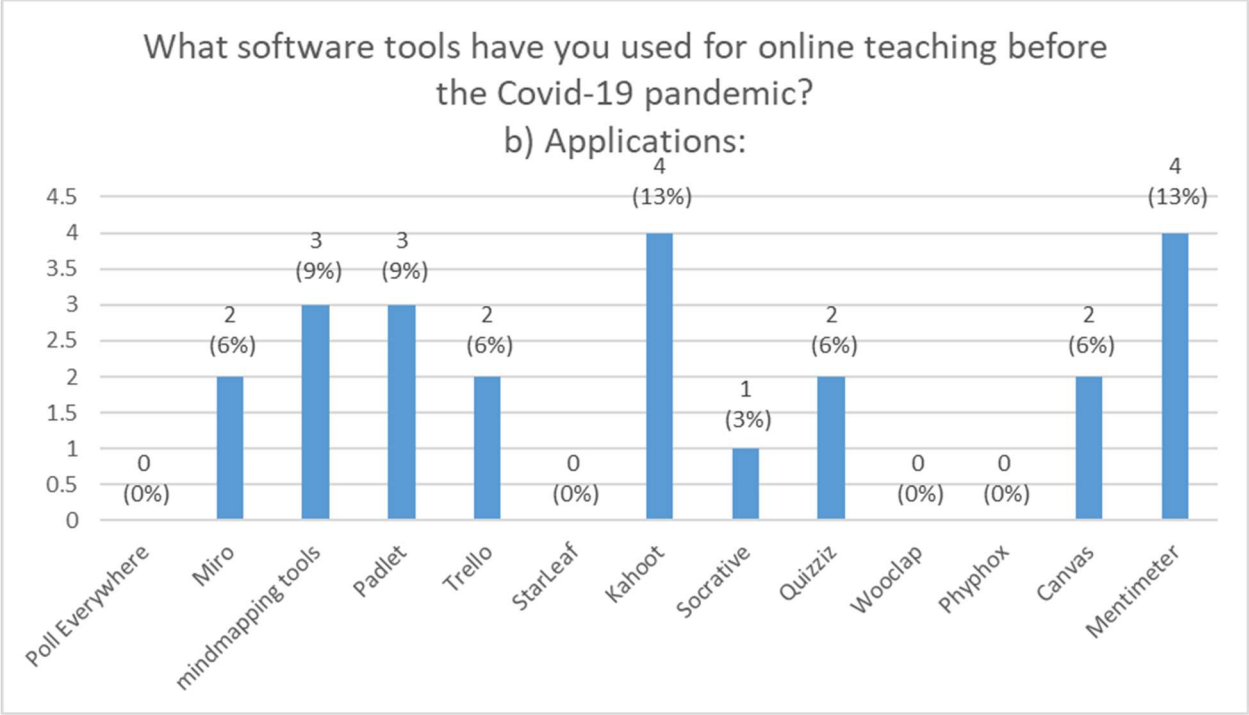


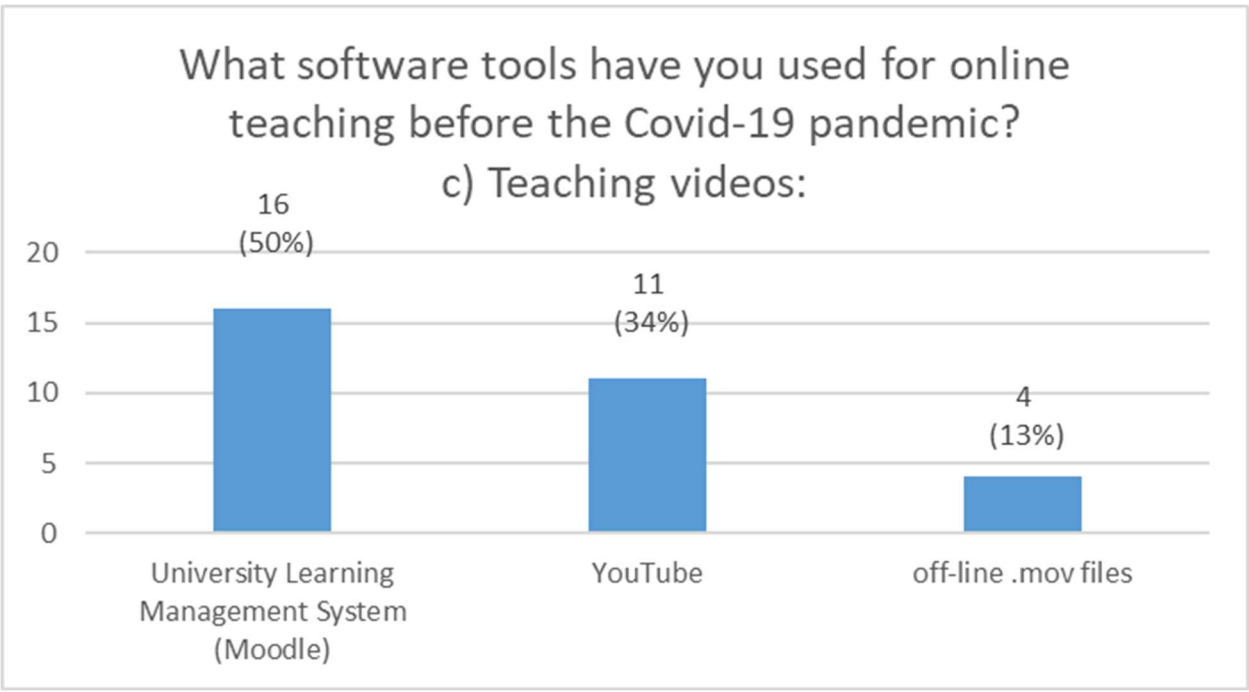
Teacher perspective

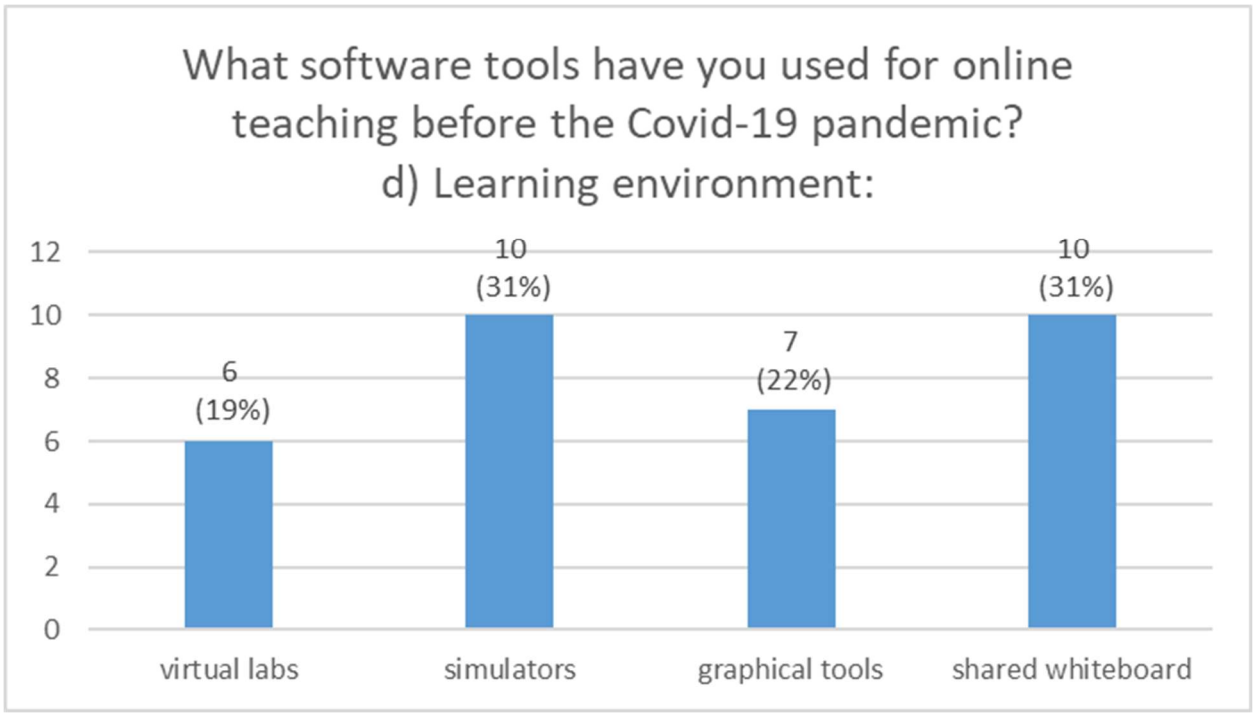
In what follows, we present the answers of the teachers from the University of Aveiro on seventeen questions connected with delivery of classes during the pandemic period and the support, tools, and difficulties they felt during this time. This information permits one to analyse the most important and more popular solutions found by the teachers.

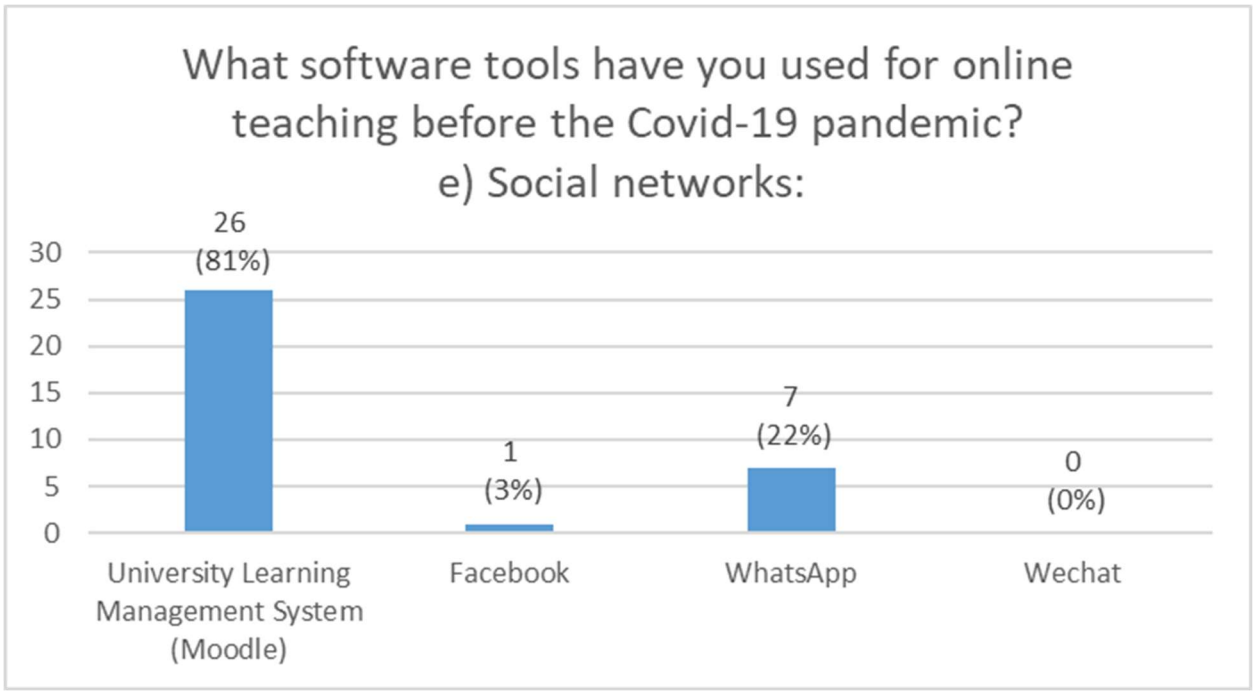

Face-to-face (camera ON) communication is very important while learning remotely
1
3%
0
0%
1
3%
11
34%
19
60%
strongly agree
agree
undecided / neutral
disagree
strongly disagree


What software tools have you used for online teaching before the Covid-19 pandemic?
a) Videoconferencing/Communication tools:
18
16
14
12
10
8
6
4
2
0
15 (47%)
14 (44%)
2 (6%)
16 (50%)
0 (0%)
0 (0%)
2 (6%)
0 (0%)
Zoom
MS Teams
GoToMeeting
Skype
ezTalks Meetings
StarLeaf
Google Classroom
Big Blue Button


What software tools have you used for online teaching before the Covid-19 pandemic?
b) Applications:
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0 (0%)
2 (6%)
3 (9%)
3 (9%)
2 (6%)
0 (0%)
4 (13%)
1 (3%)
2 (6%)
0 (0%)
0 (0%)
2 (6%)
4 (13%)
Poll Everywhere
Miro
mindmapping tools
Padlet
Trello
StarLeaf
Kahoot
Socrative
Quizziz
Wooclap
Phyphox
Canvas
Mentimeter

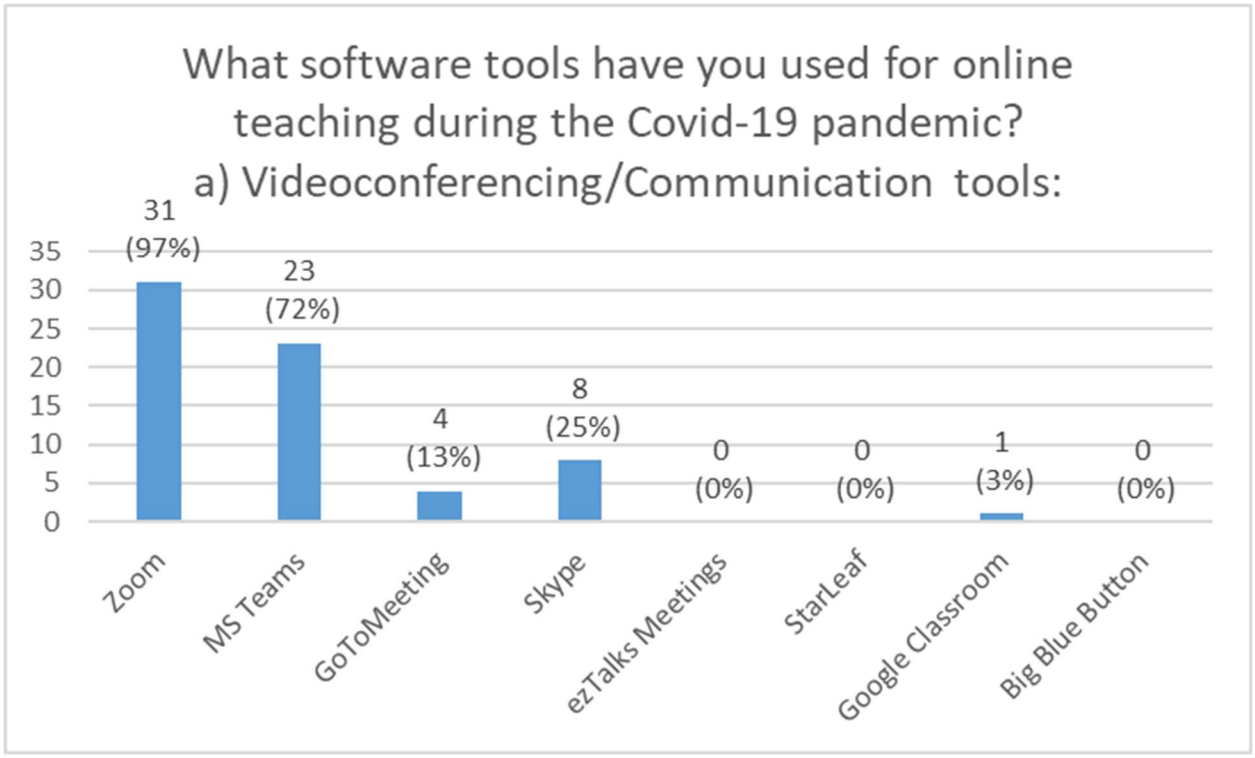

What software tools have you used for online teaching before the Covid-19 pandemic?
c) Teaching videos:
20
15
10
5
0
16 (50%)
11 (34%)
4 (13%)
University Learning Management System (Moodle)
YouTube
off-line .mov files

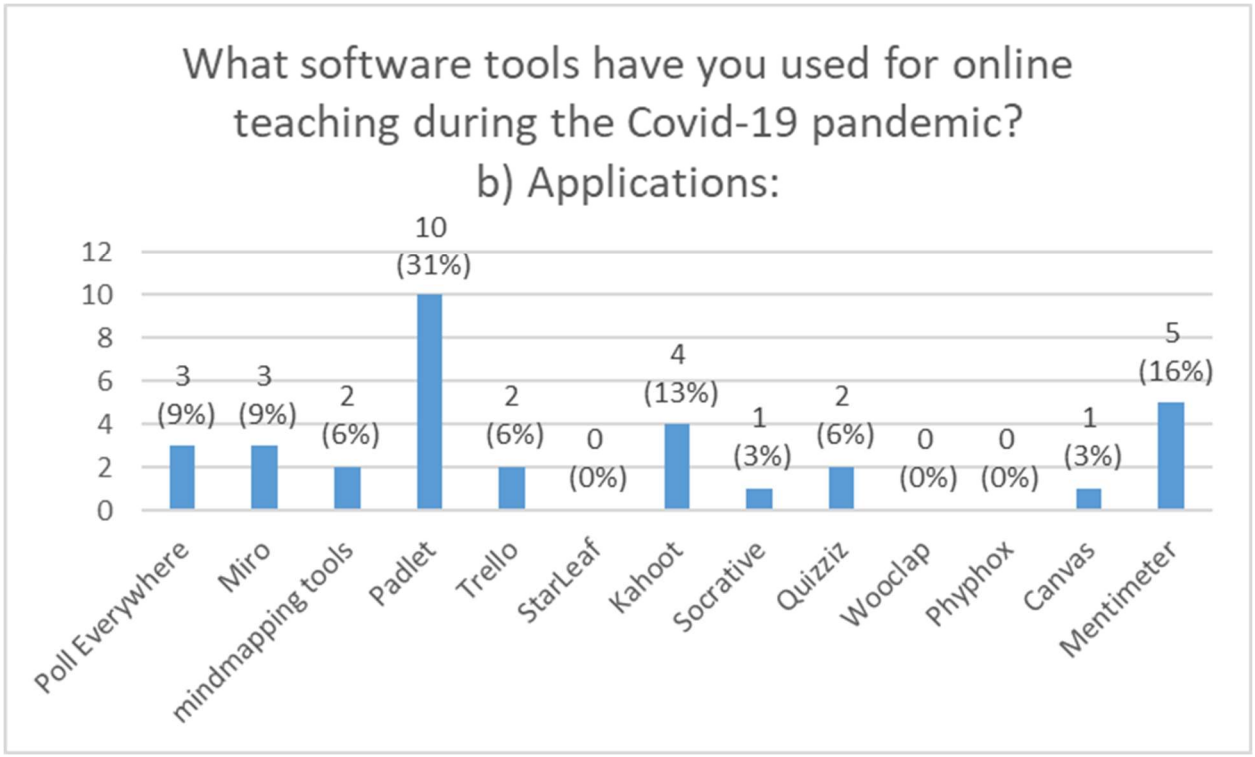


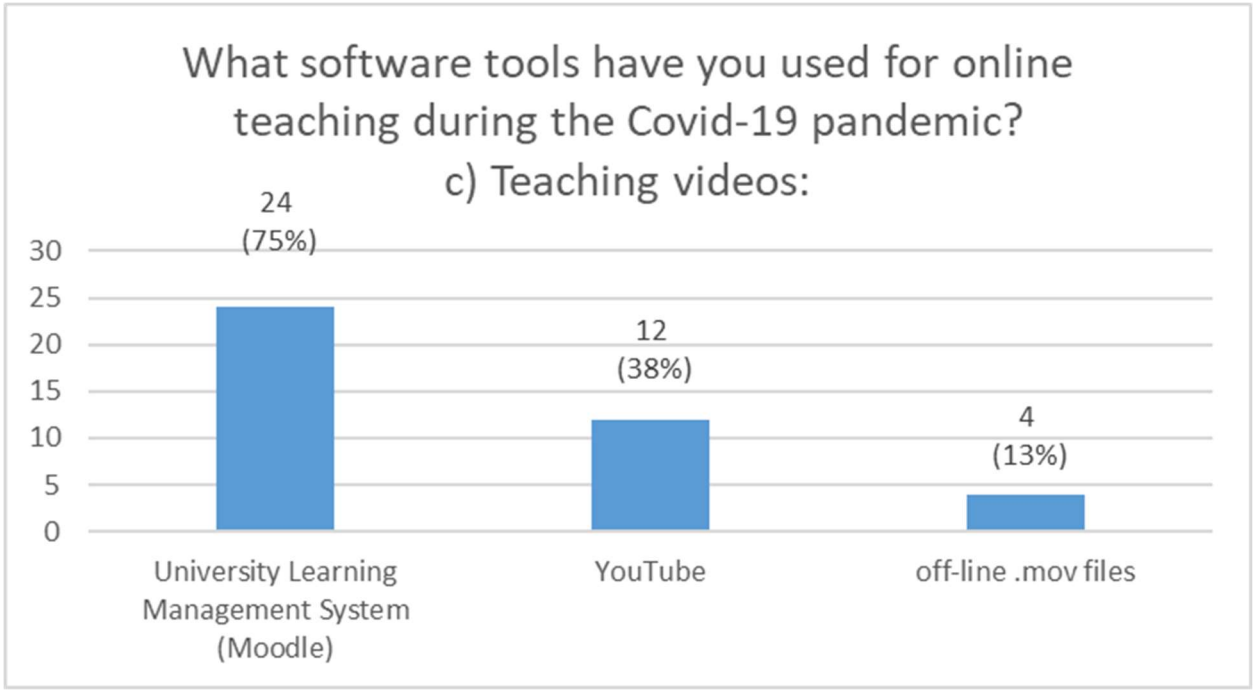


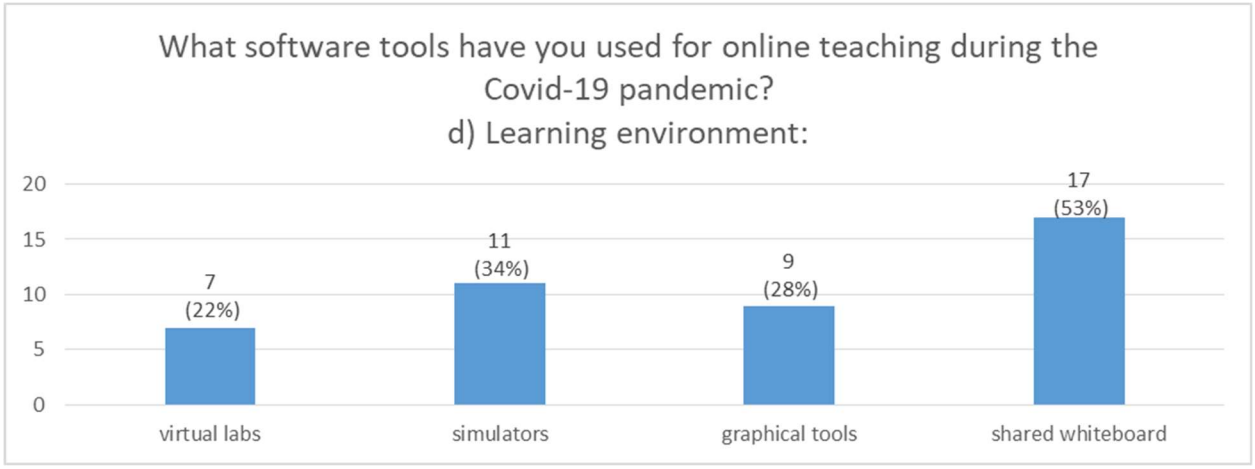
Notice that before the COVID-19 pandemic, 22% of the respondents did not use videoconference platforms, about 41% did not use any application, 19% did not use teaching videos, 31% did not use any learning environment, and 13% did not use any social network in the framework of the courses they taught.

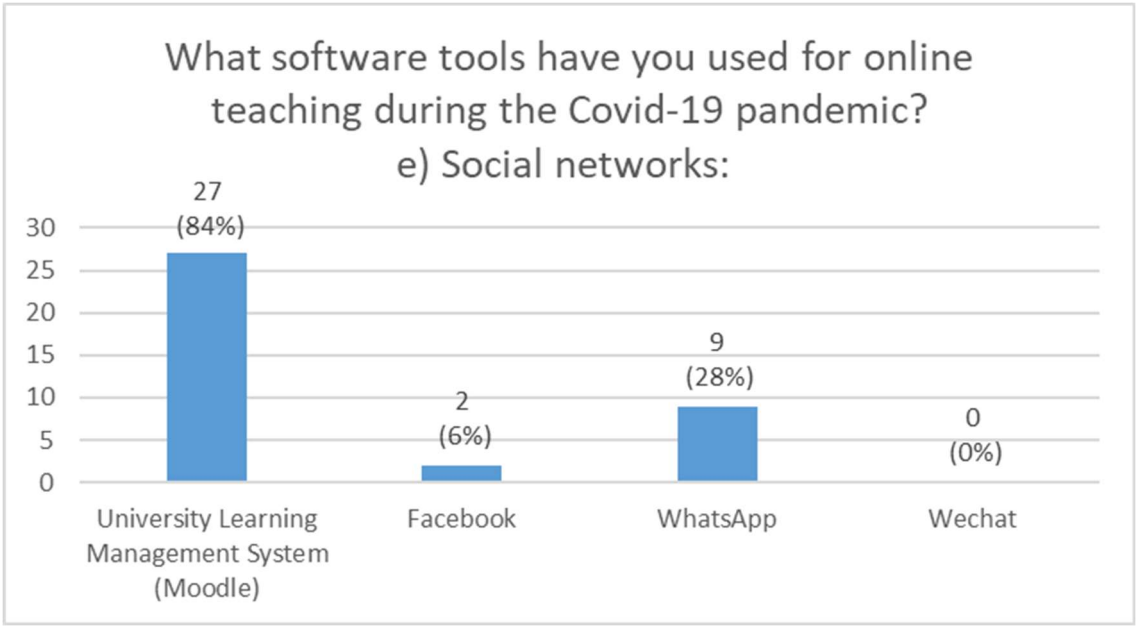
The following five figures illustrate the answers about software tools used for online teaching during the COVID-19 pandemic.


What software tools have you used for online teaching during the Covid-19 pandemic?
a) Videoconferencing/Communication tools:
35
30
25
20
15
10
5
0
31 (97%)
23 (72%)
4 (13%)
8 (25%)
0 (0%)
0 (0%)
1 (3%)
0 (0%)
Zoom
MS Teams
GoToMeeting
Skype
ezTalks Meetings
StarLeaf
Google Classroom
Big Blue Button


What software tools have you used for online teaching during the Covid-19 pandemic?
b) Applications:
12
10
8
6
4
2
0
3 (9%)
3 (9%)
2 (6%)
10 (31%)
2 (6%)
0 (0%)
4 (13%)
1 (3%)
2 (6%)
0 (0%)
0 (0%)
1 (3%)
5 (16%)
Poll Everywhere
Miro
mindmapping tools
Padlet
Trello
StarLeaf
Kahoot
Socrative
Quizziz
Wooclap
Phyphox
Canvas
Mentimeter


What software tools have you used for online teaching during the Covid-19 pandemic?
c) Teaching videos:
24
(75%)
12
(38%)
4
(13%)
30
25
20
15
10
5
0
University Learning Management System (Moodle)
YouTube
off-line .mov files



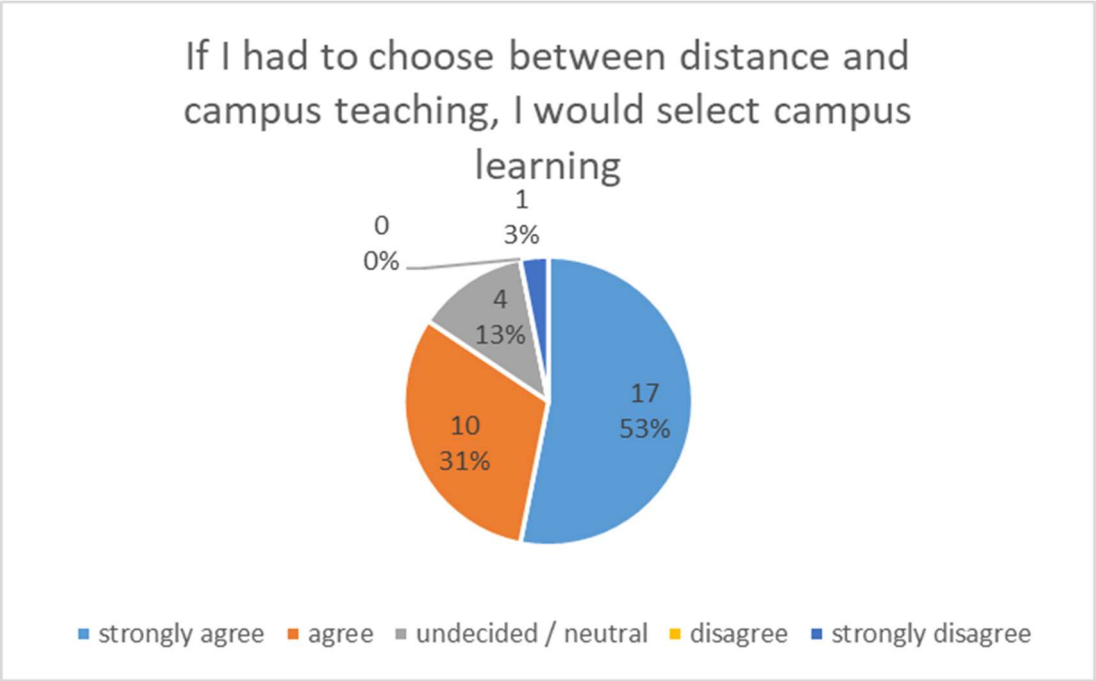


It should be noted that, during the pandemic, all the respondents used videoconference platforms, but 22% continued to not use any software application, 16% did not use teaching videos, 13% did not use any learning environment and 9% did not use any social network in the framework of the courses they taught.

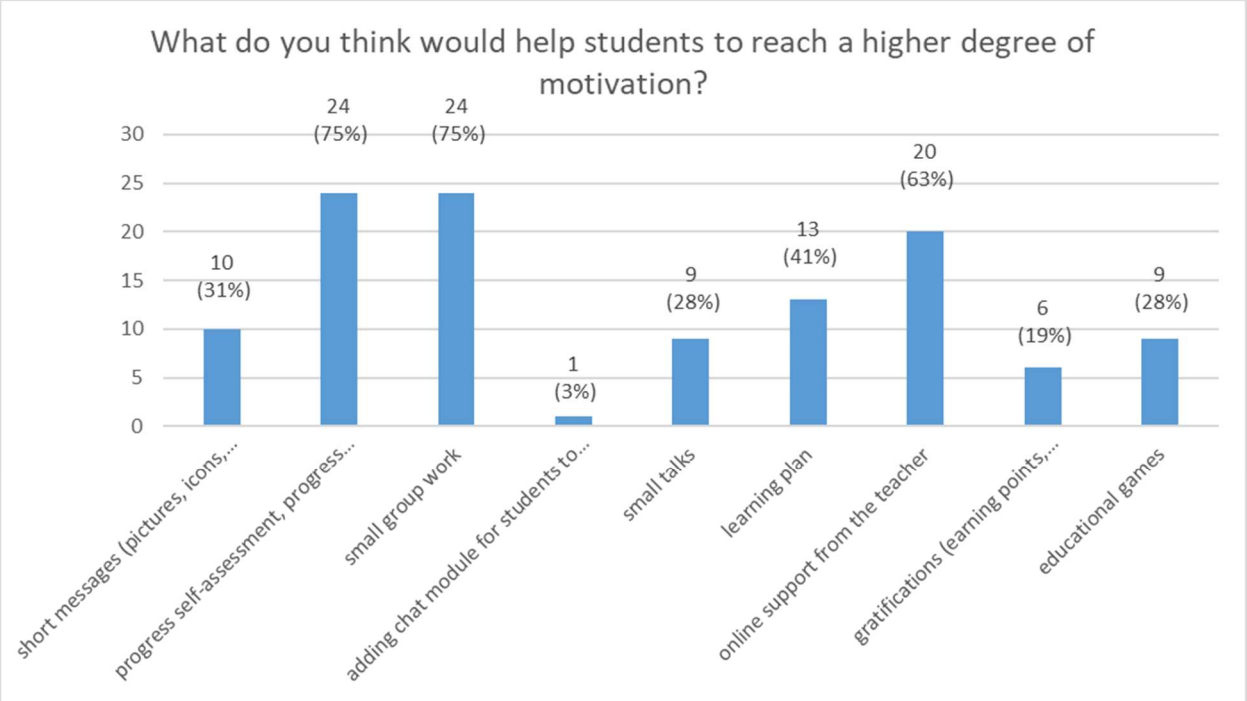
Questioned about functionality or tools that the teachers were missing during the COVID-19 pandemic, 28% answered that they did not miss anything, 19% missed contact/interaction with students and face to face classes, and 6% missed manual writing on black/white board.

With regard to the material resources which the respondents needed, the following was mentioned: a digital tablet to draw, touch screen to "emulate" whiteboard, stable internet connection, tools to create mind maps and videos; an ergonomic camera to show devices working on the desk, experimental laboratory, one single tool that could include all features for remote teaching (e.g., a mix between LMS and MS Teams), a versatile and failsafe tool to conduct remote proctored exams.

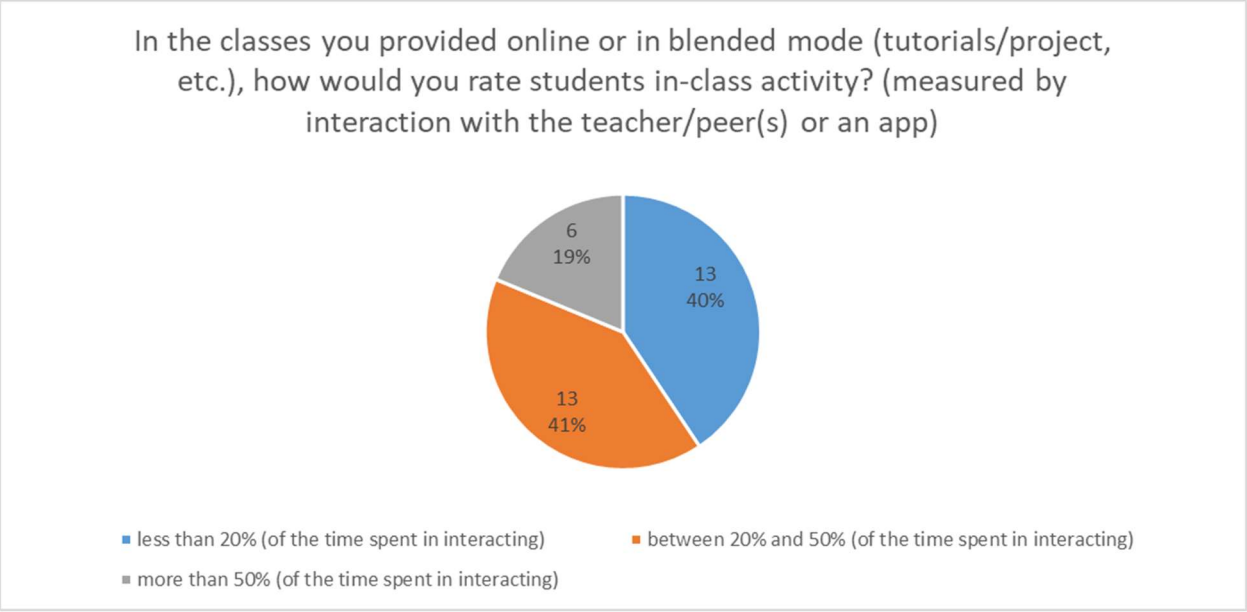
When asked about the possibility of choosing between distance and campus teaching, most opted for campus teaching, as illustrated by the following diagram.



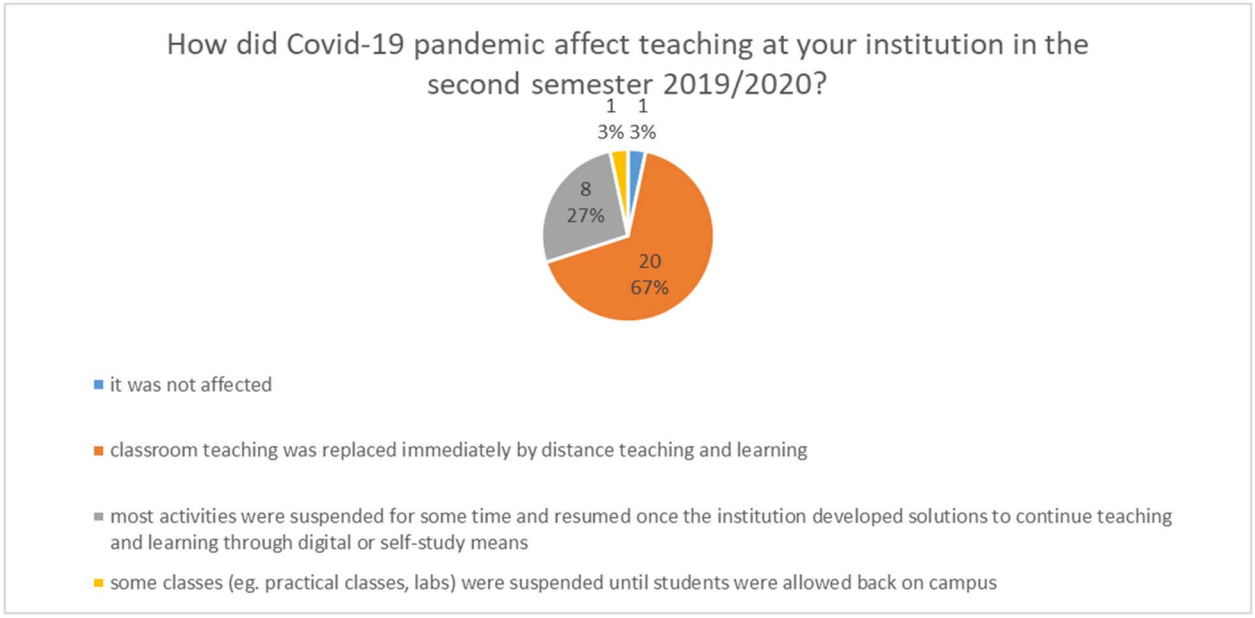
The following figure provides answers on how to help students to achieve a higher degree of motivation. According to one respondent, if students knew that a good job awaits them, they would be more motivated. Another view is that it is necessary to explain to students why the subject they are studying is important.



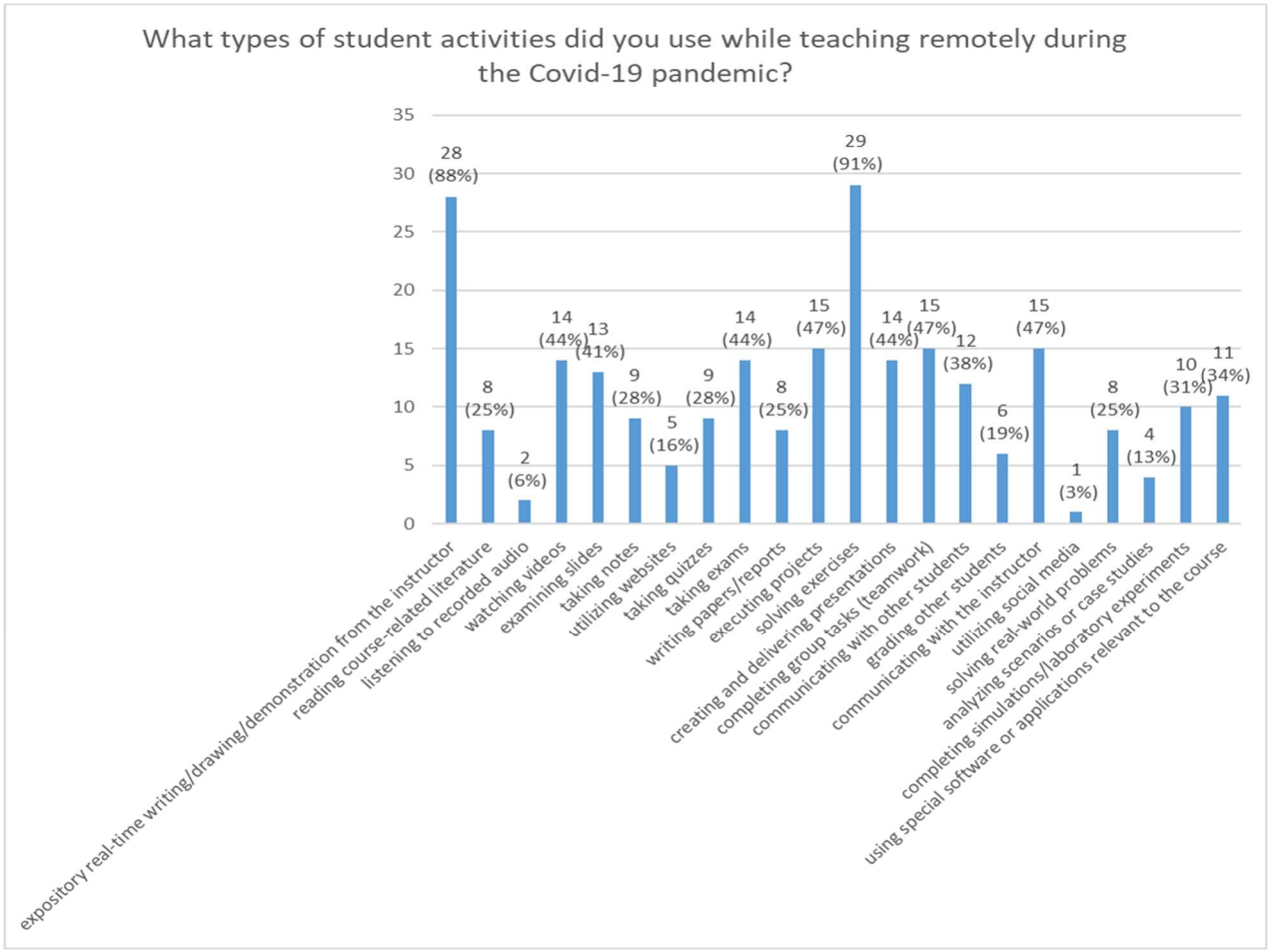
The following diagram shows the answers to the question about the students in-class activity.



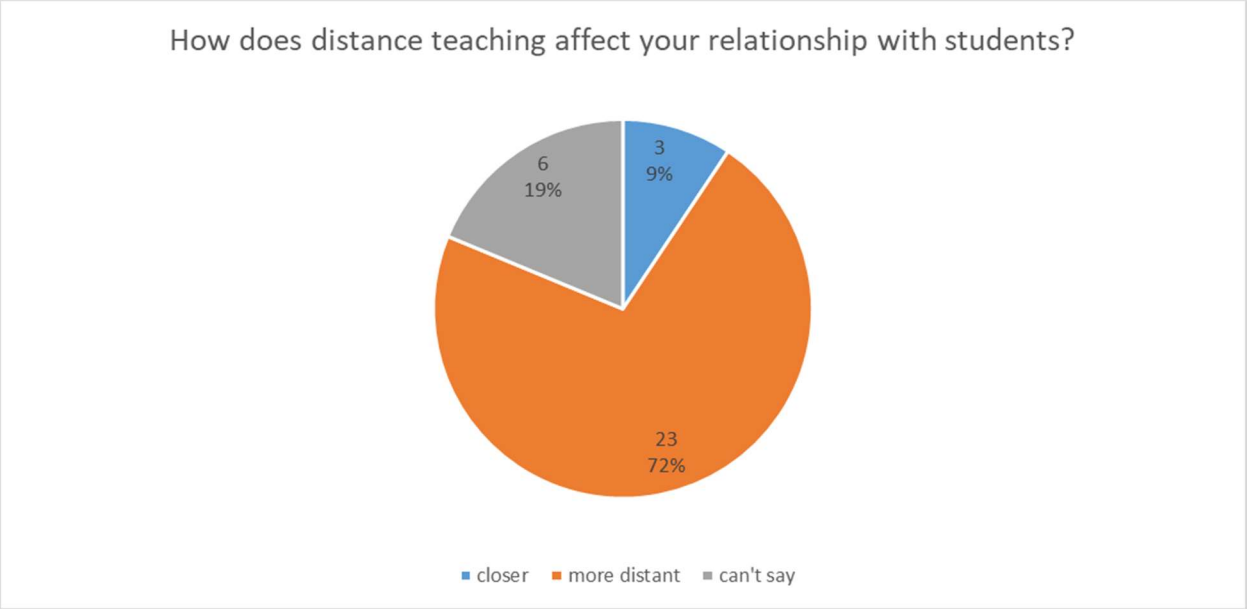
The next diagram shows the answers about how strongly the COVID-19 pandemic has affected teaching during the second semester of the 2019/2020 academic year.



From the following chart, one can see the variety of activities offered to students in distance learning during the COVID-19 pandemic.



The following chart shows the expected results, providing answers to the question of how distance learning has affected the relationship between teachers and students.



Conclusions

The majority of students (62%) consider face-to-face communication with cameras on to be very important in distance learning. In terms of videconferencing/communication tools, Zoom and MS teams are the most popular, 100% and 87% respectively. It should be noted that the students did not have the opportunity to choose the tools for conducting videconferences/communication since these were selected by the teachers. In terms of applications, Kahoot and Mentimeter were rated as the most popular. For social communication, the university learning management system was mainly used.

Although the transition to remote learning has been rapid and relatively smooth, 73% of students definitely prefer on-campus learning to distance learning. 60% of students consider online support from teachers to be very important for achieving a higher degree of motivation during distance learning and 50% consider self-assessment of progress to be meaningful. 59% of students noted that their in-class activity decreased compared to the pre-pandemic period. As for practice, students prefer solving exercises, watching videos, expository real-time writing/drawing/demonstration from an instructor, and taking notes during online classes.

According to almost all teachers (94%), face-to-face communication with cameras is important in distance teaching. With regard to video conferencing/communication tools, it should be noticed that the majority of teachers had already used some of them before the pandemic, and absolutely all teachers used one or more tools during remote classes. The most popular tools for videoconferencing are Skype, Zoom and MS Teams.
Padlet, Kahoot and Mentimeter were rated as the most popular apps. The most popular platforms for teachers were shared whiteboard (53%), simulators (34%), graphical tools (28%),

and virtual labs (22%). Moodle was the most popular communication tool (84%). Some teachers used WhatsApp (28%) and only 6% used Facebook to communicate with students.

While some teachers responded that they didn't miss anything during the pandemic period, the majority (84%) definitely prefer campus to distance teaching.

Assessment

University perspective

In the second semester of the 2019/2020 academic year, the rector's decision to assess students was that remote assessment should be used by default. Only in very exceptional cases was the face-to-face assessment considered with the approval of the respective Director of the Organic Unit and the Pedagogical Council.

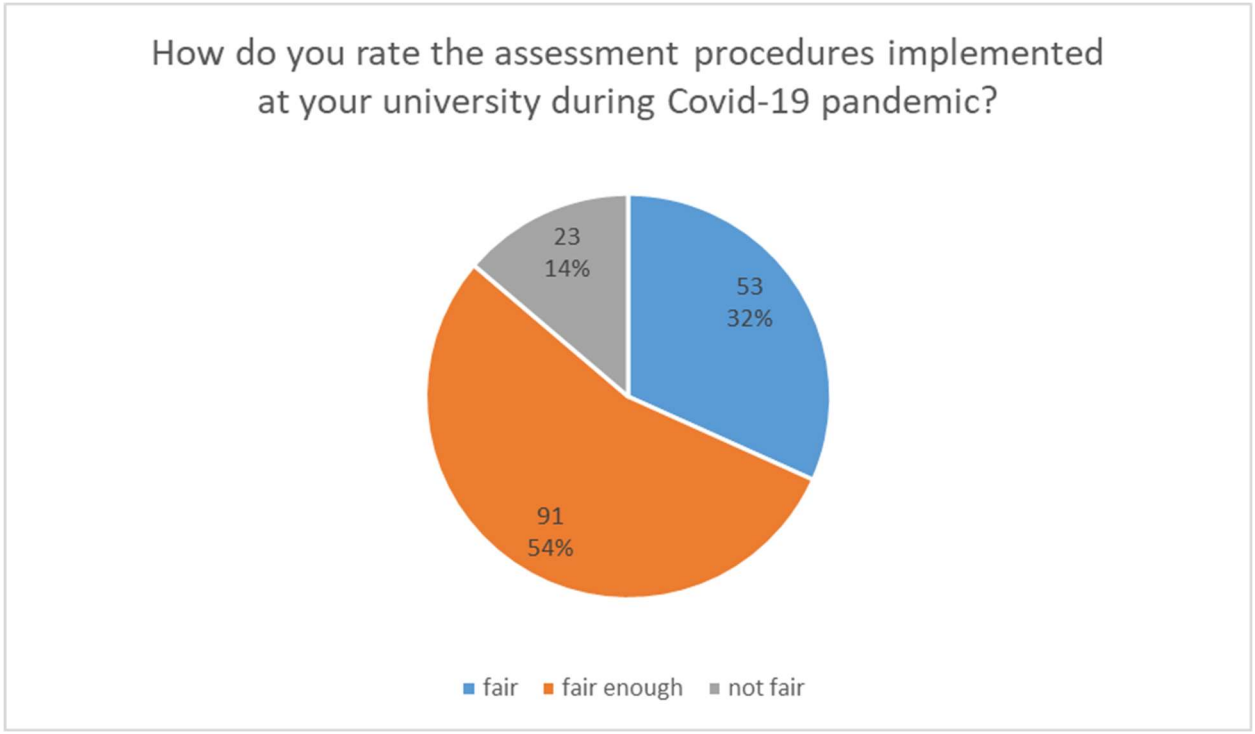
In the first semester of the 2020/2021 academic year, due to the worsening of the pandemic situation and the new lockdown set by the Portuguese government, the starting date of the exam season was postponed, and student assessments took place online.

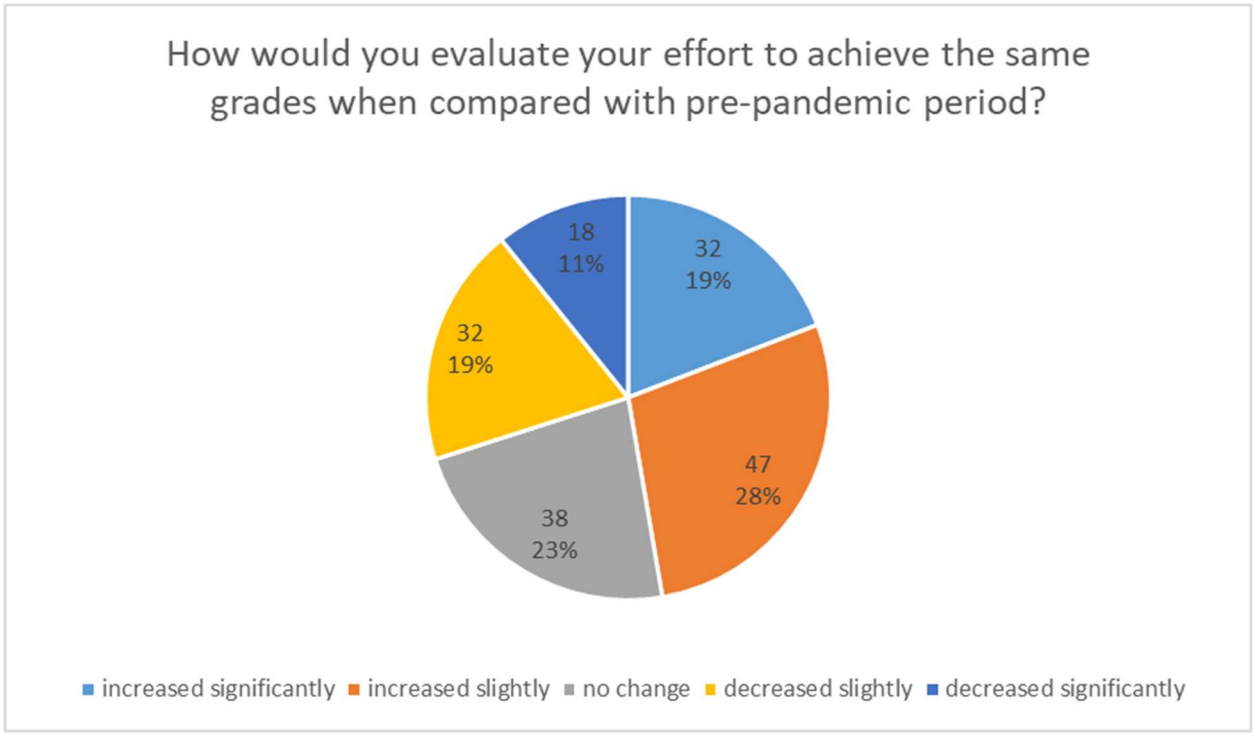
In the first month of the second semester 2020/2021, educational and assessment activities were held online. Given the positive evolution of the COVID-19 pandemic, online mode has been replaced by blended mode, subject to all recommended precautions, namely those related to hygiene, physical distance, and the use of personal protective equipment.

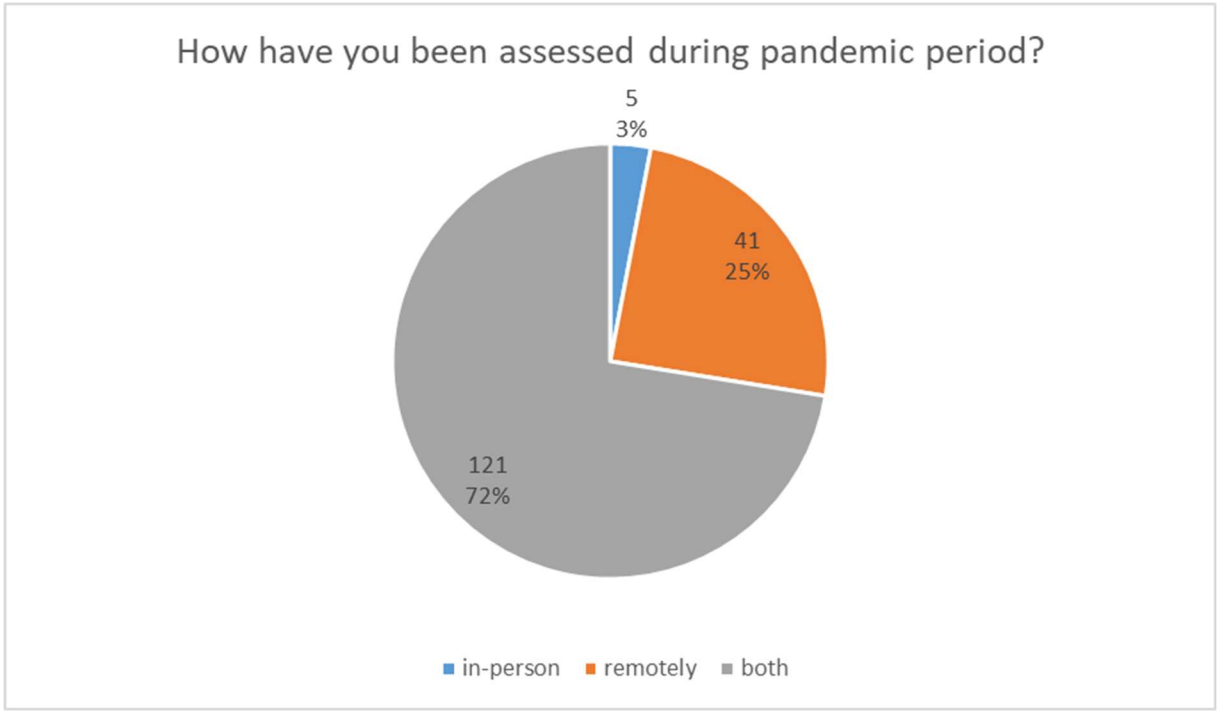
To prevent fraud in student assessments, each Organic Unit of UA has established a set of guidelines, including limiting the number of students in a virtual room, a mandatory camera, and identification of all students by identity card. Note that many teachers needed a second camera focusing on the student's workspace.

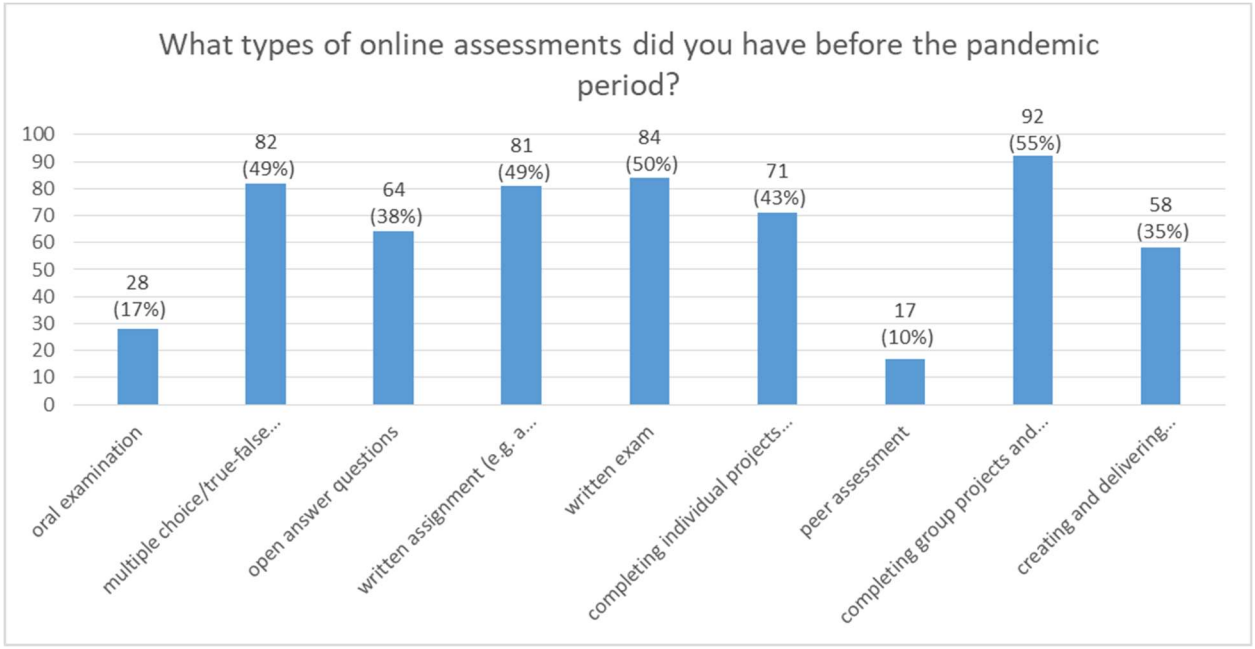
Student perspective

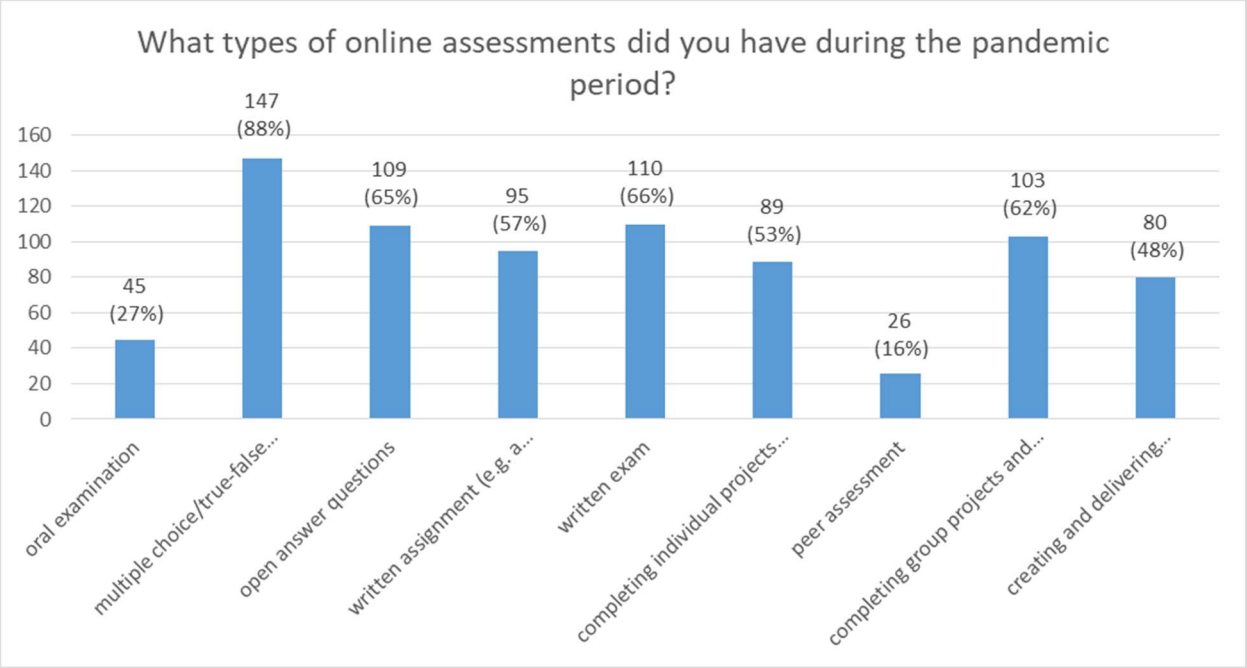
The assessment part of the student's questionnaire is devoted to monitoring the learning outcomes achieved through distance learning methods and techniques. Five questions were proposed in this category, the answers to which are summarised in the diagrams below.


How do you rate the assessment procedures implemented at your university during Covid-19 pandemic?
23
14%
53
32%
91
54%
fair
fair enough
not fair


How would you evaluate your effort to achieve the same grades when compared with pre-pandemic period?
18
11%
32
19%
32
19%
47
28%
38
23%
increased significantly
increased slightly
no change
decreased slightly
decreased significantly

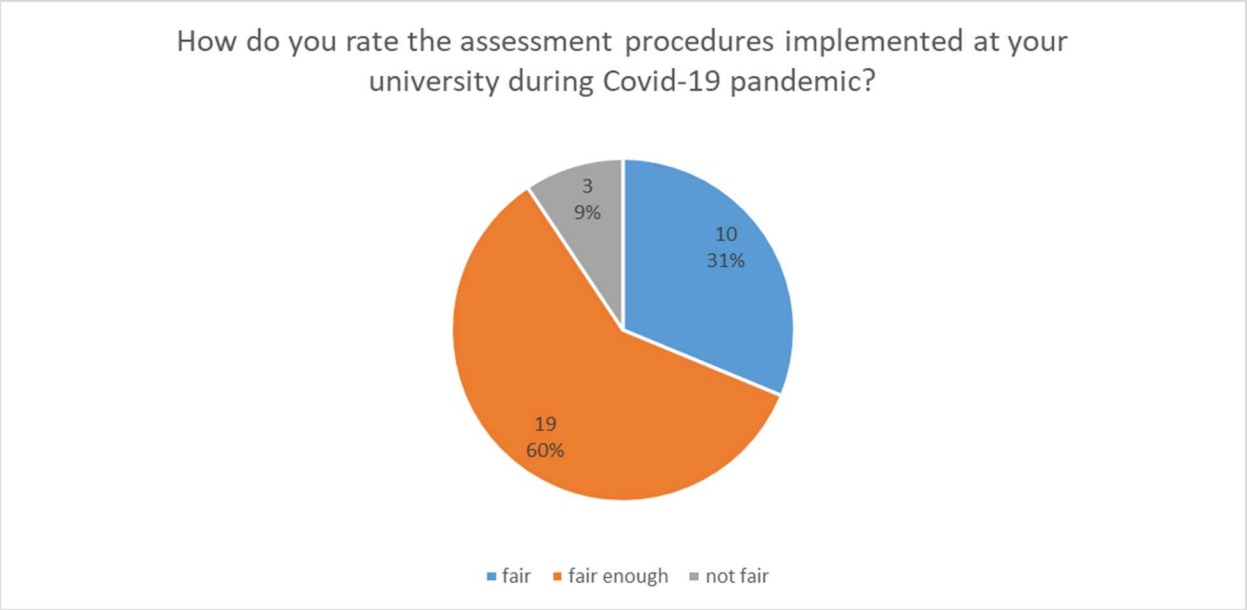

How have you been assessed during pandemic period?
5
3%
41
25%
121
72%
in-person
remotely
both

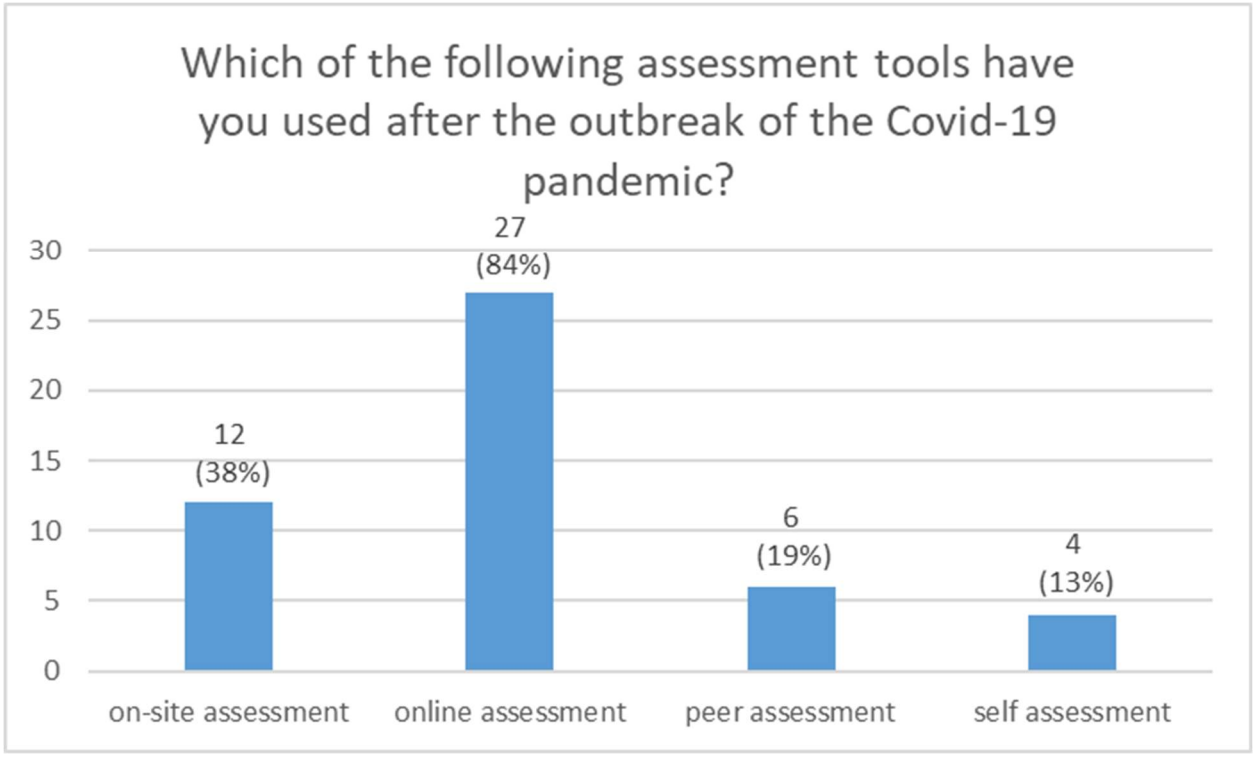

What types of online assessments did you have before the pandemic period?
100
90
80
70
60
50
40
30
20
10
0
28 (17%)
82 (49%)
64 (38%)
81 (49%)
84 (50%)
71 (43%)
17 (10%)
92 (55%)
58 (35%)
oral examination
multiple choice/true-false...
open answer questions
written assignment (e.g. a...
written exam
completing individual projects...
peer assessment
completing group projects and...
creating and delivering...

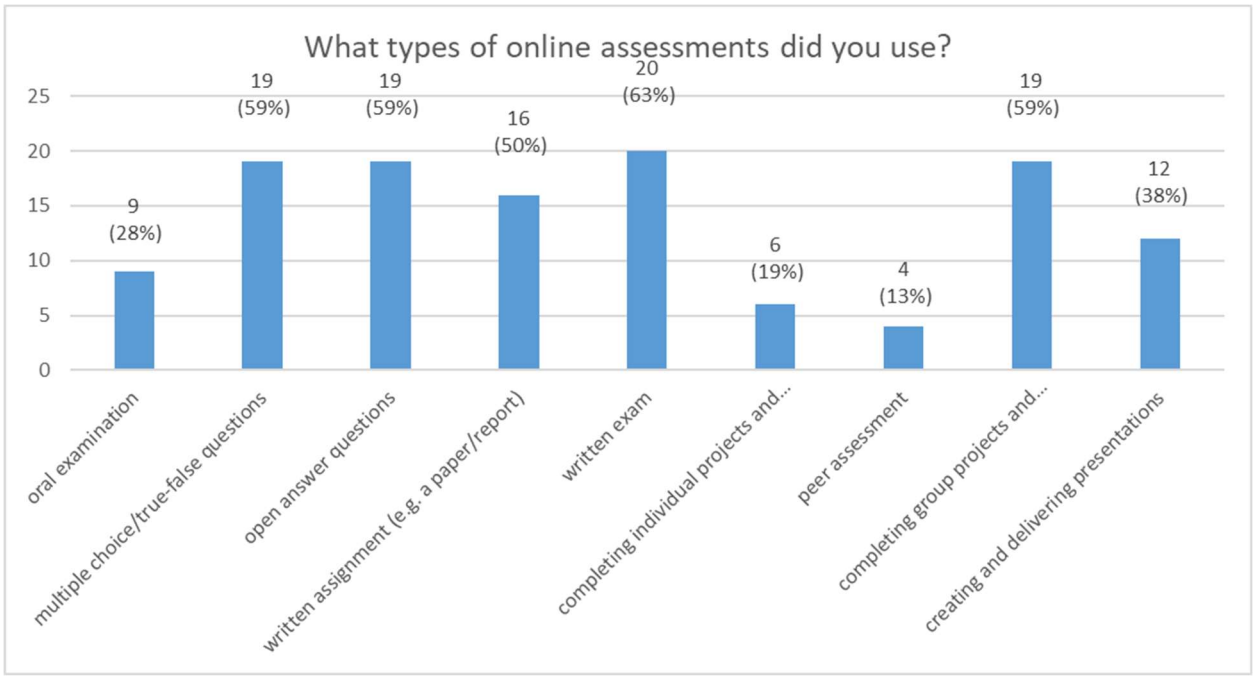


Teacher perspective

The teachers survey contained three questions about the assessment. The answers are presented in the following diagrams.







Conclusions

Only 14% of the students consider that the assessment procedures implemented during the pandemic are unfair. Almost half (47%) believe that their efforts to achieve the same grades as in the pre-pandemic era increased. Only 3% of the students were assessed exclusively in person, and 72% completed both face-to-face and distance assessments.

In general, the teachers consider that the assessment procedures introduced during the pandemic were fair or fair enough. Only 9% find these procedures unfair. Depending on the level of training and subject, 84% of teachers used online assessment, 34% used on-site assessment, and 19% and 13%, respectively, used peer assessment and self-assessment. Among the most popular types of online assessment were written exams (63%), multiple choice/true-false questions, open answer questions, and completing group projects and assignments (59% each).

Evaluation

University perspective

In the first days of the first lockdown (March 2020), UA created a Reflection Scientific-Pedagogical Support Group to monitor all the process of distance activities and produced recommendations for distance assessment.

As a rule, in the case of curricular units where several teachers taught, the responsible, in agreement with his/her colleagues, established the rules that everyone else had to follow. This procedure was particularly important in distance teaching, as almost all UA teachers had no online education experience before the first lockdown.

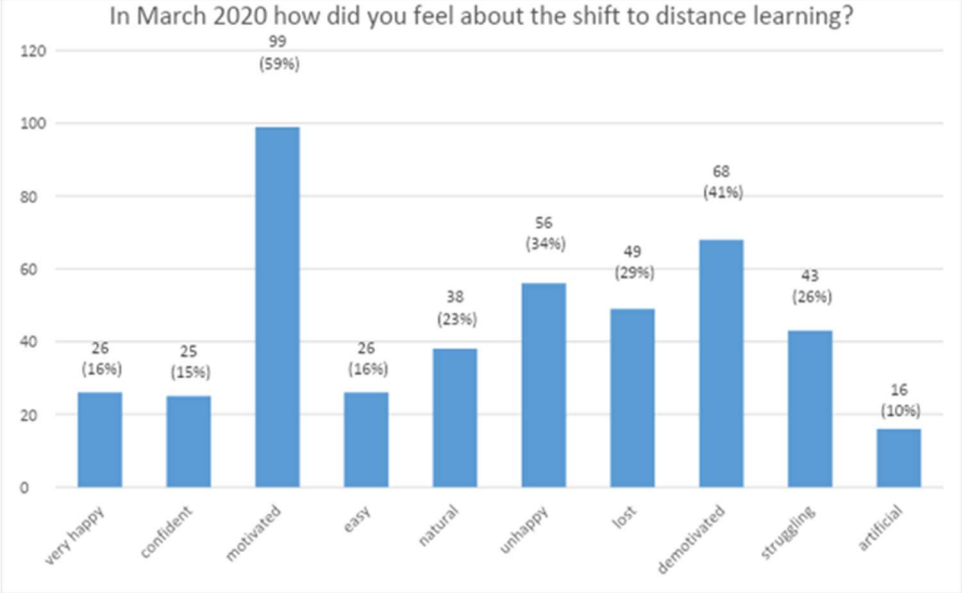
At UA, at the end of each semester, students respond to a survey that evaluates each curricular unit and its teachers, with the aim of monitoring the quality of teaching / learning. This review identifies best practices that are prevalent at the university, while curricular units with problems are controlled by the organic unit's management. The results of the survey also affect the professional evaluation of teachers.

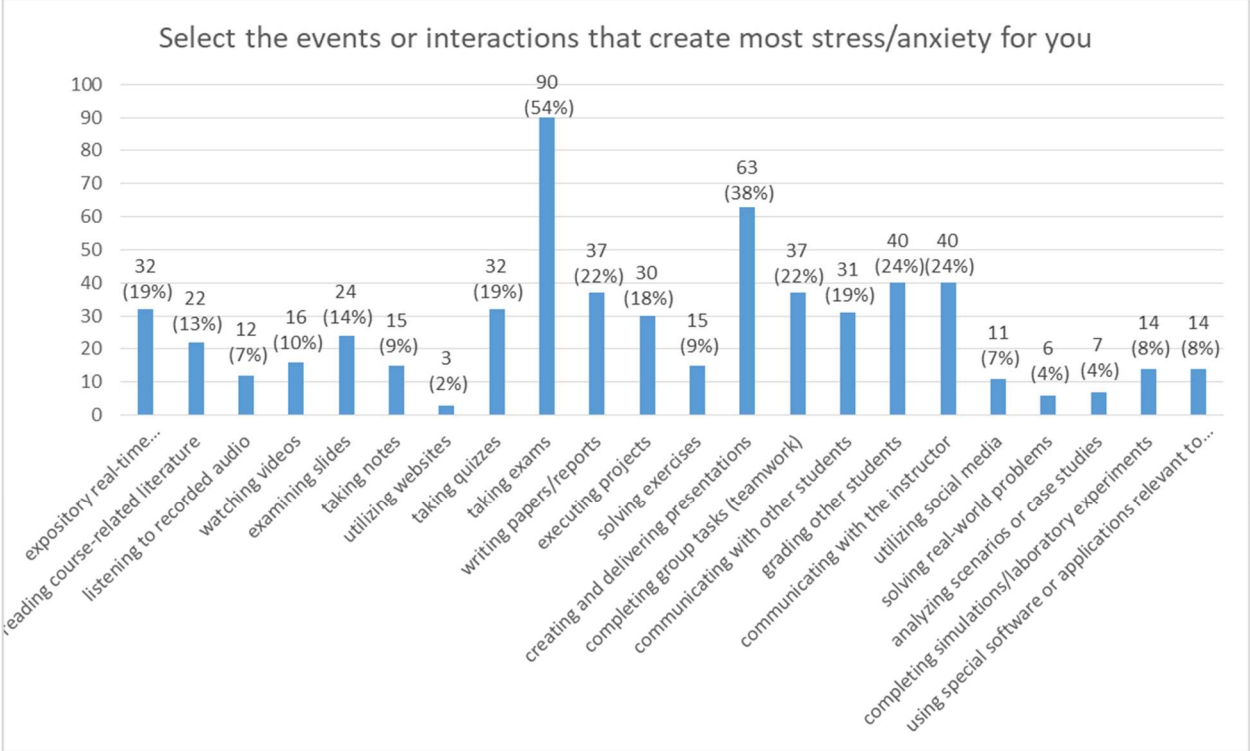
In the case of online teaching, the university did not conduct an official survey. However, some teachers carried on their own informal surveys to assess online teaching.

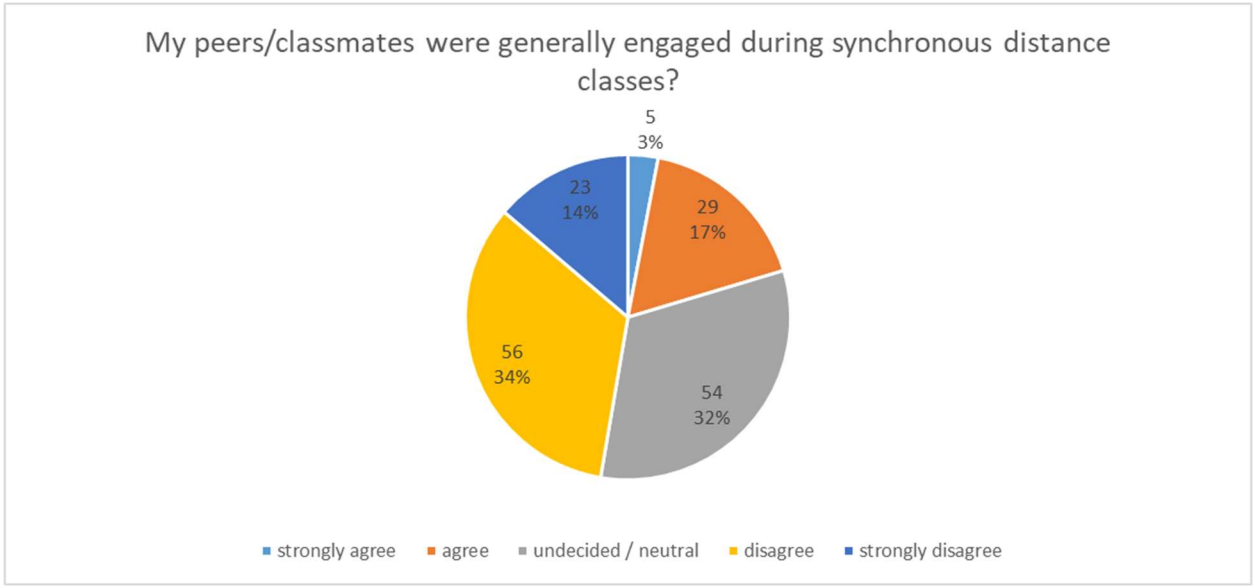
Student perspective

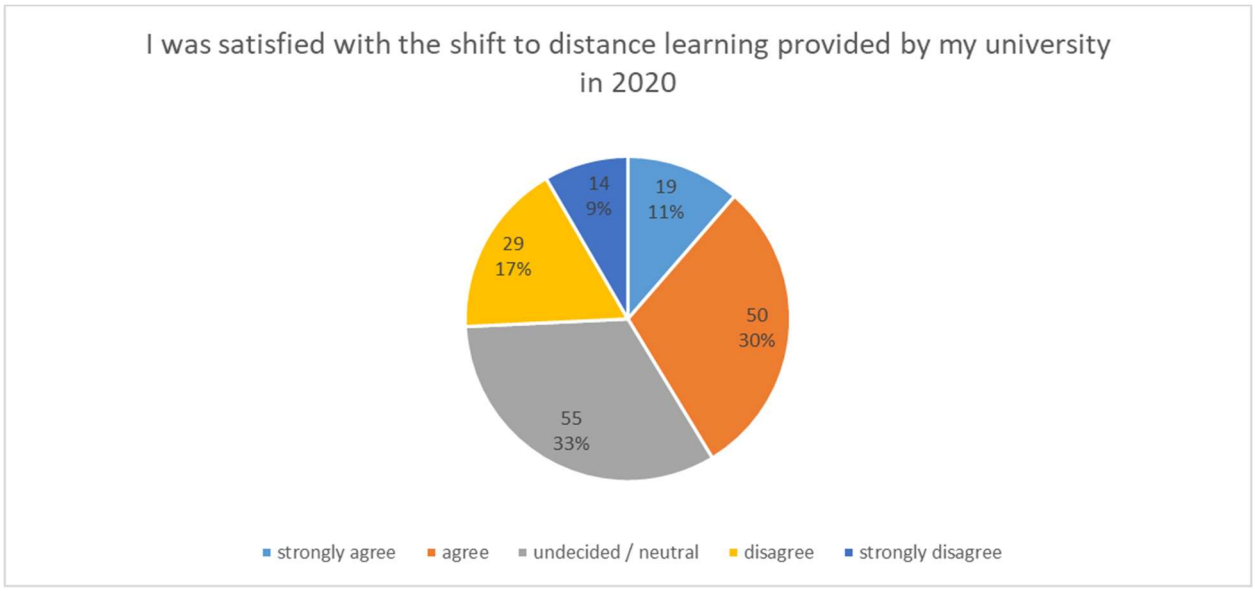
This section deals with the final evaluation of the quality of the adopted distance learning techniques and methods. Twelve questions fall in this category and the results are summarised in the figures below.

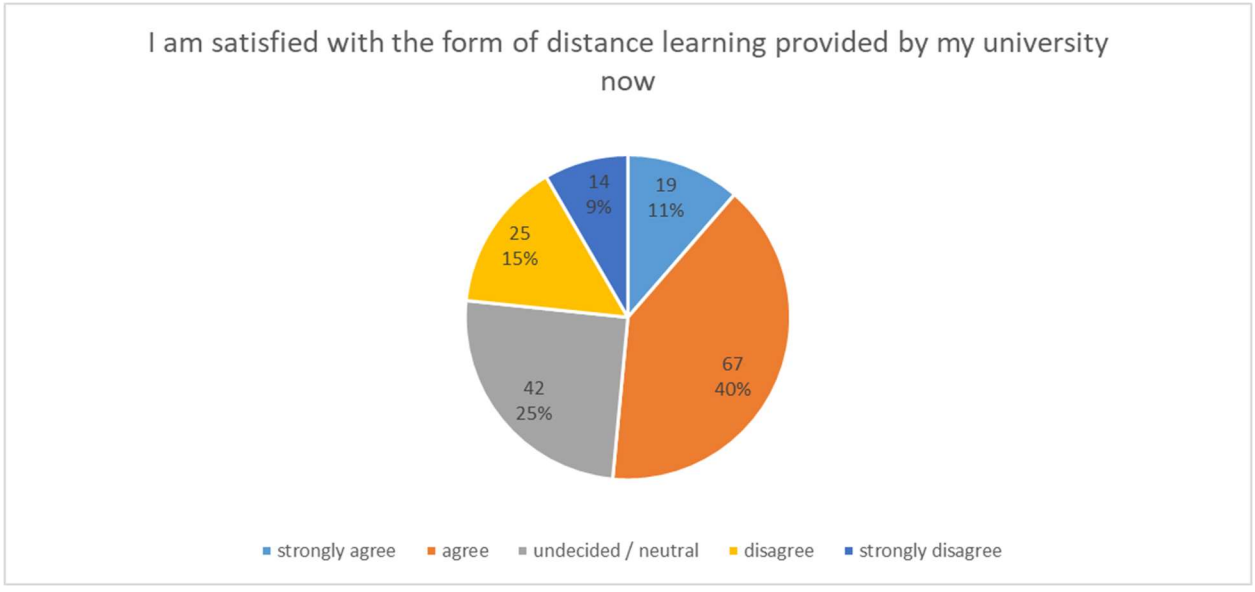
Students' answers to the first question about their feelings immediately after switching to online learning in 2020 show that they experienced a wide variety of and sometimes contradictory feelings.

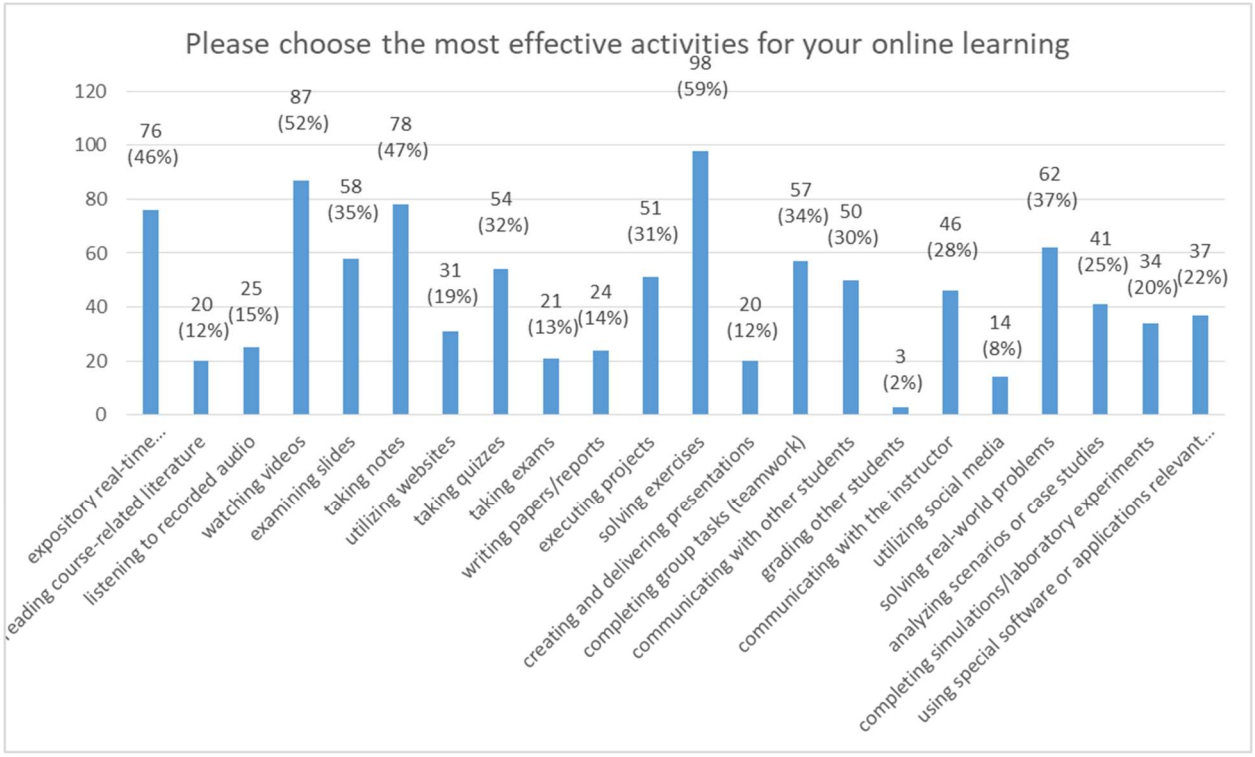

In March 2020 how did you feel about the shift to distance learning?
120
100
80
60
40
20
0
26 (16%)
25 (15%)
99 (59%)
26 (16%)
38 (23%)
56 (34%)
49 (29%)
68 (41%)
43 (26%)
16 (10%)
very happy
confident
motivated
easy
natural
unhappy
lost
demotivated
struggling
artificial

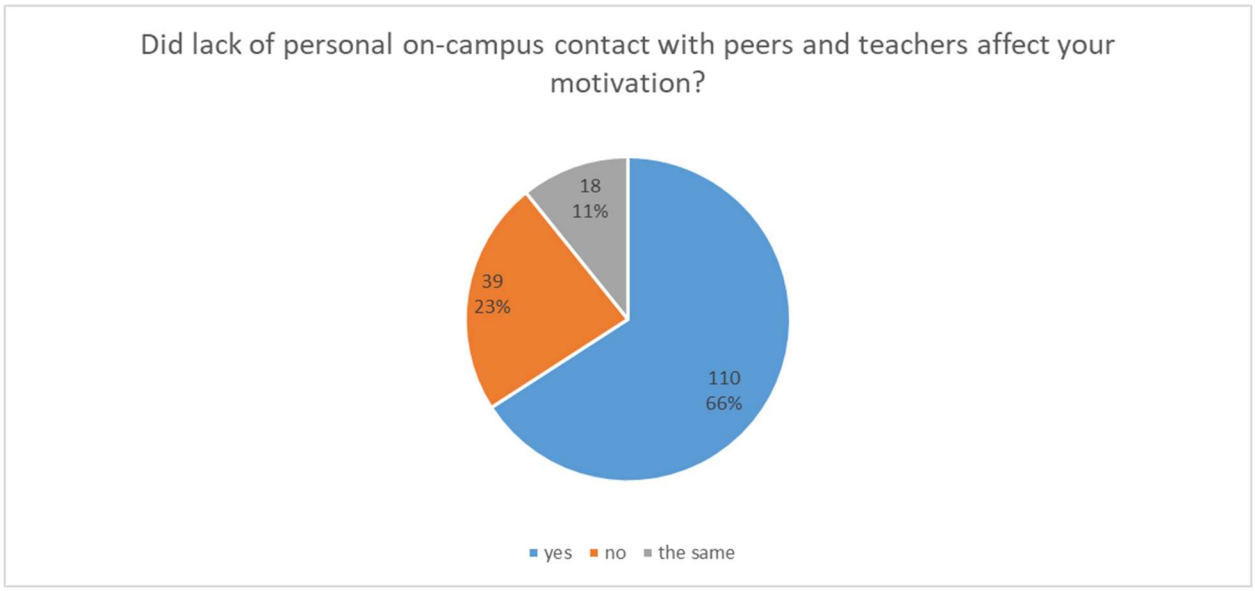

Select the events or interactions that create most stress/anxiety for you
100
90
80
70
60
50
40
30
20
10
0
32 (19%)
22 (13%)
12 (7%)
16 (10%)
24 (14%)
15 (9%)
3 (2%)
32 (19%)
90 (54%)
37 (22%)
30 (18%)
15 (9%)
63 (38%)
37 (22%)
31 (19%)
40 (24%)
40 (24%)
11 (7%)
6 (4%)
7 (4%)
14 (8%)
14 (8%)
expository real-time...
reading course-related literature
listening to recorded audio
watching videos
examining slides
taking notes
utilizing websites
taking quizzes
taking exams
writing papers/reports
executing projects
solving exercises
creating and delivering presentations
completing group tasks (teamwork)
communicating with other students
grading other students
communicating with the instructor
utilizing social media
solving real-world problems
analyzing scenarios or case studies
completing simulations/laboratory experiments
using special software or applications relevant to...

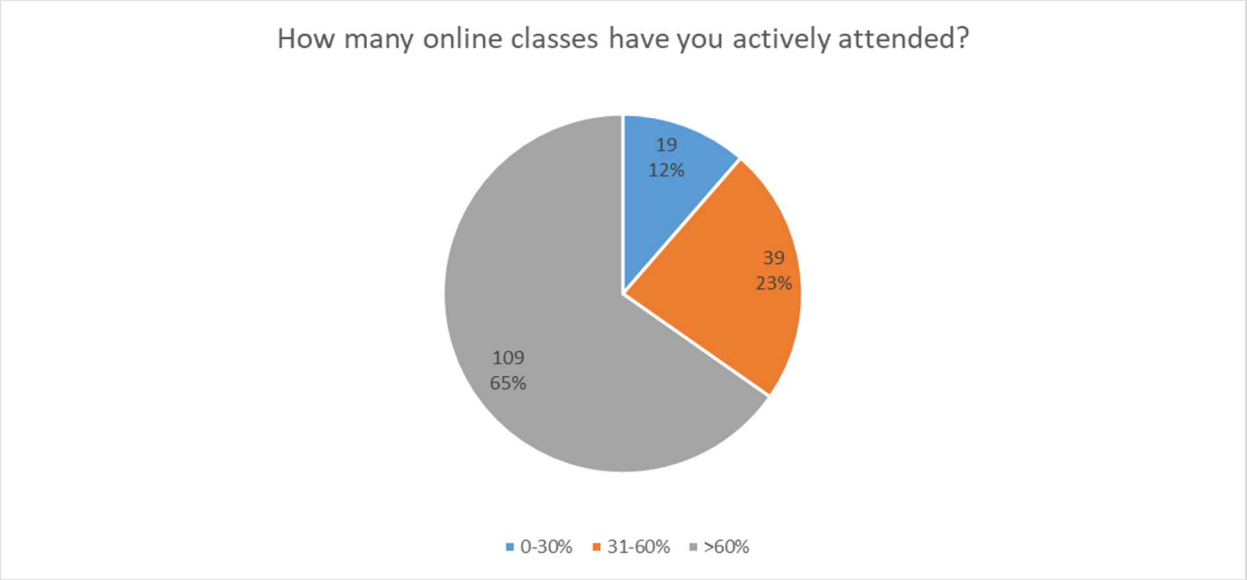

My peers/classmates were generally engaged during synchronous distance classes?
5
3%
29
17%
54
32%
56
34%
23
14%
strongly agree
agree
undecided / neutral
disagree
strongly disagree

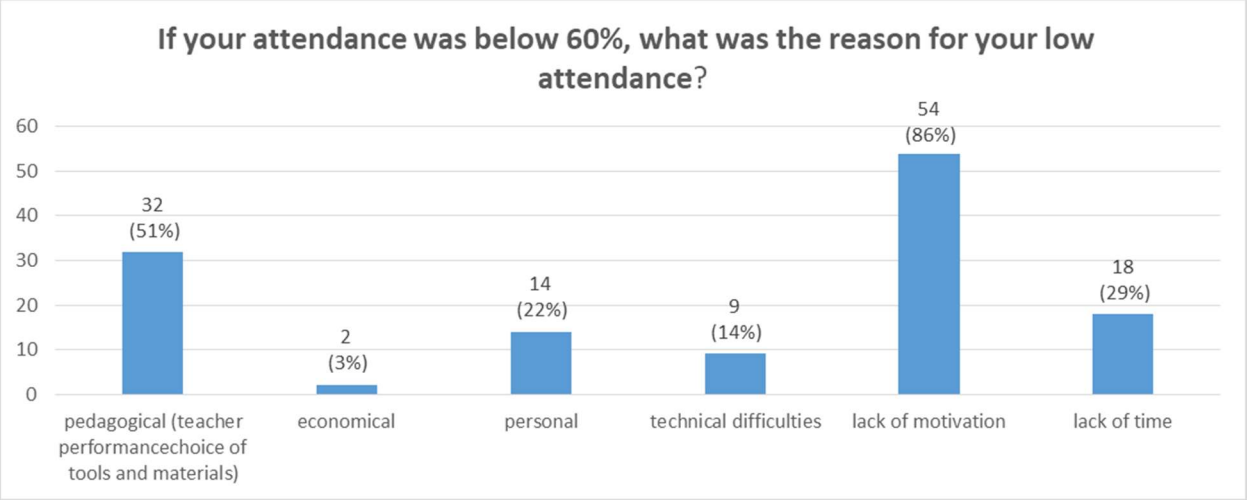

I was satisfied with the shift to distance learning provided by my university in 2020
19
11%
50
30%
55
33%
29
17%
14
9%
strongly agree
agree
undecided / neutral
disagree
strongly disagree

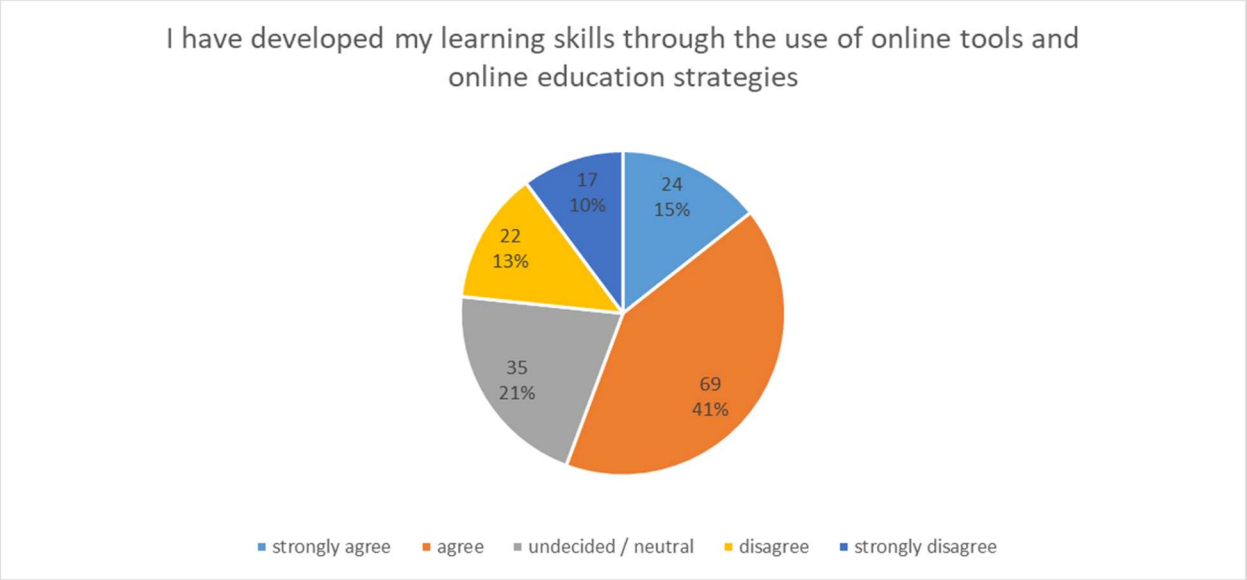

I am satisfied with the form of distance learning provided by my university now
19
11%
67
40%
42
25%
25
15%
14
9%
strongly agree
agree
undecided / neutral
disagree
strongly disagree


Please choose the most effective activities for your online learning
120
100
80
60
40
20
0
76 (46%)
20 (12%)
25 (15%)
87 (52%)
58 (35%)
78 (47%)
31 (19%)
54 (32%)
21 (13%)
24 (14%)
51 (31%)
98 (59%)
20 (12%)
57 (34%)
50 (30%)
3 (2%)
46 (28%)
14 (8%)
62 (37%)
41 (25%)
34 (20%)
37 (22%)
expository real-time...
reading course-related literature
listening to recorded audio
watching videos
examining slides
taking notes
utilizing websites
taking quizzes
taking exams
writing papers/reports
executing projects
solving exercises
creating and delivering presentations
completing group tasks (teamwork)
communicating with other students
grading other students
communicating with the instructor
utilizing social media
solving real-world problems
analyzing scenarios or case studies
completing simulations/laboratory experiments
using special software or applications relevant...


Did lack of personal on-campus contact with peers and teachers affect your motivation?
18
11%
39
23%
110
66%
yes
no
the same







Apart from the fixed-answer questions above, students were asked one open question about which aspect of online learning was the most challenging. The main challenge appointed by

students was concentration and focusing attention to classes: about 36% of respondents indicated this factor. In particular, some students mentioned that they were tired of looking at a computer screen for many hours a day and keeping their attention in the classroom; some mentioned that one of the reasons was that they often got “distracted using their mobile phone, playing video games, watching other stuff”.

Another issue pointed out by students (about 12%) was lack of motivation, decreasing motivation, and “battling the thought of dropping out”.

About 13% of respondents noted that the lack of personal contact with colleagues and teachers is a problem. Specifically, they mentioned “lack of real life connection”, “less (physical) contact with teachers”, “not having a teacher following my development,” and “lack of social interaction.”

6% of responders mentioned a heavy workload with assignments, a large amount of work after classes, designed to compensate for the fact that too much time of classes was used to show videos, and a “crazy amount of projects”. Some students felt that this extra work was not accompanied by sufficient support from the teachers.

The next most frequently cited negative factors were technical problems (5%) – poor Internet connection, problems with webcam and microphone, and even not good Internet connection of the teachers; and not being happy with the online assessment (5%). Some students shared the opinion that the tests were too difficult because teachers tried to avoid copying.

At the same time, 5% of students have easily switched to online learning, and even noted that they like it and that even in a COVID-19-free world, online education is ideal, since it provides “access to education to people all around the country, from any University.”

Less frequent answers about the challenges were:

- time management (2%);
- “learning by myself” (2%);
- not having a special physical space for learning (2%);
- teachers not prepared for teaching online (2%).

Only 2% of students mentioned psychological problems (boredom, pessimism about life, the crushing weight of isolation and other personal problems).

A small number of students noted that the classes were poorly prepared and that it was difficult for them to follow practical classes, some had trouble scheduling time, and some felt that it was difficult to keep their grades at the same level as before. Others were unhappy to see ”the

professors' efforts to keep people interested in class and no one caring" and to be unable to separate the work from personal life.

The second open-answer question concerned how distance learning could be improved. The most popular proposal (about 36%) was a change in the way of teaching. Students prefer "less expositive classes", and instead would like to have more exercises solved in classes, shorter and more dynamic classes followed by "interactive activities and quizzes". Some students suggest dividing groups into smaller subgroups of maximum 10 students "so that the professor and students could interact more and feel less pressure when they had to answer questions", others suggested giving more classes in the form of tutorials. Many students want to keep records of classes to rewatch them after, suggesting that teachers could prepare supporting videos, slides, and notes that would be made available for independent work. Some students showed that they needed to have more contact/pressure/monitoring from teachers, since they (students) "... were so lost in everything". The use of online whiteboards was highly appreciated. The students expect more engagement and more interaction from the teachers, more project executions and real-world problems. They consider that distance learning should be "a mixture between asynchronous (e.g., brief theoretical exposition) and synchronous (e.g., further developments, answers to student questions, solving problems) activities". Another suggestion is to "reduce workload and apply a mandatory "camera on" policy to assure the professor who's lecturing doesn't lose motivation".

The second more frequent answer is connected with technical challenges (about 12%). The majority of students want to have recorded classes, many consider that it is important that the students have cameras on during classes, and some prefer shorter theoretical classes. It was suggested that the university should provide labs for people who don't have their own computers, and that the teachers should stop using "... old techniques". Some respondents (9%) consider that in distance learning the classes (especially theoretical) should be shorter, and with more practical components.

12% of students believe that teachers should also change. Students want to "have more dialogue and more captive teachers, more interaction between the students and teacher". They believe that " teachers should be more open to distance learning methods, and trying new stuff, instead of always pushing for in class classes". They want teachers to try to engage and motivate students in their classrooms, they believe that teachers should "try new and original approaches of teaching to capture the attention of the student". One way to do this is to "employ young teachers, with superior capabilities to interface with this new era." About 6% of respondents showed their interest in more student-centred teaching. They consider that it is important to have more communication and more interaction between students and teachers.
Also, the students expect more innovation at the Universities: "There is a reason why educational Youtube channels are more engaging than university classes. 3Blue1Brown and Kurzgesagt come to mind. Take a hint from their success and implement changes that help us all." They consider

that “people like to learn, it's an amazing feeling. Somehow universities create so much noise with grades and bureaucracies that people feel distressed instead of happy to learn.” Some students suggest changing the assessment system, suggesting “more evaluations spread out throughout the year, less weighted… more practical work/exam preparation instead of just theory dumps.”

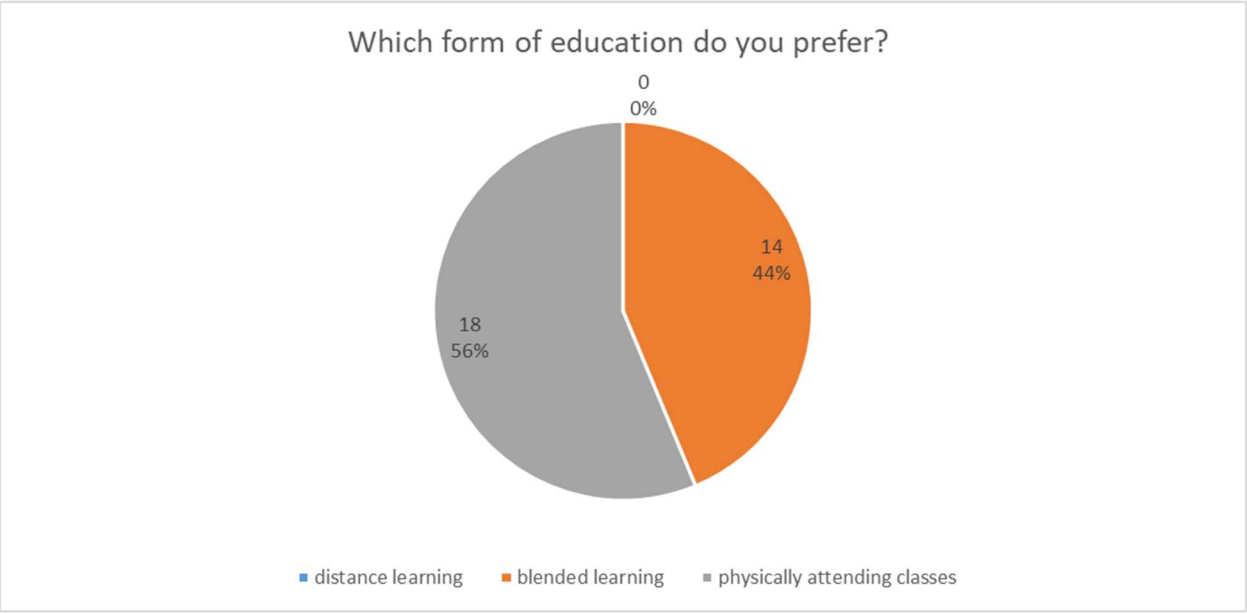
8% of the students expressed explicitly that they do not like distance learning, that “theoretical classes should be a place for bidirectional discussion therefore they should be presential if possible.” About 9% of respondents showed their pessimism (“but the reality is that the student doesn't learn anything when compared to face to face class”) and answered that either nothing can be improved or that they do not know how something can be improved.

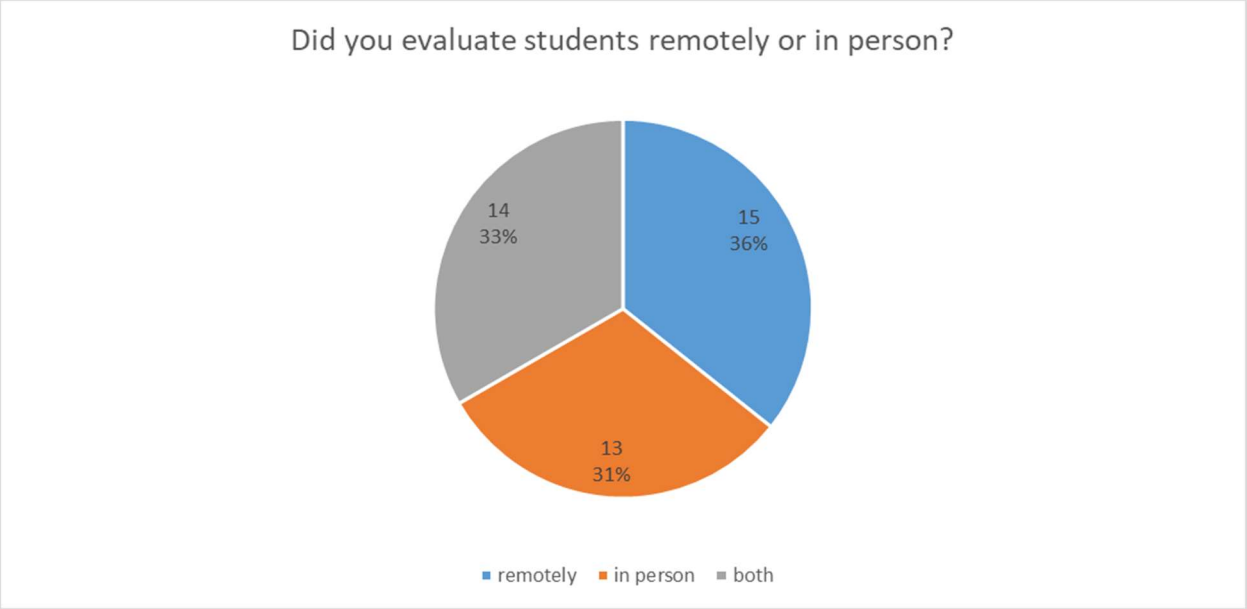
At the same time, some students are more positive and consider that “if the teacher gives enough material to the students to work with and understands the pros and cons of online learning and can work with that, it's ok, if not even better, than on campus learning (depends on the class)” and that “this could help some students, work-students or students with health problems”.

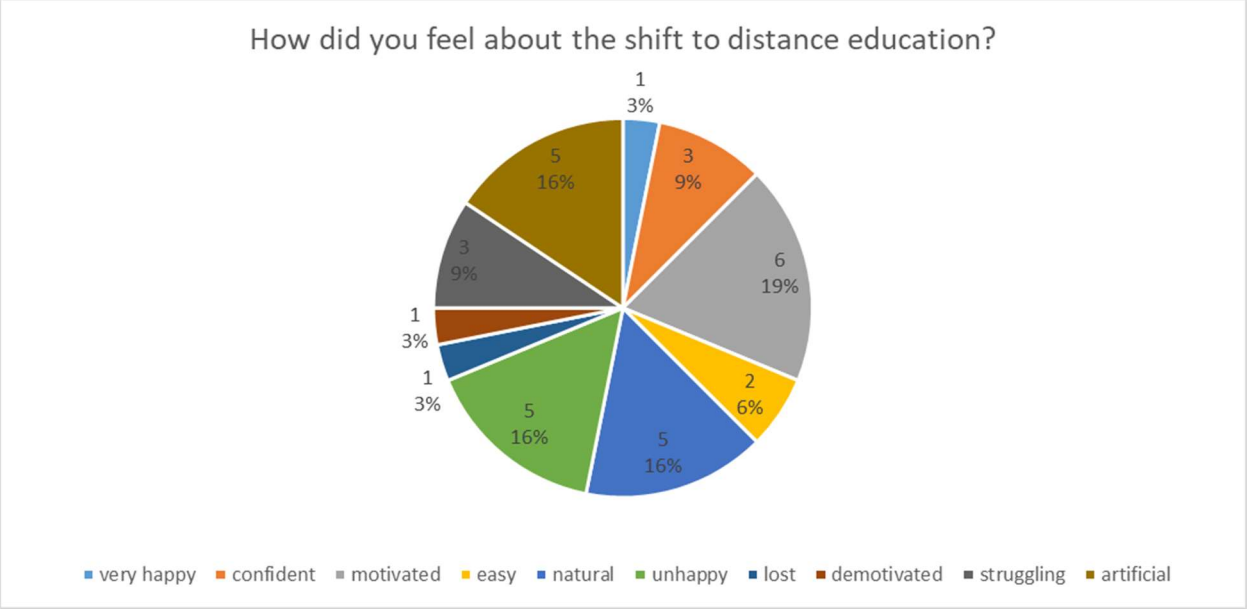
Teacher perspective

There were thirteen questions suggested for teachers in the category of evaluation.

The first three questions in this category were of multiple choice and the answers are summarised in the diagrams below.







Regarding the question about what was the most challenging aspect of distance teaching and learning, the majority of teachers answered that it was to keep students motivated (34%), the lack of immediate feedback from students on remote lectures, inability to understand students' progress at distance (19%), and the lack of contact with students and colleagues (9%). The teachers also mentioned challenges with assessment (6%), few experience with communication tools (6%), difficulty in providing individual support for students during practical classes (6%), the lack of time to prepare materials for flipped learning (6%), and communication problems (6%). Other answers were: difficulties in controlling the behaviour of students and monitoring the students' activity, the lack of physical interaction between the students, their psychological well-being, teachers' own physical isolation from their peers, and adaptation to new approaches to teaching.

The answers to the question: “In your opinion, what would you recommend to improve the distance learning quality?” – can be divided into four categories.

a) Recommendations connected with the improvements of the technical base. The teachers consider that the university should provide them with modern equipment and training, guarantee better assessment tools and VPN control, ensure good technological conditions (computers and internet connections) for students and teaching staff (not all the students could follow the lectures from their homes), provide technical support and tools for the instructor to be able to handwrite on the PC screen and to keep all student cameras on, and, finally, more functional technology that allows the use of whiteboards.

b) Recommendations connected with the training support from the university. The teachers need support in the development of innovative learning-teaching methodologies, digital support to improve online face-to-face contact, allowing to see the faces of all students in class.

c) Recommendations connected with methodological issues consist in implementing tasks (individual and group) to increase students' interest, give time to learn new tools and methodologies. Producing online study materials is also important. Examples of good practice (ex. Coursera company and similar ones) were given by some respondents.

d) Among more specific suggestions the following were done:

· Reducing the number of students per virtual class.

· Implementing some kind of teacher control, as some teachers stopped giving classes and redirected students to reading books, etc.

· Using more interactive quizzes / polls or other active learning strategies to engage students.

· Reducing the lecturing time and increasing the group work activities, promoting the self-learning by the students and shifting the teacher role to a more supportive one.

· Giving less classes per week, to have more time to properly prepare materials.

· Keeping courses on teaching/learning innovation and ICT tools.

· Using different types of classes to motivate students: lectures, expository classes, solving exercises, group work and also flipped classrooms.

· Higher commitment from all the intervenients (teacher and students).

· Increasing student motivation, always including on-campus moments.

· Creating social interaction events.

To the question “How do you try to prevent cheating by students during tests and exams?”, the following answers were given:

a) Technical solutions:

Video surveillance/camera on: 47%;

Using Safe Exam Browser: 28%;

Use restricted access tools: 3%;

Exploiting digital tools functionalities and software functionality, using software like FishEye: 3%

Checking the submitted documents metadata: 3%.

b) Organisation of the tests:

- limiting the exam time: 16%;

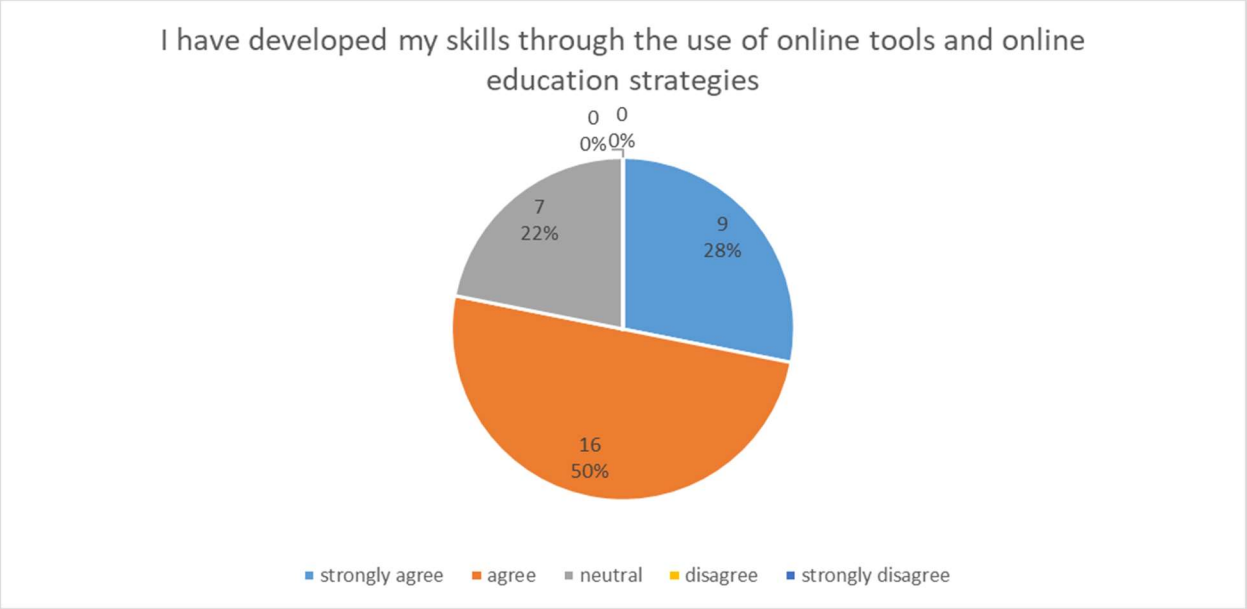
- dividing the test/exam into short parts (15-20 min.): 3%;

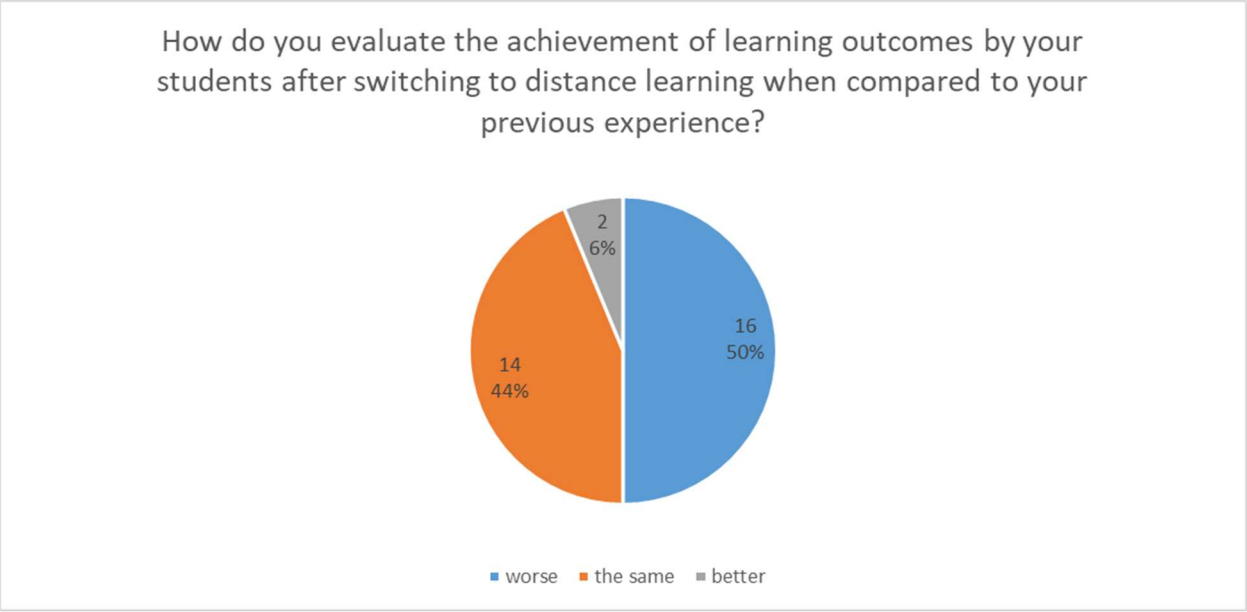
- using different questions for different students: 22%;

- random/parameterised questions from a big database: 9%.

Other comments were as follows:

- “It is difficult, this is a challenge”;
- “It's not possible”;
- “Maybe using SEB but it's not 100% guaranteed because someone could be in the room or filming the computer screen, etc. It's sad that we are giving a degree to people who cheat but we don't know who they are. It's like politics”;
- “By not doing any remote written exams. Written exams have to be in person. Otherwise I would simply have skipped the written exams altogether, because is it impossible to detect cheating by a sufficiently motivated/tech savvy student”.





When asked about some “Anecdote problems" during online classes, the teachers mentioned some more typical “situations”:

· having personal talks without the micro off;

· “when teaching, it is almost impossible to get feedback from students unless you stop and interact with them. In that case, only some interact with the professor”;

· somebody on the screen when the camera is on/pets appearing/ students with siblings also involved in online learning activities in the same space/ parents cooking in the background (the students had no personal space to attend the online session);

· the students sometimes are connected but not present and do not participate in the class at all.

One less funny situation where the teacher needed some tact and psychology:

“Once, a pair of parents was strongly involved in an argument (I muted the student, and eventually also stopped the video feed, because the student was so embarrassed that he couldn't react immediately): the student wanted to drop out of the course and I organised private sessions with him to avoid that. After a month, he eventually came back to the online group sessions. The parents asked to talk to me online to apologise, which was also stressful for me, but a life learning experience. I still "sort" of act as a tutor to this student.”

Conclusions

Quite surprisingly, 59% of the students felt motivated when shifting to distance learning. At the same time, many students felt unhappy (34%), lost (29%), and unmotivated (41%). Mainly, students get stressed with the exams (54%), delivering presentations (38%), grading other students (24%), and communicating with the instructor (24%). 48% of the students believe that their colleagues were not engaged in synchronous online classes. 41% of the students were satisfied with the shift to the distance learning provided by the university, and 33% were undecided/neutral. The percentage of satisfied students increased to 51% (with 25% being undecided/neutral) when considering the summer of 2021, i.e. about 15-16 months after the switch to distance learning. In terms of the most effective activities for online learning, the students voted for solving exercises, watching videos, taking notes and expository real-time writing/drawing/demonstration from the instructor. They definitely do not consider effectively grading other students and utilising social media. 23% of students felt comfortable with the lack of on-campus contact with peers and teachers. About 12% of students participated in less than 30% of online classes and 65% of students attended more than 60% of online classes. The main reasons for the low attendance rate were a lack of motivation and pedagogical reasons (either the teacher’s performance or an unfortunate choice of tools and materials). Students also mentioned difficulties in concentration, lack of personal contact with teachers and peers, overload with work, and technical problems (internet connection faults) as the most challenging aspects of online learning. Nevertheless, 56% of students believe that they have developed their learning skills through the use of online tools and online education strategies. As a suggestion for improving online learning, the students propose to change the way of teaching so that the classes would be shorter, less expositive, with more exercises solved, accompanied with interactive activities and quizzes. Students prefer to have much more involvement and interaction and younger, more captive and open to distance learning methods teachers.

The majority of teachers prefer campus teaching to the distant one. They've mentioned that it was difficult to keep students motivated, they felt the lack of immediate feedback from the students on remote lectures, inability to understand students' progress at distance, and the shortage of contact with students and colleagues. The recommendations to improve the quality of distance learning are mostly connected with expanding the technical base, training and methodological support from the university, and changes in the structure of the classes: shorter classes with smaller groups of students, more interactive activities. Also, the teachers considered that they needed more time to prepare the distant classes and would like to have more support. The question of preventing cheating during tests is also important for all the teachers and some concrete solutions connected with technical aspects (video surveillance etc.) and with organisation of tests were suggested. In addition, as a result of the survey, it became clear that in addition to technical and pedagogical issues, teachers had to face a number of psychological and human issues.

Recommendations

Recommendations from the student perspective

The great majority of students (92%) have never attended a real distance class before the pandemic but with the University support (including instructional videos, manuals, and online training) the transition to online learning was relatively smooth, albeit the students' preparation workload has increased when compared to traditional face-to-face classes. 73% of students prefer campus learning over distance learning and 59% of students note that their in-class activity has reduced when compared to the pre-pandemic period. Regarding the assessment, the majority of students do agree that the assessment procedures implemented during the pandemic were fair but almost half of students think that their effort to achieve the same grades as in the pre-pandemic era was increased.

In terms of negative aspects, many students report feeling unhappy (34%), lost (29%) and demotivated (41%), being too stressed with the exams, delivering presentations, grading other students, and communicating with the instructor. The students confessed that many of their colleagues do not get engaged in synchronous online classes.

Ideas for improvements, expressed by the students, are the following:

- avoid grading other students and utilising social media during classes;
- increase the class attendance rate by enforcing greater motivation;
- the teachers should definitely be more innovative and being able to deal with students' loss of concentration, lack of personal contact, and technical problems;

- the classes should be shorter, less expositive, with more exercises solved, accompanied with interactive activities and quizzes;
- students prefer to have much more involvement and interaction and more captive and open to distance learning methods teachers.

Recommendations from the teacher perspective

Although the majority of teachers hope that distance learning will not come back, it is clear to all that some conclusions can be drawn and the experience accumulated can be used in the future. In some situations, distance learning is a good solution, but in order to make fruitful use of it, the following recommendations can be derived:

- Provide teachers with modern equipment and specific training, guarantee better assessment tools and VPN control, ensure good technological conditions (computers and internet connections) for both students and teaching staff.
- Provide teachers with innovative learning-teaching methodologies and digital support to improve the online face-to-face contact, allowing to see the face of all the students in the class.
- Distance assessment is the most challenging part of distance learning, and specific technical and organisational measures should be applied in the case some elements of such assessment will be used in the future.

The results of the statistical analysis

A statistical analysis of answers to the students' survey was performed (according to details presented in the Appendix) allowing the following recommendations to be derived.

Recommended activities

Following the statistical analysis (see Appendix), it is noticed that "solving exercises", "watching videos", "taking notes" and "expository real-time writing/drawing/demonstration from the instructor" are the activities that the students value the most for their online learning, so they should be recommended for online courses. These activities are followed by "solving real-world problems", "examining slides", "completing group tasks (teamwork)" and "taking quizzes", as preferred by the students. A curiosity is observed, since "examining slides" is the 6th most rated activity, but a statistically significant relationship with popularity is not observed. This is because "examining slides" is a widely used activity in both, the most and the least popular courses (the mostly used activity in the least popular courses and the 5th mostly used activity in the most popular courses, among 22 different activities). Accordingly, these are also considered activities to recommend.

On the other side is “grading other students”, which was rated as the 22nd most effective activity for online learning, among 22 activities. In addition, it is the third event/interaction that creates the most stress/anxiety to the students (selected by 24% of the respondents), being the first two “taking exams” and “creating and delivering presentations”, showing that the students feel uncomfortable with scrutiny of themselves and their peers. In conclusion, in our opinion, universities should have effective solutions to help students to cope with the assessment stress/anxiety.

Recommended differences between undergraduate and graduate programs

Focusing on the statistical analysis from the Appendix, it is observed that undergraduate and graduate students have different perceptions and motivations, with undergraduate students being more sensitive than graduate students to the change from on-campus to online learning, particularly regarding their in-class activity when compared to the pre-pandemic period, which decreased for the majority of the undergraduate students, and their motivation, which was affected by the lack of personal on-campus contact for the majority of the undergraduate students, even if more than one third of these students reported a decreased effort to achieve the same grades when compared with the pre-pandemic period. In this regard, it is recommended to be especially attentive to the needs of the undergraduate students, who are less autonomous.

Appendix – Statistical analysis

To deepen the study and examine relationships that might not be readily evident, a statistical analysis of answers to the students' survey was performed using the software tool IBM SPSS[1]. The analysis focused firstly on the potential influence of gender and study level on the answers, and secondly on the potential influence of the required activities on the popularity of a certain course. The count of how many cases exist in a particular category of a particular variable is the analysis that was performed along the report when analysing the categorical data from the respondents' answers, as usually done[2]. These counts can be organised in a table, named frequency distribution[3]. To perform the statistical analysis, the simple frequency distributions corresponding to the respondents' answers were considered as the base (categorical) data. To relate the categories of one variable with the categories of a second variable, cross tabulation[4] was considered. In addition, the chi-square test[5] was applied in order to understand if a certain relationship is statistically significant, as it measures the difference between what was observed and what would be expected in the general population. The chi-square test was used to test the null hypothesis that there is no relationship between the two variables or the hypothesis that the cases are distributed evenly over the variable categories in a one-way table. When selecting the chi-square test, IBM SPSS calculates the *p*-value, which is the probability that it would be incorrect to reject the null hypothesis. In this regard, in this study it was defined that a relationship is considered statistically significant when the *p*-value is lower than 0.05 (a typically used value).

Previously, the raw data was treated in order to correct and unify misleading answers. This corresponded, mainly, to i) translating some answers from Portuguese to English, ii) correcting spelling, and iii) unifying similar terms to a single one, if belonging to the same category (e.g., PhD, PHD, Ph.D., doctoral degree).

Gender and Degree influence

An analysis was performed to understand if gender and the degree attended by the respondents (undergraduate/graduate) would affect the answers.

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[1] IBM (2022). IBM SPSS Advanced Statistics V27, International Business Machines Corporation, retrieved from https://www.ibm.com/docs/en/SSLVMB_27.0.0/pdf/en/IBM_SPSS_Advanced_Statistics.pdf on January 6, 2022.

[2] Rubin A. (2007). Statistics for Evidence-based Practice and Evaluation. Belmont, CA: Brooks / Cole.

[3] Hafner A.W. (1998). Descriptive Statistical Techniques for Librarians (2nd ed.). Chicago, IL: American Library Association.

[4] Wildemuth B.M. (2017). Chapter 36: Frequencies, Cross-tabulation, and the Chi-square Statistic. In B.M. Wildemuth (Ed.). *Applications of Social Research Methods to Questions in Information and Library Science* (2nd edition, 361-372). Santa Barbara, California: Libraries Unlimited.

[5] Byrne, G. (2007). A statistical primer: Understanding descriptive and inferential statistics, Evidence Based Library and Information Practice, 2(1), 32-47.

Previous to the statistical analysis, the sample was reduced to 160 respondents, to take into account only undergraduate and master students, as only 7 PhD students replied to the questionnaire. In addition, 4 other respondents were eliminated as their gender was not specified. The final sample was, then, of 156 respondents.

Cross tabulation was considered, to analyse if the gender and attended degree of the respondents would affect their answers. In addition, a chi-square test was used to determine if the relationship between gender and attended degree and the answers would be statistically significant.

The chi-square test returned that gender did not affect the answers (Table A1), although for questions 12 and 24 a relationship is somehow captured. In fact, if, by definition, a relationship would be considered statistically significant when the *p*-value was lower than 0.10, it could be said that the answers to these two questions would have a statistically significant relationship with gender. This potential relationship could be validated with a more in depth statistical analysis, if considered important.

Table A1: p-value for the relationship between the answer to selected questions and gender

Question	*p*-value
7. How would you evaluate your workload needed before the class (meeting online) during the pandemic?	0.792
8. Face-to-face (camera ON) communication is very important while learning remotely.	0.129
10. If I had to choose between distance and campus learning, I would select campus learning	0.631
12. How would you rate your in-class activity (measured by your interaction with the teacher/peer(s) or an app) when compared to pre-pandemic period?	0.072
16. How do you rate the assessment procedures implemented at your university during COVID-19 pandemic?	0.768
17. How would you evaluate your effort to achieve the same grades when compared with pre-pandemic period?	0.882
23. My peers/classmates were generally engaged during synchronous distance classes?	0.513
24. I was satisfied with the shift to distance learning provided by my university in 2020.	0.066

25. I am satisfied with the form of distance learning provided by my university now.	0.521
27. Did lack of personal on-campus contact with peers and teachers affect your motivation?	0.396
32. I have developed my learning skills through the use of online tools and online education strategies.	0.558

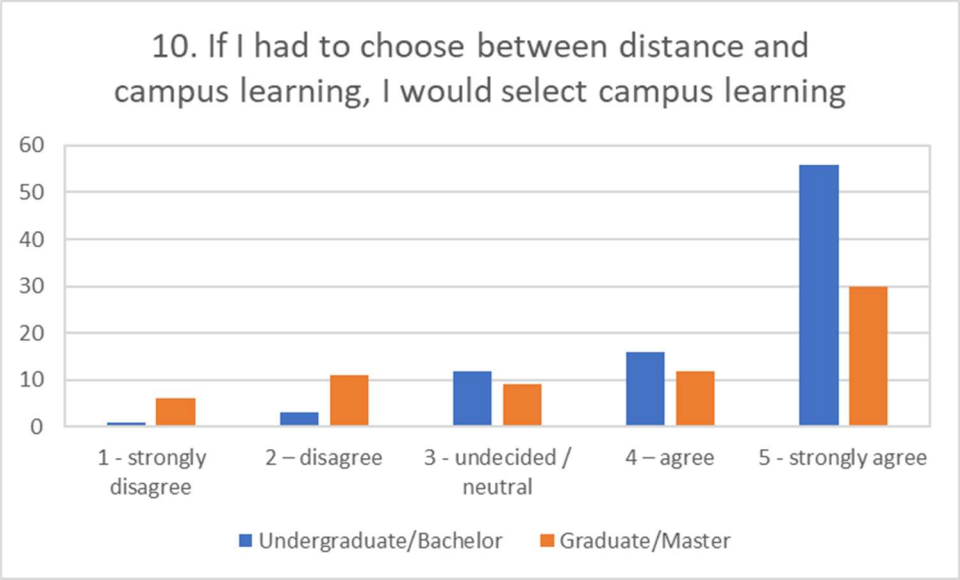
Regarding the degree attended by the respondents, the chi-square test returned that for questions 10, 12, 17 and 27 the respondents would reply differently if they were undergraduate or graduate students (Table A2). The comparison between the replies of the undergraduate and graduate students for these four questions are presented in Figure A1.

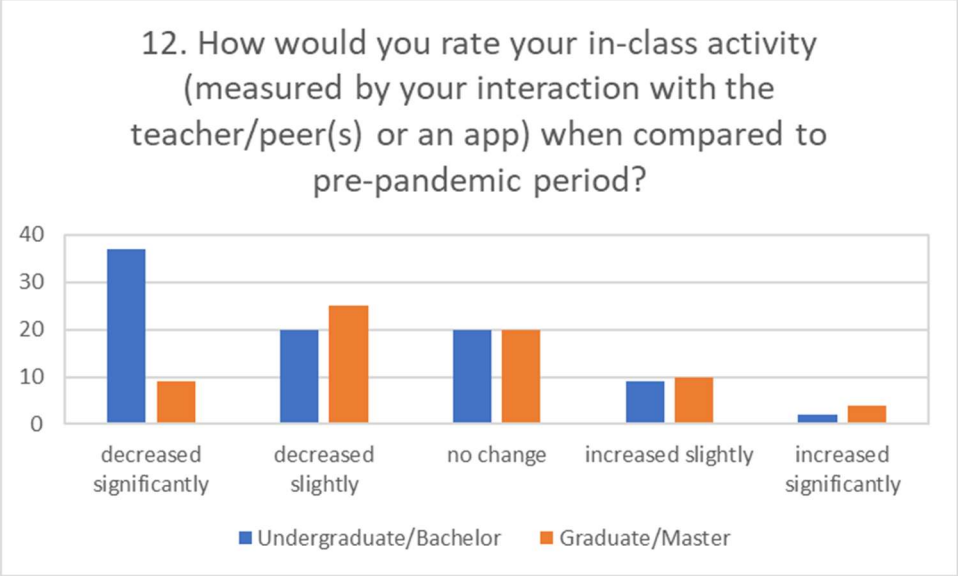
As observed for gender, if, by definition, a relationship was considered statistically significant when the *p*-value was lower than 0.10, it could be said that the answers for questions 24 and 32 would have a statistically significant relationship with the degree of attendance. This potential relationship could be validated with a more in-depth statistical analysis, if considered important.

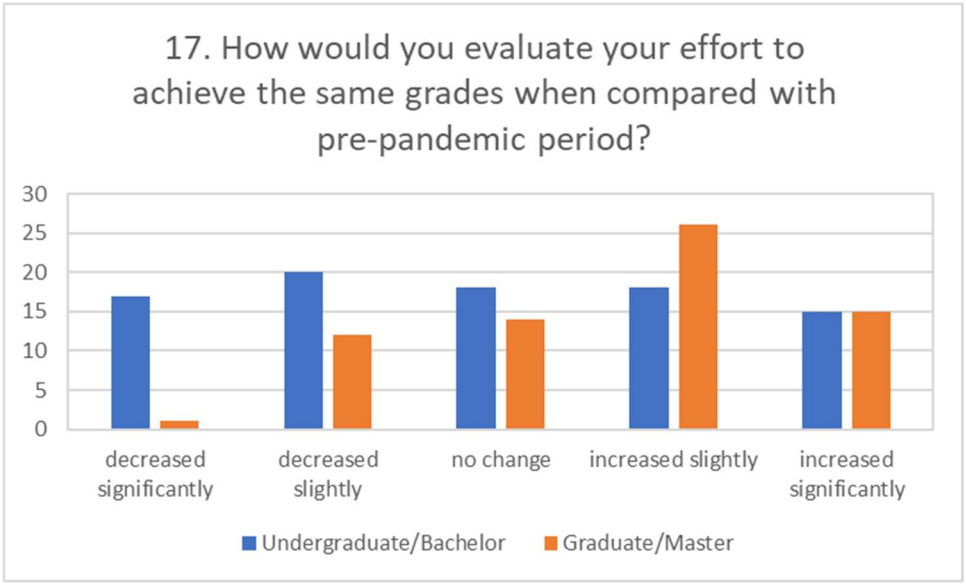
Table A2: p-value for the relationship between the answer to selected questions and the attended degree

Question	*p*-value
7. How would you evaluate your workload needed before the class (meeting online) during the pandemic?	0.556
8. Face-to-face (camera ON) communication is very important while learning remotely.	0.452
10. If I had to choose between distance and campus learning, I would select campus learning	0.005
12. How would you rate your in-class activity (measured by your interaction with the teacher/peer(s) or an app) when compared to pre-pandemic period?	0.003
16. How do you rate the assessment procedures implemented at your university during COVID-19 pandemic?	0.797
17. How would you evaluate your effort to achieve the same grades when compared with pre-pandemic period?	0.003
23. My peers/classmates were generally engaged during synchronous distance classes?	0.143

24. I was satisfied with the shift to distance learning provided by my university in 2020.	0.099
25. I am satisfied with the form of distance learning provided by my university now.	0.424
27. Did lack of personal on-campus contact with peers and teachers affect your motivation?	0.004
32. I have developed my learning skills through the use of online tools and online education strategies.	0.086







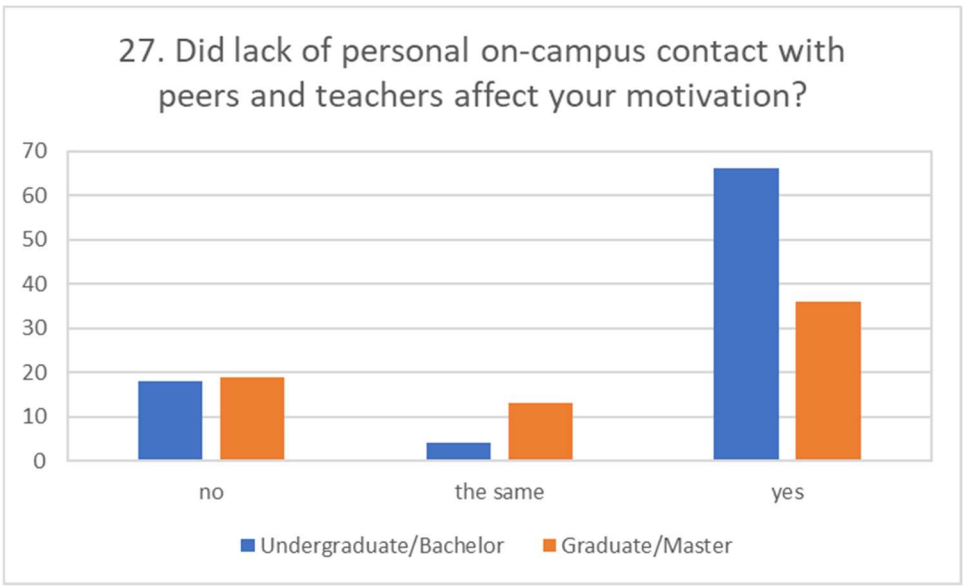


Figure A1: Comparison between the replies of the undergraduate and graduate students for certain questions

Type of activities influence on the popularity of online courses

The answers for the questions "*What types of activities were required in your favourite online course?*" and "*What types of activities were required in your least popular online course?*" were cross analysed statistically using IBM SPSS, with a sample of 166 respondents. The objective was to understand if the type of activities required in a certain course could affect its popularity.

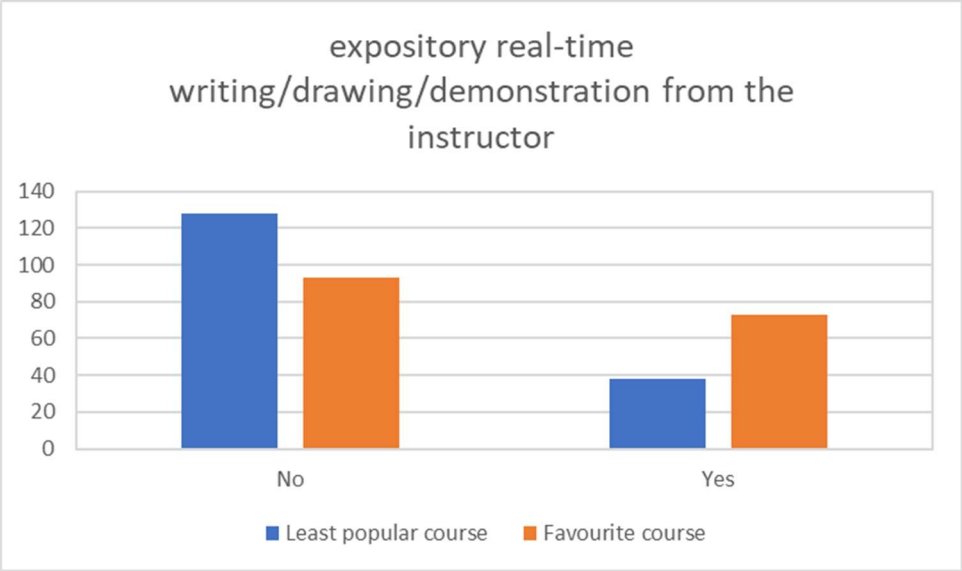
Cross tabulation was considered, to analyse if each activity, independently, would affect the popularity of the course. In addition, a chi-square test was used to determine if the relationship would be statistically significant.

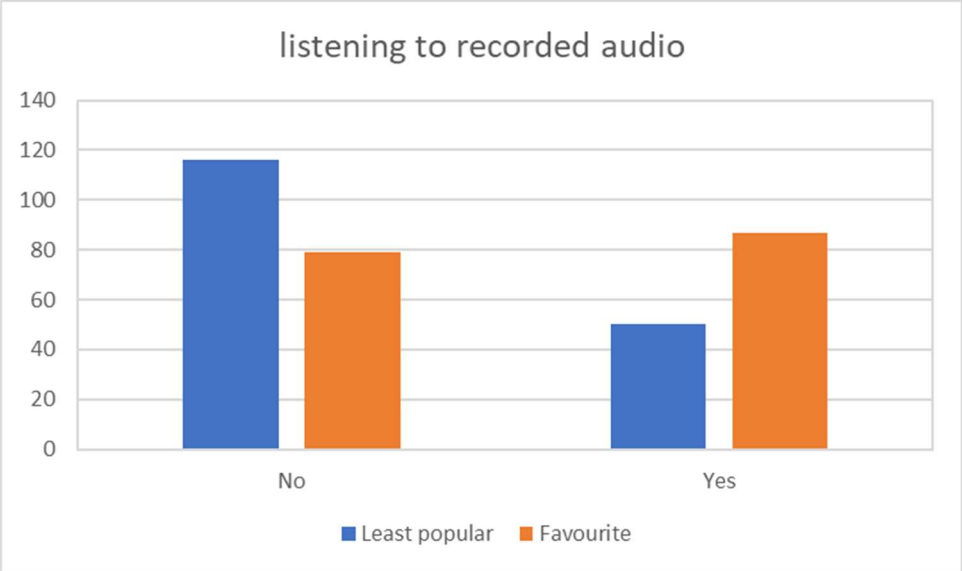
It was observed statistical significance on the relationship between the performed activities and the popularity of the course for 13 activities (Table A3), although the answers varied widely, even for these 13 activities (Figure A2).

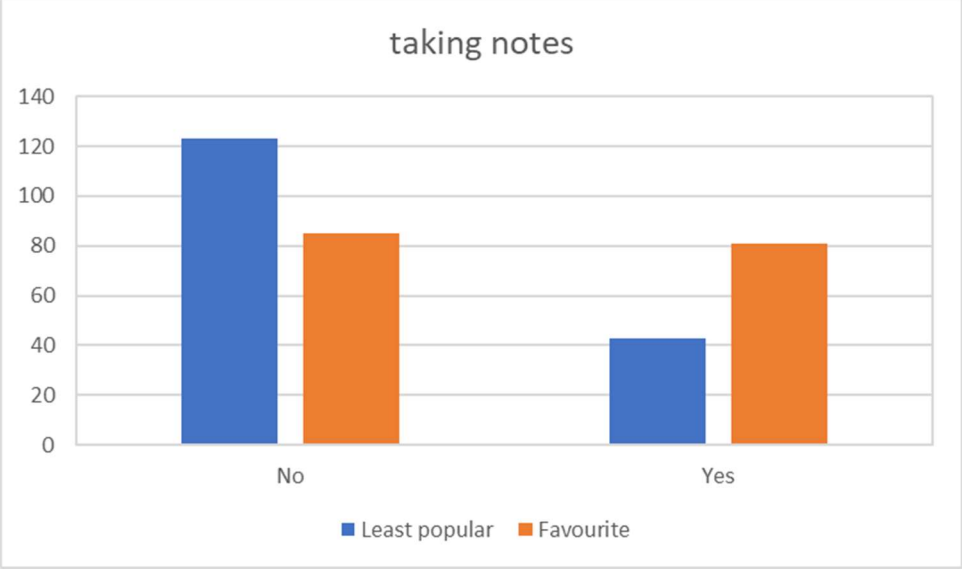
Table A3: p-value for the relationship between the performed activities and the popularity of the course

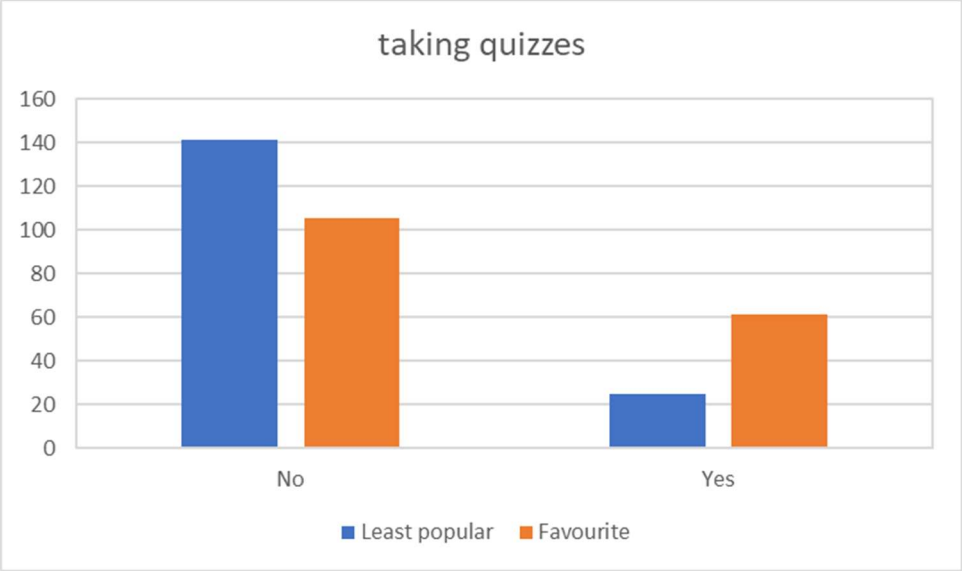
Activity	p-value
expository real-time writing/drawing/demonstration from the instructor	0.000
reading course-related literature	0.072
listening to recorded audio	0.177
watching videos	0.000
examining slides	0.736
taking notes	0.000
utilising websites	0.204
taking quizzes	0.000
taking exams	1.000
writing papers/reports	0.228
executing projects	0.000
solving exercises	0.000
creating and delivering presentations	1.000
completing group tasks (teamwork)	0.003
communicating with other students	0.000
grading other students	0.004
communicating with the instructor	0.000
utilising social media	0.240
solving real-world problems	0.000
analysing scenarios or case studies	0.025
completing simulations/laboratory experiments	0.195

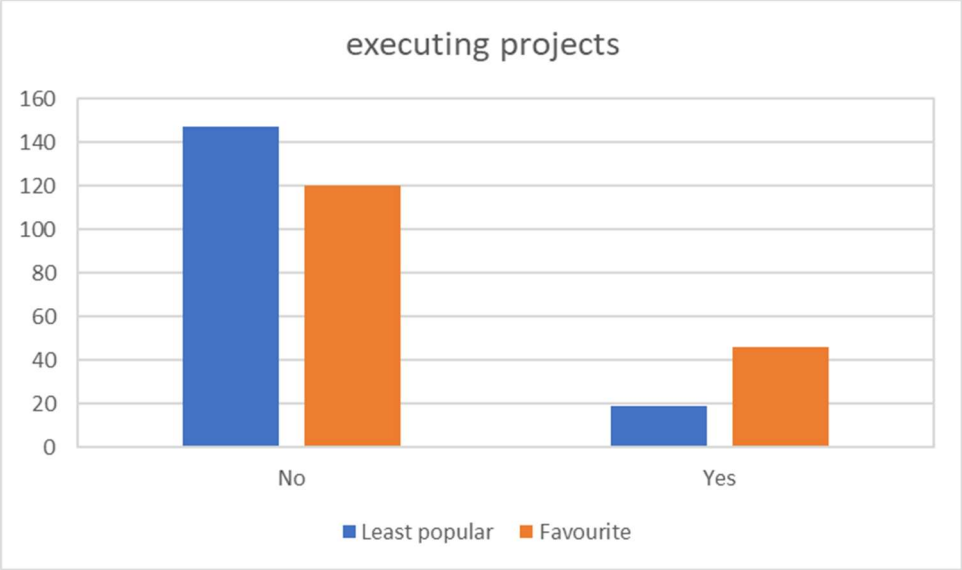
using special software or applications relevant to the course	0.000

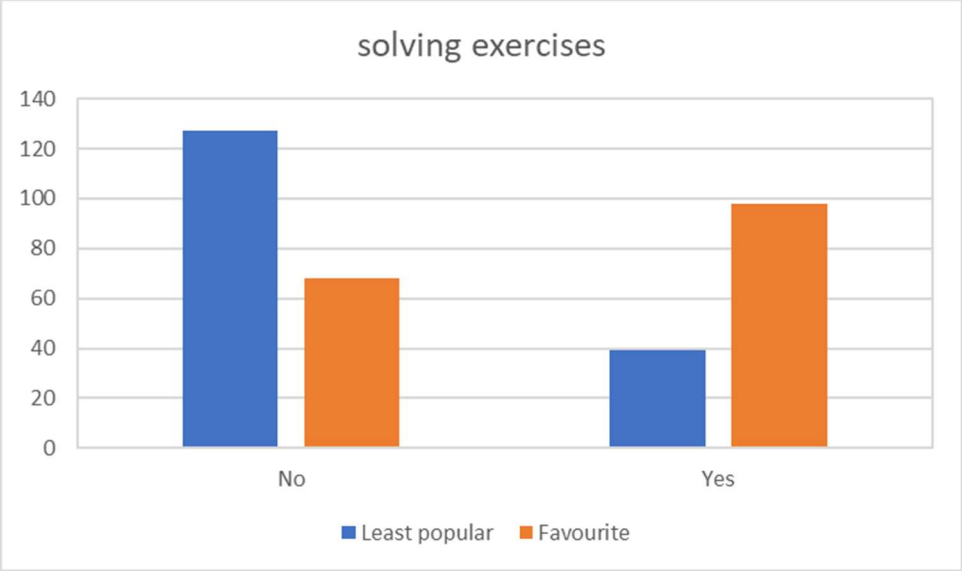

expository real-time writing/drawing/demonstration from the instructor
140
120
100
80
60
40
20
0
No
Yes
Least popular course
Favourite course

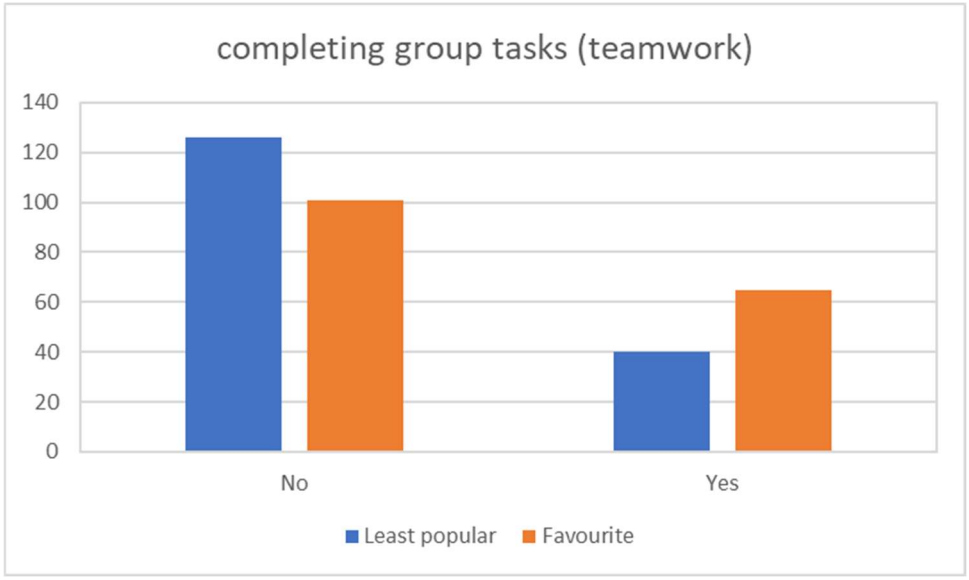

listening to recorded audio
140
120
100
80
60
40
20
0
No
Yes
Least popular
Favourite

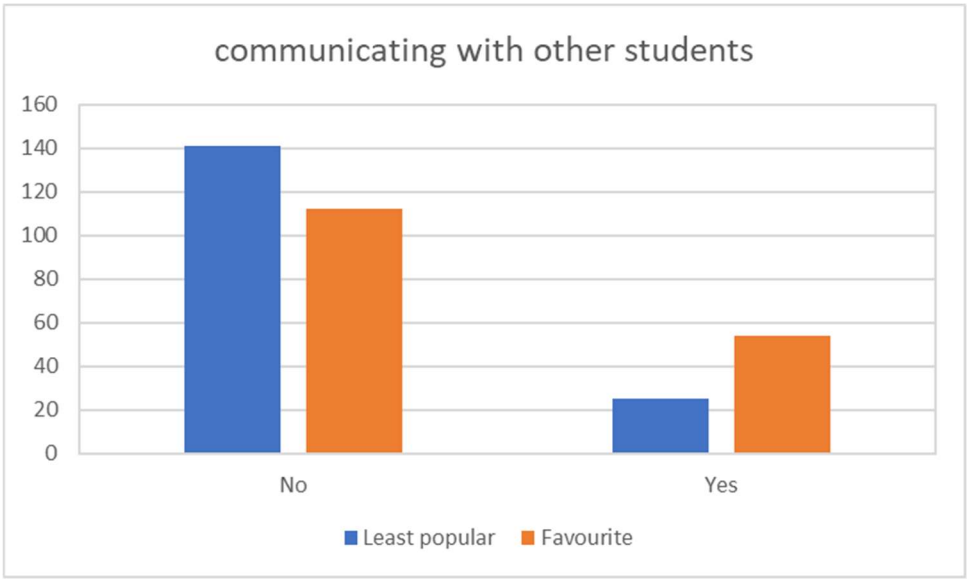

taking notes
140
120
100
80
60
40
20
0
No
Yes
Least popular
Favourite

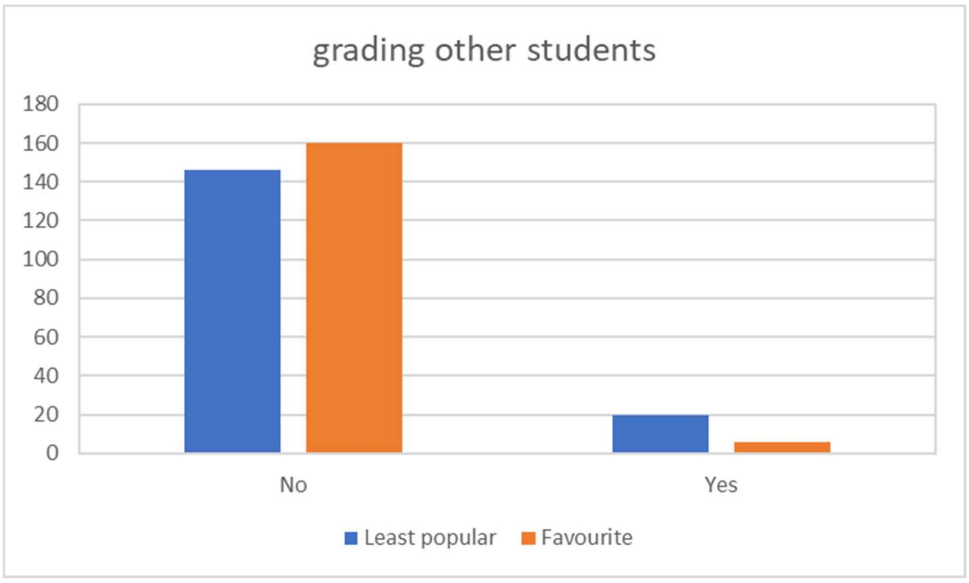

taking quizzes
160
140
120
100
80
60
40
20
0
No
Yes
Least popular
Favourite

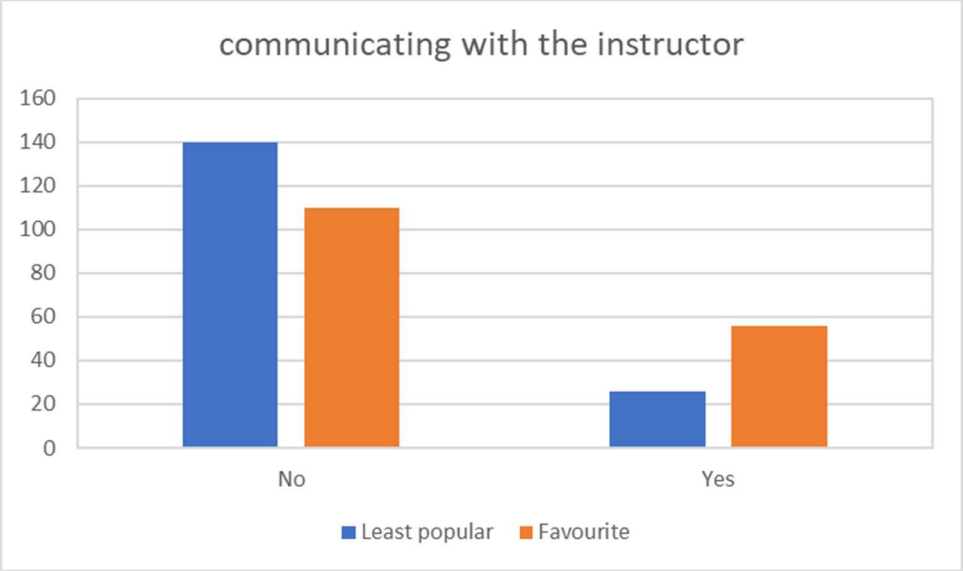

executing projects
160
140
120
100
80
60
40
20
0
No
Yes
Least popular
Favourite

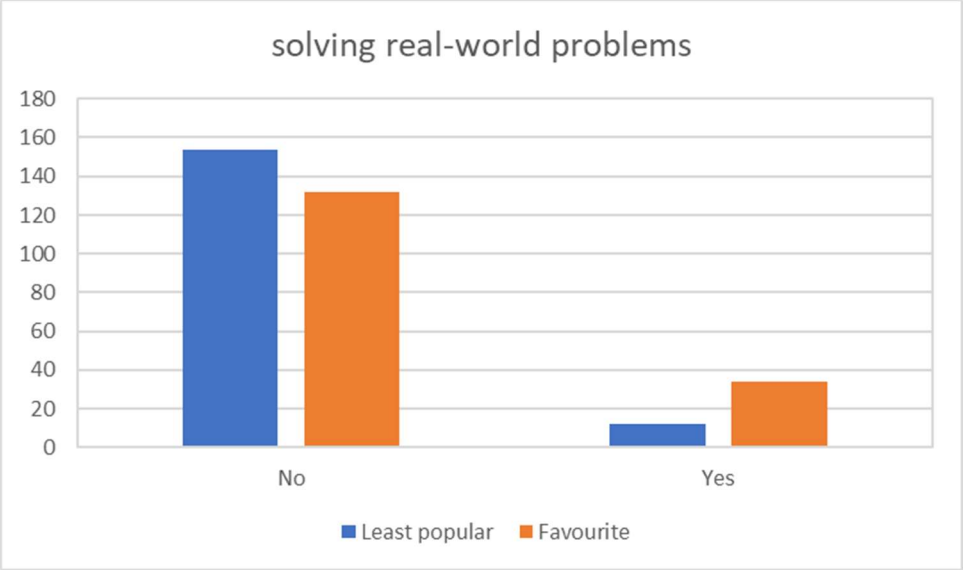

solving exercises
140
120
100
80
60
40
20
0
No
Yes
Least popular
Favourite

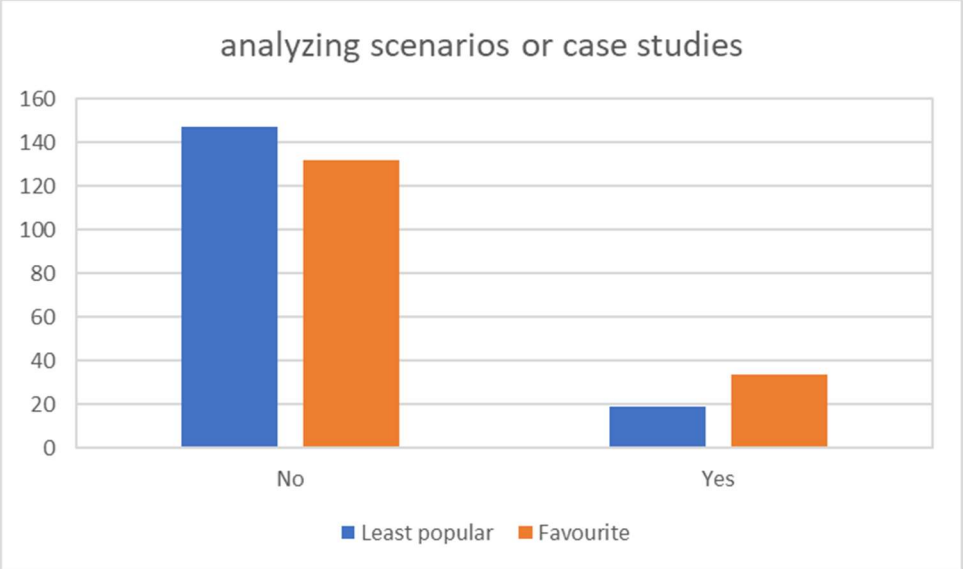

completing group tasks (teamwork)
140
120
100
80
60
40
20
0
No
Yes
Least popular
Favourite


communicating with other students
160
140
120
100
80
60
40
20
0
No
Yes
Least popular
Favourite


grading other students
180
160
140
120
100
80
60
40
20
0
No
Yes
Least popular
Favourite


communicating with the instructor
160
140
120
100
80
60
40
20
0
No
Yes
Least popular
Favourite


solving real-world problems
180
160
140
120
100
80
60
40
20
0
No
Yes
Least popular
Favourite


analyzing scenarios or case studies
160
140
120
100
80
60
40
20
0
No
Yes
Least popular
Favourite

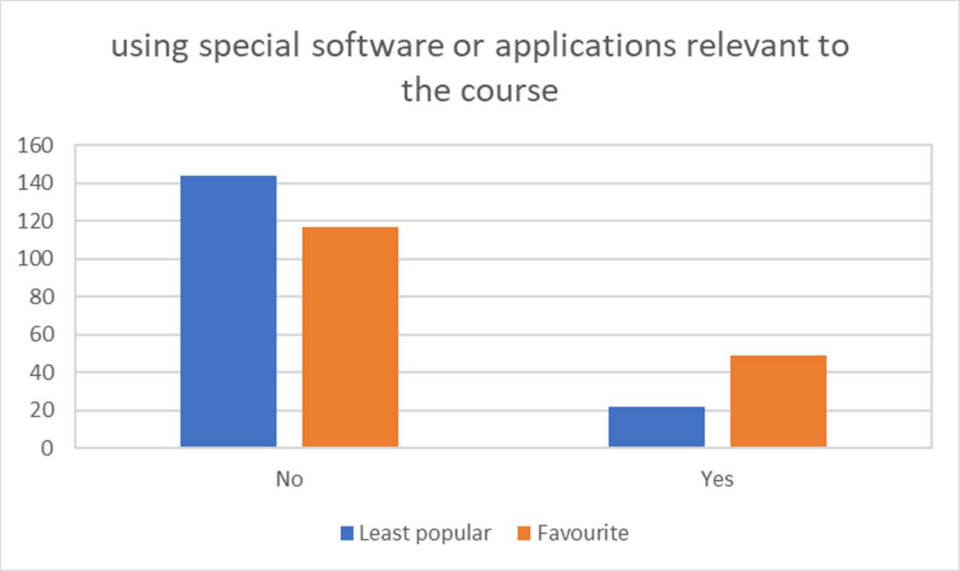


Figure A2: Comparison between the activities performed in the least popular and the favourite courses

In conclusion, from the performed statistical analysis it can be said that the hypothesis that the students like a certain online course increases if the course requires the following activities:

- solving exercises (1st position, 59% of the respondents);
- watching videos (2nd position, 52% of the respondents);
- taking notes (3rd position, 47% of the respondents);
- expository real-time writing/drawing/demonstration from the instructor (4th position, 46% of the respondents);
- solving real-world problems (5th position, 37% of the respondents);
- completing group tasks (teamwork) (7th position, 34% of the respondents);
- taking quizzes (8th position, 32% of the respondents);
- executing projects (9th position, 31% of the respondents);
- communicating with other students (10th position, 30% of the respondents);
- communicating with the instructor (11th position, 28% of the respondents);
- analysing scenarios or case studies (12th position, 25% of the respondents);
- using special software or applications relevant to the course (13th position, 22% of respondents);
- not grading other students (22nd position for grading other students, only 3% of the respondents chose grading other students as effective for their online learning).

On the contrary, from the performed statistical analysis no conclusion can be performed on the popularity of a certain online course that requires the following activities:

- examining slides (6th position, 35% of the respondents);
- completing simulations/laboratory experiments (14th position, 20% of the respondents);
- utilising websites (15th position, 19% of the respondents);
- listening to recorded audio (16th position, 15% of the respondents);
- writing papers/reports (17th position, 14% of the respondents);
- taking exams (18th position, 13% of the respondents);
- reading course-related literature (19th position, 12% of the respondents);
- creating and delivering presentations (19th position, 12% of the respondents);
- utilising social media (21st position, 8% of the respondents).