Synchronous and Asynchronous Collaborative Dynamics and Strategies in an Online University Using Digital Tools

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***Abstract*—This article analyzes the results of an innovative experience that took place in an online university in Spain, with the aim of finding the best strategies, dynamics and digital tools to encourage synchronous and asynchronous student participation. For this purpose, students from the Bachelor's Degree in Early Childhood Education and students from the Master's Degree in Secondary Education voluntarily and anonymously answered a pre-tested questionnaire. The sample was made up of a total of 69 students, 33 from the bachelor's degree and 36 master's students. The results have confirmed that students prefer to work in small groups and that they appreciate complementary activities in order to continue learning and to improve their digital competence. With specific reference to digital tools, those that allow collaboration and those that foster autonomy and a sense of belonging to a group are the ones most highlighted by students. Also noteworthy are the tools that allow students to leave contributions both during the live classes and later in recorded classes, facilitating the participation of all the students and the possibility of reflecting in a calm manner before making contributions. Finally, it has been shown that there is a need to continue searching for better strategies so that students who watch the recorded classes can take advantage of the time and enjoy the group activities done by their classmates in a synchronous way.**

***Keywords*—online education, collaborative learning, digital tools, educational technology, interaction**

I. Introduction

The teaching and learning process in an online context involves a series of complex challenges that are different to those that may be encountered in a face-to-face educational context. In this sense, analyzing and reflecting on what strategies and dynamics we can implement, both in live online classes and through asynchronous communication, can contribute to improving processes that are becoming more and more widespread. Whether for health reasons, as happened a few years ago, or because of the life we lead today, online education is becoming more and more widespread, and we should not lose sight of the objective to contribute to its optimization.

With this study, we intend to offer a practical example of how to develop strategies and work dynamics in an online university which can contribute to improving the experience and involvement of our students from a holistic point of view, i.e., considering the experience from a global perspective that includes both synchronous and asynchronous strategies. It is important to always consider digital tools and digital competence, as this is a key aspect for both teachers and students in an online context.

II. Literature Review

When we talk about online education, we are referring to a type of education with its own characteristics that requires specific teaching and learning strategies. During the pandemic, people spoke about online education, but, in fact, they were talking about emergency education, as teachers from all educational stages attempted to adapt their face-to-face teaching to the digital environment. In many cases they made no methodological changes, they only changed the context. That obviously was not enough, although, at that time, it was a matter of simply getting through the situation [1, 2]. Once back in the face-to-face environment, many teachers dared to comment on their experience, criticizing online education because of the distance they felt with students and the coldness involved. However, as we said, they weren't talking about online teaching, but rather a type of emergency education, with every man for himself, which is what happened during that period [3].

The reality is that online education is not something new, it has many years and a lot of research behind it in which the emotional aspect and the creation and sense of belonging to a group have been considered [4–6]. Evidently, this is not achieved in one day. Changing the methodology, the dynamics, the strategies, the way of teaching a class, carrying out activities or participating in a forum are all factors in the success of a distance learning course.

In this paradigm shift, the digital competence of teachers and students plays a fundamental role [6–12]. Knowledge of suitable resources, tools and platforms for online education is a plus that will facilitate not only student participation, but also attention to diversity and an inclusive approach through the Universal Design for Learning (UDL) [13–16]. In this sense, teacher and student training will be key to achieving an adequate and motivational environment for learning to take place, both from a methodological point of view and from a pedagogical and didactic point of view [5, 17].

If we focus specifically on distance education in the university stage, one of the objectives to be achieved in an online university is the active participation of students [18, 19]. The profile of a student who decides to study at an online university is usually someone who has other priorities and more responsibilities, only being able to dedicate a limited amount of time to their studies.

In this sense, getting them to participate will not be an easy task and our proposals should help them to motivate themselves, self-regulate and develop their autonomy, while at the same time fostering a friendly and warm environment in which they may feel like participating and making contributions with the rest of their peers [20–23]. It is an attempt to transfer the feeling of belonging that can be felt in a face-to-face university to a virtual one.

For this purpose, we have synchronous interaction and opportunities to participate in live classes for example, as well as asynchronous opportunities, such as in a forum, to give the most obvious example [24]. How we dynamize and interact with these spaces can make the difference in achieving these objectives.

As mentioned above, in this sense, digital tools, applications and platforms, when properly used, will be an ally that we should not ignore and which we should learn to use [25]. Moreover, employing digital tools as teachers will not only serve to energize or motivate students, but will also develop our digital competence and, of course, that of our students too, an aspect that will be especially significant if they are future teachers, as is the case that will be seen in this article [26–30].

Another relevant issue that we cannot ignore is that when we talk about participation, interaction and group work, this includes two aspects, one collaborative and the other cooperative. When talking about collaborative and cooperative learning, we find studies in which the terms are used in very different ways, sometimes as synonyms and, on other occasions, in a contradictory way. In the case that concerns us here, we will leave aside cooperative learning, as understood by Johnson and Johnson [31], to focus on collaborative learning in which the participants contribute to the group, but their contributions are not indispensable nor is an interdependent relationship established, as is the case in cooperative learning [32]. In collaborative learning, as we understand it here, everyone's contributions help to improve the result and it allows us to see different points of view and perspectives, but in no case is any contribution indispensable for the resulting product to be complete. It is a very appropriate learning process for the type of voluntary activities that take place in this proposal, removing pressure and stress from the participants, by not making others depend on them, as happens in cooperative learning, which would be appropriate for other types of tasks and contexts [33]. Furthermore, collaborative learning contributes to improving attention to diversity and fostering adequate and friendly environments for learning to occur, especially when we talk about an online environment [5, 16].

With this in mind, in this article we will try to achieve the following objectives:

- Analyze what it means for students to watch recorded classes at a later date.
- Determine students' opinions about the incorporation of specific forums, one for information and the other for voluntary participation in challenges.
- Rate the use of certain digital tools, both in synchronous and asynchronous proposals.
- Check whether there are differences between undergraduate and master's degree students.

III. Materials and Methods

A. About the Experience

The research presented here is an analysis of the classroom experience of a professor at a Spanish online university, carried out during the 24/25 academic year. Specifically, it includes education students i.e. future teachers from the Bachelor's Degree in Early Childhood Education and the Master's Degree in Secondary Education (an obligatory master's degree in Spain to be able to work in public schools).

The experience was carried out with 130 students from the Master's Degree in Secondary Education and 47 students from the Bachelor's Degree in Early Childhood Education. They all had the same teacher. Of the 177 students, a total of 69 students answered the voluntary and anonymous form. In other words, 38.98% of the total. We will discuss this later.

As for the proposal made, it is part of a class dynamic and a methodology that the teacher has been applying for years in her classroom [4, 8, 9, 33] and to which she is adding new components. Different aspects of it are being analyzed to know which strategies work better, which do not, or the appropriate tools for it, both from the point of view of the teacher and the students. This type of research is useful as it can be transferred to other contexts, subjects and educational stages.

In the part presented in this paper, we focus on the following aspects of this online teaching proposal:

- In synchronous, live sessions, the teacher uses collaborative tools so that students can work in groups to respond to any question asked. They are then put together in that same session, during the live class. The teacher visits the groups while they are working to answer any specific questions they may have. They are simple tools that do not involve a large learning curve and, therefore, can be introduced and used during the class itself. An example of this tool would be Google Docs. Documents can be prepared in advance, or created as you go along, so that each group can access them and work together on an activity proposed in the document itself. Subsequently, the documents can be made available to the rest of the class in a non-editable version. These links can be uploaded to the so-called "News Forum" so that they can be accessed for viewing.
- In the same synchronous sessions, if there aren't many students and subgroups do not seem appropriate, digital tools are used for the collaborative work of all students in the same space [33]. This is done with tools such as Slices by wbrain, Fastboard.io, Wakelet, MindMeinster or Padlet. It allows everyone to work together, sharing a screen. Corrections and comments are made in the live classroom. Some of these tools allow you to continue working after the class has ended. Others, which do not require registration, such as Slices by wbrain or Fastboard.io, are not available after the class, but screenshots are taken to provide a graphical summary of the class results. This is added to the "News Forum".
- The "News Forum", as it is known, is a unidirectional forum which only the professor writes in. The teacher includes news related to the subject but also includes a summary after each live class, which is what interests us here [34]. It is a summary that allows students who were not there to know what has been discussed in class and those who were there to remember it. It also allows everyone to access the links to discussions that took place during the session, as well as the digital tools, whether it is to view the results or to participate. In addition, these messages include links to video tutorials of the tools used, as the students are future teachers, and

this can help them develop their digital competence.

- In addition to the "News Forum", the teacher creates another one called the "Innovation and Research Forum". In this forum, voluntary challenges and activities are proposed to further develop digital competence [8, 9] and to create a group feeling among students, an aspect that, as we saw, is difficult to achieve in an online university [4]. An example of this type of activity is an initial challenge that involves creating an avatar. Different digital tools are proposed to create the avatar (web tools that don't require registration, mobile applications or artificial intelligence tools) and students are told that, once they have created their avatar, they must upload the image to a Wakelet collection (a collaborative tool that does not require them to register).
- Over the course of the degree program, other types of tools are used, both for synchronous sessions (such as Mentimeter) and for asynchronous sessions or for the ongoing assessment activities (the courses in question have an ongoing assessment component involving the submission of activities and a final exam). These tools include Genially, Loom, Strawpoll and Edpuzzle, among others.

Table 1 shows the main tools used. We include a brief description of each of them and how they were used in this experience.

Table 1. Tools used during the experience

Tool	Description	Concrete use
Google Docs	Tool which allows the creation of text documents which can be worked on collaboratively. It's free. The students don't need to register. The learning curve is very low.	Google documents were used to work in small groups in online classes. Documents subsequently remained available in a non-editable format and their links were shared on the "News forum" so that the rest of the students could see their classmates' work. A Google document was used so that the whole class could collaboratively contribute asynchronously, proposing an activity in the "Innovation and Research Forum".
Slides by wbrain	Collaborative mural-type tool that does not require the teacher nor the students to register. The result cannot be downloaded, but a screenshot of the result can be taken. Its learning curve is very low.	It was used for the collaborative work of the whole class in live sessions. Contributions are anonymous and the teacher can share and correct the contributions. Subsequently, a screenshot of the resulting "mural" was taken, and the image was shared in the "News Forum" in the post-class summary. The video tutorial for using the tool was also made available, as is done with all of them.
Wakelet	Tool with several work possibilities, including a collaborative option. Students do not have to register to be able to upload materials and resources in a very intuitive way.	It was used for voluntary collaborative activities for the whole class proposed in the "Innovation and Research Forum".
Padlet	A collaborative tool with different options in which students can participate without having to register. It can be used to upload materials, resources, videos or audio, among other possibilities.	It was used for collaborative work with the entire class, both synchronously and asynchronously. The activity was made available after the class so that people who had not been in class or those who had not had time during the session could participate. The link was shared in the "Innovation and Research Forum" as an extra activity for those who wished to do it. These asynchronous contributions were corrected in the following session. Again, as with the previous examples, it has a minimal learning curve.
MindMeinster	Tool used to create concept maps. Students don't have to register. Although, in the last update it seems to have been modified, and it is very possible that it won't be used in the future.	It was used in the live sessions for the collaborative work of the class. The map is available for review in the "News Forum". Students cannot work on the map after the class, so the map does not get modified. In its free version, the map is not downloadable, but screenshots can be taken. In this case, screenshots weren't taken because the map can be accessed through a link.
Fastboard.io	Digital whiteboard in which neither the teacher nor the students must register. Very simple to use. The whiteboard can be downloaded in an image format (jpg file). You can write on the whiteboard but also share PDF documents and images.	It was used for whole-group collaborative work in live classes. The result was downloaded and shared as an attachment in the summary presented after each class in the "News Forum". As in the other cases, a video tutorial was also shared in this summary.
Avatars Mirror App Avatars AI Free website for creating avatars that doesn't require you to sign up	Different tools which can be used to make avatars. Includes a mobile application. A prompt to create the avatar with an artificial intelligence tool and a website where avatars can be created without registering.	At the beginning of the course, students must create an avatar to get to know each other better. A live class demonstrates the three tools and how to upload the avatar to the Wakelet collaborative collection. All information is available in the "Innovation and Research Forum".
Mentimeter	It is used to create interactive presentations. It has a free part and a paid part. Students do not have to register in order to interact during the presentation. The presentation can be downloaded later in PDF format. It is also available for reviewing online, although it is no longer possible to participate in the interactive aspect.	It is used in some of the sessions to present theoretical materials. Interactive slides are included for student participation. The link remains available afterwards so that the presentation can be reviewed once the class is over. It is included in the "News Forum", in the session summary.
Strawpoll	Used to create surveys quickly and easily. Neither students nor teachers have to register. You can see how the results change in real time. You can participate live or later. It is accessed through a link.	It was used during live classes to do surveys. Subsequently, the link was made available in the summary in the "News Forum" for further participation.
Loom	Screen recorder with many options for further editing. It is a free tool, but you must register to use it. It has a basic	The tool is explained in one of the synchronous sessions so that students can use it to make a presentation that they have to create in

	option and an educational option in which we register with an educational email. This option offers 45 minutes of recording instead of the five minutes offered in the free version. The person can appear on screen or not. It also records audio. The video is downloadable in mp4 format or can be shared by link and can even be password-protected. Comments and emoticons can be left during the video.	one of the ongoing assessment activities. Its learning curve is medium.
Edpuzzle	Enriching videos platform. A platform where you can upload your own videos, or use YouTube videos and include both self-correction and open-ended questions. We can decide whether the student must register or not, both options are available. Teachers must register, and the learning curve is medium to high for teachers. In its free version, it only includes five videos, but this can be increased if more people sign up through a link of their own.	The platform is demonstrated in class and a video is shared in the "Innovation and Research Forum" so that students can try it out and review class materials on a voluntary basis. As in the previous cases, a video tutorial is also provided.
Genially	A tool with many options. It can be used to make presentations or prepare games, among other possibilities. It has a free part and a paid part. Its learning curve is high.	This tool is used to make extra materials available to students that may be helpful for their studies. Corresponding links are left in the "News Forum" on the days the materials are taught in class. Some of the students who were already familiar with the tool previously used it to make presentations for some of the ongoing assessment activities.

It should be noted that we are talking about either free tools or tools that have a paid and a free part (freemium), with the free version always being used [25]. The idea is that future teachers can learn about the possibilities of these tools so that they can use them in the future as teachers in their own classrooms.

B. The Questionnaire

As mentioned at the beginning of this section, the research was carried out in a Spanish online university in the 24/25 academic year, with the same teacher in two subjects, one in the early childhood education degree and the other in the secondary education master's degree. Combined, the degrees have a total of 177 students, 47 from the bachelor's degree and 130 from the master's degree.

These students were offered the opportunity to answer a questionnaire on a voluntary basis at the end of the courses. The questionnaire included nine closed questions and one open-ended question. As previously mentioned, 69 students answered the questionnaire, which is 38.98% of the total. The questionnaire was previously tested in a pilot group through which we were able to improve it and correct the errors detected [35, 36]. In addition, it is a questionnaire based on previous studies and adapted to the specific needs of this research [33, 37, 38].

The first question is socio-demographic in nature and is only intended to differentiate between the master's degree and bachelor's degree students. No question on gender is included because the majority of students are female, and no meaningful results could be extracted in that regard. We did not consider asking for age, or dividing into age ranges, because it was not one of the primary objectives of the research and we wanted to preserve the privacy and complete anonymity of the people who answered the form.

This question was followed by nine more quantitative, closed questions, which fall into four dimensions: (1) Use of collaborative tools in live classes. Students' preferences (2 questions); (2) Students' preferences regarding watching recorded classes (2 questions); (3) Relevance of class summaries and the innovation and research forum (2 questions); (4) The digital tools used (2 questions). After these eight questions, the questionnaire ends with a final open-ended question for further comments and feedback. This tries to alleviate any inconvenience, error or doubt that the student may have encountered when answering the form, and it allows a space for reflection in case the student considers that he/she wants to provide further explanations on any of the issues raised or if he/she considers that there is some aspect of the subject that has not been addressed and should be included.

IV. Result and Discussion

Here we will present the results and discuss the findings, taking into account the four dimensions into which the questionnaire has been divided: (1) Use of collaborative tools in live classes. Students' preferences; (2) Students' preferences regarding watching recorded classes; (3) Relevance of class summaries and the innovation and research forum; (4) The digital tools used.

Before starting with the first dimension, we should mention the initial question which refers to the associated study. Of the 69 students who responded to the questionnaire (39.98% of the total), 36 were master's students (52.17%) and 33 were undergraduate students (47.83%). These two figures are very similar at an absolute level, with a difference of only three students. However, if we consider that there are a total of 130 master's students and 47 undergraduate students, the numbers change and it can be said that 70.21% of the undergraduate students voluntarily participated in the questionnaire, while only 27.69% of the master's students participated. At this point, we could ask ourselves whether the fact that there are fewer students in the bachelor's course might have led to a greater feeling of closeness and a higher degree of personalization and motivation that may have had an impact on their willingness to participate. In addition, this is a figure that should be taken into consideration when assessing the relevance of the responses obtained from the undergraduate and master's degree students.

Regarding the first dimension on the usefulness of collaborative tools in live classes, there are two closed, multiple-choice questions. In the first one, students were asked if they liked to use digital tools in live classes to work in small groups in a collaborative way and, in the second one, they were asked the same thing but for working with the whole class in a collaborative way. In both cases, six response options were offered, on a Likert-type scale: 1) I don't know what you are talking about (it should be noted

that students who had never seen a class, neither live nor recorded could answer the questionnaire); 2) I have never been in a live class; 3) I did not like this possibility; 4) I liked this possibility somewhat; 5) I liked this possibility rather a lot; 6) I liked this possibility very much.

The following tables show the overall results of the two questions. Table 2 shows the results for the students of the Bachelor's Degree in Early Childhood Education, Table 3 shows the data for the master's degree students and Table 4 shows the grouped data, comparing the global preferences of the students regarding working in small groups or with the class as a whole.

In this sense, in Table 2, it can be seen that in the bachelor's degree, there is a predilection for collaborative work with the class as a whole. A total of 81.82% of the students voted that they like this option of working together "rather a lot" or "very much". Another figure that shows this greater enthusiasm is that more than half of the students rated this option as good (54.55%), compared to only 27.27% who chose the option "very much" in the case of work in smaller groups.

Table 2. Undergraduate students rating of live classes

Degree in Early Childhood Education	N In groups	% In groups	N The whole class	% The whole class
I've never been in a live class before	3	9.09	3	9.09
I didn't like this possibility	0	0.00	0	0.00
I somewhat liked this possibility	9	27.27	3	9.09
I liked this possibility rather a lot	12	36.36	9	27.27
I liked this possibility very much	9	27.27	18	54.55
TOTAL	33	100	33	100

In Table 3, we can see that the trend is similar, but even more pronounced, since, if we add the figures for the "rather a lot" and "very much" options, we see that 100% of the students felt this way about working with collaborative tools as a whole class. In the case of small group work, the figures are also positive, but, in this case, we found three master's degree students who do not like small group work, an option that had not appeared in the case of the undergraduate students.

Table 3. Master´s students rating of live classes

Master's Degree in Secondary Education	N In groups	% In groups	N The whole class	% The whole class
I've never been in a live class before	0	0.00	0	0.00
I didn't like this possibility	3	8.33	0	0.00
I somewhat liked this possibility	6	16.67	0	0.00
I liked this possibility rather a lot	15	41.67	15	41.67
I liked this possibility very much	12	33.33	21	58.33
TOTAL	36	100	36	100

In short, in the fourth table we can see that, regardless of what they are studying, the use of collaborative digital tools to work together in the synchronous session is highly valued by students [5]. The comparison is interesting because in the master's degree program there are more students, so there are usually more people in class, which could lead us to think that working together on an external collaborative platform could be chaotic, but it does not seem to be an impediment for them. I understand that here we will have to address, as mentioned in the literature review and as many studies have already pointed out, that it is essential to develop the digital competence of teachers, not only in reference to the specific use of a tool but, above all, in relation to their pedagogical and didactic knowledge [17].

Table 4. Global rating of the live lessons

Total	N In groups	% In groups	N The whole class	% The whole class
I've never been in a live class before	3	4.35	3	4.35
I didn't like this possibility	3	4.35	0	0.00
I somewhat liked this possibility	15	21.74	3	4.35
I liked this possibility rather a lot	27	39.13	24	34.78
I liked this possibility very much	21	30.43	39	56.52
TOTAL	69	100	69	100

As can be seen in the graph (Fig. 1), the correlation between the variables in live lessons (in groups vs. the whole class) is positive (0.56), being more positive in the Bachelor's Degree (0.77) than in the Master's Degree (0.21).

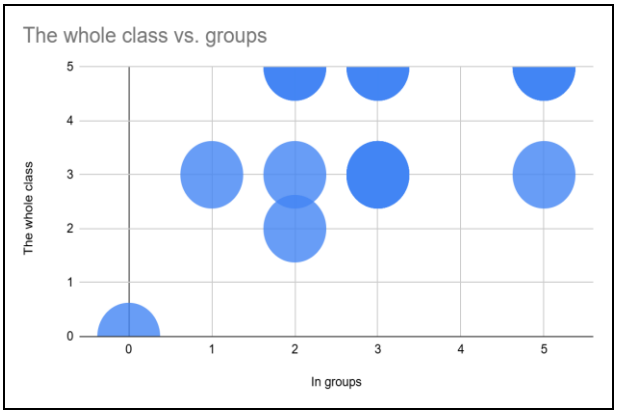

Fig. 1. Correlation between variables in live lessons.

As for the second dimension, student preferences regarding watching recorded lectures, two Likert-type response questions are also included. On this occasion they are asked about the usefulness of watching recorded classes in which work is done in groups using collaborative digital tools. The options presented are the following: 1) I don't know what you are talking about; 2) I have never watched a recorded class with collaborative work; 3) I did not find it useful to watch the class; 4) I found it somewhat useful to watch the class; 5) I found it rather useful to watch the class; 6) I found it very useful to watch the class.

To analyze the results, we have again chosen to present three tables referring, once again, to the results of the bachelor's degree, the master's degree and the global results.

In Table 5 we can see that the numbers vary quite a bit from those obtained in the live classes. In other words, as might be expected, it is not the same to work with collaborative tools in live classes as it is to watch how other classmates work with them in recorded classes. In addition, it

is important to note that small group work is done in individual rooms, i.e., students work in separate rooms while the main room does not display information, although they can share, for example, the chats of the rooms in which their classmates are working, and the teacher can comment on them. This means that watching a recorded session in which classmates have been working in small groups has parts that do not provide information, as reflected in some of the comments in the final open-ended question: "I have watched most of the classes at a later date and when you work in groups and each group is sent to a different room, whoever is watching the recording is not able to go to those groups. You don't see the process of the task as such even though you correct everything afterwards and stuff. Also, when you go to the groups, I imagine you give feedback, and with that you can also learn a lot, but those who watch the recording miss it" (Answer 67). Again, the relevance of structuring an online session with appropriate dynamics is reflected [5, 39].

If we consider the four degrees of satisfaction with the classes, from "I did not find it useful" to "I found it very useful", the average is 2.55 points. This would be somewhere between "I found it somewhat useful" and "I found it rather useful". However, if we consider the work done by the whole class together, which is carried out in the main room, so that the entire process can also be seen when viewing the recorded class, the average already rises to 2.91 points, practically placing it at "I found it rather useful to watch the class". In this case, the most common response was "I found it very useful to watch the class", with 12 points.

Table 5. Undergraduate students rating of the recorded classes

Degree in Early Childhood Education	N In groups	% In groups	N The whole class	% The whole class
I have never seen a recorded class	0	0.00	0	0.00
I didn't find it useful to watch the class	3	9.09	3	9.09
I found it somewhat useful to watch the class	12	36.36	9	27.27
I found it rather useful to watch the class	12	36.36	9	27.27
It found it very useful to watch the class	6	18.18	12	36.36
TOTAL	33	100	33	100

In the case of the master's degree, reflected in Table 6, these figures are even more intensified, which is not surprising, since the same trend also existed in the first dimension. Again, the figures are much lower in the case of watching classes of small group work, as can be seen in the percentages and numbers reflected in the table, as well as in the resulting average, 2.83. This figure rises to 3.67 points in the case of viewing recorded classes with whole-class group work. Surprisingly, this average even exceeds that obtained in Table 3. That is to say, the average satisfaction obtained from watching the class recording at a later date with whole-class group work (3.67), is even higher than the average obtained by the master's students during their live work (3.58). Perhaps of special relevance at this point is the fact that watching a recorded class allows for reflection, pauses and does not entail the immediacy and tension that a live class can involve [20].

Table 7 shows the overall satisfaction with recorded classes, both when they include work in small groups and when they include collaborative work by the entire class. The trend is the same as in the live classes: greater satisfaction and perceived usefulness of classes in which all students work together. In addition to what has been mentioned in previous paragraphs, we could consider the fact that working together could lead to less individual responsibility and, therefore, less stress [5, 20].

Table 6. Master´s students rating of the recorded classes

Master's Degree in Secondary Education	N In groups	% In groups	N The whole class	% The whole class
I have never seen a recorded class	0	0.00	0	0.00
I didn't find it useful to watch the class	3	8.33	0	0.00
I found it somewhat useful to watch the class	12	33.33	3	8.33
I found it rather useful to watch the class	9	25.00	6	16.67
It found it very useful to watch the class	12	33.33	27	75.00
TOTAL	36	100	36	100

Table 7. Global rating of the recorded classes

Total	N In groups	% In groups	N The whole class	% The whole class
I have never seen a recorded class	0	0.00	0	0.00
I didn't find it useful to watch the class	6	8.70	3	4.35
I found it somewhat useful to watch the class	24	34.78	12	17.39
I found it rather useful to watch the class	21	30.43	15	21.74
It found it very useful to watch the class	18	26.09	39	56.52
TOTAL	69	100	69	100

As can be seen in the graph (Fig. 2), the correlation between the variables in recorded classes (in groups vs. the whole class) is positive (0.50), being more positive in the Bachelor´s Degree (0,58) than in the Master´s Degree (0,45).

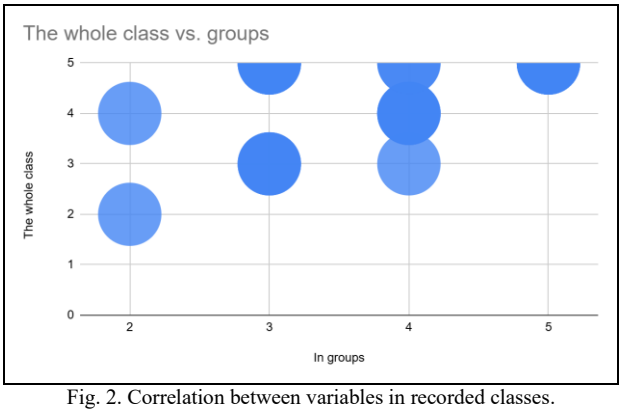

Fig. 2. Correlation between variables in recorded classes.

In the third dimension, the relevance of the class summaries and the innovation and research forum, the two questions make reference to the usefulness of the summaries that are left after the classes, which review what has been covered in the live classes and include links of interest, as well as the forum created to overcome collaborative challenges and share interesting links. It is worth mentioning that we are talking about a complementary and voluntary

forum. In this dimension, we again have two closed Likert-type questions with five options to choose from. In the case of the class summaries, students were asked about their usefulness: 1) I don't know what you're talking about; 2) I didn't find it useful; 3) I found it somewhat useful; 4) I found it rather useful; 5) I found it very useful. In the question on the Innovation and Research Forum, the options were similar, but they asked if you liked that forum or not.

In Table 8 we can see the results regarding the class summaries. The figures are similar in the bachelor's degree (early childhood education) and the master's degree (secondary education). Thus, the resulting averages (1 being "I did not find it useful" and 4 "I found it very useful") are 3.45 among undergraduates and 3.42 for master's students, close to the highest category in the two groups, where we find the mode in both cases. These numbers highlight the importance of offering different ways of accessing information [13–16], as well as the relevance of developing strategies that can help students self-regulate [16, 18, 19].

Table 8. Usefulness of the summaries after the live classes

Summaries	N Early Childhood	% Early Childhood	N Secondary	% Secondary
I don't know what you're talking about	0	0.00	0	0.00
I didn't find it useful	3	9.09	3	8.33
I found it somewhat useful	0	0.00	3	8.33
I found it rather useful	9	27.27	6	16.67
I found it very useful	21	63.64	24	66.67
TOTAL	33	100	36	100

As for the Innovation and Research Forum, the results also show positive figures, although they are more dispersed. Thus, as can be seen in Table 9 with the percentages, the averages decrease a little, with 3.36 for undergraduate students and 3.17 for master's students. In any case, it is above "I rather like it". This implies that students from both levels of study are prepared to dedicate extra time to subjects when the teacher offers options which they find interesting [4, 8, 9, 19, 34].

Table 9. Rating of the Innovation and Research Forum

Innovation Forum	N Early Childhood	% Early Childhood	N Secondary	% Secondary
I don't know what you're talking about	0	0.00	0	0.00
I didn't like it	0	0.00	3	8.33
I somewhat liked it	3	9.09	3	8.33
I liked it quite a lot	15	45.45	15	41.67
I really liked it	15	45.45	15	41.67
TOTAL	33	100	36	100

The fourth and last dimension, referring to the use of digital tools, was also based around two questions. The first of these refers to the possibility that sometimes existed of continuing to participate through collaborative tools in activities that had been planned in class. Some tools that can be made available once the class is over so that students, both those who were there live and those who watch the recording of the class, can continue to leave their contributions, in a calmer and more reflective manner. This question, like the previous ones, includes five options in a Likert-type scale: 1) I don't know what you are talking about; 2) I didn't like this possibility; 3) I somewhat liked this possibility; 4) I liked this possibility rather a lot; 5) I liked this possibility very much. The second part of this dimension, which we will address later, refers to the use of specific tools.

Table 10 includes the results of this first question related to the tools that could be used during live classes and could continue to be used in recorded classes. In general, again we find very positive figures, even above those seen in Table 8. Most of the responses are centered at the top of the table with the mode located in the upper range, both in undergraduate students and master's students. Thus, the averages are 3.55 and 3.67, respectively. These tools that allow synchronous and asynchronous use are very well accepted by students, offering them greater flexibility and freedom [4, 22]. This was reflected in some of the responses to the final open-ended question: "Working with the tools you have proposed has been very enriching. The only drawback has been not having more time with the collaborative tools, when it came to solving them. Having said that, you have looked for a solution to make up for that lack of time" (Answer 46).

Table 10. Synchronous and asynchronous tools

Synch. and asynch. tools	N Early Childhood	% Early Childhood	N Secondary	% Secondary
I don't know what you're talking about	0	0.00	0	0.00
I didn't like this possibility	0	0.00	0	0.00
I somewhat liked this possibility	3	9.09	0	0.00
I liked this possibility rather a lot	9	27.27	12	33.33
I liked this possibility very much	21	63.64	24	66.67
TOTAL	33	100	36	100

Lastly, and continuing with this fourth dimension, students were asked if they had liked any of the tools used, following the list shown in Table 1. For each of them, they had to choose between the following options: 1) I don't know it; 2) I don't remember having used it in the subject; 3) I didn't like it; 4) I liked it somewhat; 5) I liked it very much. Table 11 summarizes the results with the mean of each tool, broken down into undergraduates and master's students, as well as including the total of both. The means range from 0 (they don't know the tool) to 4, with 4 being considered as the highest mean rating.

Starting with the overall rating of the tools, the rating is on average, a little above the middle (M = 2.64), with a more positive rating among master's students (M = 2.77) than undergraduates (M = 2.5). It is true that in the responses to the final open-ended question, a number of comments referred to the fact they learned about many tools during the course: "I was surprised by the number of tools that exist and that we can use these days" (Answer 13); "I love being up to date in the use of digital tools as it allows me to use them in different

contexts; meetings with families at the school, surveys, teacher meetings, creating teamwork dynamics...” (Answer 25). This knowledge and use of tools contributes to the development of the digital competence of future teachers, which is a key aspect to consider [8].

The tool rated most highly by both the undergraduates and master’s students is Genially, while the lowest rated is Strawpoll. Tools such as Google Docs, Padlet, the free website for creating avatars and Edpuzzle can be highlighted as the best rated. This partly coincides with previous studies in which Google Docs and Padlet also stood out for their collaborative aspect [33]. They are rather popular tools as reflected by some students in their answers to the final open-ended question: “Before taking this course, I only used Google Docs and Padlet. Throughout the course, I really liked Genially, Loom (the most similar to Flipgrid) and Wakelet” (Answer 3). Edpuzzle is a tool that contributes to student autonomy, which is so important in online education [5, 20–23]. This free avatar creation website, which does not require you to sign up, stands out for its simplicity and for providing a way to facilitate team bonding and a group feeling among students by creating their own avatars and sharing them with their classmates [4, 9, 19]. In general, in previous studies, tools like Padlet or Edpuzzle were also highlighted by teachers as suitable for their students [22].

Table 11. Rating of the digital tools used

	M Early Childhood	M Secondary	M Total
Google Docs	3.18	3.00	3.09
Mentimeter	1.91	2.83	2.39
Fastboard.io	1.36	**1.50**	**1.43**
Strawpoll	**1.27**	2.25	1.78
Wakelet	1.82	2.17	2
Loom	3.00	1.58	2.26
Padlet	3.45	**3.50**	3.48
Mindmeinster	1.82	2.17	2
Edpuzzle	2.91	3.33	3.13
Genially	**3.73**	**3.50**	**3.61**
Avatars Mirror	2.27	3.33	2.83
Avatars AI	2.27	3.42	2.87
Avatars web	3.45	3.42	3.43
TOTAL	2.50	2.77	2.64

V. Conclusion

Considering the objectives regarding the use of collaborative tools, the results presented indicate that students, regardless of the degree they have chosen, whether it is the Bachelor’s Degree in Early Childhood Education or the Master’s Degree in Secondary Education, prefer to work collaboratively with all classmates and not in small groups, results that are even more intensified in the case of viewing the recorded classes at a later date.

Likewise, both groups positively value the incorporation of tools that allow both synchronous and asynchronous work, as well as the summaries included in the forum after the live classes and the possibility of being able to continue researching and developing their digital competence through the voluntary proposals in the Innovation and Research Forum.

As for the tools, the results are in line with previous studies, highlighting the tools that allow collaborative work, but also those that encourage student autonomy and self-regulation, as well as those that promote a sense of belonging to a group, which is so important in an online university.

It would be advisable for educators to take into account the educational potential of collaborative digital tools, not only to encourage participation and interaction between students and with teachers, but also to contribute to their digital competence.

No significant differences were observed between the students of the two degrees, although, in general, the students of the Master’s Degree in Secondary Education offered slightly more positive ratings than those of the Bachelor’s Degree in Early Childhood Education. In the future, it would be good to delve deeper into the differences involved in studying a four-year degree or a one- or two-year master’s degree, to determine the profile of the students and the different variables that can influence them. Likewise, it would be interesting to delve deeper into the relevance of ratio in online education, to find out to what extent having more or fewer classmates in a course can influence students’ behavior, participation and even results.

Regarding the questionnaire, it would have been interesting to have included more qualitative questions to know the reasons for some of the answers. In this sense, conducting focus groups could also have been interesting.

With regard to the future, on the one hand, having to do with the experience itself, it would be necessary to improve the weak points detected, such as better management of small group work or offering alternatives for people who watch the recorded classes at a later date. On the other hand, as far as the research is concerned, the low number of students involved limits the generalizability of the findings, if possible, it would be advisable to expand the study in forthcoming contributions.

However, we hope that it can serve as a starting point for further reflection on the main aspects to be taken into consideration when developing our teaching in a non-face-to-face context.

In any case, it should always be assumed that in education each class is different and there are many variables involved, each group is different from the previous one and a teacher can also make a difference.

Conflict of Interest

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