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Inverted classroom: analysis of the experience of teachers teaching mathematics and statistics.

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Abstract. The article analyzes the perception of teachers of mathematics and statistics at the National Technical University, on the knowledge, application, and perception of the inverted classroom methodology for the development of soft skills. The main objective is to determine the lack of training of teachers in the face of changes in the educational model to achieve quality education, i.e., teachers are able to recognize their methodological weaknesses and are willing to update, train and acquire skills in the technological area according to the demands of a changing student population.
The study had a mixed approach, an exploratory scope, and used a digital questionnaire applied with convenience sampling, on a total population of 9 teachers. The pedagogical innovation in the learning processes and the knowledge transmitted with the result obtained is evidence that this methodology is used by all teachers in all courses. It should be noted that the application of the inverted classroom alone does not guarantee the improvement of academic performance since teachers do not have the knowledge or adequate training for the correct use of the inverted classroom.

Keywords: flipped classroom, teachers, training, classroom activities, problem solving.

1 Introduction

The implementation of the Flipped Classroom pedagogical model "consists of inverting certain learning processes that used to take place in the classroom, transferring them out of it, that is, carrying them out at home, and vice versa" (Zamar 2020, p.78).
For teachers, the implementation of the flipped classroom represents the elaboration and use of excessive digital instructional materials based on images, presentations, audio and video; it establishes a difference with respect to the traditional teaching/learning approach. Likewise, pre-class, in-class and post-class activities should be designed based on the context, projects and personal goals of the students, since, in this way, it is easier to connect them with the topics they need to learn from the subject.
The objective of this research is to analyze the perception obtained by the teachers of the implementation of the methodology in their courses, to know the frontal commitment they must assume to incorporate more practices under the competency-based

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learning approach, since more time is required for planning and evaluation of learning activities on a continuous basis. Likewise, to examine the commitment to improve the teaching praxis so that together with the students, a quality education is achieved.

2 Theoretical framework

An educational model where the student is more protagonist, more active, and more capable of the social demands, is part of the change to innovate higher education, as long as students have different capabilities than those established so far, since, as Bernal (2009) suggests,

> "The key to success in the development of active methodologies is to keep in mind that the most important thing is the student, each student:
> The key to success in the development of active methodologies is to keep in mind that the most important thing is the student, each student. The idea that students are happy, well-developed learners, free to progress at their own pace and to acquire fundamental knowledge more easily, is not a utopia, it must be a reality (p.105).

The role of the teacher must adapt to technological changes, inclusion, and above all to the different ways of learning of each student, because, "advances in the educational field, specifically how to teach and how to learn, have enhanced the development of quality requirements of the educational system (Merellano-Navarro, p.937).

The inverted classroom requires teachers to develop personal competencies to promote student performance. Each teacher must plan activities responsibly to avoid obstacles that may arise during the academic management process, in which the teacher's action as a teacher of learning, the role of the researcher in educational projects, the role of promoter, and community management stand out (Inciarte 2006, p.121).

On the other hand, the type of evaluation of the courses varies with respect to the traditional, since "evaluation is a means to adequately assess and guide both the student and the educational system itself" (Arredondo, S. 2010). In the case of mathematics and statistics courses, the evaluation is carried out by means of the items indicated in Table 1:

Table1. Evaluation of Mathematics and Statistics courses.

Items	Percentage
Pre-class	12%
In-class activities	24%
Post-class	24%
2 Short tests	10%
2 Mid-term tests	30%
Total	100%

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The elaboration of activities is undoubtedly a challenge for teachers, so they must have time, material and be clear that students are the builders of their own evaluation and learning process, so it is vital that teachers are trained to use the methodology and be a motivator and provider of autonomy and knowledge in students.

Figure 1. Phases of preparation and application of the flipped classroom.

3 Method

The research conducted was characterized by using the mixed approach with an exploratory scope in that it allowed "obtaining information to conduct a more complete investigation of a particular context, investigate new problems, identify promising concepts or variables, establish priorities for future research" (Hernández, Fernández and Baptista, 2010).

The questionnaire was answered voluntarily by 9 teachers and the heading indicated the characteristics of informed consent. The questionnaire is made up of three subsections. The first, composed of five questions, inquired about the teachers' knowledge and use of the flipped classroom methodology; the second section contained 8 questions about the teachers' perception of the academic management processes; the third subsection was composed of 4 questions about the challenges, opportunities, and improvements that teachers have with the use of the flipped classroom methodology in their courses.

4 Results

Next (Figure 2) shows the results that 67% of the teachers use the inverted classroom methodology in their courses. Likewise, (Figure 3) shows that 55.6% of teachers use the methodology very frequently.

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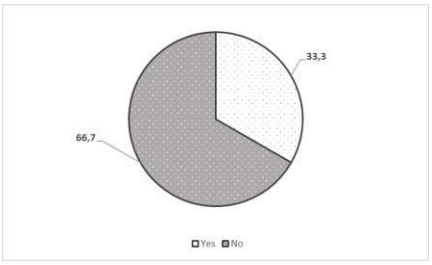

Fig. 2. Use of the inverted classroom methodology.

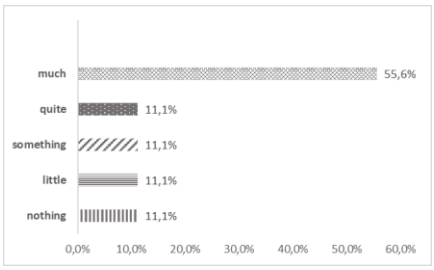

Fig. 3. Frequency of use of inverted classroom.

Figure 4 shows that 44.4% of the teachers have read to learn about the methodology, only 22% have received training.

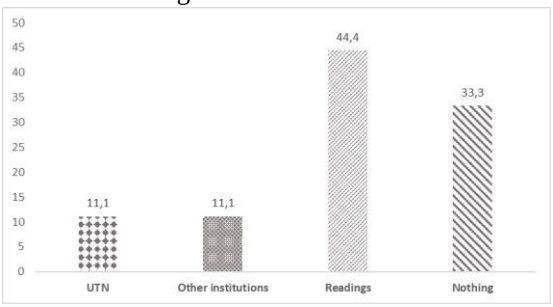

Fig. 4. Training on the flipped classroom methodology

Tabla 2. Challenges, opportunities and improvements for the proper implementation of the flipped classroom methodology in your courses.

Challenges	Opportunities	Improvements
Achieving learning outcomes	The student is actively involved in the learning process in their learning process	Academic innovation
The level of student learning does not does not undergo major changes	Updating of teachers	Training teachers in the use of technology and the classroom environment: (use of software and production of pedagogical materials, good internet access and portable laboratories).
Fostering Discipline	Promotes appreciation based on based on practice	Students to be the protagonist of their learning
Time for construction of didactic material	Advance more in the realization of concrete exercises and problems	Preparation of didactic material and pedagogical games.
Availability of technology.	Encourage independent study	Improve student engagement and motivation.
Training (Teacher-Students)	Prior knowledge on the part of students in the dynamics of the flipped classroom.	Evaluate its implementation at a general level.
Commitment	Learning by doing	Combination with other types of methodologies
Change in evaluation	Greater use of technology	More use of Tics
Pedagogical and technological knowledge	Development of competencies	Develop skills

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5 Discussion

In the study, we have shown that, although teachers frequently use the inverted classroom methodology, they do not have the training for its adequate implementation. The discussion group allows us to go deeper into relevant aspects related to the implementation of the methodology such as evaluation, preparation of material, use of technology, motivation, and how to improve it.
On the other hand, teachers perceive that they develop the methodology in a regular way, but it could be done better if they had time, training, and knowledge in the use of the inverted classroom methodology and technology. In this research, it is perceived that teachers do not favor the use of the inverted classroom methodology in mathematics courses and bet on further training in other methodologies.

6 Conclusions

In conclusion, the results of this study are of interest and relevance in order to deepen and understand the implications and demands that teachers need in order to acquire positive attitudes and use more active learning strategies in the curricula. These demands refer to training, capacity building, and material resources. Therefore, emphasis should be placed on these aspects in order to achieve the success of all students in their teaching and learning process and for everyone to have a quality education.

7 Limitations and Future Research

The limitation of the research is related to the methodology used; it is not possible to make any type of statistical inference with the intention of generalizing the results to larger populations. Future research could focus on knowing what training exists and whether it has an impact on the adequate use of the methodology, but also on the impact it has on the students in the teaching-learning process.

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