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Was the incorporation of Microsoft Teams in higher education an effective tool as a result of the Covid-19 pandemic?

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At the Polytechnic University of Valencia (UPV) widespread and massive use of the Microsoft Teams application began in the academic year 19/20 and 20/21 as a result of the Covid-19 pandemic. The objective of this work is to know if the incorporation of this application in university education is effective, both in a synchronous non-face-to-face teaching model, as well as in a hybrid teaching model. In addition, it will be analyzed from the perspective of teachers and students. In the first case, the performance of the students will be evaluated with the use of Teams and without its use; and in the second case, their perceptions will be analyzed through a questionnaire. The results of the research allow us to confirm that from the teaching point of view, the incorporation of the Teams application in university education is effective as a consequence of the Covid-19 pandemic. However, from the students' point of view, they consider traditional teaching to be more effective than hybrid teaching through the Microsoft Teams application.

Keywords: Covid-19, hybrid teaching, Microsoft Teams, non-face-to-face education, synchronous teaching, tele-teaching application, traditional teaching

INTRODUCTION

On March 11, 2020, the World Health Organization (WHO) declared Covid-19 a global pandemic. All countries took strong measures to avoid spreading this virus, such as confinement or multiple mobility restrictions for companies and citizens (**Carballosa et al., 2021**). These events led to the interruption of face-to-face teaching in educational institutions' second quarter of the 2019-20 academic year (**Pather et al., 2020**). In this way, the Universitat Politècnica de València (UPV) immediately suspended all academic

and non-academic activity within the university facilities and moved to an online model, forcing the arrival of teleworking and teleteaching on all its campus.

In the case of teaching, the use of the Microsoft Teams application was required. This application is incorporated into the Microsoft Office 365 software, which the UPV had already contracted before the pandemic, and serves to hold videoconferencing meetings (**UPV ASIC manuals, 2020**); specifically, it allows communication and collaboration through chat and video, file sharing and integrates some applications, that is, it integrates users, content, and tools to improve work and, in this case, teaching at the university (**Varga-Salgado et al., 2020**).

The entire university community had to move from a traditional teaching model, where classes are mainly taught face-to-face in the classrooms and facilities of the UPV, to a non-face-to-face teaching model guided through the Microsoft Teams application, where neither teachers nor students shared spaces; they only met virtually at the usual class times to continue with synchronous non-face-to-face teaching. In this way, this was the teaching model that was followed at the UPV from the beginning of the pandemic until the end of the second semester of the 2019-20 academic year.

Throughout the first semester of the 2020-21 academic year, the pandemic has been going through different stages of severity: in the most severe phases, synchronous remote teaching was maintained at the UPV, and in the less severe steps, different teaching models were allowed, depending on each faculty, department, course, and/or number of students, among other factors. Generally, mixed or hybrid teaching models have predominated (**García-Peñalbo, 2020**), in which part of the students follow the classes from the classroom, and the other part follows it live through Microsoft Teams. The students who were in class or through the Internet were rotating. This is the model suggested in the document of recommendations of the Ministry of Universities (**Government of Spain, 2020**).

This work aims to know the perceptions of students and teachers about the incorporation of the Teams application in university education as a result of the Covid-19 pandemic, especially to find out if they consider it an effective tool.

OBJECTIVES

The main objective of this research is to know if incorporating the Teams application in university education is effective due to the Covid-19 pandemic, both from the perspective of the student and from the perspective of teachers. Five research questions arise to analyse this main objective.

In the first place, and about the perspective of the students will be analyzed if the hybrid teaching model taught through Microsoft Teams is effective in university education, and also the perception of students about this teaching model used at the UPV to find out if they consider it more effective than traditional face-to-face teaching. Therefore, this first part aims to resolve the following two issues:

i. Is the hybrid teaching model through Microsoft Teams effective in university education?

ii. Is traditional face-to-face teaching more effective than hybrid teaching, depending on students' perceptions, applied with Microsoft Teams?

Secondly, concerning teachers' perspectives, the perception of teachers of the Department of Economics and Social Sciences (DECS) of the UPV on the Microsoft Teams application used in teaching will be analyzed. Specifically, from this perspective, it will be examined, on the one hand, if the incorporation of the Teams affected teachers emotionally, and on the other, if this application is effective in hybrid and synchronous non-face-to-face teaching. Therefore, the research questions to be answered are:

iii. Did the use of the Microsoft Teams app emotionally affect teachers so that they were concerned at the beginning of its use in teaching due to the pandemic?

Although it seems logical that any innovation or teaching change can produce some uneasiness, the incorporation of Teams in teaching was indeed something unusual since both teachers and students had to face the challenge *ipso facto*, which added to the confusion that the pandemic and confinements had already generated. That is why this work raises the *third* research question; Moreover, this fact may have produced a change in the mentality of teachers and students and allowed them to quickly adapt to other possible future innovations.

iv. *Is hybrid teaching through the Microsoft Teams application effective in the teaching-learning process?*

v. *Is synchronous non-face-to-face teaching through the Microsoft Teams application effective in the teaching-learning process?*

DEVELOPMENT OF INNOVATION

The methodology used to solve the first research question: *Is the teaching model hybrid or through Microsoft Teams effective in university education?* is an analysis of the performance obtained by the students of the Business subject in the 2020-21 academic year, where hybrid teaching was applied with Teams, and the yields obtained in the 2019-20 academic year, where traditional face-to-face teaching was applied. This analysis is performed with descriptive statistics (mean, median, minimum, maximum, and relative frequency graph). The use of frequency graphs to assess students' academic performance in different courses has already been used by other authors (**Montanes et al., 2018; Varga-Salgado et al., 2020**).

It is worth mentioning that the number of students enrolled in the business subject in the 2020-21 academic year was 122 students (54 from the ARA group and 68 from the Spanish group), while in the 2019-20 academic year, it was 115 students (46 from the ARA group and 69 from the Spanish group). In addition, the subject is taught in the first semester of the first year of the Degree in Aerospace Engineering at the UPV.

For the development of the second research question: *ii. Is traditional face-to-face teaching more effective than hybrid teaching, depending on students' perceptions, applied with Microsoft Teams?;* descriptive research has been used using a questionnaire previously designed through Google Forms. This questionnaire was emailed in February 2021 to all students of the Business subject of the 2020-21 academic year. The survey is composed of 13 closed-answer questions of a single answer, except three questions with multiple answers. And it is structured in 3 parts: The 1st part corresponds to the first three questions, which demographically classify the sample according to their gender, origin, and enrollment group. The 2nd part is formed by questions 4 to 11, which refer to whether students consider hybrid teaching effective, specifically in the subject Business, and which will mainly help solve question *ii* of this research. The 3rd part of the survey is formed by questions 12 and 13, which are related to the advantages and disadvantages of this teaching with Teams.

The research is carried out on a sample of the subject company's students enrolled in the academic year 2020-21, formed by a total of 122 students. The response rate was 80.3%; 98 students answered the questionnaires, 20 women and 77 men. 55.7% belonged to the Spanish enrollment group, and the remaining 44.3% to the ARA group. In addition, 66% of students come from the Valencian Community, 30.9% from the rest of Spain, and only 3.1% from outside Spain.

Regarding research questions *iii*, *iv*, and *v*, concerning teachers' perception, the questionnaire has also been used as a research method, allowing the collection of data and descriptive analysis of the same to answer the research questions. Thus, a questionnaire was designed through Google Forms. After validating it in the pilot phase, it was sent by email to all the professors that make up the DECS in February 2021, when the teaching of the first semester of the academic year 2020/2021 had already concluded. The questionnaires have already been used by other authors, both to know the perception of students about the methodology implemented against the traditional method (**Llorens-Molina and Cardona, 2019**) and to see the perception of teachers (**Pérez-Sayans et al., 2020**).

This second survey comprises 22 closed-answer questions of a single answer, except four questions with multiple answers. The questionnaire is structured in 5 parts: The 1st part corresponds to the first three questions, which classify the sample demographically and professionally according to their gender, age range, and professional category. The 2nd part is formed by questions 4, 5, and 10, which also classify the

sample, but in this case, in relation to the Teams and the type of teaching taught. The 3rd part is formed by questions 6 to 9, which refer to the emotional impact that the Teams application produced on teachers as well as the time spent knowing the application before teaching. These questions will be used to resolve question *iii* of this research. The 4th part is related to hybrid teaching, and is formed by questions 11 to 16, with which question *iv* of this work will be resolved. The 5th and last part of the questionnaire is related to synchronous remote teaching, and is formed by questions 17 to 22, with which question *v* of this research will be answered.

This analysis is carried out on a sample of teachers active in the DECS in the academic year 2020/2021. Of these, 33.3% answered the questionnaires. Therefore, our model consists of 40 teachers, 22 women, and 18 men. Only 2 are under 35 years old, and also 2, are over 61. Of the rest, 42.5% are between 36 and 50 years old, and 47.5% are between 51 and 60. Regarding their professional category, 35% are associates lecturers, 25% are senior lecturers, 27.5% are lecturers, another 10% are professors, and the remaining 2.5% are research personnel in training

RESULTS

Results From the Perspective of Students

Results of the Research Question on the Effectiveness of Hybrid Teaching Using Teams

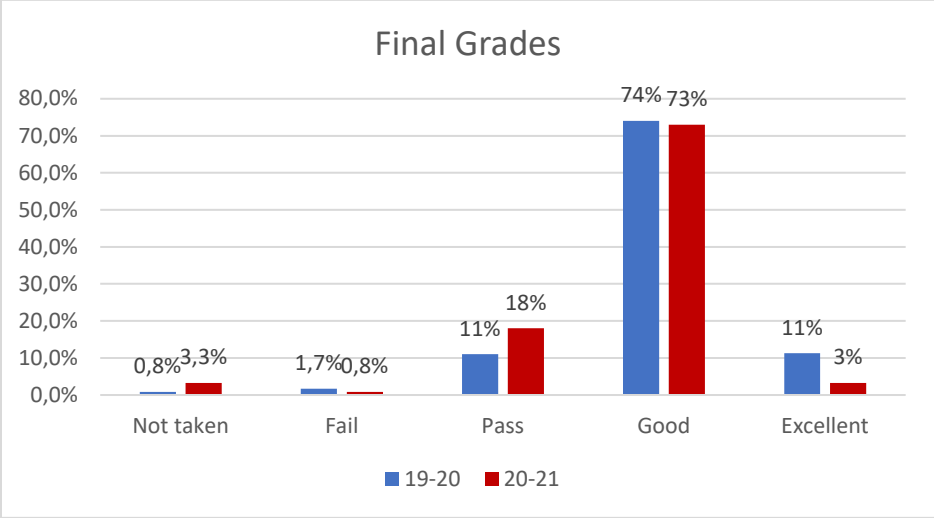
The results obtained through descriptive statistics try to solve our first research question: *i. Is the teaching model hybrid or through Microsoft Teams effective in university education*?

Table 1 shows that the performances obtained by students in the 2019-20 academic years with traditional teaching, and in the 2020-21 academic year, with hybrid teaching through Microsoft Teams, are very similar through the four statistics analyzed, obtaining an average final grade of around 7.7, a median around 7.8 and the maximum grade close to 9.7.

TABLE 1
DESCRIPTIVE STATISTICS ON THE FINAL GRADES OF THE SUBJECT BUSINESS IN THE COURSES 2019-20 AND 2020-21

	Academic year 2019-20	Academic year 2020-21
Medium	7,81	7,65
Median	8,01	7,76
Minimal	0	0
Maximum	9,8	9,59

FIGURE 1
FINAL GRADES OBTAINED IN THE SUBJECT BUSINESS IN THE COURSES 2019-20 AND 2020-21, ON THE TOTAL NUMBER OF STUDENTS IN EACH COURSE



NOTE: The final grades (FG) of each category respond to: Fail: FG<5; Pass: 5≥FG<7; Good: 7≥FG<9; Excellent: FG≥9

Figure 1 also confirms these results. It shows, in percentage, the final performances of students in each course, classified by categories (not taken, failed, passed, good, and exellent) according to their grade. It is observed that the number of students per category between both courses is very similar. The percentage of passes was higher than 97% in the 2019-20 academic year, and close to 96% in the 2020-21 academic year. It stands out that most students, about 74% in both courses, obtained a Good in the final grade of the Business subject. In addition, there is a slight increase in the highest yields (excellent) in the course with traditional teaching. This can also be seen in the table, where the statistics are slightly higher for this course. However, this slight trend is not so significant as to think that the yields with traditional teaching are higher than those obtained with hybrid teaching through Teams.

Results of the Research Question on the Effectiveness of Teams in Teaching

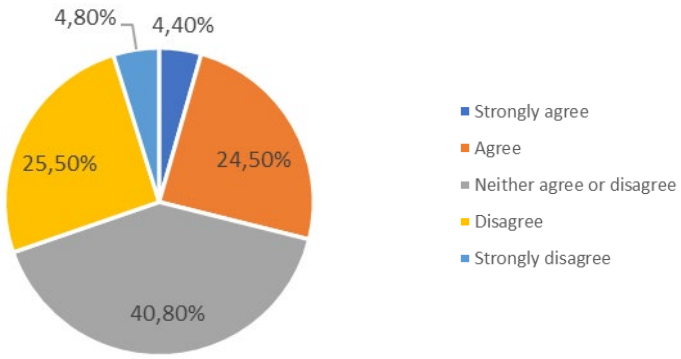
The results of the questionnaire analysis try to solve our second research question: *ii. Is traditional face-to-face teaching more effective than hybrid teaching, depending on students' perceptions, applied with Microsoft Teams?*

In the first place, we observe that 77.6% of the students consider that their grade in the subject Business reflects their level of knowledge; the remaining percentage is distributed proportionally among those who believe their grade should have been higher or lower. However, when asked if they consider that their final grade would have been higher with traditional face-to-face teaching (without the use of Teams), 53.1% consider yes because they believe it has affected something in their learning, 30.6% consider that it has not, and only 16.3% consider that it has affected their learning a lot.

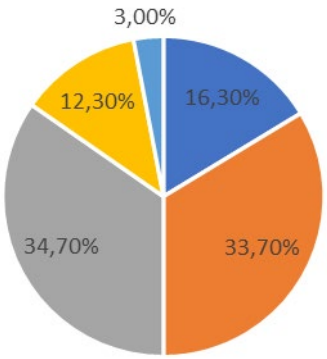
It is also interesting to note that, faced with a scenario in which face-to-face teaching is not possible, 66.3% of students prefer hybrid teaching, 16.3% non-face-to-face teaching (100% remotely by Teams), and the remaining 17.3% are indifferent.

On the other hand, as seen in figure 2 (question 7), students are not unanimous about whether hybrid teaching with Teams in the Business subject has optimized their learning process. However, 50% of students do consider it quite or totally suitable for remote education with Teams, although it is also observed that 34.7% are indifferent (figure 2, question 9). In addition, they consider that the part of the Business subject that best adapts to this type of teaching is classroom theory at 41.54%, laboratory practices at 35.38%, and at 23.08% computer practices. On the other hand, when asked if they consider the Degree in Aerospace Engineering suitable for remote teaching with Teams, more than 70% of students strongly or totally disagree.

FIGURE 2
QUESTIONS 7 AND 9



Question 7: Do you consider that hybrid teaching with Teams in the Business subject has optimized your learning process in the subject?



Question 9: Do you consider that the subject Business, due to its contents, is suitable for remote teaching through Teams?

Finally, from the analysis of the third part of the questionnaire on the advantages and disadvantages of hybrid teaching with Teams in the learning process, students highlight that the main disadvantages, with very similar percentages, are the greater effort to follow the class, the lower motivation, the lack of interaction with other students, and the difficult interaction with the teacher. Regarding the main advantages, the ease of following the class from anywhere stands out with 44%, with 30% the ease of use of the Teams application, and with 18% the ease of connecting with the teacher outside of class.

Results From the Perspective of Teachers

From the classification questions that make up the 2nd part of the questionnaire sent to teachers, we obtain that 80% of teachers had never used the Microsoft Teams application before the pandemic, and 82.5% used Teams for the first time in their subjects in the second semester of the 2019/2020 academic year, while 17.5% used it for the first time in the first semester of the 2020/2021 academic year. In addition, the teaching of the DECS has been taught in 20% in person, 34.6% in hybrid teaching modality, and in 45.3% in synchronous non-face-to-face teaching modality.

Results of the Research Question on the Emotional Impact of Teachers By the Use of Teams

The results obtained in the 3rd part of the survey try to analyze the perception of the teachers of the DECS of the UPV about the Microsoft Teams application used in teaching, specifically solving the third question posed by this research: iii. *Did the use of the Microsoft Teams app emotionally affect teachers so that they were concerned at the beginning of its use in teaching due to the pandemic?*

We can see in Figure 3 that 77.5% of teachers were an added concerned about the announcement of the incorporation of the Teams application into teaching. The analyzes also determined that 67.86% produced negative feelings (restlessness, stress, nerves, anguish), while 30.36% produced positive feelings (tranquility and satisfaction). Regarding the time spent to know the application, 40% recognize that they dedicated between 1 and 4 hours, 30% between 5 and 8 hours, 15% nothing or very little time, 10% between 9 and 12 hours, and 5% dedicated more than 13 hours. On the other hand, Figure 4 shows that 65% of teachers were worried about the use of Teams, but that feeling disappeared, specifically, 20% were worried only before teaching, 17.5% only on the first day of class with Teams, and 27.5% until the first week; while 12.5% recognize that they have not yet disappeared the concern about the use of Teams in their teaching practice, and 17.5% that it did not cause problem.

FIGURE 3

QUESTION 6: WAS THE ANNOUNCEMENT OF THE INCORPORATION OF THE TEAMS APPLICATION INTO TEACHING ADDED CONCERN?

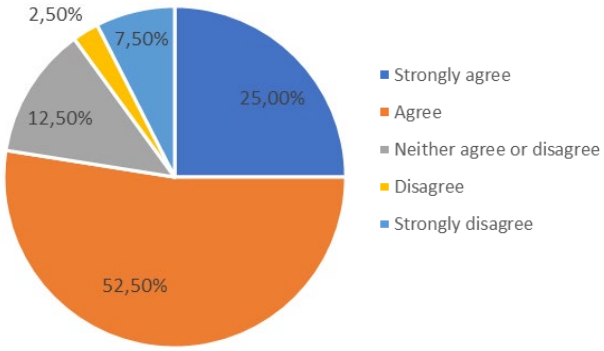
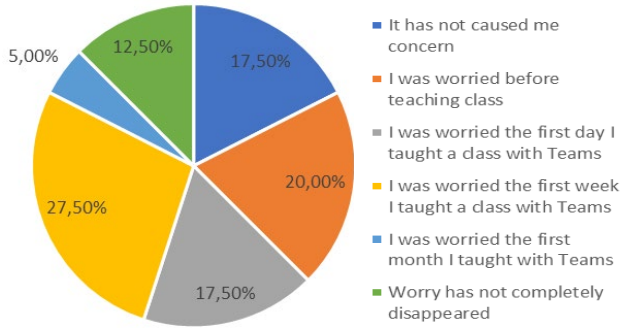


FIGURE 4
QUESTION 8: REGARDING THE USE OF TEAMS IN YOUR TEACHING PRACTICE, I WOULD SAY THAT:

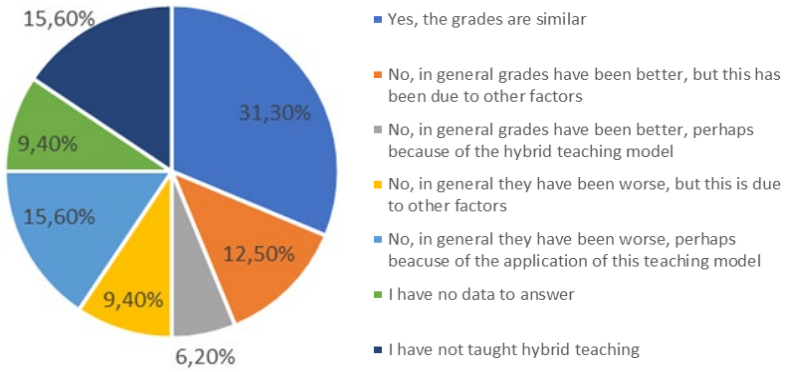


Results of the Research Question on the Effectiveness of Hybrid Teaching Using Teams

The results obtained in the 4th and 5th parts of the survey sent to teachers try to examine the effectiveness of the Microsoft Teams application, both in hybrid and synchronous non-face-to-face teaching, through the perception of teachers of the DECS of the UPV. Specifically, the analysis of the questions of the 4th part of the questionnaire will help to reveal the research question: *iv iv. Is hybrid teaching through the Microsoft Teams application effective in the teaching-learning process?* and the questions of the 5th part, the research question: *v. Is synchronous non-face-to-face teaching through the Microsoft Teams application effective in the teaching-learning process?*

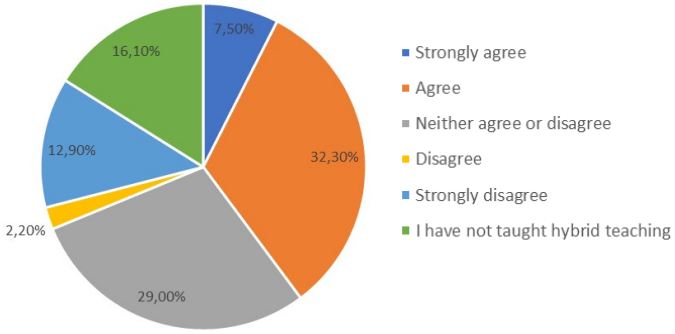
From the analysis of the questions of the 4th part of the questionnaire on hybrid teaching, we observed that 71.9% of teachers totally or fairly agree that Teams has been a useful tool in this type of teaching. Even 31.3% confirm that the grades obtained have been similar to those of previous years, only 6.3% indicate that the grades have possibly been better due to the hybrid teaching model, and 15.6% indicate that they have probably been worse due to the application of this teaching model (Figure 5). As for the aspects that pose an inconvenience in the teaching process, the difficult interaction with the students (31.7%) and the lower motivation of these (28.57%) stand out, while the rest of the answers achieved a fairly similar low percentage.

FIGURE 5
QUESTION 13: IF YOU HAVE TAUGHT IN A HYBRID WAY, HAVE THE AVERAGE GRADES OF YOUR SUBJECT(S) BEEN MAINTAINED TO THAT OF PREVIOUS YEARS?



Regarding whether the learning process of students has been harmed by the use of Teams in hybrid teaching, teachers strongly or totally agree (39.8%), although there are contrary opinions, as shown in Figure 6. In addition, 12.5% indicate that more than 76% of their students followed classes through Teams, 31.3% indicate that they did so between 51-75% of their students, 18.8% among 26-50% of their students, and 12.5% that they followed less than 25% were their students. Likewise, 65.6% of teachers confirm that student participation has been lower in hybrid teaching through Teams than in traditional face-to-face classes, with no response recorded in case participation had been higher.

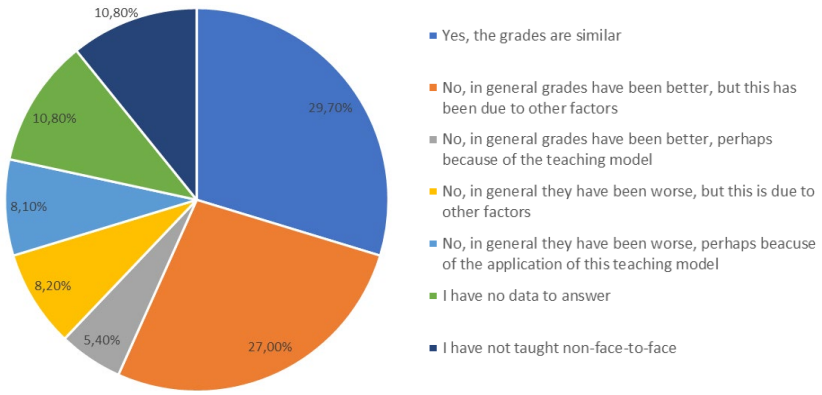
FIGURE 6
QUESTION 12: IF YOU HAVE TAUGHT IN A HYBRID WAY, DO YOU CONSIDER THAT THE STUDENT'S LEARNING PROCESS HAS BEEN HARMED BY USING TEAMS?



Finally, regarding the analysis of the questions of the 5th part of the questionnaire on synchronous remote teaching, it is observed that 82% of teachers totally or fairly agree that Teams has been a useful tool in this type of teaching, highlighting that no teacher is quite or totally in disagreement. Likewise, 29.7% confirm that the grades obtained have been similar to those of previous years, and 32.4% indicate that the grades have been better, but of these, only 5.4% say that this may be due to the synchronous teaching model, while 8.1% indicate that they have probably been worse due to the application of this teaching model (Figure 7). As for the aspects that pose an inconvenience in the teaching process, as in hybrid teaching, the difficult interaction with students (32.14%) and their lower motivation (25%) stand out, although the greatest effort to prepare classes also appears in third place (16.6%).

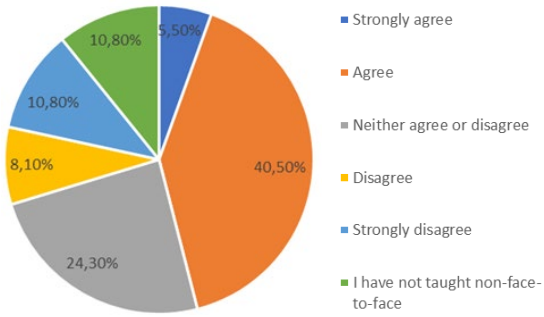
FIGURE 7
QUESTION 19: IF YOU HAVE TAUGHT REMOTELY, HAVE THE AVERAGE GRADES OF YOUR SUBJECT(S) BEEN MAINTAINED TO THOSE OF PREVIOUS YEARS

WITHOUT THE USE OF TEAMS?



As for whether students' learning process has been harmed by the use of Teams in synchronous remote teaching, teachers are fairly or totally in agreement (45.9%), as shown in Figure 8. In addition, 42.1%, stated that the follow-up was lower than in traditional face-to-face classes, and in the same percentage that the follow-up was the same. Likewise, 73.7% of teachers confirm that student participation has been lower in synchronous non-face-to-face teaching through Teams than in traditional face-to-face classes.

FIGURE 8
QUESTION 18: IF YOU HAVE TAUGHT REMOTELY, DO YOU CONSIDER THAT THE STUDENT'S LEARNING PROCESS HAS BEEN HARMED BY USING TEAMS?



CONCLUSIONS

In this paper, we have examined the perceptions, both of students and teachers, about the incorporation of the Teams application in university education as a result of the Covid-19 pandemic, especially to find out if they consider it an effective tool.

From the students' perspective, we have raised two research questions. Concerning the first: *i Is the hybrid teaching model through Microsoft Teams effective in university education?* The results obtained with descriptive statistics affirm this first question since it has been proven that the performances of students in the 2019-20 academic year with traditional teaching were similar to those of the 2020-21 academic year with hybrid teaching through Teams, so the hybrid teaching model through Teams in university education can be considered effective. Regarding the second question: *ii Is traditional face-to-face teaching more effective than hybrid teaching, depending on students' perceptions, applied with Microsoft Teams?* we can confirm that for the students of the subject Business traditional teaching is more effective than hybrid teaching through Teams, since the analysis of the results of the questionnaires reveals that almost 70% of students consider that their final grades would have been higher with traditional teaching because they believe that the hybrid teaching model with Teams has affected something or a lot in their learning. In

addition, students are not unanimous about whether hybrid teaching with Teams in the subject Business has optimized their learning process, despite the fact that 50% of students do consider that the subject is quite or totally suitable for remote teaching with Teams. However, we note that these results cannot be extrapolated to the Degree in Aerospace Engineering, since in this case, more than 70% of students strongly or totally disagree in considering the Degree suitable for remote teaching with Teams. All this leads us to affirm our second question of investigation. Although it must be taken into account that it is a single experience, collecting the students' perceptions of a specific subject is not representative to affirm categorically that hybrid teaching with Teams is effective or that traditional teaching is more effective than a hybrid.

Despite this, and according to the above, we can confirm that from the teaching point of view, analyzed through the performances of the students in our sample, the incorporation of the Teams application in university education is effective as a result of the Covid-19 pandemic. However, from the point of view of students, they consider traditional teaching more effective than hybrid. In addition, it is worth mentioning that to try to improve the perception of students about hybrid teaching with Teams compared to the traditional one, it would be convenient to investigate teaching methodologies or techniques that would minimize the main drawbacks of teaching with Teams seen by students, such as, the greater effort to follow the class, the least motivation, the lack of interaction with the other students, and the difficult interaction with the teacher.

This communication has raised three additional research questions from the teachers' perspective. Regarding the third question: iii *Did the use of the Microsoft Teams application affect teachers emotionally in such a way that it generated concern at the beginning of its use in teaching as a result of the pandemic?* through the results obtained, we confirm that the teachers of the DECS did feel concerned about the incorporation of the Microsoft Teams application in teaching; specifically, 77.5% felt enough or total concern when this incorporation was announced, even 85% recognized that they spent time getting to know the application. In addition, 67.86% had negative feelings, such as restlessness or stress. However, for most DECS teachers (65%), this concern disappeared the first day or days, or they never even felt worried (17.5%). Therefore, we confirm that teachers did feel an added concern when the incorporation of this application in teaching was announced as a result of the pandemic. Although this concern has disappeared in most teachers, 12.5% say that it has not yet entirely disappeared. Regarding the latest research questions: *iv Is hybrid teaching through the Microsoft Teams application effective in the teaching-learning process?* and v *Is synchronous non-face-to-face teaching through the Microsoft Teams application effective in the teaching-learning process?* through the results obtained, we can conclude that for a large percentage of DECS teachers, 71.9% in the case of hybrid teaching and 82% for the case of synchronous non-face-to-face teaching, Teams have been a helpful tool. In both teaching models, grades have remained similar to those of previous years in a similar percentage, close to 30%. The answers that indicate that the results could have been better or worse due to the use of Teams are not relevant, since they do not exceed 15% in any of the cases and for any of the educational models. Also similar in both teaching models, the aspects that pose an inconvenience in the teaching process to teachers and that are mainly the difficult interaction with students and less motivation of these. Regarding the learning process of students, almost half of teachers (45.9%) consider that it has been significantly or totally harmed by the use of Teams in the case of synchronous remote teaching, and a slightly lower percentage (39.8%) consider it in hybrid teaching, where there are more discordances. Likewise, most teachers confirm that participation has been lower through Teams than with the traditional face-to-face system (65.6% in the case of the hybrid model and 73.7% in synchronous non-face-to-face teaching), even the percentages of follow-up of classes through Teams that manifest in both teaching models are also lower than in the traditional system.

According to the above, we can confirm that for DECS teachers, both hybrid and synchronous non-face-to-face teaching taught through the Microsoft Teams application are effective models from the point of view of the teaching process since a high percentage of teachers (71.9% and 82% for each teaching model respectively) consider this a helpful tool, and the notes have remained similar to those of previous years, or the possible changes are not appreciated as a result of the use of this tool. However, these teaching models taught through Teams are not considered as effective from the point of view of the learning process,

where teachers consider that it has been quite or totally harmed by the use of Teams (39.8% and 45.9% for each teaching model respectively) and that both the participation of students, as the follow-up of the classes has been lower in both educational models than through the traditional face-to-face system.

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