Impact Of B-Learning Supported By The Flipped Classroom: An Experience In Higher Education

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ABSTRACT

The objective of the study was to identify the impact of B-Learning supported by the Flipped Classroom on the learning and development of competencies, carried out in an academic program of a university institution in Colombia. A quantitative approach was adopted, with a descriptive scope and a non-experimental design. The study was carried out with 40 students during the first semester of 2022, to analyze and compare their performance in a virtual platform and their percentage evaluations in a pretest and post-test, through the calculation of Hake's learning gain. As the main result, the role of the teacher as a facilitator and guide is evidenced, and the student's participation in teamwork. It is concluded that the use of B-Learning supported by the Flipped Classroom is a viable alternative to apply in higher education subjects because it strengthens learning and develops various competencies in students.

Keywords: inverted classroom, hybrid learning, mathematics, virtual platform.

INTRODUCTION

The educational system at all levels faces great challenges and changes, but at the higher education level, it is necessary to analyze the advances and transformations it has gone through for the formation of digital competencies and how to face the demands of society to establish models and methodologies that facilitate the adoption of knowledge, according to current trends (Gamboa, 2022;

Bernate & Vargas, 2020; Chaparro et al., 2018). As Information and Communication Technologies (ICT) evolve, so does education through their curricular integration (Ortíz-Arismendy et al., 2019; Claro-Vásquez, 2017), so a conceptual approach from this point of view, is that of being a set of tools and resources that stimulate and contribute to the dynamic interaction between individuals, thus facilitating learning and the dissemination of knowledge (Rodríguez et al., 2021; Ortega et al., 2019; Díaz-Padilla, 2017). The problem with ICT is that on many occasions teachers do not know how to implement them in their pedagogical practice, because they lack the basic competencies necessary for their use (Hernández et al., 2019; Prada et al., 2019; Hernández-Suárez et al., 2018). Therefore, the development of digital (or ICT) competencies of teachers not only allows them to implement technologies correctly in the classroom, but also to develop them in their students (Adoumieh, 2021; Rodríguez, 2018; Contreras-Colmenares & Jiménez-Villamarín, 2020; Hernández et al., 2016; Hernández et al., 2016).

It is in this scenario where ICTs enter the educational environment, classified with different terminologies according to their orientation towards uses such as learning (Learning and Knowledge Technologies or LKT), participation and teamwork (Empowerment and Participation Technologies or EPT) and social relations (Relationship, Information and Communication Technologies or RICT) (García & Fernández, 2017; Nieto & Vergara, 2021; Avalos et al., 2021), to orient them towards use in a formative and collaborative way, both for the student and the teacher (Prada et al., 2019).

Therefore, each of these approaches to technology applied to teaching and learning plays a distinctive role, which allows understanding that the scope and purpose of these tools are not necessarily the same (Rodríguez et al., 2021; Espinel-Rubio et al., 2020). That is, ICT alone does not contribute by itself to the formative and collaborative development of students, but it is the teacher's role to reorient towards these approaches (LKT, EPT and RICT), and thus achieve autonomous, meaningful and collaborative learning in the student (Pérez et al., 2022).

Within this ICT (LKT, EPT and RICT), the Virtual Learning Environments (VLE) are developed, which help to strengthen learning in different areas of knowledge through interaction between students and teachers asynchronously or synchronously (Contreras-Colmenares, & Garcés-Díaz, 2019). In this sense, online education (virtual or e-learning) uses any digital device. Likewise, hybrid learning or blended learning (b-Learning) is another training modality that combines online and face-to-face education. Both modalities are part of the training offered by universities to strengthen the educational process and seek to break space-time barriers. In this sense, the incorporation of ICT in the field of education has been gaining importance and evolving over the last few years, since its use in the teaching process has gone from being a possibility to establishing itself as a necessary didactic tool in the improvement of the quality of the teaching-learning process for both teachers and students (Hernández-Suárez, 2020).

On the other hand, the usual training model in classroom subjects, which has been used for decades, is called the traditional model. However, in recent years it is possible to identify the inverted classroom as a model that contrasts with this traditional scheme. Its origin dates back to the 1990s, from focusing on the importance of the use of class time to consolidate knowledge instead of the transmission of information (King, 1993). Although it does not directly illustrate the concept of

"inverting" the classroom, it promotes the investment in the educational space for active learning. In addition, the strategy called "peer instruction" is developed that involves "inverting" the traditional classroom by transferring information outward and bringing the assimilation of information into the classroom (Mazur, 1997). Finally, Walvoord and Johnson (1998) offer the first outlines of this approach, although without making an explicit reference to it. Starting in 2000, terms such as "Inverted Classroom" (Lage et al., 2000) and "Classroom Flip" (Baker, 2000) began to be coined, in which the inversion of place between the two main activities of the traditional model is proposed: classroom explanations and homework at home. The expression and the model were consolidated in 2007 with the proposal of Bergman and Sams (2012).

The central aspect of these models is that lectures are replaced by videos, readings or any other material (either physical or preferably virtual, available on some platform) that the student can do independently outside of class, and the classroom space is transformed into a meeting place where collaborative practical activities are carried out. A general component of these models is that their application requires a major organizational change in learning. As such changes are not easy to make, it requires a great effort on the part of the teacher to invert a traditional face-to-face subject. In this sense, the inverted classroom is a novel strategy that due to the period of non-face-to-face caused by Covid-19 began to be implemented to complement the teaching-learning processes during this period, having a very profound impact on teachers (Hernández-Suárez et al., 2022).

Conceptually, the inverted classroom is a modality of B-learning, because it combines face-to-face and virtual methodologies through the use of technologies (Salinas et al., 2018; Morán, 2022). Therefore, they seek to empower students in their formative process and have greater possibilities to take advantage of the information on the web, through educational platforms, and face-to-face meetings, to develop better learning (Prada et al., 2019; Hernández-Suárez et al., 2020).

Finally, the use of educational platforms is very diversified. One of the most widely used is Moodle, a Learning Management System (LMS) characterized by being modular, usable on any device and with the possibility of integrating various tools to guide learning in virtual courses, individually or collaboratively (Rizales-Semprum et al., 2019; Hernández et al., 2021). Several studies have analyzed their impact and formative advantages, as well as the impact of the feedback offered on student motivation (Prada et al., 2019).

In 2016, the Universidad Francisco de Paula Santander (UFPS) Cúcuta-Colombia campus began to implement in Moodle the Teaching Support Platform or PLAD (In Spanish, Plataforma de Apoyo a la Docencia) to support students' independent work, which was extended to many subjects as a result of the educational emergency due to Covid-19 (Prada et al., 2022). Since the return to face-to-face, many teachers started to use the Flipped Classroom to support their pedagogical practice in directing face-to-face work. The study material is very explicit, and should not only use a presentation but on the contrary should seek to combine audio and video elements to give greater clarity to the subject, which should be previously available on the virtual platform not only for a class session but also as reference material, and finally, the classroom is where the combination of the above attributes is carried out and where ideas and concepts should flow, thus achieving a mixture that helps the student to confront what has been learned, apply and from the knowledge acquired, create the concepts

necessary for their training.

Finally, most of the studies on the flipped classroom are based on determining the perception of the usefulness of the model in both teachers and students (Hernández-Suárez et al., 2022; Hernández-Suarez et al., 2022), with very few studies on its impact on learning. Therefore, this study is conducted with higher education students applying the Flipped Classroom model together with Moodle-based LMS through B-Learning-based intervention, whose objective is to determine the impact of B-Learning supported by Flipped Classroom on learning and competency development. Specifically, it is intended to assess its usefulness in a subject of a teacher training program, as well as to examine the level of student participation in the Moodle-based LMS called PLAD, by reviewing the scores obtained in each face-to-face and virtual training activity.

METHOD

Type and design of research.
The methodology was quantitative under a quasi-experimental pretest-posttest design, with a descriptive scope, using a single group to which a pretest is applied, then the intervention is applied and finally, the results of the application are analyzed through a posttest.

Population and sample.
Forty students from the Bachelor's Degree in Early Childhood Education academic program who took the subject Quantitative Research under the B-Learning model supported by the Flipped Classroom, during the months of February to April 2022, were considered. The selection of the participating groups was by convenience, according to the availability of the teachers interested in participating in the study.

Instruments and data collection.
Two knowledge tests were used for data collection: a diagnostic test at the beginning of the course and a mid-course test. The first one contains 15 questions and the second one contains 30 multiple-choice questions, both with four answer options. Both tests were elaborated by the researchers with a coincidence of topics in both of them of 85%, this because the diagnostic included questions from the second part of the course. The knowledge tests were applied in class sessions using the PLAD.

Reliability was calculated using the K-R20 coefficient, obtaining the following values for the pretest (0.56) and posttest (0.77), which according to Ruíz (2002) correspond to moderate and high reliability, respectively. To accept the moderate reliability in the pretest, it was verified that the standard error was less than the total standard deviation.

Description of the experience.
For the online component, the PLAD contained general and specific information about the course and each topic, with information (videos and documents) and interactive questions that could be reviewed several times, a quiz per lesson with 10 random multiple-choice questions, from a question base of 50 items, a ranking of students through a badge module for each test passed.

In addition, activities were created for students to work on the PLAD and collaborative activities were designed to be done during the lessons in a Shared Work folder in Google Drive.

The videos used contain the explanation of the theoretical foundation and its procedure as well as some questions to be answered by the students before the class, which also functions as an evaluation mechanism. The videos were uploaded to PLAD through a Youtube channel. Regarding the duration of the videos, care was taken that the videos did not take more than 10 min (in some cases, it was not possible), to prevent the student from losing interest due to their duration. However, each of the videos should have complete information, so that the students could study and perform the exercises without any inconvenience. This was a challenge for the teachers, who had to be very concise and brief during the instructions. The videos were recorded without students to avoid unforeseen events and interruptions.

For the face-to-face work, each session lasted 4 hours (2 for direct work and 2 for tutoring) and the following was addressed: verification of online learning through strategies for recovery of prior knowledge and organization (Morales, 2009), adding elements of gamification through team competitions, implementation of application, analysis and synthesis activities, using various resources, and metacognition with the sharing of class learning (Prada et al., 2021). Under the inverted classroom approach, students are grouped into teams, doubts are solved, exercises are performed in the Drive folder and the different groups correct the exercises among themselves, making a presentation. The teacher's role is that of advisor and evaluator. He is in charge of checking if the students carry out the procedures described in the videos, correct them if necessary, resolve doubts and evaluate skills.

Information analysis.
Finally, the results obtained from both tests and the average obtained in the PLAD were organized in a database. The learning gain from one test to the other was calculated. Comparative graphs were also constructed for analysis.

RESULTS

The learning gain was calculated using Hake's factor (g) (Hake, 1998) to determine the level of achievement of conceptual learning after the application of the B-Learning model supported by the Flipped Classroom, that is, with the results of the pretest and posttest, the impact on the assimilation of conceptual knowledge is determined.

$$g = \frac{\text{Postest(\%)} - \text{Pretest(\%)}}{100 - \text{Pretest(\%)}}$$

In addition, the value of g can take values between 0 and 1, where 0 represents the absence of learning, while 1 corresponds to the maximum possible learning. For this purpose, three categories are established for the normalized average gain, which indicates the degree of effectiveness of the Flipped Classroom model, supported with the PLAD, high ($0.7 < g \leq 1$), medium ($0.3 < g \leq 0.7$), and low ($0 \leq g \leq 0.3$).

According to Hake (1998), the target group obtained an average learning gain (Table 1).

Table 1. Learning gain

Group (Students)	Pretest Average (%)	Average Posttest (%)	Average PLAD (%)	Hake Index (Pre-Post)	Hake Index (Pre-PLAD)
40	59.3	74.2	77.1	0.37	0.44

According to Table 1, it can be observed that the percentage of students who passed the post-test performed well in the PLAD and that their averages are very close to those of students who passed the post-test.

Considering the learning gains in Table 1, it can be verified that the low learning gain may be due to the lack of commitment to the development of the proposed activities. Although it can be evidenced that students who had failed the diagnostic and who were committed to the work, increased their performance both in the post-test and in the PLAD activities. In addition, it is observed that the average in PLAD seems to be associated with a higher learning gain, so the dispersion of grades in PLAD was plotted concerning those of the Posttest. Figure 1 shows a higher percentage of students passing the posttest and PLAD (70%).
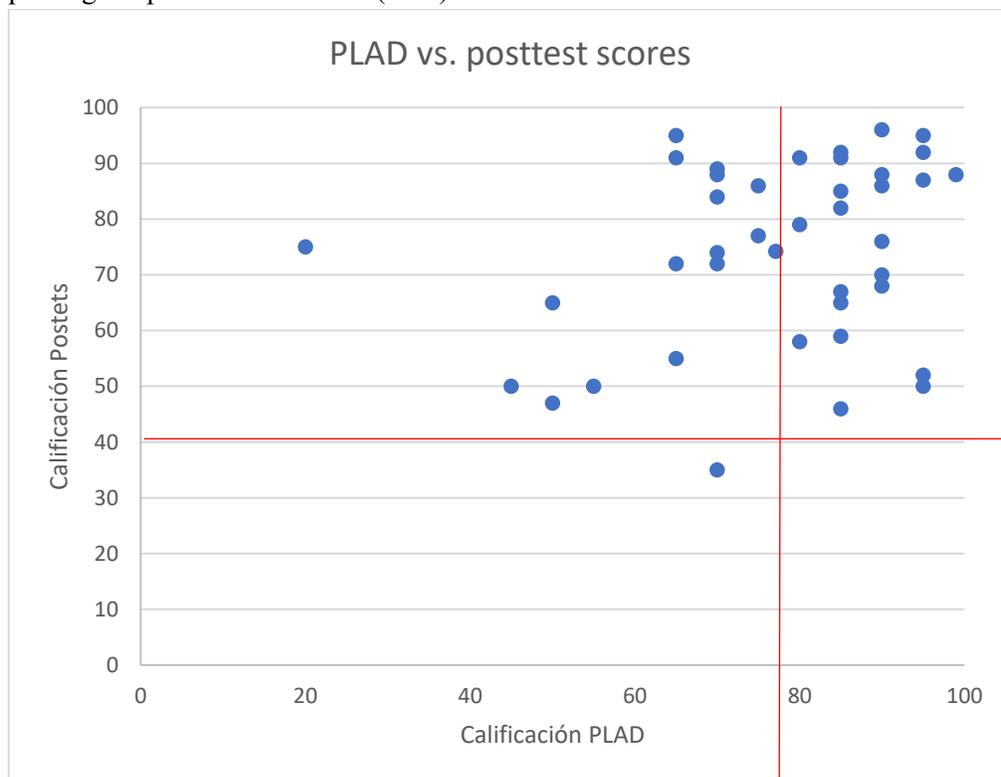
Figure 1. Dispersion of PLAD and Posttest scores.
According to Figure 1, the agglomeration of scores in the quadrants of those who passed the PLAD and the post-test is noteworthy. This consideration supports that the low learning gains were because some students were not fully engaged in their formative process.

DISCUSSION

The inverted classroom as an educational approach managed to reduce the theoretical sessions of the classes to allow working with practical activities, and the use of the PLAD allows the teacher to have a compilation of evaluation results before the class, which has allowed reinforcing the concepts in which the students' results showed a lower grade, and to follow up on the student's progress by providing feedback. It has also allowed for online and autonomous learning, guided by teacher feedback. In other words, with the implementation of B-Learning supported by the Flipped Classroom model, it is possible to reduce theoretical sessions to give way to practical activities in the classroom, as has also been evidenced in studies such as those of Yaroslavova et al. (2020). By giving more importance to practical activities and more autonomy to the student, he/she becomes better organized and improves his/her participation skills and the ability to come up with alternative solutions.

The above implies knowing, understanding and mastering the basic aspects of ICT from different perspectives: technological, social and communicative (Mascarell, 2019) where from the TEP they imply the use of technologies towards participation and personal fulfillment and that through the TAC making a good technological use enable meaningful and autonomous learning, as well as the development of competencies (Paniagua, 2022), to favor it through the participation of the same, thus enhancing a social character in the classroom, as promoted by the RICT.

The results allow verifying a considerable, but undesired, learning gain. Arias-Rueda (2021) explains that the Flipped Classroom model, when applied in virtual mathematics classes with interactive videos and review activities with immediate feedback, contributes to student participation in their learning processes. According to this, the Flipped Classroom supports the student's commitment to their training, so it was found that those who performed the activities in the PLAD achieved better results in the class exams, but one of the difficulties that were evident in the process was the progress in the topics, without sufficient feedback of the topics seen.

Analyzing student participation, it was verified that González & Huerta (2019), conclude that regarding student motivation concerning the inverted classroom model its success depends on the direct and continuous collaboration of the student to verify the constructivist principle of learning by doing (Hernández-Suárez et al., 2020), which encourages active learning (Prada-Nuñez et al., 2021). This is evidenced by the fact that students who failed the diagnostic increased their performance. This coincides with Mendaña-Cuervo & López-González (2021), who explain that the academic performance of students who have been subjected to the inverted classroom methodology is higher than that of traditional classroom students. In addition, when the flipped classroom is supported by B-Learning, the student has an active role that allows the development of competencies and self-learning (Prada Núñez et al., 2021).

Finally, students who participate in Flipped Classroom find greater motivation to learn, and, consequently, they achieve the development of more complex skills, such as applying, analyzing, evaluating, and creating among others and that was given because of the available material (videos and lessons) favored student-learning object interactions (Hernández Suárez et al., 2021).

CONCLUSIONS

A didactic experience has been designed and implemented in a teacher training program, and it has been taught in the B-Learning modality supported by the Flipped Classroom model together with the application of active work methodologies that encourage collaborative work and the use of ICT such as LKT, EPT and RICT. With this approach, student learning improves in the traditional classroom, as long as there is adequate curricular planning for the moments before the class (virtual) and face-to-face in which student activity and student-teacher interactions are guaranteed, to facilitate active learning. That is to say, it was evidenced that students with a low performance benefit from the inverted classroom when they work in it. Accordingly, it is concluded that the inverted classroom in its different moments positively impacts performance, but those who actively participate have a better performance. Finally, students and teachers find PLAD a platform under the principles of the flipped classroom, as a suitable environment for the development of the teaching-learning-assessment process.

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