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Active Methodologies to Enhance Blended Learning: Exploring the Perceptions of Pre-Service Teachers

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The perceptions of blended learning teachers on the usefulness of different techniques in different aspects are tested: the technique improves the understanding of content and application of knowledge, to test the perception of learning; the technique facilitates blended learning; and the technique improves autonomy, commitment, and the perception of achievement with respect to the subject, to test aspects related to learning. This is an exploratory study with a pre-experimental design. Thus, for this proposal, a mixed method is used with a scale questionnaire to obtain quantitative measures of mean and standard deviation, in addition to using the ANOVA test to check that the differences are significant, and an interview with some participants to complement with qualitative information and deepen the results obtained. Participants highlighted their combination and considered that self-regulated learning strategies are especially useful for monitoring progress and perception of achievement; flipped classroom to improve autonomy, which in conjunction with self-regulated learning improves understanding; and cooperative projects to improve understanding and application of knowledge when learning among peers. In conclusion, each technique is suitable for different purposes and the combination would be ideal.

Keywords: flipped classroom, cooperative learning, student projects, self-regulated learning, blended learning

INTRODUCTION

With the possibilities of technology, and the improvement in autonomy shown by some students after COVID-19 (Yaşar and Atay, 2023), many higher education institutions are opting for blended learning (b-learning) (Singh et al., 2021). However, some teachers do not know which online learning tools to use, as well as some students do not take advantage of hybrid learning due to low motivation (Nuriddin, 2024). For these reasons, and according to Rasheed, et al. (2020), it is necessary to use actives methodologies such as the Flipped Classroom (FC), Cooperative Projects (CP), and support strategies for Self-regulated Learning (SRL) in b-learning.

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FC rethinks and takes advantage of class sessions in a practical and applied way within a limited time. This is possible because theoretical material is provided in advance, and students prepare it at home before they attend class (Milman, 2012; Tucker, 2012). Class time can therefore be devoted to cooperative activities (Foldnes, 2016). Specifically, the FC model allows for pre-class content comprehension, provided it is done in a self-directed manner, so that it may facilitate knowledge application in class (Brewer and Movahedazarhouligh ,2018). FC is commonly used in higher education (Lundin et al., 2018). Its use has a positive effect on learning (Shi et al., 2019), which can be enhanced by preparing students beforehand (Låg and Sæle, 2019). The FC favours teaching flexibility and allows students to individualize the learning process (Durak, 2018). If we add adequate support from the teacher, the FC creates the prime conditions for the development of students' autonomy, which significantly affects their perception of achievement (Yoon, et al., 2020). This model allows for improved participation and engagement in the classroom (Ayçiçek and Yelken, 2018). The degree of engagement the FC elicits proves satisfying for students, regardless of their perception of achievement (Fisher, et al., 2018). In this regard, evidence has shown that the FC improves students' efforts and positive perceptions (Akçayır and Akçayır, 2018), as well their self-efficacy (Thai, et al., 2017). B-learning produces better learning results than the face-to-face and online modalities (Thai, et al., 2017), and it is also the modality that increases student engagement the most (Burke and Fedorek, 2017).

Project-based learning consists of cooperative work conducted by groups of students; it facilitates dynamic learning, which can improve students' perception of achievement (Granado et al., 2018). In fact, improvements in student achievement have been found, especially when creativity is considered (Marsiti, et al., 2023). While it is true that school performance may vary depending on the level of education, in general, the implementation of b-learning situations has a positive effect compared to traditional methods of instruction (Suyantiningsih, et al., 2023). Online environments rely on cooperative learning because peer support helps students understand content (Davis et al., 2018) and encourages positive attitudes (Aghajani and Adloo, 2018). Furthermore, interaction while participating in collaborative activities improves students' ability to plan and manage group tasks (Vuopala, et al., 2015). Cooperative learning implemented together with the FC improves students' academic results (Foldnes, 2016). For group interactions to work in a b-learning situation in an FC, support through continuous dialogue (Navarro, et al., 2019) and learning regulation is advisable in terms of understanding content and applying knowledge during group work (Blau and Shamir-Inbal, 2017).

Also, projects can be combined with formative assessments, which allows for comprehensive and differentiated evaluation (Zhang and Yang, 2018). In addition, completing CP through an SRL model promotes a significative learning in a b-approach (Gandhi, et al., 2017). Implementing metacognitive strategies while completing projects allows for more confident coping, which could facilitate engagement and perceived achievement, in addition to greater autonomy (Stefanou et al., 2013). During the covid-19 pandemic, it was confirmed that self-regulation affects academic coping strategies during online learning (Sinring, et al., 2022), a fundamental part of b-learning. SRL, according to Zimmerman (2002), facilitates autonomous learning by allowing for the

use of direct learning strategies to acquire knowledge. SRL is composed of cognitive strategies, such as paraphrasing and concept mapping, which enable learning (Zimmerman, 2002); metacognitive strategies, such as planning and monitoring, which regulate the learning process (Winne, 1996); and socioemotional strategies, such as help seeking and self-efficacy, which regulate motivation and interaction (Pintrich, 2004). Furthermore, in order for teachers to see the usefulness of SRL, they need to apply it in their own training (Porter and Peters-Burton, 2021).

The success of technology-mediated learning depends not so much on technology, as one might think, but rather on students' ability to self-regulate their learning, according to Mitra (2019). In the b-approach, digital tools for SRL promote active thinking (Hooshyar et al., 2019). In the FC, this thinking is fundamental, so it is necessary to support the monitoring and self-assessment of learning (Shyr and Chen, 2017; Yoonet al., 2021). In fact, as reported by Sun, et al. (2018), SRL plays a fundamental role in the FC, so it is imperative to practice SRL skills to achieve greater effectiveness with respect to understanding the content delivered in FCs (Sletten, 2017). Students who show higher levels of SRL are more capable of autonomously guiding their learning in FCs (Zainuddin and Perera, 2017). Tools exist to facilitate specific forms of SRL, aimed at improving learning through FCs (van Alten, et al., 2020). Hooshyar et al. (2020) found that many of these tool's focus on cognitive strategies. However, metacognitive strategies are particularly important because their use promotes the development of cognitive strategies (Akamatsu, et al., 2019). The main metacognitive strategies are planning, monitoring, and self-assessment (Muijs and Bokhove, 2020). At present, digital tools that facilitate this type of strategy do not usually cover all three types. Most focus only on some aspects, such as metacognitive questioning (Dascalu et al., 2017), goal setting (Thomas, et al., 2016), or support with graphic organisers (Khiat, 2019). The design of a tool clearly must differentiate the three types of metacognitive strategies by dividing them into phases (Ortega-Ruipérez and Castellanos, 2021).

Thus, given the rise of blended learning in education, teachers should know which active methodologies to choose to enhance certain aspects of or related to learning. This research is based on the evaluation of a blended learning training programme in which three active methodologies are applied: flipped classroom, cooperative projects, and self-regulated learning strategies. For this purpose, three research questions are established: 1. the three methodologies used (FC, CP and SRL) produce an improvement in learning and which one of them is the one that leads to the greatest improvement in learning. 2. the three methodologies used (FC, CP and SRL) show a real usefulness in blended learning situations and which of them is the one that produces the greatest improvement in blended learning situations. 3. the three methodologies used (FC, CP and SRL) facilitate an improvement in aspects directly related to learning and which of them is the one that promotes a greater improvement in these aspects.

METHOD

Participants

The participants of the training program were students of a master's degree required in Spain to become a teacher of secondary education, high school, professional training,

and foreign languages. The participants belonged to two very different specialisations or disciplines of the master's degree: Physics and Chemistry, and Social Sciences, to test whether there were differences in the perceived usefulness of these methodologies depending on the area of knowledge to teach. For sample selection, two factors were considered: the use of an application to facilitate metacognitive strategies for SRL (Ortega-Ruipérez and Castellanos, 2021), and participation in all the activities and in at least 80% of the sessions. The final sample was composed of 100% of the students, a total of 60 students: 28 students from Physics and Chemistry, and 32 students from Social Sciences. The sample was drawn from the two specialisations to which the researcher had access as a teacher, which also served to check that there were no differences in the profile of the teaching staff, so that the results could be generalised.

Research Design

The research is based on the evaluation of a training programme in which three active methodologies are applied: flipped classroom, cooperative projects, and self-regulated learning strategies. The intention of this study is to study the usefulness of each of these methodologies, as three independent variables (IV), in blended learning. For this purpose, three research questions are established: 1. the three methodologies used (FC, CP and SRL) produce an improvement in learning and which one of them is the one that leads to the greatest improvement in learning. 2. the three methodologies used (FC, CP and SRL) show a real usefulness in blended learning situations and which of them is the one that produces the greatest improvement in blended learning situations. 3. the three methodologies used (FC, CP and SRL) facilitate an improvement in aspects directly related to learning and which of them is the one that promotes a greater improvement in the different aspects.

Additionally, these three research questions are composed of six dependent variables (1a, 1b, 2, 3a, 3b, 3c): 1. improvement of learning: (1a) content comprehension and (1b) knowledge application. 2. usefulness in blended learning situations. 3. improvement in aspects directly related to learning: (3a) autonomy, (3b) subject engagement, and (3c) perception of achievement in the subject.

This is an exploratory study with a pre-experimental design It aims to explore future teachers' perceptions of which techniques they consider to be most useful in blended learning, which is increasingly used in education given the possibilities of educational technology. Thus, we want to know in depth the perception of each technique in each of the six dependent variables, since a technique may be especially useful, for example, for autonomy, but not for subject engagement, both variables having been assigned to the third research question: aspects related to learning. Thus, the interpretation of the results will be made around the research questions, but the discussion of the results will be approached from each of the techniques studied as independent variables, responding better to the research gap.

It has been used a mixed approach. The combination of both methods allows for a triangulation that aims to validate the research results (Creswell, 2010). On the one hand, a questionnaire is applied to find out the perception of the teachers in training on how useful each of the three Methodologies is in each of the learning aspects measured.

On the other hand, a semi-structured interview is used to explore the opinions of the participants.

Materials

For the collection of quantitative data, a questionnaire has been developed for the purpose of the research, which allows us to know the perceived usefulness of each methodology (IV) in each of the aspects measured (DV) through a 10-point Likert-type scale. Consequently, the questionnaire is made up of questions relating to the six dependent variables for each of the three independent variables. The questionnaire has a Cronbach's alpha of 0.771, considered to have acceptable validity.

The questions have been divided into 3 sections, corresponding to each of the IVs, so that participants would find it more convenient to answer each set of questions with the active methodology of that section in mind. Therefore, the questionnaire contains 18 questions to answer our research questions, plus an initial question to differentiate the master's discipline to which each participant belongs (Table 1). The initial question will help us to check at the beginning of the results, whether the data for each discipline should be analysed separately because the answers are essentially different, or whether they can be considered similar, which would allow us to generalise to other disciplines.

Table 1
Description of questionnaire items. source: own elaboration

	ID	Item description	Answer
	1	Master's degree discipline	Open
I think the flipped classroom has been especially useful to me in terms of…	2	Understanding content	Scale (1-10)
	3	Applying knowledge	
	4	Facilitating blended learning	
	5	Improving my autonomy	
	6	Improving my engagement with the subject	
	7	Improving my perception of achievement regarding the subject matter	
I think cooperative projects have been especially useful to me in terms of…	8	Understanding content	Scale (1-10)
	9	Applying knowledge	
	10	Facilitating blended learning	
	11	Improving my autonomy	
	12	Improving my engagement with the subject	
	13	Improving my perception of achievement regarding the subject matter	
I think that the SRL tool has been especially useful to me in terms of…	14	Understanding content	Scale (1-10)
	15	Applying knowledge	
	16	Facilitating blended learning	
	17	Improving my autonomy	
	18	Improving my engagement with the subject	
	19	Improving my perception of achievement regarding the subject matter	

On the other hand, to collect qualitative data that would allow us to go deeper into the participants' perceptions, a semi-structured interview was used, using the research

questions, and more specifically the dependent variables, to create the structure. First, we asked which Methodology (FC, CP and SRL) they consider most useful for understanding content and applying knowledge. Next, we asked them which Methodology they consider most useful for facilitating b-learning. And finally, we asked which Methodology is considered most useful for improving autonomy, engagement with the subject, and perception of achievement regarding the subject.

Specifically, the structure of the interview was based on eight main questions:

1: Before we start, I want you to think about the methodologies we used: flipped classroom, cooperative projects, and self-regulated learning digital tool. Do you remember what each one was? That is, do you remember how you worked with each of them during the course?

2: Which of the three methodologies do you think has been most useful in improving your learning?

3: In particular, which of the three methodologies do you think has been the most useful for you to understand the theoretical contents? And why?

4: And regarding the application of knowledge, which of the three methodologies do you think has been most useful in applying your knowledge? And why?

5: Which of the three methodologies do you think has been the most useful for you to have carried out a blended-learning experience? And why?

6: Now I want you to think about how the use of these methodologies has helped you in some aspects related to your learning. Firstly, which of the three methodologies do you think has allowed you to learn more autonomously? And why?

7: Secondly, which of the three methodologies do you think has helped you to become more engaged with the subject? And why?

8: And finally, which of the three do you think has helped you to have a better perception of achievement with respect to the subject? In other words, by using this methodology, have you been able to see that you are more likely to achieve the goals of the subject? And why?

The interview is semi-structured because, depending on the participants' answers, further questions are asked to go deeper into each research objective, or the interview is re-directed until a valid answer to the question is obtained. For example, regarding the first question, When the answer was yes, we continued with the rest of the questions. In case of a negative answer, we must go deeper with the interviewees until we make sure that they know how to differentiate the three methodologies.

Procedure

The implementation of the training programme was carried out during the 15 weeks of the course, using all three methodologies in each session. The master's degree was conducted in blended learning: four sessions had been face-to-face (1, 5, 10 and 15), and the rest had been online (sessions 2-4, sessions 6-9, and sessions 11-14). The

university decided to organise the sessions in this way to take advantage of the advantages of combining face-to-face and online. Thus, session 1 was held in the classroom; sessions 2, 3 and 4 were held synchronously by videoconference via Microsoft Teams; session 5 was again held in the classroom; sessions 6, 7, 8 and 9 were held by videoconference; session 10 was held in the classroom; sessions 11, 12, 13 and 14 were held by videoconference; and session 15 was held in the classroom.

Firstly, and before starting the session following the Flipped Classroom model, the students were provided with audio-visual material to prepare the theoretical contents of each topic. The first part of each class (about 10-15 minutes) was devoted to resolving doubts about the theoretical content, and during the second part (about 1.5 hours), the students worked on the Cooperative Projects. At the end of each session (the last 15 minutes), students used the digital tool that helped them to use metacognitive strategies of planning, monitoring, and self-assessment for Self-Regulated Learning. Regarding data collection for the research, in the last half hour of the last session, students were asked to complete the questionnaire.

To select participants to respond to the interview, from the total number of participants, a draw was made through the web site echaloasuerte.com and 5 participants were selected from each class group, to maintain adequate representativeness of the sample. The responses were audio-recorded and then transcribed into text. From the text, the responses of the ten participants were analysed for each of the eight questions. The interviews lasted on average 5 minutes, so most of them were conducted in the same session. In the Social Sciences class, only 4 of the 5 interviews were completed when the session time was up, so it was agreed with the student to conduct the interview through the videoconferencing tool used during the online sessions: Microsoft Teams, the next day at the time that best suited the students.

Data Analysis

First, we want to check whether the participants from the two disciplines have a significantly different perception, or whether, on the contrary, their perception is similar with respect to the research questions and can therefore be considered a single sample. The nature of the data obtained through our Likert scale is discrete quantitative, having a 10-point scale and a relatively high number of subjects. Therefore, the analysis can be performed with a parametric test if the data are found to follow a normal distribution. For this purpose, the Kolmogorov-Smirnov goodness-of-fit test will be used. If it is confirmed whether the samples follow a normal distribution, Student's t-test will be used. Otherwise, Mann-Whitney U test will be used (Gibbons and Chakraborti 1991).

Secondly, the results of each dependent variable will be analysed so that we can answer the proposed research questions. The analysis of each dependent variable will be carried out in terms of the independent variables, so that we can find out how each active methodology affects each learning issue we want to measure. For this purpose, both descriptive statistics and inferential statistics will be used. About descriptive statistics, we will consider the average value and the standard deviation of each aspect of learning measured (DV) in each of the methodologies (IV), so that we can easily compare one methodology with the other two. In terms of inferential statistics, the repeated measures

ANOVA test will be used to check whether the differences between the three methodologies can be considered significant, i.e., whether one methodology can really be considered better than the other two in each aspect to be assessed.

Finally, the interview responses were analysed. The analysis of the responses was general, that is, no categories of analysis were considered, as each question was specific and independent of the others. The responses that provided the most value in understanding the quantitative results for each of the eight dependent variables were highlighted, and from there the contributions were drafted in sections of the results.

In this way, the analyses of the results for each research question, broken down into the six dependent variables, combine quantitative and qualitative results. This provides a more complete and meaningful interpretation of the results obtained.

FINDINGS

Similarity Between the Participants In The Two Disciplines

In this first point of results, want to check whether the results of the participants of the two disciplines are similarly distributed (table 2), and therefore, we can confirm that for these research questions we can generalise the results to the teaching of other knowledge disciplines. And, we have first used the Kolmogorov-Smirnov goodness-of-fit test, to confirm whether the samples follow a normal distribution, and then we use Student's t-test was used to determine whether there are significant differences in the teachers' opinions according to their discipline (Table 2). No differences were found, so the results of the sample can be studied altogether to achieve the research objectives.

Table 2
Results of the Kolmogorov-Smirnov Z test and Student's test

ID	Item key	Z	Sig.	T	Sig.	ID	Item key	Z	Sig.	T	Sig.
2	FC_Com	.328	1.000	.830	.410	11	CP_Aut	.638	.810	-1.509	.137
3	FC_Appl	.190	1.000	.173	.863	12	CP_Eng	.190	1.000	.193	.848
4	FC_Ble	.328	1.000	.830	.410	13	CP_Ach	.259	1.000	.554	.582
5	FC_Aut	.397	.998	-.980	.331	14	SRL_Com	.604	.859	-1.740	.087
6	FC_Eng	.362	.999	-.972	.335	15	SRL_Appli	.932	.351	-1.610	.113
7	FC_Ach	.242	1.000	.442	.660	16	SRL_Ble	.138	1.000	-.120	.905
8	CP_Com	.173	1.000	-.343	.733	17	SRL_Aut	.707	.699	1.702	.094
9	CP_Appl	.466	.982	.558	.579	18	SRL_Eng	.604	.859	1.634	.108
10	CP_Ble	.190	1.000	.173	.863	19	SRL_Ach	.449	.988	.851	.398

Improvement of Learning (Content Comprehension and Knowledge Application)

Table 3 shows that for both comprehension and knowledge application, the most valued Methodology was CP. For comprehension, this Methodology is applied through the FC and then SRL. For knowledge application, CP were followed by SRL, and the FC is the least valued Methodology. These differences are statistically significant (ANOVA sig.).

Table 3
Perceived usefulness of each Methodology in knowledge acquisition and application

	Comprehension			Application		
	FC	CP	SRL	FC	CP	SRL
Mean	8.3	8.65	7.58	7.05	8.82	7.22
ANOVA Sig.	.000			.000		

In the interviews, regarding knowledge comprehension, the participants mainly indicated that CP facilitated their understanding of the concepts they previously acquired (mentioned by nine out of ten). They also regarded the FC as an adequate Methodology for introducing the concepts they learned; however, they noted that by itself, it did not, in all cases, facilitate a deep understanding of these concepts—rather, it provided them with a general idea (mentioned by six out of ten). Regarding SRL, the participants stated that it did not help them understand the concepts, although it was useful in terms of helping them identify the concepts they needed to understand clearly in the context of the given subject (mentioned by four of ten).

Regarding knowledge application, the participants emphasized that CP enabled them to apply the concepts practically. Most mentioned that the advantage of applying knowledge in a group setting is that it deepened their comprehension (mentioned by eight out of ten). In this case, the teachers did not positively evaluate SRL, considering that the project did not itself require its use (mentioned by five out of ten). As for the FC, they commented that it was not necessary to use videos to complete the project because the videos were more theoretical, although some recalled visualizing the videos repeatedly to contribute to the group (mentioned by three out of ten).

Usefulness in Blended Learning Situations

Table 4 shows that the participants valued SRL the most in the blended classes, followed by the FC, while CP were less valued (i.e., 2 points less than SRL). These differences are statistically significant, as shown by ANOVA Sig.

Table 4
Methodology's perceived usefulness in blended teaching

	FC	CP	SRL
Mean	8.3	7.05	9.05
ANOVA Sig.	.000		

Regarding the information gathered in the interviews, the participants especially valued SRL as a source of help in terms of keeping pace with the demands of the course. They remarked that in their other online training courses, most of the work had been postponed until the last days of the course (mentioned by six out of ten). In contrast, the SRL tool enabled them to learn each topic in the week in which it was introduced (mentioned by eight out of ten), which helped them enormously in terms of being able to work more efficiently during the activities, especially the cooperative project (mentioned by four out of ten).

About the flexibility of the FC, they noted being able to view the videos at the times they considered to be the most appropriate (mentioned by seven out of ten). In addition,

in contrast to face-to-face teaching, they appreciated being able to watch the videos several times, stop them, restart them from the beginning, review key aspects, etc. (mentioned by all ten).

On the other hand, the participants valued CP less because of the difficulty of arranging meetings with their classmates outside of class (mentioned by eight out of ten). They were grateful for being able to dedicate a large part of the sessions to group work (mentioned by five out of ten), but they considered that time insufficient to complete all the tasks they needed to do each week. Consequently, they had to spend additional time outside the time designated for the subject to finish their group projects (mentioned by seven out of ten).

Improvement in Aspects Directly Related To Learning

Table 5 shows the results related to essential skills in the learning process, especially in higher education, where trainee teachers tend to combine these additional studies with other professional activities. These differences are statistically significant.

Table 5
Perceived usefulness in autonomy, engagement, and perceived achievement

	Autonomy			Engagement			Achievement		
	FC	CP	SRL	FC	CP	SRL	FC	CP	SRL
Mean	8.5	7.32	8.82	7.38	8.83	8.38	7.02	7.35	9.08
ANOVA Sig.	.000			.000			.000		

Regarding autonomy, SRL was the most valued, closely followed by the FC and, finally, by CP, with a difference of more than one point. In the interviews, the participants alluded to their lack of dependence on the teacher, as they had been provided with all the learning objectives at the beginning of the course and could therefore plan and supervise their weekly achievements (mentioned by eight out of ten). On the other hand, they again emphasized the flexibility that FCs offer in terms of fostering greater autonomy regarding their progress; they also linked this to the use of the SRL tool, which allowed them to plan the week in which they should watch each video (mentioned by seven out of ten). Regarding CP, the participants reiterated the difficulty of organizing group work outside of class; this challenge made planning the learning process more autonomously difficult because they had to prepare some content before each group meeting (mentioned by six out of ten).

Regarding engagement, the teachers rated CP as the technique that awakened the most engagement in them, followed by SRL, and lastly, by FC, with one point less. They highlighted their increased commitment to the subject, thanks to the CP (mentioned by eight out of ten), which they found to be a very practical and enjoyable way to work on theoretical content (mentioned by six out of ten). Completing the projects with classmates increased the participants' awareness of the need to learn the content in order to achieve a good outcome as a group (mentioned by five out of ten). They also mentioned that using the SRL tool and the fact that doing so had weight in the final course grade also stimulated their greater engagement with the course (mentioned by seven out of ten), increased their awareness that they had to learn the content in order to

pass the course, and helped them view passing the course as a way of proving to themselves that they could achieve that goal (mentioned by three out of ten).

Regarding perceived achievement, teachers especially valued SRL, followed by CP, and then by the FC, with a difference of more than two points. In the interviews, they pointed out that the ability to monitor their learning week by week using the SRL tool allowed them to observe their progress, which increased their motivation because their efforts were being rewarded (mentioned by eight out of ten). Regarding CP, they admitted that while the group work sessions made them realize that they were making progress regarding knowledge in the subject, they already knew that thanks to the SRL tool (mentioned by five out of ten). Regarding the FC, those who mentioned that it improved their perception of achievement referred to their awareness that the more videos and materials they perused, the more comfortable they felt applying the knowledge (mentioned by three out of ten).

Overall Opinion About the Techniques Used

Finally, it is worth highlighting the importance these teachers-in-training ascribed to each technique generally, that is, taking all aspects together, to understand how the techniques will be received in similar teaching situations: (1) To be conducted online (2) They must acquire and apply knowledge during the subject (3) They must do it autonomously (4) They want to strengthen their commitment (5) They have a sufficient personal sense of achievement to stay motivated during the course.

According to the results in Table 6, the technique the teachers appreciated the most is SRL, followed by CP and then the FC. These differences are statistically significant, as shown by ANOVA Sig. Although we have already seen that their opinions about the techniques' usefulness depend to a considerable extent on the objective (e.g., using a technique to improve comprehension is not the same as using it to heighten perception of achievement), the interview content can be useful to delineating the general opinion.

Table 6
Technique's general perceived usefulness

	FC	CP	SRL
Media	7.75	8.00	8.35
ANOVA Sig.	.000		

With respect to FCs, the teachers expressed that while preparing theoretical concepts in advance is ideal (mentioned by ten out of ten), it is not a substitute for the subsequent work that needs to be done to facilitate students' understanding of these concepts, since the visualization of videos is not enough for students to understand their importance in the applied context, as well as their relationship with other concepts (mentioned by seven out of ten). In addition, they noted that the FC is better for introducing concepts than teachers' explanations (mentioned by eight out of ten), since the videos are supported by images that facilitate understanding (mentioned by five out of ten), and the option of watching the videos several times caters to the different learning rhythms that may exist in the class (mentioned by six out of ten). In this sense, they pointed out that

the FC is essential in blended teaching (mentioned by eight out of ten), but they also stated that they would not use it in face-to-face contexts (mentioned by four out of ten).

Regarding CP, teachers consider them to be an especially useful technique for learning new content, since they allow students to understand while creatively applying that content to a practical case (mentioned by nine out of ten). They also pointed out that completing CP, despite certain disadvantages in blended teaching (mentioned by six out of ten), is very beneficial because all participants are enriched by their peers' contributions (mentioned by eight out of ten), which helps some group members understand issues that they would find to be more complicated if they were working individually (mentioned by five out of ten). The participating teachers-in-training indicated that this technique can be very useful when overseeing groups of students (mentioned by seven out of ten), since it can be applied in practically any area of knowledge (mentioned by four out of ten).

Finally, the teachers noted that SRL is necessary in a blended course (mentioned by eight out of 10), but that, in general, it should be used more across all educational modalities and stages because it helps students to take control of their learning (mentioned by seven out of ten). Furthermore, most underscored that students need training and practice to take control of their learning and those teachers should help students implement SRL strategies at the initial stages (mentioned by five out of ten). Some indicated that SRL should have been part of their initial teacher training, as it would have helped them improve their learning (mentioned by three out of ten). They also explicitly mentioned how easy it was to use the tool to control and monitor their learning (mentioned by six out of ten); they especially liked creating a calendar displaying their weekly study objectives (mentioned by four out of ten), although they acknowledged that at the beginning, they saw the task as unnecessary work (mentioned by two out of ten).

When asked about the combination of the three techniques and which technique they considered to be dispensable, most of the teachers stated that they would not eliminate any because the three combine very well to optimize their training (mentioned by seven out of ten), considering that it is blended training in the context of higher education. When we probed deeper on this topic, some highlighted the benefit of the FC for completing projects and being able to review the theoretical content with classmates in order to reach a consensus on a conclusion (mentioned by four out of ten). Others pointed out the advantages of using the SRL tool to keep up to date with viewing materials and make better use of CP (mentioned by six out of ten). They noted that training in the higher education context must be practical (mentioned by seven out of ten) and admitted that in the blended modality, it can be somewhat complex (mentioned by five out of ten). They further noted that the combination of these three techniques generally satisfied their training needs (mentioned by six out of ten). In addition, some emphasized that the training experience taught them the importance of SRL (mentioned by five out of ten).

DISCUSSION

In the above section, the interpretation of the results of each of the research questions has shown which methodologies are considered most beneficial by pre-service teachers in improving learning (understanding and application of knowledge), for use in blended learning and for improving related aspects (autonomy, engagement, and achievement). As it has been shown, the results have revealed the benefits of each of the techniques used; however, as has also been shown, in line with Rasheed, Kamsin, and Abdullah (2020), the combination of these techniques produces more complete, integrative results. This is evidenced by results supporting the importance of SRL in FC, in keeping with other authors' findings (Sletten 2017; Yoon, Hill, and Kim 2021).

First, it has been demonstrated that CP are especially helpful for constructing knowledge and improving academic achievement, as shown in Kurucay and Inan (2017). These results fit with Gandhi, Yang, and Mahdi (2017) in that the use of SRL in CP promotes deep learning in a b-learning setting. In addition, CP help to increase students' perception of achievement, according to Granado et al. (2018). In line with these results, this technique has been found to decrease uncertainty through interaction with peers, as shown in Hilliard et al. (2020), thereby improving students' autonomy, as noted in Stefanou et al. (2013).

It has also been proven that SRL is especially useful for b-learning in an online environment, as shown in Hooshyar et al. (2019). On the one hand, the results support that this mode of working benefits students' autonomy, which is a key aspect of SRL, as Zimmerman (2002) has already highlighted. On the other hand, SRL is highly valued in relation to students' perception of achievement and self-efficacy, according to Pintrich's (2004) proposal regarding sustained motivation throughout the learning process.

Moreover, the FC has been shown to be an ideal resource for blended learning in higher education (Lundin et al. 2018; Thai, De Wever, and Valcke 2017), as it has allowed for great flexibility with respect to student autonomy, as other authors such as Brewer and Movahedazarhouligh (2018) and Durak (2018) have already pointed out.

FCs improve students' understanding of knowledge, as previous studies such as Låg and Sæle (2019) have shown. This improvement occurs, in part, because students can check their progress and self-assess during the course, as Shyr and Chen (2017) and Yoon, Hill, and Kim (2021) have shown.

As Hooshyar et al. (2019) have already confirmed, the use of a digital SRL tool promotes the active learning that is necessary when approaching content in video format, as in FCs. These results align with Mitra's (2019) assertion that successful technology use for learning depends not so much on the technology itself, but rather on students' ability to regulate their own learning.

Based on the results of the discussion, it can be concluded that in blended learning, SRL is especially useful to facilitate deep learning. Techniques such as the FC are offered as alternatives to traditional teacher explanations, and students are very receptive to these techniques because of the flexibility they offer, for example, the freedom to replay the

explanatory materials as many times as necessary, which accommodates different learning rhythms. In addition, FCs supported by SRL allow for the accurate tracking of learning progress. On the other hand, the cooperative project is a very successful technique that, despite the inconvenience of arranging meetings with classmates outside class hours, allows for the application of the theoretical knowledge acquired in FC videos and favors peer learning, that is, classmates helping each other assimilate content through their interactions, while working toward the common goal of applying knowledge to group projects.

Regarding this study's limitations, the three combined techniques were applied for a duration of four months because the duration of the subjects being studied was taken as the study period. It would be interesting if future studies integrated these techniques across several subjects over several years. Such a study design would allow the same students to use the techniques over a longer period and share their opinions; the differences between the subjects themselves could be considered and compared with other subjects being studied.

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