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Teaching tasks of teacher trainers: study of their influence on initial teacher training

Las tareas de enseñanza de los docentes formadores: estudio de su influencia en la formación inicial de los profesores

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Abstract

The present work arises from evaluation results (OECD, 2017) that reflect low learning in primary school students in the subject of mathematics, as well as the difficulty of understanding fractions. The study was carried out with the aim of identifying strategies used by teachers' trainers for their students to appropriate the planning of mathematics in the subject of fractions, as well as the elements they take into account for their design. A qualitative approach was used with the case study methodology. The sample consisted of two teachers attending the second semester of the Bachelor in Primary Education and 6 students. The results show that teachers in training identify elements that should be considered to design the planning and are based on the Theory of Didactic Situations, this by influence of the strategies designed by the trainers of the normal school.

Planning, Theory of didactic situations, Fractions

Resumen

El presente trabajo surge a partir de resultados de evaluaciones (OCDE, 2017) que reflejan bajos aprendizajes en alumnos de las escuelas primarias en la asignatura de matemáticas, así como la dificultad de comprender las fracciones. El estudio se llevó a cabo con el objetivo de identificar estrategias que utilizan los formadores de docentes para que sus alumnos se apropien de la planeación de matemáticas en el tema de fracciones, así como los elementos que toman en cuenta para su diseño. Se utilizó un enfoque cualitativo con la metodología de estudio de casos. La muestra constó de dos profesores que atienden el segundo semestre de la Licenciatura en Educación Primaria y 6 alumnos. Los resultados muestran que los docentes en formación identifican elementos que deben considerarse para diseñar la planeación y se basan en la Teoría de las Situaciones Didácticas, ello por influencia de las estrategias diseñadas por los formadores de la escuela normal.

Planeación, Teoría de las Situaciones Didácticas, fracciones

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Introduction

Planning is an essential tool in the teaching-learning process that serves as a guide for teachers in order to encourage their students to acquire the competencies established in the study plans and programs; "a substantive element of the teaching practice to enhance student learning towards the development of competencies" (Secretaría de Educación Pública [SEP], 2011, p. 27).

Planning is understood "as a roadmap that makes the teacher aware of the learning objectives he/she seeks in each session" (SEP, 2017, p. 121), a tool that teachers should know in order to elaborate it, subsequently put it into practice and obtain efficient results, both in their professional development and in the training of their students.

With respect to planning, its appropriation, is one of the professional competencies that teachers must acquire in their initial training process. "Design planning by applying their curricular, psycho-pedagogical, disciplinary, didactic and technological knowledge to propitiate inclusive learning spaces that respond to the needs of all students within the framework of the plan and programs of study" (SEP, 2018a, p. 7) professional competence with which students at the undergraduate level in Elementary Education who are trained with the 2018 Curriculum must comply.

The Ministry of Public Education (SEP) in Mexico, in the Plan de estudios, aprendizajes clave para la educación integral of 2017, states that in order to plan effectively, didactic strategies must be related to pedagogical principles that are embodied in the same document.

In the PLANEA national assessment regarding mathematics, it shows results obtained on June 12 and 13, 2018 from students in 6th grade of elementary school that show that 59% of these are in the first level, 18% in the second, 15% in the third and only 8% reach the optimal level for the school grade (Instituto Nacional de Evaluación Educativa [INEE], 2018).

The program for teacher training in the course Arithmetic. Decimal and fractional numbers of second semester of the Bachelor's Degree in Elementary Education states that: In teaching, it is basic to master the contents of the subject being taught. We need to dedicate time and effort to achieve a deeper understanding of the mathematics to be taught and how to teach them in order to develop autonomy and taste for mathematics in basic education students. (SEP, 2018c, p. 6)

Mathematics is a subject in which basic education students present difficulties, as well as teachers themselves (Organization for Economic Cooperation and Development [OECD], 2017), which implies having difficulty in planning and developing their class effectively. (Hernández- Gutiérrez and Lizarde, 2016) in their research argue that "The specialized knowledge of the mathematics teacher" reflects that in the contents in which teachers find it difficult to teach (say in mathematics contents) it is also difficult for students to learn. Although, in order to teach something we must first master it, without this, it will be difficult to elaborate strategies according to the expected learning, adding at the same time, the correct design of the didactic device to be implemented based on the approach of the subject and the competencies they seek to develop. That is to say, it is fundamental for a better teaching and learning process of mathematics, the design of lesson plans that contemplate the aspects of mastery of the mathematical content, as well as its didactic knowledge (Hernández-Gutiérrez, Pacheco and Lizarde, 2022).

Theoretical framework

Didactic planning

(Ander-Egg, 1993) mentions that the raison d'être of planning is to achieve an objective, which is acquired through the implementation of actions and the use of organized and coherent means. The aim is to make things happen and not simply to leave it as a wish or for other factors to make it possible (Monroy-Farías, 2009).

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The latter author points out that didactic planning is a task of the teacher. It favors the development of students, meeting the expectations of the institutions, of the people, as well as enriching teacher training through the implementation of actions (the strengthening of practice is obtained by evaluating the actions, which allows seeking better alternatives to meet the goal).

Planning requires the implementation of the teacher's knowledge. He/she must have mastery of the mathematical content, didactic mastery of the content (Hernández-Gutiérrez, Pacheco and Lizarde, 2022) and a professional attitude that allow them to design them effectively. The expectation is to favor significant learning of students, that the contents are adequate, learning environments are generated, students progress in their learning, the strategies are adequate and provide sufficient and coherent resources, activities are organized in a pertinent manner and there is a formative evaluation of whether the objectives were met.

Didactic sequences and situations

Díaz-Barriga (2013) mentions that designing learning situations in a didactic sequence (organization of activities) is an important task of the teacher. The author provides a guide with the main elements that should be considered: subject, topic, content, duration and number of sessions, intentionality (objectives), whether the choice of a project, case or problem is desired, guidelines for evaluation (what and how to evaluate), the didactic sequence (beginning, development and closing, responding to content, reality, context and resources), the evidence of learning and the resources to be used.

The structure of the didactic sequence is obtained by having interrelated activities. To begin with, we start by choosing the content and its intention. Then, the design of the activities implies being aware of the goal to be achieved, how it will be evaluated, the achievements and which activities will favor it, so that the sequence of activities and evaluation (diagnostic, formative and summative) are carried out at the same time.

It is important to mention that at the moment of implementing the sequence, obstacles are also detected, as well as factors that favor learning, which would lead to readjustments in the sequence to meet the goal. Then, to obtain the structure of the sequence, the activities and the evaluation are integrated at the same time.

Another proposal with greater specificity and relation to the interaction of the didactic triangle mentioned by Brousseau (2007): Student-content-teacher; is the proposal developed at the Escuela Normal Rural "Gral. Matías Ramos Santos" de San Marcos, Loreto, Zacatecas, Mexico, in which elements of the MTSK (Specialized Knowledge of the Mathematics Teacher) (Carrillo, et al., 2017) and the TSD (Theory of Didactic Situations) are related (Brousseau, 2007), cited in (Hernández-Gutiérrez, Pacheco and Lizarde, 2022).

In said study conducted in the normal school, a didactic planning device design is proposed, which in its sections contemplates:

- Epistemological analysis of the subject, Knowledge of the mathematical subject. Definitions, properties, fundamentals, mathematical applications are written about the content to be worked on in the session and that its use is explicitly suggested with the concrete explanation of the teacher in the phase of institutionalization.

- Knowledge package (Ma, 2010), Knowledge of the structure of mathematics. It is contemplated considering connections of complexification, simplification, transversal or auxiliary, the path of the content to be addressed, this aspect allows to concretely locate the heterogeneity of the students' learning processes, to be able to use didactic variables for more advanced children or with areas of opportunity in the mathematical content that will be worked on, even, it allows a greater knowledge of a horizontal, longitudinal and transversal vision of mathematical contents.

- Knowledge of mathematical practice.

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- Planning aspect that is drafted in this section and its execution is observed in several of the parts of the device (Phases of action, formulation, validation, etc.). Ways of proceeding to solve the problem, validation, demonstration, language, specific practices of mathematics are contemplated.

- Curricular framework, Knowledge of the. Mathematics Learning Standards. Those elements are taken into account that for planning, show learning expectations, level of development, sequencing of contents; some aspects that are considered: Thematic axis, Mathematical theme, content, expected learning, mathematical standards, competencies, didactic intention, for example.

- Knowledge of mathematics teaching: Although the MTSK does not make a direct relationship with the TSD, in the study of (Hernández-Gutiérrez, Pacheco and Lizarde, 2022) this possibility of relationship between the theories is justified, confirmed and studied. In such a way that a specific teaching theory that is considered pertinent for the realization of this device to build a lesson plan in the teaching of mathematics, is the TSD. Some aspects taken into account are: The didactic material, ICTs that could be used, strategies, techniques, examples, counterexamples, didactic strategies, learning environments, situated cognition, etc.

- A priori analysis, Knowledge of the Learning Characteristics of Mathematics. Concrete diagnosis of the group around the content to be addressed in the session: strengths, difficulties, ways of interacting with the mathematical content.

- Preparation of the medium. As its name indicates, these are initial activities to prepare and organize the didactic situation that will be developed such as: Questions to visualize the didactic memory, previous knowledge about the
- content, organization and logistics of the group and space around the didactic situation.

- Action phase. The slogan of the activity with the rules, instructions, organization, possible restrictions. In this part we can also observe: the a-didactic situation (autonomy in solving the problem posed based on the knowledge that the student has) returns of the slogan, use of possible didactic variables considering the diagnosis of the students.

- Formulation phase. Activities in which the teacher visualizes the oral or written dissertation to be made by the students to formulate the procedures used to solve the problematic situation posed.

- Validation phase: This section is related to the mathematical practices. In this phase the students, with the guidance and intentional management of the teacher, validate the procedures used to solve the problem, it is a space for analysis and discussion of the procedures used, that is, the procedures are validated as a group and this allows the construction of mathematical knowledge.

- Institutionalization Phase. This section is related to the epistemological analysis section, in this one the teacher, from the assessment of the learning process, in the different moments of the didactic situation, institutionalizes the valid mathematical knowledge, pertinent and recognized by the mathematical community.

- Evaluation. This is the space where the instruments (rubrics, checklist, products, etc.) that will allow evaluating the knowledge, skills and attitudes of the planned mathematical content, both from a formative and summative evaluation perspective, are placed.

The Theory of Didactic Situations (TSD)

In addition to what has already been mentioned in previous paragraphs regarding the TSD, Brousseau's (2007) Theory of Didactic Situations is a scientific instrument that aims to improve the teaching and learning of mathematics. It assumes that the learner learns by adapting to an environment that presents contradictions, difficulties and imbalances.

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The theory allows understanding the interactions between the teacher, the student and mathematical knowledge for the construction of learning, in which the students themselves reveal the characteristics of the situations they face.

According to the author, the "didactic situation" is the medium in which the subject interacts to acquire knowledge, which is designed and manipulated by the teacher, where the student takes into account the resources (previous knowledge) he/she has to achieve them and "the medium", the circumstances in which the subject is immersed.

Methodology

The methodology of this research is case study (Stake, 1999), defined as "the study of the particularity and complexity of a singular case, in order to understand its activity in important circumstances" (p. 11).

The same author mentions three types of case studies: intrinsic, instrumental and collective case study. For this research article, an instrumental case study is taken up again; this type of case study is carried out in response to the need for a general understanding, which is possible with the study of a particular case.

By means of this methodology applied in the research, it is possible to know the strategies that the teachers of the normal school propose to their students, students in teacher training, for the appropriation of the design of efficient mathematics planning. All this will lead us to have a general understanding of the implications that lesson plans have on the teaching work, consequently, on the learning acquired by elementary school students in the subject of mathematics.

Research Assumption

Based on the above, the following research assumption can be contemplated:

It is considered that the strategies used by the teacher trainers of the Escuela Normal Rural "Gral. Matías Ramos Santos" de San Marcos, Loreto, Zacatecas in the second semester students of the degree in Elementary Education favor the appropriation of the didactic devices of mathematics in the topic of fractions, besides improving the didactics they implement in elementary schools from the strategies they develop in their sessions.

Research design

To understand the way in which teachers guide their students in the appropriation of didactic planning in mathematics in the topic of fractions, an interview was applied to the teacher of the mathematics course, in which questions are asked in which the teacher reveals strategies used to develop in students the competence of planning based on pertinent didactic devices for the teaching of mathematics.

From the course on planning and evaluation for learning, a diary of two class sessions was obtained where elements that are considered in the planning are discussed, data that were recovered by the students from their regular teachers when attending the observation visit.

From the products obtained (diaries, letter, students' products, planning) we will analyze the strategies implemented by the teachers, the importance they give to planning and the elements they take into account for its design.

Results

The importance of planning in teacher education

In the course for the training of Primary Education graduates "Planning and evaluation of teaching and learning" activities were carried out with the purpose of having students design planning with theoretical-methodological foundations as mentioned in the course syllabus: Its purpose is that teachers in training build solid frames of reference to sustain didactic interventions appropriating theoretical-methodological foundations regarding planning and evaluation (SEP, 2018b).

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One of the activities "Planning, interview analysis" consisted of designing and applying an interview on aspects of planning and evaluation (importance, process and elements of these). It was applied to students from the institution's major academies (2nd, 3rdand 4th grades) and practicing teachers. After each student elaborated and applied his or her interview script, the answers obtained by teams of five members were analyzed by means of a table. The analysis considered questions, the number of responses that yielded similar data, the responses themselves, and some added their personal conclusions.

4. Do you think planning is important?	2 questions with similar answers	Yes, because it is the main basis for the class to flow as we expect, it is the way to organize what we want to achieve with the students and how we are going to achieve it. Yes, since it helps me not to improvise what I want the students to learn.	Planning is undoubtedly one of the most important stages in the educational process. This is the first step to achieve complete and effective learning. With good planning, the results are much more predictable and therefore it is a good omen or, there is a greater possibility of achieving a satisfactory evaluation.

Figure 1 Importance of planning. Analysis of interviews
Source: Own elaboration

The previous activity corresponds to one of the suggestions provided by the course. Apply to basic education teachers an interview in which they recover the procedure they follow to plan and evaluate, the factors or elements they consider, as well as their importance (SEP, 2018b). In the one implemented by the teacher, the teacher also takes into account students in higher grades higher grades who surely observe a broader knowledge.

The work is addressed in one of the modalities in which the course mentions: collaborative learning. "Students work in small groups in order to maximize their opportunities to intervene in addressing a learning content; thereby intensifying the personal experience of learning" (SEP, 2018b, p. 11). After individually retrieving the conceptions of peers and teachers, the opportunity is offered to strengthen their perceptions by contrasting both the correspondences and the new information obtained by their other peers.

The students concluded that planning is one of the main tasks of the teaching function, given that it favors learning in students to a greater extent.

In the products, they state that planning is fundamental in the teacher's work, which implies designing learning strategies, organizing activities to achieve an objective and avoiding improvisation, which requires considering several aspects. It is mentioned that the aim is to comply with what is stated in the Plan and programs of study (approaches, competencies, expected learning) and to consider materials and resources that allow it, time, The students' previous knowledge, the context in which they develop, their motivations, interests and evaluation strategies to assess the learning they obtain.

It is necessary to take into account what is stated in the study programs, since these contain the graduate profiles of the subject that will be formed with the education we provide. These offer the approaches of the subjects, competencies to be favored, the expected learning to be acquired, so they guide the teaching practice, "they constitute the guiding axes of planning" (SEP, 2011, p. 9) that, although some of them are presented in a broad sense (profile of graduation), all of them are presented in the same way (profile of graduation). (graduate profile), everything is the basis for obtaining effective lesson plans.

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In the programs of study, the goals to be achieved are presented. The competencies for life and the traits of the profile of graduation (what they will consolidate throughout basic education). The competencies of the subjects refer to the skills, knowledge, attitudes and values that will be acquired in each of the subjects taught "implies knowing how to do (skills) with knowing (knowledge), as well as the valuation of the consequences of that doing (values and attitudes)" (SEP, 2011, p. 29).

The curricular standards on which external evaluations are based to assess student learning "referents for the design of instruments that externally evaluate students" (SEP, 2011, p. 42). The organization of learning (axes, areas, topics, contents), the expected learning that indicates the achievement indicators of what students should acquire (knowing, knowing how to do and knowing how to be), and the learning contents, aspects of the expected learning that "indicate in a specific way the learning that students should achieve" (SEP, 2011, p. 11).

All of the above are mentioned as necessary for the design of the plans in the interviews they applied. Undoubtedly, they all respond to the intentionality or objective that we expect, such aspects allow us to address the question "what do we want to achieve? as can be seen, this guides the teacher to immediately establish the learning situation, an element that will allow the significance of the lesson plan, all of this responds to the question "how to obtain the objective? which leads to consider the material and technological resources that will be used (books, cubes, maps, movies), the context (interests, motivations, culture) and their previous knowledge to provide a situated and meaningful learning, since relationships are established with the knowledge that students already have and with the environment in which they live. Another of the elements mentioned in the students' products is the evaluation, which allows to see the progress of the students, which implies, as mentioned by (Monroy-Farias), that the teacher asks himself what, how and when to evaluate, the strategies to be implemented and/or products to be considered, which will help to improve the students' learning and the trainer's practice.

In another of the activities implemented by the teacher, "My ideas, from teachers and authors about planning", they review bibliography both from the course and from other sources to build a frame of reference for planning and evaluation, a suggestion of the course (SEP, 2018b). In a table they capture their own ideas they have about planning and evaluation (importance, elements, process), once they have acquired the information from the members of the other academies and teachers, they also integrate the opinions of their head teachers (teachers in charge of the group they attend in their observation days), and theoretical referents provided by the trainer teacher, in addition they ask the students to look for more on their on their own. This allows them to base the answers of their classmates and teachers, give them meaning and accept them in order to put them into practice when designing lesson plans.

In their opinions, from teachers and theory, they recover aspects that have already been mentioned, although new ones emerge. One student recalls the following:

Planning and evaluation		
Planning		
Previous ideas about planning	Definition of the teacher	What the theory tells us
Organization of the contents to see during the class. Taking into account times, days, space and number of students.	Head teacher. What I define as the preparation of our pedagogical work, several elements are taken into account, such as: expected learning, strategies, learning environments, as well as the characteristics of both the student, as well as their social and family context. teacher 2. Planning is the way to organize a teaching process.	Didactic planning constitutes a proactive activity in which the teacher expresses his mastery and perspectives regarding the curriculum: he considers his goals, approaches, thematic contents, times, resources, and confronts these elements against the potentialities and forms of learning of his students and the particularities of the social and cultural context in which they are registered.

Figure 2 Importance of planning. Theoretical reference
Source: Own elaboration

He states that planning is the organization of the teaching process in which the curricular elements of the curricula (goals, approaches, contents, resources) are related to the characteristics of the students (context, interests, motivations), so the teacher must know and master both what the plans and programs propose and his students. (Monroy-Farías, 2009) points out that the teacher must have disciplinary, pedagogical and attitudinal mastery that allows designing the planning effectively in order to favor the development of the students. As mentioned, it is necessary for the activities to be coherent, focused on the curricular elements of the study plans, to understand the content to be taught and the way in which the teaching-learning process is carried out, so that it is not only perceived as a permanent activity of the teacher, or an administrative requirement in which actions are simply organized in a document or format "what matters is that the activities to be performed, the resources and strategies to carry them out, are consistent with the approaches of the subjects, as well as the development of competencies in students" (SEP, 2011, p. 13). 13).

In the class diary of the teacher trainer "How teachers plan", it is mentioned that planning is not always carried out as planned. The diary consists of two sessions in which the manner, procedures and elements considered by the teachers of normalistas, recovered in a text obtained by attending an observation visit to the elementary school, are discussed. Activity posed by the study program with the purpose of completing the answers of the interviews they applied and contrasted in the tables. To perform their text involved observation, as well as analysis of lesson plans and children's products (SEP, 2018b).

The following line is shared in the teacher trainer's class: "Purposes coincide. Planning does not always go as planned...it should" (Classroom journal).

The previous record coincides with what the Study Plan states, it mentions that putting planning into practice does not ensure that it will happen the way it is designed because there are situations that cannot be predicted, however, it allows acting in a critical and effective way to achieve the objective:

Planning should be understood as a roadmap that makes the teacher aware of the learning objectives he/she is looking for in each session. learning objectives sought in each session and, even if the classroom situation takes a relatively different course from the one planned, knowing clearly what the specific the classroom situation may take a relatively different course than planned, knowing clearly what the specific objectives of the session are will help the teacher session will help the teacher to lead the students' learning process. (SEP, 2017, p. 121)

The Theory of Didactic Situations in the training of future teachers.

At the Escuela Normal Rural "Gral. Matías Ramos Santos", the Theory of Didactic Situations (TSD) is favored as a basis for the teaching-learning process of mathematics. One of the teacher trainers commented the following:

I had the opportunity to approach the concepts of the Theory of Didactic Situations (hereinafter TSD) that from the beginning seemed interesting to me, what is more, I was enthusiastic about them. I have no doubt that they work in the classroom and are relevant to better understand what children learn or could learn. (Interview with teacher trainer).

Likewise, the Educational Model of the Escuela Normal Rural mentions:

Is it not time to choose the didactics of mathematics as the axis of the initial and continuous training of elementary school teachers? The case of teacher training colleges is different, since the content of mathematics teaching courses is implicitly oriented from this perspective (Hernández-Gutiérrez, et al., 2021, p. 27).

However, TSD "provides a better understanding of the possibilities for improvement and regulation of mathematics teaching" (Brousseau, 2007, p. 12). It seeks to enhance teachers' teaching and learners' learning by understanding the interactions between the learner, teacher and content (performances of the former and how the latter is transformed).

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Teacher educators teach the contents of mathematics courses based on TSD and encourage their students to take the same perspective to elementary schools, although in the Arithmetic course syllabus of the normal school, as well as the elementary school curriculum corresponding to the subject of mathematics do not specify that it refers to it, however, both the course guidelines to address the contents of fractions and the approach to the subject in elementary schools make reference to it.

In the syllabus of Arithmetic. Decimal numbers and fractions suggests the teacher to develop activities from the approach of a problem making use of materials and resources, the students will have to solve it with their own means, then proposes to share the way they did it and end the class with the participation of the teacher providing "explanations of greater depth where it is clear to the students the rationale and the meaning of the mathematical content" (SEP, 2018c, p. 11). This in order for them to obtain "a deep knowledge of mathematics" (SEP, 2018c, p. 6) which will imply knowing what to teach (content) and how to teach it (Didactification).

The above will give the possibility to teachers in training to design strategies based on what the curriculum poses. The approach to mathematics consists of "using sequences of problem situations that awaken students' interest and invite them to reflect, to find different ways to solve problems and to formulate arguments that validate the results" (SEP, 2011, p. 65). Both work strategies (way of approaching the content of teachers in training, as well as primary school students) may involve the same methodology. It refers to working autonomously, in this way different procedures will emerge to solve the situation, then be checked by themselves and finally account for the formal knowledge by the teacher.

Broadly speaking, the approach of the subject proposes to design interesting and problematic situations for students, to solve them autonomously with the use of previous knowledge, as well as to communicate mathematical information, validate procedures and handle techniques efficiently.

The TSD favors the understanding of the way in which the teacher and the student should intervene with the content in order to acquire learning in response to the approach.

TSD presents the phases of action, formulation, validation and institutionalization. The first involves responding to the situation in a personal way without the teacher's help in relation to the knowledge at stake (a-didactic situation). The second is to formulate a message for a student or group of students to be able to solve it. The third is to validate or reject proposals (successes) for this situation. Finally, institutionalization, when the teacher makes known the knowledge that was put into play, the official part of the content. Each of the phases contributes to what is expected to be developed in the students, construction of their own learning, finding a variety of strategies, communicating and validating their own actions as well as those of their classmates.

For the students in training to understand what each of the phases implies, to develop them effectively, the teacher trainer suggests that in order to appropriate the TSD they first build spontaneous analyses of what they observe in classes of classmates or other teachers. They identify what happens in class (indiscipline, distraction, disinterest, learning achievement, good attitude...) which then leads to recognize why it happens, the didactic phenomena, at which point they acquire the need to address them since they happen for a reason. In the following lines the teacher trainer mentions:

The use of concepts has made it possible to overcome spontaneous visions ("now the children were more eager to work", "this problem was easily understood by the children", "the teaching strategies now worked for me", etc.), so that the students begin to identify that classroom events have a "logic" that needs to be discovered and that very few things happen by chance. teaching strategies now worked for me", etc.), so that the students begin to identify that classroom events have a "logic" that must be discovered and that very few things happen by chance or by chance. (Interview with teacher trainer).

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After the spontaneous analyses, the concepts of the theory are reviewed in view of the need to know them in order to allow, to a greater extent, the development of the students in the primary schools. school students. In addition, we interpret records or videos, our own or not, and design lesson plans where they are present.

Once the limits of spontaneous analysis have been defined, it is a matter of interpreting the classroom records or videos (their own or those of others) and designing lesson plans where they are present. class videos (their own or others'), as well as the design of didactic sequences (Once the limits of the spontaneous analysis have been delimited, it is a matter of interpreting the records or class videos (our own or others), as well as the design of didactic sequences ("class plans") from a didactic point of view and trying to construct arguments based on what allows us to observe concepts such as didactic contract, return, didactic variable, didactic moments, knowledge, errors (semantic or syntactic), didactic memory, ... And here the panorama widens to include the Theory of Didactic Situations and other theories. (Interview with the teacher-trainer).

In planning or class sessions, they analyze the didactic phenomena that are presented, how they begin to approach the topic, its development and closure, they recognize the characteristics that are considered and which of them belong to the concepts proposed by the TSD. This will lead them to design their own planning in which the strategies they design are justified by this theory. But the acquisition of concepts does not end with the design of lesson plans; they are put into practice.

Applying the lesson plans favors understanding the concepts they study, as mentioned in the Educational Model of the teacher training college according to Astolfi (2008) cited by (Hernández- Gutiérrez, et al., 2021) "it is too often repeated that future teachers do not "see" what is proposed to them during a training process, due to a weak relationship with practices" (p. 32). Often, not making sense of what is taught in schools leads to not applying it, to forgetting it, to downplaying its importance.

As opposed to verifying that such things happen for a reason, this leads to recognizing it and considering it in the teaching work in order to comply with it (favoring the development of students).

The teacher, in view of the way of working that he follows so that his students appropriate the concepts that the theory handles, mentions that, just as it is not appropriate in school contents, such as fractions, to start from symbolic representations, which leads to not understanding their meanings, neither should one begin by approaching the concepts of the theory, but rather recover their spontaneous analyses that would correspond, in the work with fractions, to the informal strategies they use to solve the situation, to later institutionalize the knowledge of which they make use.

An analogy is pertinent here: just as it is not convenient to start from the symbolic representation of the fraction (to institutionalize this representation prematurely), it is also not convenient to propose the concepts of TSD from the beginning, but to allow the "spontaneous analyses" to appear (which would be the equivalent of informal strategies in solving a problem) and then review the concepts (Interview with the teacher trainer). (Interview with the teacher trainer).

It could be said that teachers teach TSD concepts based on the methodology proposed by the TSD. For their appropriation, the previous knowledge of the students is considered, to know why these events arise and how the teacher should guide his students, to favor justifications and arguments, in order to finally review the concepts. Likewise, they are reinforced, but looking for the students to give meaning to each one of them, so they review didactic plans as well as design their own lesson plans in which they will have to justify why each one of their moments will be developed in that way and; finally their implementation, which as mentioned by the teachers, allows them to a greater extent to appropriate them, to value their interventions and the children as important factors in the learning that they manage to acquire, both themselves and of course the student.

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In their planning, the students add phases: action, formulation, validation and institutionalization, typical of the Theory of Didactic Situations. In a first moment and as an example of what has been analyzed, they present the action phase and write the slogan to enter it. In the draft that one of the students in initial training made, she states the following: Children take out your math book on page 145 and in teams of 3 solve the problems. In response to this, the teacher trainer makes the following comment:

But, what is your slogan? Here the teacher is supposed to explain the situation and what the children are expected to do, the problem is posed, the unknown question is stated, etc. Then, the return of the task is established or what the teacher will do in case he/she is asked about the procedure to solve the problem is written. (Suggestions made by the teacher trainer in the lesson plans submitted by a student).

In the evidence, the teacher trainer suggests completing the instructions, mentioning to the students the situation they are going to solve, the problem, its unknown, its return and the way in which the teacher will act if the students ask him/her how to solve it. The slogan must consider the rules of the game; conditions to solve it and that these are understood by the students, it must also be a problem; which implies that it cannot be solved with the previous knowledge they have but that these are useful to achieve it, and allow the students to decide which strategies they will follow to answer it. After this, "to make a triple return: of the rule of the game, of the problem and of the decision" (Centeno, 1997, p. 116) to make the students responsible for carrying it out on their own, personally choosing the procedures to follow, making use of their previous knowledge without the participation of the teacher in terms of the knowledge to be put into play, so it does not imply dissociating themselves from the activity. This will be the moment when the students accept the learning situation. The didactic contract is established, they are clear about their acquired obligations, what the teacher expects from them (Brousseau, 2007).

When they accept the slogan, they will begin to solve the problems. 3 problems. According to the book for the sixth grade teacher (SEP, 2014) the challenge they chose corresponds to the content of solving problems involving a division of a fractional or decimal number by a natural number, with the didactic intention that students find a procedure to divide a fraction by a natural number, when the numerator of the fraction is a multiple of the natural number and notice that it is enough to divide the numerator by the divisor. One of the problems (number 3) is the following: In the hardware store La Tía Adriana, they emptied 6/7 of a can of paint in 3 equal containers, the same amount to each one. What part of the paint was emptied in each container? This problem, besides posing a situation of the real context of the students, allows to fulfill the didactic intention (the natural number is a multiple of the numerator of the fraction and implies a division).

When starting to solve the problems, the students will enter the action phase. They will act in the environment (situation that is presented to them) autonomously for something that will lead them to make decisions without being aware of them and these will provide them with information to guide their next actions (Brousseau, 2007). Students will read the problems and solve them based on their previous knowledge, where it may happen that at some point the strategy does not work for another problem and they will have to modify their actions, realizing that what they did in the previous problem must also be modified (Brousseau, 2007).

In the previous problem must also be modified. For example, in this challenge, according to the previous considerations offered to the teacher, a strategy of the students may be (in the first problem) that they believe that the solution is to divide both the numerator and the denominator by the divisor (4/6 by 2) but when moving on to the next ones that strategy will not be useful since dividing the denominator by the divisor gives a decimal number.

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During the situation, questions arise from the children to the teachers to tell them what they have to do where many times they are given the answer, however, it is what the teacher mentions: "write what the teacher will do in case he is asked how to solve the problem" that is why the teacher's intervention is important, he must give feedback to the students which implies not indicating how to solve it and these "are developed during the whole didactic situation and not only in the establishment phase" (Panizza, 2003). As mentioned, it is important that the teacher takes into account the possible doubts, strategies, complications that may arise in the students in order to know how to deal with them so that they themselves build their learning.

Conclusions

One of the purposes of the case was to answer:

In what way the orientation of the teachers of the Escuela Normal Rural "Gral. Matías Ramos Santos" of San Marcos, Loreto Zacatecas allows the second semester students of the degree in Elementary Education to appropriate the didactic planning of mathematics in the topic of fractions, in addition to improving their teaching strategies in elementary school?

Before it, it was found the implementation of various activities by the teacher trainers that do allow observing that the strategies designed have a significant impact on the training of teachers in initial training, which allows confirming an important influence from the design of teaching tasks, towards teachers in training.

It was found that, for the design of the learning situation in the mathematics lesson plans, they are based on the Theory of Didactic Situations. It consists of the students themselves constructing the learning by interacting with a medium (material or symbolic) without the teacher's intervention in terms of the knowledge they must bring into play.

Knowledge that they must put into play. In order to enter the learning situation they will make use of their previous knowledge and the teacher establishes the didactic contract to make the student responsible for solving the situation with his or her own means. The situations in which they will be immersed are action, formulation, validation and institutionalization. The first involves the student acting in the environment to provide a solution by making his or her own decisions. In the second, formulating a message to another subject or subjects in such a way as to enable them to act efficiently in the situation. The third is to provide an affirmation on how to act in the environment and for this to be validated or rejected by his or her peers. The previous ones are developed without the direct intervention of the teacher. The teacher participates by giving feedback on what is manifested during the development of these activities (doubts, strategies, mistakes), without providing the actions to be carried out, but rather the students themselves discover them. Institutionalization requires the teacher's intervention to account for the formal knowledge that was addressed, as well as to establish relationships with what happened during the class.

To appropriate this theory, they go to observe classes in elementary schools. They analyze what happens, which leads them to the need to plan a class and enter the concepts of TSD in order to favor the learning, knowledge, skills and values set forth in the Plan and programs of study. To reinforce this, they review, design, argue and implement lesson plans.

Regarding the acquisition of knowledge of fractions, they acquire it according to the TSD, making use of previous knowledge, providing solutions with their own means, arguing and validating the strategies they implement, and giving the status of the knowledge that was addressed by the teacher who trains them.

Regarding the appropriation of the contents of fractions, students acquire them by solving the situations posed by the teacher trainer autonomously, share, argue and validate their strategies to finally reach the formal knowledge provided by their teacher.

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Regarding the appropriation of the lesson plans, as mentioned in the previous paragraphs, the teachers of the normal implement strategies that allow their students to value the didactic planning, recognize the elements that must be considered and design them in a conventional way, in such a way that they manage to to enhance learning in elementary school students. However, the students have areas of opportunity, for example, the way in which they design the moments of the TSD. It is worth mentioning that they are in the initial stage of their training, they have their first approaches both in the design of planning and in its implementation.

Finally, as mentioned above, the study recovered the way in which teacher educators guide their students in the didactic planning of mathematics, which opens the way for future researchers interested in the subject to continue in this line. Among some aspects would be to consider the way in which students in the first grade of the bachelor's degree and how they consolidate it at the end of their training, or the way in which they plan in each of the grades (1st, 2nd, 3° and 4°), the different teaching tasks and their transcendence throughout the undergraduate education, as well as to check the effectiveness of the development of the TSD against or in complement with another methodology such as the MTSK (Hernández-Gutiérrez, Pacheco and Lizarde, 2022).

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