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Abstract. The aim of this paper is to present the importance of the teaching practice of the future professor of mathematics in a Colombian public university, through the application of the Japanese methodology of lesson study. This methodology is proposed as a set of skills and daily practices that the future professor of physics or mathematics must develop for the preparation of the class as proposed in the paper. Among the main results that the research found is the importance of the practice of lesson study for the teaching of science in general, with emphasis on physics and mathematics, although this methodology can also be applied to the human sciences. On the other hand, the research recognizes that the use of this method should be assumed as part of the process of formation of the student of mathematics, physics or any discipline that requires preparation of the classes for the teaching process. It contributes to the professional profile of the future teacher in terms of quality and professionalism of the teaching work. Thus, it can be concluded that, the teaching of mathematics from this approach is a positive resource in the training of the teacher of mathematics, or any discipline such as physics that wants to implement it, because, it is being reflected in the didactic work that mathematics, or any science wants to exercise in the pedagogical and didactic process of the classroom through the teaching practice and, later on, in the professional work of each probationer.

1. Introduction

Lesson study (LS) is a professional training method of Japanese origin that can be traced back to the end of the 19th century [1] It is a methodological proposal that has transformed professional development in the Asian country. Calling the attention of other countries with the positive experience of preparing the lesson in the oriental style. The study traditionally requires a group of people interested in improving pedagogical and didactic aspects of teaching, mainly in mathematics [2]. However, the methodology does not rule out that it can be applied to lessons in physics, chemistry, or philosophy. For this to be possible, it is necessary that the actors be in the same territory and that they share a personal interest in improving the didactic processes of teaching the subject, in this case mathematics.

As concerns Latin America and the contact with the famous Japanese method of teaching mathematics, it should be clarified that it is not the exception as in the rest of the world. There has been a great reception by South American countries in this process of improving mathematical teaching. Chile, Brazil, and Colombia have been involved in the collaborative learning process that the Japanese method brings to the teaching of mathematics, which can be assumed by teachers or by future teachers in the area [3,4]. To the point that as a successful experience it goes beyond and can be applied in other areas of knowledge. For example, physics, chemistry, philosophy, among others [5].

However, the case that will be proposed here intends to present the importance of the use of the LS method in the teaching practice of a public university in eastern Colombia at the level of teaching mathematics at the high school level. It favors the formation of the future mathematics teacher in its academic, professional, and pedagogical components. Thus, the academic space analyzed proposes, promotes, and adapts these studies and reflections on the pedagogical activity of school mathematics through mathematical education that takes place in the classroom. [6]. It is worth noting here, as it has been insisted that since it is a successful experience in the teaching of mathematical sciences, it can be applied to the physical and chemical sciences [7], among others.

Thus, LS is part of the ethnographic narrative approach which is part of the qualitative research methodology [8], who through the application of the formative method in future teachers of mathematics will demonstrate the importance that this has in university teaching as proposed in the previous paragraphs. This will be evident in the formative processes of observation carried out by the future mathematics teachers, who through the process of reflection after the exercise in the classroom will demonstrate the improvement in various aspects of the formative process. Either from the characterization of the course, based on the identification of the needs and expectations of the formation of the students of the Mathematics degree or in the teaching-learning process. Without a doubt the collaborative work that links the teacher and his students towards the solution of mathematical problems through LS makes it more dynamic and motivating. Because planning the class based on the needs of the students is a premise which makes this methodology work.

2. Method

The participants are 2 mathematics teachers, who lead the practical teaching course I, and 13 students who make up the group analyzed. The teaching practice took place in two schools in eastern Colombia where, from the beginning, it was clarified that the work methodology would be based on the Japanese teaching method. So, the process had several moments. First a theoretical investigation, so that future mathematics teachers would understand what LS is. Second, the realization of the planning with the help of the teachers. Thirdly, the review of the plans after the mathematics classes. Fourth, the implementation of the improvements in the lesson, to propose a quality professional exercise that reveals the importance of the use of this method through observation as will be seen later.

The methodology used was the implementation of LS for the exercise of mathematical practices. This was organized in the following way, namely, meetings of 1 hour a week, in planning groups the plans of the classes that were going to be implemented in the following process were developed. For this process, a new planning format authored by the supervisor was implemented, in which the possible responses, actions and reactions of the students were considered, in addition to the responses proposed for the teacher to each of these reactions.

This format also presented the class divided by activities, and each one its own objective, which would ensure the fulfillment of the objective of the 100-minute class (one class block). This format turned out to be more complete than that used in previous practices because the details of each interaction within the class were prepared. This format [9] also has the advantage of contemplating the teaching and learning of the students from the meanings mobilized by the students in front of each indication of the teacher. The execution and (external) observation of the planning correspond to the following LS process, in which the class that was planned for 6 weeks is applied. This was planned to be held starting the second week of September and ending before the week of school recess. In some cases, the prospective teachers had the opportunity to apply planning again with another group, for example, as happened with the teachers of 2nd grade (surveys and data representation), 3rd grade (Pick's theorem) and 4th grade (Representation of data).

LS is a way of improving the professional development of a certain group which assumes it in a context, the practice of which has been generalized since the 19th century in Japan. Due to its good results it has spread from the East to the West [10-13]. The implementation of LS is a methodology which favors the joint learning of those who participate. Initially, it was proposed to improve math and science practices under the motto of teachers learning together [14]. However, the reflections that arise

from the identification of the teaching and learning needs of the students are born from the initial observation of a group of students of a certain grade, which when complemented with the experience of other (future) teachers, promote cycles of discussion and reflection that allow learning from the "problematization of the different practices of teaching school mathematics" [15] as shown in Figure 1.

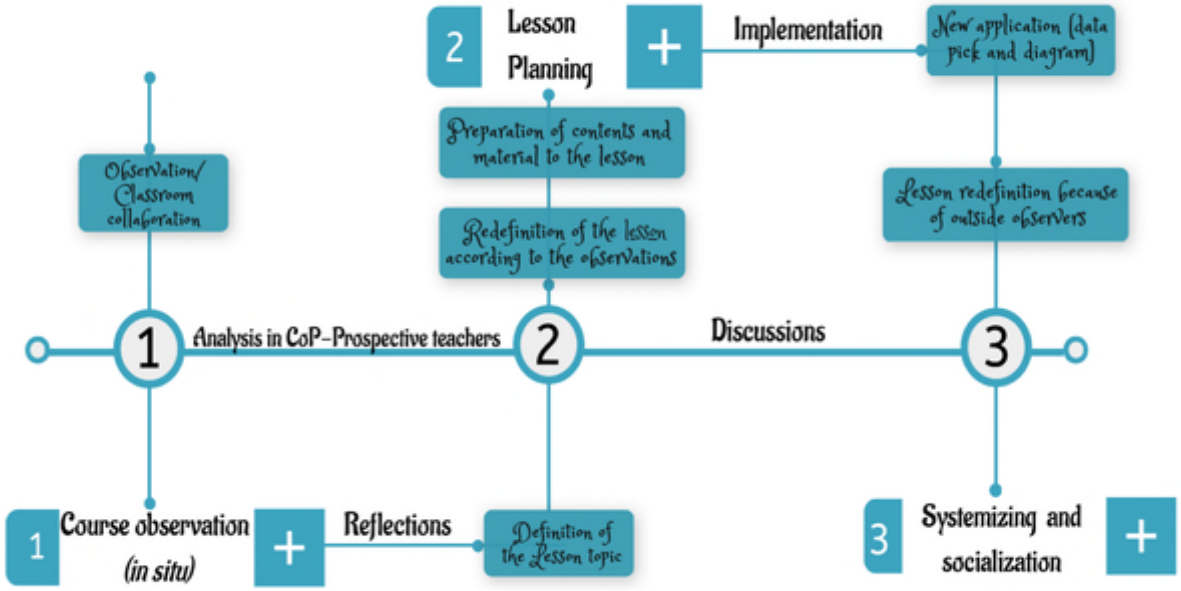

Figure 1. Lesson study activity.

This model allows planning, reflection and analysis of teaching needs through the following phases of execution: (i) observation in the classroom; (ii) identification of the topic to be developed in class; (iii) planning; (iv) implementation of the class; (v) reflection and systematization of the experience [16]. These phases will be described below, according to what has experienced in the process of teaching practice I, both in the supervision cycle within the educational institution and within the training cycle within the university. In Figure 1, the sequence of actions experienced in each of the moments of the LS cycle in the educational institutions (schools) of eastern Colombia is presented.

The training cycle starts from observation [17] in which students attend the schools assigned for accompaniment, and do not take classes without planning unless the course teachers request the application of specific activities or accompaniment. In this part of the process, students have an immersion practice in which approximately six weeks of the semester are spent observing classrooms, course dynamics, students, teaching and learning practices, difficulties in the classroom, among other aspects. These observations were recorded in the observation format, in addition to short narratives of reflection on what was observed. Based on these approaches to the classroom and school mathematics, the students identified the particular teaching needs of a specific topic, within the same mathematics area plan, or recommendations from the same classroom teacher accompanied, to begin the intervention in the classroom. As soon as the students made observations, on Fridays they shared, together with their classmates, what they evidenced in their classes, and reflected on it. During the entire application of the LS cycle, the practice was supervised by two teachers in charge of the mathematical practices.

Parallel to the observation process, the planning process was carried out [18]. For this, a complementary schedule was proposed to the meetings on Fridays but organized in such a way that they were located by level group, for example, all the students who accompanied fourth grade met at the same time. However, the organization of the meetings could not be located with all the levels in the same way for 1st and 6th grades, so there was only one student in each of the levels. Illustration 1 shows the organization of the levels and the schedule in which the meetings were held. These meetings were held within the training cycle given by the supervisor and all were recorded with a video camera, so this device was not a strange element [19] when implementing the class.

3. Result and discussion

The main result of this experience in the application of LS described in this section, aims, as we have mentioned from the beginning of the paper, to present the importance of LS in the training stage of teachers at the university in the area of their first professional practices. This is because by implementing class planning by means of observation and reflection processes it is possible to see the before and after study of the lesson. In other words, observe what progress future mathematics teachers have made in applying this working method of Japanese origin.

3.1. The visibility of lesson study's intervention

When you want to find out about the quality of the application of LS in a subject such as the course of teaching practice I, you see the need to prepare the lesson. Not only for the future mathematics teacher, but also for the director of the practice since the quality of the professional practice to be carried out depends on this. Hence the decision to propose some phases of research on LS before applying it. Because although the directors of the course know the work methodology well, the 13 students with whom the LS practice was carried out in the teaching of school mathematics were not familiar with the Japanese method.

This implies, not supposition. When a professional practice is carried out in any discipline, whether it is called physics, chemistry, or mathematics, as in the present case, it is based on assumptions which create a bad experience for the students. After the exercise of comprehension of LS, it is possible to think about putting into practice what has been learned, and the application of the method with a cyclical character as is evidenced in Figure 1. Where the starting point is the observation (in situ) to carry out the planning of the classes and to proceed to the implementation of the teaching of mathematical concepts.

3.2. The implementation of lesson study in the planning stage of mathematical content

When one wants to improve the professional practices of any discipline, in this case school mathematics, it is necessary that the future mathematics teacher (prospective teacher) carries out not only a theoretical research on the subject, but also a process of observation "in situ". An observation with an ethnographic tinge, which will progressively bring him/her closer to the reality of his/her professional practice. It is not only to propose how to teach a theorem like Pick's, but to observe what are the learning possibilities of this concept in the middle of the context that learning brings. This will allow the generation of learning agreements in the planning stage of the class.

This implies that negotiation and reflection through discussion are necessary elements for the preparation of the mathematics class, but as we have emphasized it can be applied to any discipline. Finally, this aspect of lesson preparation should be clarified that the 13 students kept their interest in lesson planning because they saw positive developments in the way they performed in the mathematics class. This guaranteed the attendance of the members and the interest in the preparation with the methodology. This leads to the statement that the essence of the Japanese method is the preparation of the lesson to be taught. Although the whole cycle of LS is important for a process of training in professional practices. When a subject is prepared with this method, thinking about the reality that the prospective teacher is going to assume, it allows for the generation of real experiences that have already been thought of, and not those that lead to improvisation; thus, the remaining colleagues in this exercise and the teachers in charge, play the role of observers who will help through subsequent reflection that the performance of the prospective teacher will improve. This allowed the projected activities during the university academic semester (16 weeks) to be fully accomplished. The students of professional practice I practiced extensively documenting the process of their peers using the camera and the field journal of all attendees in this process.

3.3. Implementation of lesson study in see stage

In the third moment of the LS process comes the reflexive moment, which starts from the observation mentioned in the previous point. All the participants in the research (13 students while teaching practice

I) of the improvement of professional practices through discussion make the reflective process in coordination with the two professors in charge at the university. The process of improvement of the professional mathematical practice is encouraged in a constructivist sense [20]; because the contribution of all produces an improvement in the pedagogy and didactics of the members of the group.

According to the above, in general terms, the quality of the exercise of implementing L in a subject as a professional practice was high. Since the comments made by the 13 students to this exercise were good at the time of the hetero evaluation This idea allows the presentation of the LS as a successful experience not only in Japan from modernity but also in Colombia from contemporary times. This leads to the analysis that the teaching of mathematics with this method, or the teaching of physics or chemistry with this perspective will be successful. If they stick to the model presented in general terms. On the other hand, this application of LS demonstrated that prospective teachers as well as teachers in the professional practice of teaching can implement innovations in collaborative learning.

This is evidenced by the seriousness of the application of the exercises in class, in a procedural sense; generating a predisposition to accept advice or criticism for the best performance of their work. This involves that LS makes the teaching work in the classroom more friendly, making the teaching process more positive between students and practitioners. Since the experience of the practice coordinators is shared with the students generating a sense of collaboration to find solutions related to the process of teaching mathematics. Providing the methodology of LS with a positive response in those who are taught. In other words, the implementation of better concepts, which in the end allow for critical thinking developed in the classroom through mathematics.

An idea which highlights the social and real sense of the mathematics learned and taught because of the collaborative discussions around LS. All these formative elements that arise from the application of LS allow us to see the importance of the Japanese method in the teaching of future mathematics teachers. From which the idea that LS is a professional educational model through collaborative learning and sustainable learning based on the observations and notes of colleagues with a critical sense, in favor of the quality of learning and professional work, emerges. In addition, LS in the sense of the research proposed in this paper, is based on self-formulation processes and on feedback processes formulated by a learning community based on the study of its own work. In which observing, planning, applying, and reflecting make sense again and again in favor of the quality of teaching in their practice.

4. Conclusion

It is noteworthy in this research the importance of the use of LS for prospective mathematics teachers in their teaching practice since they saw how decisive it is to observe, investigate and adequately prepare the mathematical contents as in the case of the exposition of pick's theorem because this topic was re-applied twice among the members of the group; however, the subject of data collection was done by the 2nd and 5th-grade students, but the second-grade students proposed an independent planning from the 5th-grade. Those of 5th grade was applied twice by each group of students since they oversaw 2 groups in educational institutions. For the most part, the following application came out better than the previous ones, which was started by the prospective mathematics teachers who directed in statistics (2nd and 5th) and measurement with pick (3rd). Well, improvisation is not an element of the didactics of mathematics, but preparation mediated by a method of observation and reflection is something that will help in professional practice, influencing the mathematical teaching model with quality and professionalism.

On the other hand, the LS teaching model makes it easier to integrate the instruction of mathematical concepts and categories with reality, since the observation and subsequent reflection of the mathematical teaching exercise make it possible to implement the gaps that the form of mathematical teaching has, and not only the errors when it comes to direct teaching, sometimes guided by the instruction of the teacher with experience in teaching mathematics. Thus, mathematics becomes a planned science, more pleasant and easy to understand for students who are taught various concepts of the mathematical universe, and who often do not connect with the reality of those who are educated, therefore, possible misconceptions in classrooms can be avoided or mitigated if they are thought through in advance during the planning process.

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