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To cite this article: R Prada *et al* 2019 *J. Phys.: Conf. Ser.* **1388** 012046

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Different scenarios for the teaching of mathematics with the support of virtual platforms: Flipped classroom

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Abstract. This text shows the initial findings of an investigation that sought to implement an alternative model for the teaching of mathematics at a public university in Norte de Santander, Colombia, using virtual platforms to support teaching. The research paradigm focuses on the mixed method to identify the positive elements and aspects to improve of this didactic proposal. Among the findings, it is highlighted that one of the difficulties in implementing this tool refers to the limitations of space in the material attached to the platform, which meant proposing only the links of the material created. Implications for teacher training and suggestions for future implementations are discussed.

1. Introduction

The growing use of information and communication technology (ICT) as a means for the teaching-learning-assessment process are clearly placing different strategies and application approaches in the classroom. The educational community is circulating through forms of behavior, communication and social relation, where ICT is the means of interaction. Currently universities have better connectivity and access to educational platforms from anywhere. In addition, teachers and students have their own laptop and/or smart device, which allows them to be communicated, make inquiries, send and receive files, among others, which makes the ways of learning and teaching are influenced by these changes, so the didactic strategies that implement ICT emphasize the potentialization of the educational process.

In the educational field, different proposals are being implemented to use ICT, especially virtual education or e-Learning, which can be typified in the technology and learning model used as the virtual learning environments, virtual learning environments, flipped classroom or inverted classroom, blended learning or b-learning (blended learning), cloud learning or c-learning (learning in the cloud), mobile learning or m-learning (mobile learning), video learning or v-learning (video learning) and will surely appear more as the technology advances.

School 2.0 must also offer opportunities for students to develop search, selection, and analysis skills for information available on the network; learn to communicate and collaborate in social networks; be able to produce and express themselves using audiovisual or hypertext documents; and become critically aware of the role of media and technologies in our daily life [1].

1.1. Flipped classroom

Jonathan Bergmann and Aaron Sams, coined the term "flipped classroom" in 2007, and can be translated as an inverted classroom or classroom upside down. They started recording videos that contained PowerPoint presentations with voice and notes to help students who could not attend classes. Later, they



made themselves available to the students so that they would not fall behind and could review the classes or prepare exams [2-4].

The flipped classroom model is based on knowledge not only acquired in the classroom, but the student has previously an approach to content such as videos, podcasts, presentations, infographics, images, heuristic tools (digital information desirably available on any platform) before attending classes, this allows the teacher to deepen and feedback the learning within the classroom, through a series of instructions to develop the activities, with interactive methods of collaborative work, problem-based learning and project realization [5], although it can also be individual depending on the student's conditions. All of the above implies changing the roles of both the student and the teacher.

In this sense, students actively assume the construction of their own knowledge through the search, selection and synthesis of information. In this process, they develop skills in communication, inquiry, critical thinking, problem solving, among others [6]. On the other hand, the teacher guides the students as they apply the concepts and actively engage in their learning within the classroom developing an interactive environment centered on the student [7].

1.2. Flipped classroom and digital platforms

According to several authors [8-10], work is currently being developed on the application of the flipped classroom in the training of teachers, so there is little evidence. The model is considered appropriate for teacher training courses as it fosters student responsibility for their own learning, and at the same time frees up class time to expose trainee teachers to a variety of instructional strategies that favor learning of the student during the application of the contents they have learned [11].

The use of virtual platforms within a flipped classroom model can facilitate access to content selected by the teacher, for use before, during and after school, or as a collaborative space to facilitate interaction between students and teachers outside the classroom, through the virtual space. Now, using virtual platforms facilitates the implementation of the flipped classroom, without implying transforming a classroom course into a virtual one. [8] In addition, teachers need to implement educational platforms in order to facilitate communication, interaction and orientation of issues to their students [12].

The “Universidad Francisco de Paula Santander, San José de Cúcuta (UFPS)” from the second semester of 2016, is implemented the “Plataforma de Apoyo a la Docencia (PLAD)”, in which teachers can upload their educational materials in the various subjects that guide. It is an application dedicated to the University community, where teachers and students can use the educational tools for learning, communication and evaluation provided by Moodle technology to enhance the educational processes that take place in the course of each academic semester. The flexibility of schedule for the use of the platform and the permanent provision allows access to it at all times. In addition, the microcurriculum of the subjects is available, which makes it possible to clarify the path to be followed by the student in the acquisition of their learning.

The PLAD as a teaching support resource is a tool with different functionalities to achieve a better teaching-learning process, it is a new assistance to face-to-face teaching, different from traditional classes, which is why the classroom model is proposed invested, where the teacher is completely responsible for structuring and organizing the total group activities. Students can access videos recorded by teachers, to presentations used, pre-reading documents to classes, as well as references to the bibliography needed for the study.

The training of teachers is a challenge assumed by the Faculty of Education, Arts and Humanities of the UFPS. Faced with this situation, it is proposed to implement learning strategies (Flipped Classroom) that are useful for education, is the problem addressed in this work, articulated with strategies that favor the construction of concepts in cooperative and interactive environments (PLAD) aim to achieve the promotion of a renewed and flexible teaching profile able to achieve with the mission of education, learning.

This work deals with the development and foundation of the didactic strategy that allows the implementation of the flipped classroom, which aims to make effective the critical dialogical

pedagogical approach of the UFPS and the result of the deconstructed educational process through a participative methodology.

Teachers in training must know the methodological strategies that are currently being implemented. That is why the implementation of this strategy is focused on the training of teachers, on the one hand, to see how the use of the Flipped classroom strategy affects the development of skills and, on the other hand, to be the beneficiary of the application of the strategy they can know and to future apply it in their professional development.

2. Methodology

It must be taken into account that a mixed methodology is being used to achieve the research objectives. For the quantitative part, a questionnaire on the use of the flipped classroom was used in the PLAD. For the qualitative part, the analysis of the students' portfolio developed during the development of the subjects as a means of teaching learning and evaluation of the contents and competences of the teachers in training will be carried out.

This research was carried out at the UFPS in the city of San José de Cúcuta, Colombia, a public university located in northeastern Colombia. For the purposes of this research, the population under study is made up of teachers and students assigned to the bachelor of Mathematics program at the Universidad Francisco de Paula Santander in the first semester of 2018. For the particular case of this communication, the subject geometry was taken. The stages of development of the strategy are the techno-pedagogical design were considered the following aspects:

- The technological component: the use of the resources of the teaching support portal (PLAD) and its tools, the programs for editing texts, audio, video and the preparation of presentations. The strategy was supported by videos, with content quality to contribute to learning: Clear and pleasant slides with examples that give clarity to the presented concepts and clarity in the exhibition, present the subject in a pleasant way, use an intonation and adequate emphasis, avoid sounds or background music because it can interrupt the teacher's explanation. The average duration of the video was between 10 and 15 minutes, this for a better compression, for it the topics were divided so that they can be exposed in this time.
- The pedagogical component: curricular design resources in relation to teaching, learning and evaluation activities such as collaborative learning as a teaching-learning strategy, the use of the portfolio as evidence of the group's progress. For the application of the flipped classroom strategy, the design of the adequate and necessary teaching material to carry out its execution was taken into account.

3. Relationship between PLAD and flipped classroom

For the development of this communication, action research was used to improve educational practices by developing proactive and transformative knowledge, through a process of interaction with the teachers in training, and thus the flipped classroom strategy included in the PLAD was developed. In this case, it has focused on those reflections that have been made by teachers and students who were involved in the experience on the application of the flipped classroom.

Since its inception, the PLAD is used as a support for the distribution of complementary materials (presentations, materials, and web links, among others) of the classes taught in the classroom. The communication describes and analyzes the use of the PLAD to use the flipped classroom model.

Within the curricular structure of the subjects, there are differentiated activities carried out in the classroom and those performed outside the same. In the traditional models of teaching, the teacher about the syllabus of the subject uses class time mainly for the development of explanations. The work outside the classroom supposes the accomplishment of activities on the part of the student. The flipped classroom proposes to reverse this order and use class time to carry out activities, usually in groups, under the guidance of the teacher and leave the classroom to follow the explanations through videos

previously made by the teacher. The PLAD offers simple tools for teachers to apply this methodology, without it being necessary to have specific technological support infrastructures.

The curricular design of the subjects in the UFPS combines face-to-face teaching activities with those of independent work developed by the students. The different subjects that the students receive come from a combination of the work of the professors of the academic departments of the University. Teachers are responsible for the curricular design of the subject, the production of different types of materials, development of tests and correction of these. In addition, the teachers of the departments attend, through the PLAD, the doubts raised by the students through the forums or through face-to-face tutorials where they solve doubts and carry out the correction of the evaluations carried out.

The classes are generally of an expository and transmissive nature in which the knowledge acquired by the students was verified by exams at the end of each semester. The critical dialogical pedagogical approach of the UFPS was conceived for the development of competences beyond the transmission of knowledge. In order to respond to these demands, the decision to modify the methodology of this program was adopted by the curricular committee of the bachelor's program in Mathematics.

It would be, therefore, to do at home what is done now in the classroom and in the classroom, what is done at home. It is a very simple way to define this concept. If the pedagogical practices of the teacher, his presentation, his presentations in the classroom, his general orientations, his reading recommendations, etc., can be recorded in a video or in a narrated presentation, these materials can be viewed, studied, by the students in their own home, with the peculiarity that they can return to them as many times as necessary if some concept or idea was not sufficiently clear.

That is why the Faculty of Education, Arts and Humanities are currently carrying out research on the subject [13-16]. Table 1 shows the notions of teachers and students that could be classified as advantages and disadvantages around the use of the classroom model invested in the PLAD.

Table 1. Aspects to highlight teachers and students about the use of the classroom model invested in the PLAD.

Advantage	Disadvantages
Facilitates communication (students and teachers).	The entrance of the students to PLAD hinders the development of the flipped classroom strategy (teachers).
It promotes autonomous learning of students, as well as research and ICT skills (teachers)	Requires more dedication, time and commitment to the study of content (student)
Reduces costs in the delivery of jobs (teachers and students).	Out-of-class activities continue to be a continuation of the class (student)
Encourages teamwork (teachers and students)	Requires responsibility in the preparation of classes (teacher)
Promotes the active and leading role of the student (teachers)	The strategy serves only for some content (teachers and students)
Suitable for different learning styles (teachers)	

4. Conclusions

The importance of the results obtained so far, despite being applied to a small sample, lies in considering that the strategy was implemented for a group of students of a teacher training program, who in the future will be able to implement in their classrooms the type of strategies, tools and knowledge acquired in this stage. However, if the training of the future teacher maintains its traditional style of classes, it will be very difficult for them to innovate in the classroom and teach according to current trends. In this regard, any change that can be generated in them regarding the ways of learning and teaching can imply great differences in their future professional role.

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