

Improving educational practice using the methodological approach known as “lesson study

DOI: 10.46932/sfjdv3n6-060

Received in: November 14th, 2022

Accepted in: December 19th, 2022

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ABSTRACT

This project is designed for the improvement of educational practice using the methodological approach known as “lesson study” in the teaching-learning process of mathematics in the first grade of elementary education. The research, which took place in elementary schools of the city of Puebla, was quasi-experimental with a mixed approach and a descriptive correlational study. It showed that there is indeed a relation between reflective teaching and achievement in students. The process of interpretation of the results is described at the end of the article in a descriptive and explanatory way.

Keywords: reflective teaching, lesson study, educational practice, school achievement.

1 INTRODUCTION

The project responds to a problem experienced by students of elementary education in the learning of mathematics. This situation made us rethink our role as a teacher training institution and the possibility of carrying out research work in which the normal students themselves will reflect on the question: “will there be a significant difference in the improvement of educational practice and a repercussion in the level of mathematics achievement of students of three groups of first grade of elementary schools whose professors in formation of the (Meritorious Normal Institute of the State) (in elementary Education participate in a methodological proposal of lesson study? While reviewing the theoretical-conceptual elements of lesson study, we discovered that the background of this proposal is compatible with the trend of reflective teaching, which is why, and based on the previous question, we took on the task of inquire which are the theoreticians who have followed the trend of reflective teaching and investigate what experiences are related to the implementation of proposals with this approach. First, when reviewing the literature, we found that several theories about reflexive thought have been developed. If we locate these studies in the teaching practice, we can pick up theoreticians like John Dewey (1933), Jackson (1968) and Donald Schön (1983), among others. Later, we will review their main contributions.

2 LITERATURE REVIEW

In many countries, interesting experiences are being carried out on the methodology of teacher training, and even though the research has been focused on teaching math, this alternative methodology to teacher training is also being used in different areas of study. It is increasingly common to hear about the application of reflective practice as a proposal to improve teachers' work and consequently to have an impact on student learning. One of the trends of reflective practice is Lesson Study (*LS*), which may be explained as teamwork among teachers who collaboratively carry out the following the process of a) lesson planning, b) peer observation and c) lesson feedback.

Based on the literature review, we can highlight the research called Lesson Study - Rigid Transformations, carried out in the normal school Normal Superior Enrique Vallejo and in the institution Las Mesas in Colombia, (Calvache and Escobar, 2009) in which something related to the action on objectives in the teaching of math at the of primary and secondary levels was found, which is cited as follows:

The student can build his own mathematical knowledge, rediscovering the concepts, laws, and mathematical properties, through action on the objectives, reflection on that action and permanent dialogue with other students, to reach the symbolization of concepts and to understand new mathematical knowledge (p.112).

Therefore, it follows that intuition precedes the concept and the same logic is possible after invention and that the ideal solution would be to guide students from the intuitive and concrete, to the deductive and abstract.

In research on LS, Lenski, J. Caskey, M. and Anfara, V. (2010) point out that it is an approach and a way in which teachers can improve their professional development by doing activities together and promoting changes in their teaching, as cited in the book "Curriculum and Instruction", where they state "when teachers meet in professional learning communities to discuss their planning, they become active participants in reform" (p.56). Something very similar had already been seen decades ago by John Dewey (1933), who argued that teachers are a critical mass and that they can produce curriculum by themselves.

On the other hand, LS may be understood as a system of teacher professional development and its definition is found in Isoda & Olfos (2011) when they argue that the idea of LS is simple, saying that "a small group of teachers plans a class, one or two teachers implement the class with their students, the class is observed and analyzed publicly" (p.17). In the preparation of the class to be studied, the teachers design in detail the activities and prepare questions to guide the students, among other didactic situations.

Masami Isoda, one of the promoters of LS, promotes this alternative work to improve math teaching, and has led him to define it as "a scientific activity for teachers who try to erect their own theories to develop and share good practices" (Isoda, 2012, p. 65). Additionally, the author highlights that:

After a year and a half of implementation of the project of studying math classes at Ozone Basic School, through the use of checklists for teaching math, the performance in this subject improved in such a way that the mathematical thinking capacity key for the children learning by and for themselves was observed since the performance of the children in 5th grade elementary school increased 15 points on a mathematical thinking test compared to the average of schools across the prefecture (2012, p.75).

LS has many virtues from the perspective of researchers around the world, such as Nesusin, N. Passara, I. Supadol, P. Piengkkes, N. & Poonpipathana, S. (2013), who in the fifth Conference of Educational Sciences presented the advantages of developing lesson plans with this approach in a social study. The main virtues they establish are:

The approach allows teachers to be in constant professional development; it retains the concept of learning and learning; it emphasizes the development of teaching in the context of the classroom; it promotes an emphasis between groups with a co-learning system; teachers who build their plans learn in groups and by themselves to support and base their knowledge on a pedagogy, and at the same time they are developing the teaching profession (p.113).

Related to studies on mathematics, research such as the one carried out on the Implementation of the LS Methodology in the Educative Institution Gran Colombia has been done at the elementary level in math where findings were made regarding the profile of the math teacher, whose characteristics we want to synthesize, taking only a few of them as an example:

They have serious deficiencies in disciplinary training, which contributes to a very poor conceptual development regarding the pedagogical process. The absence of self-training level is reflected in the absence of didactic and disciplinary references at the level of classroom practices; they lack teamwork or cooperative work; they are resistance to change, especially in the case of teachers close to retirement; they have difficulties lesson planning, tending to plan more according to the teacher than to the student; dependence by some teachers on educational technology, that is, waiting to be told what to teach and how to teach it (Hernández, 2014, p.47).

The research in question presents the features identified in the teachers that served as a basis for developing a proposal on the improvement of teacher performance (a very logical reference) to carry out work where LS may be applied that, among other things, aims to eradicate routine, improvisation, and lack of interest by the teacher on their own work.

LS may promote the formation of professional learning communities according to William (as cited by Dudley, 2015) in "Lesson Study Professional learning for our time" highlights that "learning communities offer the work team flexibility, learning opportunities, support in the design and preparation of classes and they seek to have optimal working conditions for the professional development of the

teachers themselves" (p.18); therefore, Mena (2016) defines it as "a process by which teachers work together to progressively improve their pedagogical methods by examining and criticizing each other's teaching techniques" (p.11).

On the other hand, it is necessary to clarify that there are several alternatives whose purpose is to strengthen teachers' teaching skills, like what was intended to be done in the research that was carried out on a model of continuous training for math teachers, based on experience.

This training alternative presents a model aimed at the math teacher called *Mejoramiento de la Experiencia Docente (MED)*, through which it has been shown that its application has been successful in the appropriation of a pedagogical knowledge of the content. The results of this study show that the advisors saw the impact of MED training, especially on math teachers, as well as the rest of the staff who assumed a positive attitude regarding the topics of training and argumentation in the math class and were able to realize error management, therefore achieving their willingness to be recorded in their class by their colleagues, which was a breakthrough highlighted by the study (Solar, H. Ortíz, A. & Ulloa, R. 2016).

Also, in a study done in the Netherlands, the virtues of LS in improving teachers' work are confirmed, based on the analysis of the application of the instruments of De Vries, Prenger and Poortman (2017), it was seen that teachers improved their knowledge and changed their beliefs. An interesting aspect to highlight is that they commented that they had learned more about their students and their thinking and that they had better knowledge of teaching in general, which had consciously impacted their teaching.

On the other hand, the study showed that the impact was mainly on the teacher's awareness about their own teaching and the approach with students, which leads one to suppose that teachers could experience new forms of teaching with other techniques that are more suitable to the purposes intended in the training of students, which shows that their way of working is more based on a theory and is therefore less subjective.

Regarding this, it is worth highlighting the importance of teachers supporting their work theoretically, although experience and relationship with peers also affects their training, such is the case of research focused on studying teachers' classes and aimed at observing growth and professional development. Yalcin (2018), according to a quantitative analysis, found some very interesting aspects. First, the results indicate that "all participants had focused on their professional growth during their lesson time. The findings suggest three areas of opportunity, namely a) teaching-oriented professional growth, b) knowledge-oriented professional growth, c) learning-oriented professional growth" (p.6).

As may be seen in the previous studies, LS is not only focused on student learning, but it may also be oriented to improving academic performance so teachers can learn from their own practice. As for the

studies carried out on learning math, we find research done in Indonesia, a group of teachers from the University of Jember published the results of their work aimed at developing tools for learning Math.

The authors specifically worked with material on sequences and series of numbers with ninth grade students from a middle school through the LS approach to achieve community learning and observe the influence on the development of creative thinking skills. The study was carried out with a combined methods approach, meaning it was both quantitative and qualitative, in addition, the theoretical model was used for the qualitative part that was applied to two groups, one experimental and one control.

The conclusions based on the results may be summarized in two points, a) the learning tools and categories were valid, effective, and practical, and b) the application of LSLC resulted in a significant effect on students regarding creative thinking skills and indicated by a value less than 0.05" (Husniawati, J. Hobri, A. Prihandoko and Utomo, B, 2019, p.10). This means that the experimental group, after application of the model, showed better development of creative thinking skills than the control group.

If we reflect on the previous cases, we can easily see that LS is applicable to several subjects and is not only an alternative for improvement in teaching math. Since this study was carried out with that area of study, we made a broader review of the studies of the subject.

As mentioned earlier, the model is not exclusive to any area of study; for example, in a study on art teaching, we find reflections on professional development. After working with the model, Hicyilmaz, & Aykan (2020) emphasize that the LS benefits the perspective of teachers, contributes to their knowledge for them to prepare their classes, and improves their skills to conduct their classes positively. Teachers understand what points they must prepare during the implementation of the model are, and they recognize their mistakes in their lesson plans during the planning itself.

On the other hand, they improve their methods and techniques positively, they emphasize the recognition of their problems. Additionally, among other positive situations, the model provides them with contributions for the evaluation of student learning as well as their own evaluation. They recognize what the best ways to evaluate the subject and at the same time to evaluate their own practice are.

An example of the most recent application of LS is the one that several teachers from three universities in the Netherlands developed to improve the educational practice of teachers. The research was conducted with a case study method and using LS itself as a research approach.

We believe that Lesson Study is a promising approach to unite the pedagogical and didactic knowledge and experience of teachers and the theoretical knowledge of the educational research community and could therefore contribute to bridging the gap between research based on educational theory and practice (Jansen, S. Christine, M. Knippels, P. & Joolingen, R. 2021, p.300).

Without intending to exhaust all the approaches, uses and applications of LS, we will close this section of Literature Review with the explanation of a study carried out in Chile, where it was found that

"teachers recognize a contribution in the collaborative work they manage to develop, qualifying it as an authentic experience that challenges and problematizes their key professional skills for their pedagogical work" (Rojas, B. Gajardo, A. Albornoz, T. & Romero, I. 2022, p.6).

3 THEORETICAL FRAMEWORK

An approach to its definition is offered by Flores V. (2019) when he says that:

The conceptualization of reflexive teaching has to do with the constructs that this movement theorists have developed with the purpose of giving meaning to their writings. As it is well known, reflective teaching is becoming a trend in research and is in the process of consolidation. It is a trend that aims to be an alternative in educational research, the classroom is its context, students and teachers are its subjects, and the teaching from the reflective approach is its educational fact (p.16).

In the article "Historical roots of reflective teaching", reviewed for this research, Zeichner and Liston reference the contributions of Dewey and point out the three basic attitudes in reflective teaching:

- Open mind: the willingness to listen to points of view and question one's own.
- Responsibility: consider with great attention the consequences of each personal, academic, social, and political action.
- Honesty: open mind and responsibility are central components of the professional life of the reflective teacher. Honesty is what allows us to examine one's own beliefs (Zeichner & Liston, 1996, p.3).

A constant topic that was evident in the literature review is that this reflective process is linked by the authors with an element that is an effect of the reflection itself and that they all call "reconstruction". For this reason, in the following sections we review the contributions of these researchers that take on teaching practice from an analytical-reconstructive perspective, that is, from a reflexive approach. One of them is Dewey (1916), who defines education as "that reconstruction or reflective reorganization of the experience that gives meaning to it and increases the capacity to direct the course of its subsequent course" (p.88). In that sense, experience has an important value.

The contributions reviewed focus their attention on the stage of the reconstruction of teaching practice. It might be necessary to say that such is the object upon which reflective thinking is centered. However, we consider that it is a process that develops in all the moments of teaching practice. Because of that, Jackson (1968) speaks of a systematic model of the teaching around tasks and defines a reflexive process divided in three phases: pre-active, inter-active and post-active.

The same author refers that in the first phase those who teach must plan their activities and prepare the instruments they will need to carry it out. In the second phase, those who teach must conduct the teaching process in class: they get in action with the students and direct their learning. In the third phase,

those who teach evaluate the results of the process and take it in consideration to rectify their new preparation. If we review the process, we will see that in all three phases, reflection is indispensable as a function and an important element of foresight, action, and evaluation.

Another theorist who analyzes teaching practice through the search of a reflective teaching system, especially in its action-reflection phase, is Donald Shön (1983), who claims that “we can reflect on the action in two moments, always remembering our thoughts on what we have done to discover our knowledge in the action and how it may have contributed to an unexpected result” (p.36). To do this, the author says that there are two ways to proceed: we can do it immediately after the action or stop during the process and he even picks up the words of Hannah Arendt “stop to think”.

We could continue to mention more theorists of reflexive thinking, but our interest focuses not only in reviewing the theory of reflective practice but also in attracting attention to an experience of class analysis as a methodological alternative of an approach that has been carried out in several countries but had its origin in Japan. We are talking about the lesson study.

The lesson study is a program developed by Masami Isoda whose contributions have reached more than 25 countries. (Isoda, M; Mena, A; & Arcavi, A, 2011) defines it simply as “a modality of professional teacher development” (p.11). In his book published with Raymundo Olfos, Isoda claims that the lesson study occurs when “a small group of teachers plan a class that one or two teachers implement to work with their students, the class is observed and analyzed in public” (Isoda & Olfos, 2012 p. 3).

The lesson study is a process in which teachers work together to progressively improve their pedagogical methods by examining and criticizing each other’s teaching techniques. This modality originated in Japan some time ago and has been evolving with other characteristic aspects of the classes in that country. Despite their ostensible differences with Japanese school culture, a growing number of countries are successfully experimenting with that style of work.

Our response to the problems suggested that teachers in formation who develop mathematics sessions and receive orientation of their classes through the methodological proposal of the lesson study will improve their teaching work and this will affect the level of achievement of children from three groups of first grade. To complement our study, we consider proving whether the application of this methodological approach in the intensive practice of normal students in mathematics could significantly improve their teaching practice and had a better impact of the children’s achievement.

4 METHOD OF STUDY

Observing the purposes of the study, we decided to do quasi-experimental research and planned a partial control. On the other hand, the principle of random assignment of subjects for the designation of groups was not fulfilled. For this reason, intact groups were studied. To complement the pre-experiment, we used the descriptive-exploratory type of study, as the final intention was to explain the conditions that enable the improvement of teaching work and its impact on the achievement in mathematics of children.

These methodological foundations led us to the construction of a proposal of improvement of the practice that could impact the students and with the purpose of guiding and developing their teaching practice through the experimental sessions in three cases of students in initial formation that began to plan, develop, and receive feedback from their math classes through this methodological approach integrated in an innovative proposal of analysis of teaching practice.

The stages involved in the lesson study process are three: class planning, monitoring and observation of the class, and finally evaluation and reflection on the classes.

During the first stage, class planning, the goals of the class and how they should be presented must be considered. For this, the teacher in training must decide the goals of the class including the type of knowledge, skills, attitudes, and values that he wants the students to learn. Also, the teacher develops a plan to achieve their goals according to the contents that will be taught.

The second stage is the experimental class observed by one or several teachers that take notes to discuss at the end of the class. The third stage, considered the most important of all, is the reflection promoted when the teacher who is conducting the class makes a general review of what happened and listens to the feedback from the teachers who observed the class.

The subjects who participated in the research were three teachers in training with their respective advisors and 120 first-grade children from three primary schools, plus the corresponding group teachers and three specialist teachers who served as observers.

We used a mixed and comparative approach between the teachers in training of each school. With it, we tried to prove if their teaching practice was strengthened out of the methodological approach of the lesson study and if the improvement of the teaching practice impacted in the level of achievement in mathematics of the students. For the latter point, the results of two applied tests (pretest and posttest) were compared in the three groups.

In general, and according to the analysis of the results obtained in the two instruments of quantitative (ISCT-02) and qualitative systematization (ISCL-03), we will present the similarities observed in the performance of the teachers in formation and we will describe how the students incorporated the observers' suggestions after the analysis of the six class sessions, how they transformed these suggestions into strengths and showed an improvement in their teaching practice and other aspects.

5 RESULTS AND CONCLUSIONS

The analysis is presented according to the different phases of the class contained in the lesson study approach (preactive, interactive and postactive), upon which the students had not reflected yet in any other moments of their teaching practice. In some cases, these suggestions could not be modified either by the very nature of the work or by some other inconveniences, such as differences in the sociocultural contexts, changes made by the educational program RIEB (Integral Reform of the Basic Education) and the academic background of the teachers in formation. Therefore, the progress and difficulties that persisted throughout their teaching practice are explained in the following paragraphs.

6 PREACTIVE PHASE (PLANNING OF THE CLASS)

- Regarding the levels of development and learning styles, it was necessary to consider the logical processes and notions of number already existing in the children to teach them more easily the new content. This situation was observed especially in the first three sessions, although later, with the experience obtained, they were able to better adapt the contents.
- A notorious weakness was that, in general, teachers did not consider the learning styles of the children, as there was no diagnostic instrument that accurately defined the predominant styles. However, through observation during the last sessions, activities planned were more suitable.
- In relation to the articulation of purposes, approaches and contents, difficulties were present in the first few sessions. Some contents suggested by RIEB (Elementary Integral Education Reform) were too advanced for the development level of the children in the study, therefore some teaching strategies that could rely on the previous knowledge of the students needed to be redefined, as well as the approach to solving problems and the possibility of adapting plans.
- Evaluation activities prepared for this phase were not completed to analyze the actual reach of the purposes due to the complex structure that the RIEB suggests in its project work methodology, which establishes a continuous form of integration of activities. That complicated the visualization of other aspects in the beginning, development, and closure for each session.
- About the didactic resources and teaching materials, in the three cases, the teachers in formation provided relevant materials that were concrete, attractive, and creative to enable the achievement of the purposes.

7 INTERACTIVE PHASE (DEVELOPMENT OF THE CLASS)

- On group organization, moments of the class and didactic sequence: it was generally observed that pre-service teachers organized students according to the established purpose. During the development of the class, it was possible to notice the different activities for the three moments

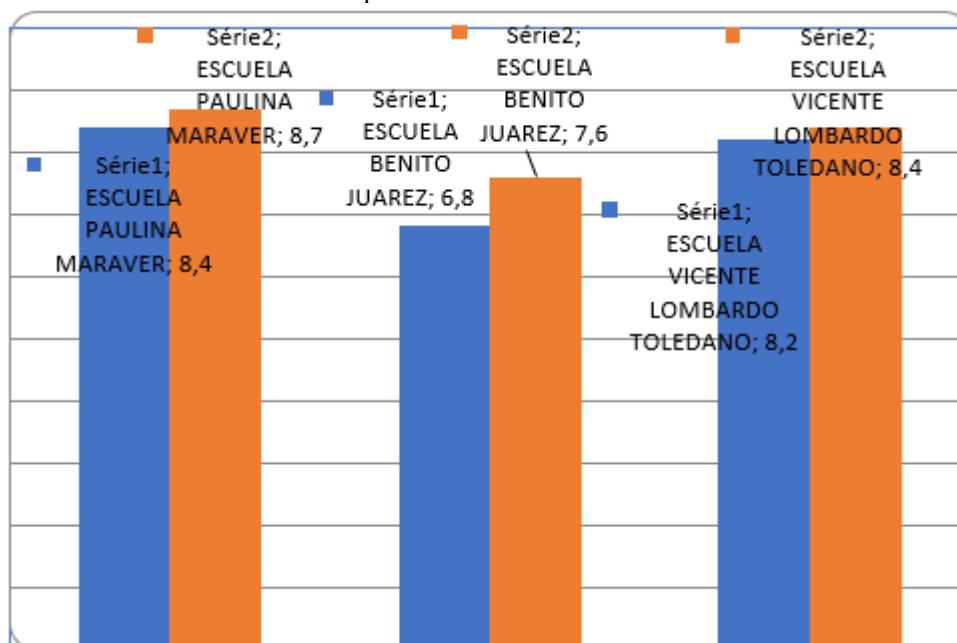
of the work session: start, development and closure. In most cases, the young students followed the sequence of planned activities, but in some situations, they needed to do adjustments, especially to reinforce the new content.

- About recovering previous experiences and developing strategies for meaningful learning: in the three cases, it was difficult for the normal students to recover previous knowledge. However, two of them worked on this gradually until it became a strength, raising generative questions and problematization. This led them to promote meaningful learning for children and could be noticed when the teacher in training resorted to the approach of examples of the context of the child and transferred the knowledge acquired.
- Regarding the use of didactic resources and teaching materials: two of the normal students did not apply the material considered in the planning and it was necessary to incorporate more concrete material to reaffirm the purposes of the subject. In the third case, the student did incorporate the planned materials and elaborated them very creatively.
- In relation to the skills and sensitivity for communication with children: these skills were gradually developed by the students until they became a strength, because they constantly asked generative questions and induced the children to confront their own answers to reach a reflection. The students became more patient to grant enough time to the answers of the children.
- Finally, about the forms of evaluation: in all three cases, evaluation was seen as a weakness, in part because of what was mentioned before about preactive phase and the complexity of the project methodology and in other moments because time in class was not enough to develop more complete evaluation activities that allowed assessing the achievement of the purposes. Besides, sometimes evaluations were not linked to the purpose.

8 POSTACTIVE PHASE (EVALUATION AND REFLECTION OF THE CLASS)

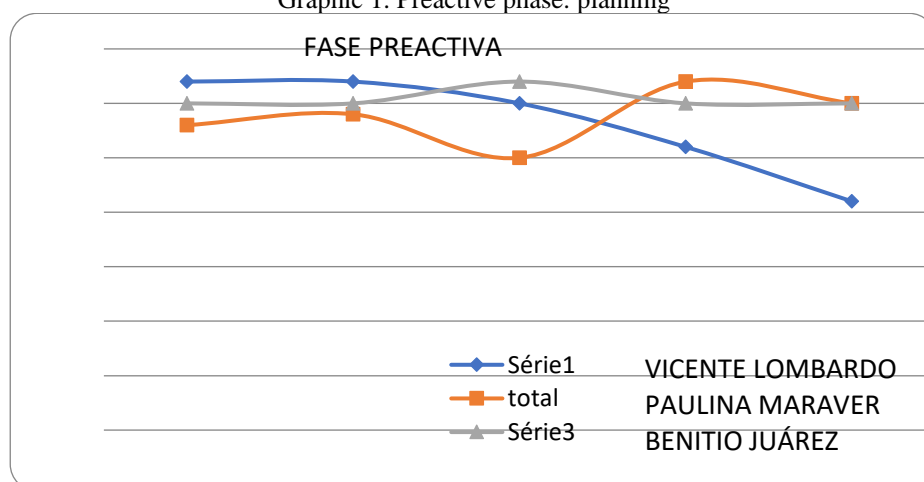
- On the participation of the practitioner in the planning: a weakness was observed that since the beginning, advisors, tutors, and teachers in training were not integrated to develop a collaborative planning that incorporated the different points of view and suggestions of this academic collegiate. It was also noteworthy the lack of total attachment to planning and that some activities were omitted due to lack of time, while others needed to be changed according to the needs. The latter could be justified since there must be adjustments to the planning according to the context.
- Regarding the disposition, interest, and motivation to work throughout the process: in general, there was a good disposition to the work developed, and interest and initiative were observed when the project became more familiar to the students.
- About the reflection on the importance of planning and the development of the class: in a general way it can be concluded that in most cases it was possible to conduce teachers to a reflection on their teaching work, gradually incorporating the suggestions made by the academic collegiate for the improvement of a significant educational practice. There were coincidences in the suggestions and constructive observations. At first, one of the three students showed vulnerable to feedback and considered that criticism was personal and not focused on the teaching work. However, upon finishing the work, all the students adopted an attitude of greater openness and professionalism.
- In a general way, we can conclude that in the three cases it was possible to strengthen and improve the teaching practice of the teachers in training because they were driven to a reflection on its different components and its different phases (preactive, interactive and postactive). This had an impact in the mathematics achievement of the first-grade students at elementary school that were part of the study, since, according to the results obtained in the application of the pretest and posttest, a relative improvement of the average grades of these groups was observed, as we can see in the following graphic.

Graphic 1. School achievement



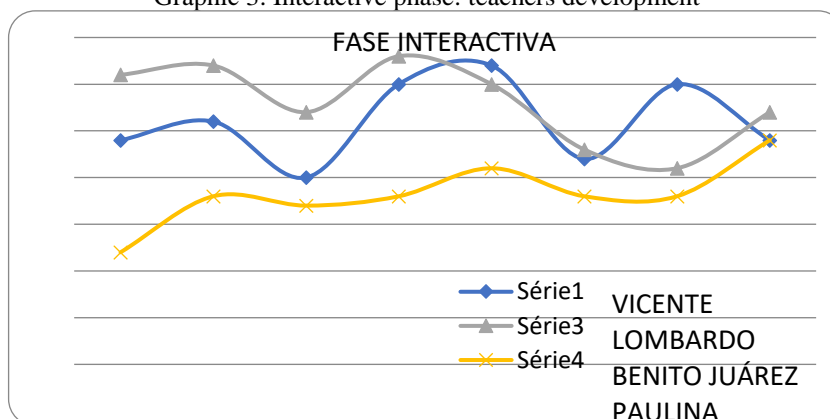
The three following graphics have been prepared to show the three moments covered by the research with the lesson study methodology (preactive, interactive and postactive phase), so that we can show how the teaching work of normal students changed according to the scores assigned by the observers in each class session (for each class, a scale with a value of 5 points was used for each indicator, for a total of 40 points for each phase).

Graphic 1. Preactive phase: planning



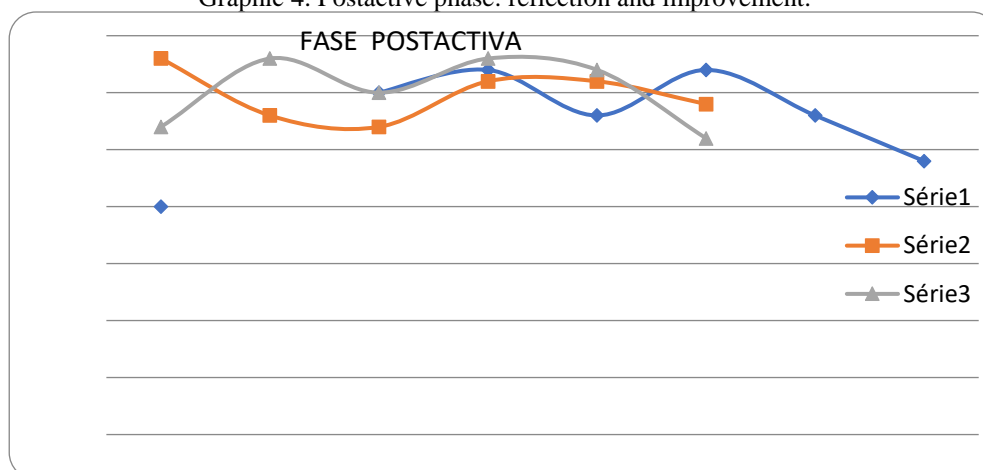
Interpretation. In this graphic we can appreciate how planning was an irregular situation. In fact, it is observed that in the three cases it went down. There was no collaborative work or homogeneous application since each student worked with, they own style. In the end, it was showed that they did not consider substantial elements of planning.

Graphic 3. Interactive phase: teachers development



Interpretation. In this phase, students showed their best strengths since their score was regularly high in relation to the development of the classes. Worked hard and improved their teaching work. Even if it was not a constantly improving score, they considered more elements to improve their class and their enthusiasm got better despite some falls in the process.

Graphic 4. Postactive phase: reflection and improvement.



Interpretation. The postactive phase was also irregular according to the graphic scores and even though a good reflection and improvement was achieved in the first sessions. In the end, the trend went down. It seems to us that this phase is the most important in the process and even when students did manage to do a reflection on their work, more impulse and feedback were needed.

Finally, we want to provide some general information about the development of the project, such as its mixed methodology that combines a quasi-experimental quantitative study and a qualitative methodology in the interpretation of results. We would like to highlight that we have the approval of the principals of the elementary schools “Lic. Vicente Lombardo Toledano” from Cuautlancingo, “Lic. Benito Juárez” from Lomas de Castillotla and “Paulina Maraver” from San Pedro Cholula. The group of researchers in training and their functions are as follows: Coordinator and responsible of the project:

P.H.D. Fernando Flores Vázquez. Responsible for design, application and interpretation of project results,
P.H.D. Guadalupe Badillo Márquez and PHD Guadalupe Vega García.

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