Context of Contextualized Teaching Situations in the Initial Training of Mathematics Teachers at the Popular University of Cesar

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Abstract

The purpose of this research is to reflect on the role of the context environment of the contextualized situations of teaching school mathematics, which make significant contributions to the initial training of the mathematics teacher at the Universidad Popular del Cesar-Valledupar-Colombia, where the informants were the twelve students enrolled in the subjects of Elective III, Mathematics Didactics, History and Epistemology of Mathematics and Degree Work II, of the VI, VII, VIII and IX semesters respectively, of the Bachelor's Degree in Mathematics program; assigned to the Faculty of Education, of the Universidad Popular del Cesar. The study was situated in the qualitative paradigm, under the epistemological approach of sociocultural constructivism, with the recapitulations of the foundations and orientations of the phenomenological-transcendental methodology. It is concluded that it is feasible to change the mathematics master class for a space where students can interact in the teaching-learning process, with the necessary knowledge to understand the messages of the context of the habitat of the subject who learns; and for this reason, the relationships of the trio: Teacher-School Mathematical Knowledge-Students and these with the context can always be placed in the context of mathematics education.

Keywords: Contextualized situations, mathematics teaching, interact, context, habitat.

1. Introduction

In the first quarter of the twenty-first century, the percentage of errors, difficulties and obstacles of the ontological, epistemological and didactic order is representative Epochal (Garcia, Cifuentes, & Bolaño, 2018), which lead students to drop out and to a marked unfavorable

tendency towards the structures of school mathematics; implied that the school as a glocal and globalized educational system, has not been able to give a contextualized meaning to the sequencing of school mathematical knowledge, proposed in the subjects of the curricula of each Educational Institution (EI); since, decontextualized teaching based on memorization and directed towards logarithmic exercise continues to predominate; thereby provoking cognitive conflicts in the synthesis, recapitulation, argumentation, reflection, understanding, appropriation and interpretation of teaching processes in contextualized situations of the daily life of their habitat.

Therefore, the Colombian education system has not been able to comply with the demands made by the Colombian Ministry of National Education; which demands from the community of mathematical educators attached to the different Faculties of Education, the comprehensive training of a mathematically competent Human Talent. This, as a response to the improvement of the contextualized teaching process of mathematics, which allows reflecting on the role of the environment of the context of the contextualized situations of teaching school mathematics, which make significant contributions to the initial training of mathematics teacher, of the Popular University of Cesar-Valledupar-Colombia (UPC).(MEN, 2006)

2. Bibliographic Review.

The research references that guide this work revolve around the context of the descriptive, interpretive, contrastive and applicative explorations that, since the beginning of the dissimilar historical epochs of humanity, have had the didactic obstacles of the mathematics teacher in the teaching-learning process of mathematics, through the reflection of the role of the environment in the context of contextualized situations of teaching school mathematics, which make significant contributions to the initial training of mathematics teachers, of the Popular University of Cesar-Valledupar-Colombia (UPC), inexorably oriented to the appropriation, deconstruction and social construction of mathematical knowledge, as a primitive and polyvalent activity, with different supports, routines and epochal interpretations.(Garcia, Cifuentes, & Bolaño, 2018)

However, the globalized society of the 21st century of the 21st century of the Mathematics Education (MA) research school knowledge requires the communities of the Educational Institutions (EI) not to continue to turn their backs on the celeric and unbridled changes and competitive developments of the knowledge society. On the contrary, it allows mathematical educators to generate knowledge of specific and significant school knowledge, contextualized in the real situations of the students, where the teaching process takes place in the context of the sociocultural interactions of the teacher, the school mathematical knowledge, the student and his social, cultural, economic and political fabric so that work in the classroom by small groups is one of the modalities of predominant work. (Minciencias;, 2023) (Brousseau, 2007)

In concomitance with the above, it can be deduced that the object of the teaching of mathematics in the XXI Century is to institute in direct connection with the sociocultural and economic fabric of the Universe, and this with the environment of its constructs, the sequences of school knowledge and the context, which is what allows it to perceive the true contextualized meaning of learning. in daily life and other intrinsic sciences in the environments that situate the student

with his ecosystem, which in unison guide the meaning of the teaching process of schooled mathematics.

Consequently, one of the problems encountered in the journey of learning and assimilating the behavior of the structures of the (MS), immersed in the case of the contextualized teaching situation in the initial training of the mathematics teacher of the (UPC), is that it is difficult for the student-teachers to understand its basic foundations, because the relationship of school mathematics with the behavior and functioning of the real world is not immediate. (Gimeno, 2005)

In this sense, there is in the history of humanity, from the Babylonians to the first quarter of the twenty-first century, the hypothesis that it is enough to know the discipline of mathematics for its teaching; since today, there are two clear agreements in the educational community: 1. It is a necessary condition to know Mathematics with a broad mastery of the field; 2°. Knowing only Mathematics is not enough to be able to guide and manage its teaching in a mathematical context. (Pochulu & Rodriguéz, 2013)

That is to say, the teachers in charge of orienting, guiding and managing school mathematics in significant contextualized sociocultural fabrics, act as if their training corresponded to professional mathematicians and not as guides of a process of construction of a human, social, cultural, political and economic nature of school mathematics and its relationship with the daily life of its contextualized globalization. endowed with a significant high degree of teaching-learning, for its glocal and global educational communities.

From the point of view of professional mathematicians and their imitators; (Royo, 2017)(Guevara, 2019), state that in From these perspectives, it is evident the high percentage of difficulties, failure and demotivation towards the teaching-learning process of mathematics; which is not exclusively due to the student, it is also influenced by the meaning that the school gives to the teaching of mathematics, to the motivation towards the subject, among others; since teaching based on memorization and algorithmic exercise predominates, hindering the understanding of the interactive usefulness of learning in everyday life.

In addition, the way of explaining mathematics or understanding it is not related to, much less corresponds to, what the student observes and experiences in their reality of their ecosystem; therefore, it is presented in a decontextualized and static way, which causes anarchy and confusion about the advantages and prerogatives of mathematical learning. (Guevara, 2019)

It should be noted that decontextualized, rigid, doctrinal and axiomatized teaching with unquestionable vision, induces students to comply solely and exclusively with school demands, thus detracting from the link with reality; As a counterproductive effect, it causes the absence and separation of reflection on the interdisciplinary applicability of the integral knowledge of mathematical knowledge immersed in the universe, necessary to understand the messages of the contexts of the prerogatives of the teaching-learning processes of mathematical knowledge with the social fabric of its habitat.

This situation leads to presenting and viewing the teaching of mathematics as homogeneous (the same for all), based only on the exercise of the algorithm; which is promoted and exemplified

by the teacher; therefore, the action of the students is to imitate what is taught; thus evidencing a decrease in the use of contextualized teaching situations linked to daily life. (Beltrán-Pellicer, 2020)

In this sense, the lack of motivation and little use by the teacher towards the foundation of contextualized situations of teaching school mathematical knowledge, externalizes experientially in students the disconnection and decontextualization of the school knowledge that is being taught with the reality of their habitat; therefore, the total detachment of historical epistemological sociocultural structures, from research processes and from the construction and deconstruction of mathematical knowledge, are not present in the contextualized teaching situation of school mathematics, much less its significant contributions to the initial training of mathematics teachers, of the (UPC). Since, students only have the desire to learn in order to move from one course to another, or to meet the demands of the teacher; encouraging this, a null reflection on the benefits and/or usefulness that school mathematics learning provides. (Lerner, 2011)

However, today in the area of the genesis of the epistemological ruptures of mathematics, analyzed and agreed upon by the community of mathematical educators of the first quarter of the twenty-first century, two agreements are established in the educational community, as follows: (Pochulu & Rodríguez, 2015,9)

The first as a necessary condition of mathematical knowledge, for a wide domain of the disciplinary field and the second that distinguishes that mathematical knowledge is not enough, for its management and orientation with a high sense of significance in contexts of school mathematics.

In concomitance with the above, teachers sometimes detract from the contextualization of mathematics teaching, conceiving it as an agreed, harmonized and finished disciplined whole; isolated from interdisciplinarity and integration with the social, cultural, economic and political fabric; that is, leaving aside the fundamental and preponderant role of the interaction of the triad: Teacher-School Mathematical Knowledge-Student with the Environment where the educational act is present.

Hence, according to him, it is necessary to take into account the variables involved in the process of the context of contextualized teaching situations, such as: social and cultural conditions both locally and globally, the type of interactions, the interests that are generated, the beliefs, as well as the economic conditions of the social group in which the educational act takes place. which are determining factors to achieve the meaning of mathematics during the course lived and experienced in the teaching-learning processes. (MEN;, 1998,33)

Therefore, it is necessary to relate the school mathematical knowledge (programmatic contents) of learning, with the daily experiences of the binomial: Teaching Students; as well as to locate the management of the teaching-learning process in a Context of Contextualized Situations of Teaching in Mathematics (SCEM); therefore, emphasizing them in the exchanges of the different perspectives of the interaction of the triad: Teacher-School Mathematical Knowledge-Students, permeated by the typologies of their habitat, leading to a global and comprehensive vision of the

work of the initial training process of the mathematics professor of the (UPC) within and outside the classroom (MEN, 1998,36).

Consequently, they argue that the new vision of the historical, didactic and epistemological evolutions of the different theoretical perspectives of the community of mathematics educators requires today, more than yesterday, the mathematical educator to consider: (Pochulo & Rodríguez, 2015,10)

1. A new competitive behavior and a new attitude towards students; with flexible epistemological, didactic and pedagogical knowledge, according to the different contextualized teaching situations present in their habitat, together with their educational social fabrics; therefore, to the use of the theoretical foundations of the discipline itself, and the didactic knowledge associated with it.

2. In these challenges to math educators, it is expected and intended that they:

✓ To promote and motivate the work of schoolchildren by bringing them closer to the reflection of mathematical work.

✓ They master social, cultural, economic and disturbing aspects of schoolchildren.

✓ Be competitive in the interdisciplinary generation of contextualized environments where the teaching process is present, mathematically rich and enriching.

✓ Design models that adapt to the uncertain and changing teaching-learning conditions that occur in the academic spaces of mathematics planned for this purpose.

All of the above makes it essential for the mathematical educator of the XXI Century, to see from the perspective of contextualized situations of teaching in mathematics (SCEM), the need and purpose of training their students from the interaction with their habitat, for an interdisciplinary integration of knowledge that trains them constructively in the solution of the different problem situations of their environment and in participation with the world of work. as well as for the continuity of higher education. (Pochulo & Rodríguez, 2015,10)

From this reality, it can be interpreted that the function of the philosophy of mathematics accounts for its nature from a broad perspective where the postulates raised in the philosophical schools of mathematics remain in force (MEN, 1998, 34); since today, the need is felt to combine the learning process with external aspects such as the history, genesis and social practices of mathematics, permeated by didactic transpositions, educational and didactic systems and exchanges and integration between the triad (Teacher-School Mathematical Knowledge-Context), with the culture of the society in which it originates; which implies considering mathematics as a cultural subsystem, with characteristics largely common to other similar systems. (Wilder, 2006) (MEN, 1998,34)

Consequently, taking as a reference the above, it should be noted that the changes in the reconceptualization of the understanding and the very feeling of mathematicians about their own work have been causing, in a more or less conscious way, important fluctuations in the considerations about what the teaching of mathematics should be; that is, it is necessary to take into account the different conceptions and perspectives about the nature of mathematics and its

didactic implications, as well as the elements that affect a reconceptualization of (EM) today, of mathematical knowledge and of didactic transposition; as well as the justification and genesis, both of mathematical knowledge, and of the sequences of school knowledge present in the contextualized situation. (Gil & De Guzmám, 1993)

For this reason, this new approach has led to consider that mathematical knowledge is presented in dissimilar forms; since this provides the student and the teacher with a means to organize their activity and accumulate in a minimum of time, a maximum of knowledge quite close to the Scholarly Knowledge (Chevallar, 1998); obviously, connected to the social, economic, political and cultural life of humanity, and all this with its ecosystem, which is used to make certain decisions that affect the community and that serves as an argument of justification for the contextualization of the teaching of school mathematics. (Ernest, 1991)

Three contexts in the teaching-learning process of mathematics.

The context of the teaching-learning process of school mathematics includes not only the physical place, but also the sociocultural aspect where meaning and meaning are built through school mathematical activities and knowledge; therefore, from these spaces connections are established with the daily life of the students, including their families and other activities of the Educational Institution, even involving other sciences with other areas of mathematics themselves. (MEN, 2006,70)

Now, the word context, as used in the Mathematics Curricular Guidelines; (MEN, 1998,36)(MEN, 2006, 70), Refers:

"Both to the broader context and to the sociocultural environment, to the local, regional, national and international environment, as well as to the intermediate context of the school institution, where different situations are experienced and different areas are studied; the same as the immediate learning context prepared by the teacher in the classroom space, with the construction of contextualized teaching situations referring to mathematics, or, to other areas, to school life and the sociocultural environment itself, among others, or, to hypothetical and even fantastic situations, from which students can think, formulate, discuss, argue and construct knowledge in a meaningful and comprehensive way" (pp.71).

In summary, it can be said that there are at least three types or levels of context, which although they are different, are interrelated with each other, which are: (MEN;, 2006;70-76)

1. The immediate context or classroom context, created by the arrangement of walls, windows, furniture and materials, by the explicit or implicit rules with which the class is worked and by the contextualized problem situation planned, organized and presented by the teacher (p. 70).

2. The school context or institutional context, configured by the scenarios of the different daily activities, the school architecture, traditions and the knowledge of students, teachers, administrative employees and managers, as well as by the IEP, rules of coexistence, the explicit curriculum of the different curricular areas and the so-called "hidden curriculum" of the Institution (p. 71).

3. The extracurricular context or sociocultural context, made up of everything that happens outside the Institution in the environment of the local community, the region, the country and the world. It represents a series of elements that refer to the environment in which Human Talent develops (social and cultural), which have an influence on their customs and ways of life, (p. 72).(Weihrich, 1998)

It is unavoidable to conceptualize what is conceived by context; since this term has different meanings and is even visible from different knowledges such as: (Cardozo, Hernández, Vargas, & García, 2018)

Therefore, starting from its root according to it, the term context is derived from the Latin contextus, referring to everything that surrounds, whether tangible or intangible and from where a fact is interpreted or understood. Likewise, he affirms that it is not possible to understand the human communicational dynamics in society if the context is not taken into account. Similarly, it argues that it is impossible to carry out an analysis of reality or statements without taking into account the context in which they are produced, since they are determined by factors that qualify as contextual. Likewise, it presents it as the praxis, the reality or measurement of the world in the process of education for freedom from a humanization approach. (Pérez; Gardey, 2012) (Salguero., 2007)(Berbeira., 2008)(Freire, 2005)

(Cusel, Pechin, & Alzamora., 2017)In the same order of ideas, they review in detail the main areas of influence related to the social development of children and adolescents, where the context stands out as a founding part, highlighting the family, the school environment, the media, the economy, culture, interrelations, among others, which influence the school and condition its administrative management and the work of teachers. As well as internal factors, such as resources, physical and technological infrastructure, school actors, among others.

(Rodrigo., 1994)In this regard, he considers that the context corresponds to the complex set, in which the construction of knowledge occurs. In this sense, context corresponds to the complex set of facts that are part of the environment or a given phenomenon; These facts are considered factors that influence directly and indirectly and can be internal or external to the situations under study. Finally, it contextualizes the term within education, stating that it is necessary to have stages of organization, that is, that the Educational Institution itself provides spaces and moments of knowledge of the circumstances in which students develop, in order to carry out a successful educational intervention based on the contexts. Therefore, they affirm that there are a series of exogenous and endogenous variables that affect the stereotypes or circumstances of the context where the development of the educational act is present. (Gairin., 2004)(Vásquez & Martínez., 2008)

In conclusion, taking into account the aforementioned perspectives, context can be understood as the combination of physical or symbolic scenarios or situations that surround an event, which are determined for the purpose of interpreting and understanding it. However, these conceptualizations offer the opportunity and quantifications to deeply analyze the contextual factors that influence the contextualized teaching-learning process.

In other words, the context is a set of circumstances or situations circumscribed during the communication process, where the sender and receiver are producing the message. For analysis,

according to(Martínez, 2012) (Watzlawic, Beavin, & Jackson, 1968,48), it is necessary to consider the social, linguistic, cultural system, and the questions Who?, How? and When? Therefore, contextualizing refers to placing in context a situation, a fact or a source or document, which has been received in isolation and separately from all those elements that surround it.

Contextualization is also understood as the search for the meaning of knowledge from contexts of the world or society in general; that is, it is to lead the student to understand the relevance of the application of knowledge, to understand the facts, trends, phenomena and processes that surround him. Therefore, contextualization is established as one of the principles for the organization of the curriculum through themes of the students' experiences. In the same way, the context is conceived as the necessary and sufficient knowledge of the world, which allows us to understand the messages of the interlocutors, because every statement is always situated in a specific context; Surely it is not possible to say anything outside of it. (Wartha & Falojini-Alário, 2005)

For , the term contextualization is used with different meanings: 1). Contextualization as a teaching-learning strategy; 2). Contextualization as a scientific description of facts and processes that assume the student's daily life; 3). Contextualization as the development of attitudes and values for the formation of a critical citizen. Meaning by this, that in disciplinary teaching there is a need to articulate scientific knowledge with educational, ethical and humanistic values that allow us to go beyond the simple learning of facts, laws and theories. (Santo & Mortimer., 1999)(Wartha & Falojini-Alário, 2005)

(Delizoicov, Angoth, & Pernambuco., 2002)Therefore, for him, the differentiation between contextualization in teaching and the teaching of sciences related to everyday life implies that the teaching of science in everyday life deals with scientific concepts related to the phenomena of daily life. In this case, the approach continues to focus on scientific concepts. While contextualization addresses the teaching of science focused on its social environment, including economic, social, and cultural interrelations, among others. In this way, the use of mathematics education is used to better understand the world in which we live, with the aim of becoming aware of the implications of our actions on reality, and not simply using examples of this daily reality in the search for a better understanding of scientific concepts.

Therefore, the mathematical context represents an argumentative and reflective area where the (SCEM) is developed, which include the sequences of school mathematical knowledge; its objective being the formulation of contextualized problematic teaching situations, which lead to the critical-reflective-argumentative study, of a rigorous mathematical invariant, together with the set of their school knowledge to present solutions based on an enveloping central question.

For this reason, the SCEMs give meaning to mathematics in EI; since for this it is necessary to structure the process in five steps: Formulate and solve problems; to model processes and phenomena of reality; communicate; reason; and finally formulate, compare and exercise procedures and algorithms; additionally, to take into account the three components proposed by him: Numerical-Variational, Metric-Geometric and Statistical, contemplated in the five thoughts of the Mathematics Curricular Guidelines (L.C.M) proposed by him. (MEN;, 2006;70-76) (MEN, 1998,74-92)

In the same order, a situation can be understood as a sociocultural or natural fact or event that occurs in the student's environment, which is transformed into a teaching situation, when it is used for academic, pedagogical and didactic training purposes; that is, it is brought to the educational act planned by the teacher to support and leverage the construction, deconstruction and epistemological historical reconstruction of knowledge, present in the episode of the teaching-learning process of significant typologies through systematic activities, articulated in a contextualized teaching scenario. (Sarmiento, 2007)

Therefore, the Contextualized Situations of Teaching in Mathematics (SCEM), they can be simulated, reconstructed, staged or analyzed through didactic strategies such as: videos, films, informative notes, photographic records or visits to the scene of the events. Therefore, in order to (Obando & Munera, 2003),all the scenarios of the educational system of their habitat can be used to generate knowledge, develop competencies, skills, attitudes and values; providing the student with strategies that allow them to develop competencies in mathematics and for mathematics.

In this regard, cited by , confirms that a (Frade, 2008)(Herrera, Añez, & Colina, 2023) contextualized situation, requires the action of all participants of the educational community, where the teacher, in addition to supervising, promotes spontaneous participation in the teaching-learning process in students. Therefore, it has an implicit inclusive didactic sequence, which logically circumscribes systematic and contextualized activities, to resolve the cognitive conflict that arises in each contextualized teaching situation.

In conclusion, the contextualized teaching situation implies that the student is in direct contact with his/her reality, so that he/she reveals, shares, discusses and reconstructs new meanings; since, in the sociocultural interaction with the environment, he/she is sensitized to the problems of the environment; therefore, the methodological foundations used cannot be the traditional ones, on the contrary, their typologies are broad, integral, fruitful, constructive, productive, active, proactive, versatile, dynamic, dynamizing, hermeneutical, interpretive, phenomenological-transcendental; because they allow all the actors involved in the teaching-learning process to address the mathematical knowledge of school knowledge in a holistic way, through the real problems of their habitat.

Contextualized situations for the teaching of school mathematics.

The new knowledge society of the 21st century requires Educational Institutions (EI) of different levels and orders to train human talents that respond to the social, cultural, economic and political demands of their environment with a broad, interactive and interdisciplinary vision of the knowledge addressed in the classroom, especially the knowledge of mathematical knowledge. endowed with a humanistic-social capacity, which allows the student to face and solve problems of their sociocultural fabric with the least possible difficulties.

For this reason, in their training processes it is necessary to develop the different competencies, which allow them to appropriate and reach the different levels of knowledge, to apply them in the school environment and in their daily lives, in order to provide them with the necessary elements for the effective solution of situations that arise throughout their lives. be it socially and individually. (Izquierdo M. , 2013)

In view of the above, the SCEMs are related to the previous knowledge and social practices carried out by the students; since they allow them to inquire about what happens in real time, allowing them to experience their learning in a meaningful sense with physical objects perceptual from their own environment, even in virtual reality, due to the process of interaction with new communication and information technologies.

In the same sense, (Acosta & Pacheco, 2020)Claim that, for the process of identifying a contextualized teaching situation, it can be carried out in two ways, firstly, when the teacher's experience as a researcher is turned towards the preparation of meaningful activities arranged for the group; therefore, attending to their needs and logically validating the responses of the situation during the didactic implementation in the classroom (p. 278).

Second, when teachers or researchers identify activities associated with a social practice, in which one or more natural phenomena occur, validating learning with the application of questionnaires related to them, in order to determine if they are relevant to the group of students, taking the input from the results to design the teaching situation (p 278).

For this reason, the identification process of a contextualized teaching situation is aimed at exalting the relevance of strengthening in teachers and students the capacity for analysis, reflection, argumentation and criticism as part of professional growth, whose flows will be present in improving their practice. Since, through the teacher's reflection, it is possible to overcome the mere passive adoption of the social construction imposed by the curriculum, in order to understand reality; as well as its dynamic and complex nature. (Abreo, 2002)

Finally, the (SCEM) they involve the challenge of relating the contents of the school mathematical knowledge that is taught, with the interests of the students and the significant facts for them; logically, this with emphasis on a process of socializing construction, which allows appropriating the context through reflection, argumentation and intervention of the scenario of which it is part. (Arias, 2020) (Blomhoj, 2008)

Therefore, the guiding principle of the (SCEM), is based on the context, since it allows us to visualize the common thread of the proposed activity to be worked on, which is to introduce and develop the school conceptual mathematical invariants, projected in the planning of the sequentializations of institutional knowledge, which allow building and acquiring the necessary and sufficient knowledge and competencies, to face and solve the problem situations of their sociocultural fabric, with the minimum didactic, ontological and epistemological obstacles, possible in the scope of their daily life throughout their glocal and global life, which are related to the social practices that a group of students carry out together inside and outside the classroom. (Sanmartí & Herrera, 2012)

Consequently, they propose the following routes to identify contextualized teaching situations (SCE):(Acosta & Pacheco, 2020)

1°. Structure and systematize the conceptual invariants and their sequentializations of the school knowledge of the course or programs to be guided or managed.

2°. To study the social and cultural conditions, both local and international, the type of interactions, the interests that are generated, the beliefs, as well as the economic conditions of the social group in which the educational act is concentrated.(MEN;, 1998,36)

3°. Investigate the social activities carried out by the students or their experiences, which are significant in their sociocultural context.

4°. Determine the aspects of the student's social reality in which they are immersed, the phenomena or contextualized situations of teaching.

5°. Select a series of contextualized situations for teaching, according to the topics to be worked on, taking into account the elements that make it up, internal interactions and with the environment and its evolutionary state.

6°. Make a detailed description of the system of the (SCE), through a modelling process where its objective and the laws involved are explained.

7°. To make the pertinent simplified systematization, to build the models that best describe the SCE, according to its rigor established for each level of schooling. (Izquierdo, 2017)

3. Methodological Foundations.

The research involved the compilation and systematization of the categories of the theoretical underpinnings of the elements applied to the particularity of the study of the context of the contextualized teaching situations in the initial training of the mathematics teacher of the Popular University of Cesar, in the proposed case study activity: "Getting to know the Department of Cesar: Mathematical Study", immersed in the reality of the student's ecosystem, of the school mathematical knowledge present in the (SCEM) and of the teachers, who are in charge of guiding, directing and managing the sequences of school knowledge of elective subjects I, II and III, Didactics of Mathematics and History and Epistemology of Mathematics, Grade I, II, and III work, attached to the Bachelor's Degree in Mathematics program of the Faculty of Education.

For this reason, he studied was placed under the epistemological position of the qualitative paradigm; of the cut and precepts of sociocultural constructivism; since, the knowledge and understanding of the school mathematical knowledge present in the (SCEM): "Knowing the Department of Cesar: Mathematical Study", are constructed, through the influence of the interactions of the triad: Teacher-School Mathematical Knowledge -Students and these with the social and cultural contexts of their environment; therefore, learning is a constructive, active and collaborative process, where students learn through interactions with others, including the teacher, their peers and the culture in general; all of this gravitated in the approach of the methodology (Sandini, 2003) (Corona, 2018)(Vygtsky, 1988)Phenomenological-transcendental (Husserl, 2002,386), permeated by the structures of research processes.(Padrón J. , 2000)

This approach focuses its study on transcendental human, social, and cultural actions; the same as in observation, contrast, theorizing, analysis, reflection, argumentation, comprehension and interpretation, as well as in the evaluation of what happened with the sequences of school

mathematical knowledge, in the reality object under study: "Knowing the Department of Cesar Mathematical Study". Therefore, this approach is compatible with the context of the (SCEM) worked on in the classroom environment; because in it, the social and cultural conditions are studied and analyzed, the type of interactions of the teacher with the school mathematical knowledge and these with the student; the same as the interests that are generated, their characteristics, beliefs, interests, interactions, purposes, intentions, opinions and the economic and political conditions of the group where the educational act occurs, among other internal typologies of the object under study.

According to him, the purpose of phenomenology is: "The study of phenomena as they are experienced, lived and perceived by man" (p. 61). That is, it tries to reveal in it, the essence and nature of the phenomenon from the framework of the subject who lives it; for this reason, it consists of describing what are the phenomena present in the contextualized teaching situation in the proposed school mathematics: "Knowing the Department of Cesar: Mathematical Study", and its relationship with the sequencing of the school and school mathematical knowledge found. (Husserl E. , 1994)

It should be noted that the qualitative research for this research is oriented to the in-depth study of realities and is conceptualized by ,. This allowed the members of the research team, who are attached to the interdisciplinary research group study of numerical thinking, public policies of science, technology and innovation, environment and problems of education Latin America and the Caribbean "Penume", the systematization of school mathematical knowledge, immersed in the educational and sociocultural phenomena that lead to the discovery and development of an organized corpus of knowledge through the development of the Penal Society. through the subjective and intersubjective experiences of the subjects involved in the research process.(Sandini, 2003) (Corona, 2018)

From this point of view, the epistemological approach of qualitative research proposed for this research presents heterogeneous typologies, which allow from the proposed study to clarify, explain, argue and interpret the problematic situation as it occurs in the context, in order to understand, elucidate and examine what happens in the contextualized situation of teaching in school mathematics. with the students enrolled in the subjects that are the objects of the selected sample, logically from their own perspectives, since they are the ones who live reality.

So, phenomenologically and starting from the apprehensible particularity of mathematical knowledge, to arrive at the reality of the sequentializations of the school mathematical knowledge present in the contextualized situation of teaching in mathematics, case study: "Knowing the Department of Cesar study Mathematics", the phenomenology-transcendental is taken, as a method to capture the nature of the phenomenon itself, from the experience of the trio: Teacher-Mathematical Knowledge-Student and Context, who are the ones who live and share the process of teaching mathematics in the context of the reality of the subjects object of the sample selected for this research.

Likewise, he indicates that: "Phenomenology seeks to explain and interpret the meanings in which we are immersed in everyday life" (p. 8). Hence, the events that occur in the contextualized teaching situation in the initial training of the mathematics teacher of the Popular University of

Cesar, case study: "Knowing the Department of Cesar Mathematics Study", are appreciated as they occur, since nothing is supposed, much less are they based on some imagination; what is sought is to generate a real contextualized vision in its protagonists that is of interest to this research.(Van Manen, 2004)

4. Scenario and Informants of the Research.

The educational setting where the research was developed is the Popular University of Cesar (UPC), of an official and national nature, headquarters of the Sabanas del Valle University Campus, exit to the city of Fundación Magdalena, located at diagonal 21, Nº. 29-56 of the Sabanas del Valle neighborhood in the city of Valledupar, Department of Cesar-Colombia. Specifically, with the students subject to the sample, of the Bachelor's Program in Mathematics, attached to the Faculty of Education of the (UPC), where the context of the contextualized situations of teaching in school mathematics in the Colombian University of Cesar, are fundamental for their professional competencies as future graduates.

The choice of the informants was made in accordance with the informants, "... considered in qualitative research are chosen because they meet certain requirements that, in the same educational context or in the same population, other members of the group or community do not meet" (Rodríguez, Gil, & García, 2000)(p. 135). In the case of this research, the group of all students enrolled in the subject Elective III, Didactics of Mathematics, History and Epistemology of the Grade II Math and Work, of the semesters VI, VII, VIII and IX respectively, which are in total 12 Subject; where 8 of them are teachers of mathematics reinforcement at the levels of the Elementary and Secondary Academic proposed by the (MEN) and the others four are monitors of the new technologies laboratory of the Bachelor's Program in Mathematics of the (UPC), to which from in-depth interviews and the records of diagnostic observations; as well as from the contrasts and applications in the (SCEM), relevant information was obtained that was codified and categorized in favor of the corresponding theorization.

The selection of the informants was carried out through interaction, through personal dialogue and with the contact of the interviewed informants; taking into account that "The easiest way to constitute a group of informants is the snowball technique: to meet some informants and get them to introduce us to others". In this theme, the subjects thus constituted, allowed a multitude of information related to the object of study, which helped to a large extent to glimpse the meaning and the actions that are developed in the context of the research of the (SCEM): "Knowing the Department of Cesar study Mathematics".(Taylor & Bogdan, 2000;109)

5. Analysis and Interpretation of the Results.

As a result of the open and central coding, the Emergent Category System (SCE) was conceived, which is presented below. In this action, the assignment of codes was carried out as a result of the interpretation of the information collected, through repeated and consequent in-depth interviews and the records of the contrasts of the diagnostic observations; then, a second level of analysis was carried out from the conformation of dimensions that group the codes in reference.

Next, a level or phase of axial coding or the process of relating the categories to the subcategories is highlighted, since they were developed with the intention of regrouping the data that were separated during open coding. When continuing with the categorization, those dimensions that although not identical, had the same properties or attributes were considered, giving rise to a subcategory, which comes to group several dimensions, and finally, those subcategories that were more related to the categories of the object of study, which were grouped to culminate the categorization with a last grouping called category.(Strauss & Corbin, 2000)

From this categorization, three macros of categories are detailed, these being:

1. School Mathematical Knowledge.
2. Design of Teaching Situations.
3. Contextualized Teaching Processes.

The recurrence in the reports, which have been presented by students in previous semesters, has allowed the classification of the categories, as a methodology for processing the information.

Table 1. School Mathematical Knowledge.

CODES.	DIMENSION	SUB-DIMENSION	CATEGORY
Mathematical school knowledge in the construction of subjectivities.	**The Context of the (SCEM).**	**Interacting with objects in your environment**	**Associated mathematical knowledge**
Directing the interest of the globalized international market.			
Discourse of mathematical knowledge and its relationship with modes of production.			
Relationship between the context, the teacher, the student and mathematical knowledge.			
Socio-political and cultural context.			
Context of the mathematical knowledge that is taught.			
Process of signification of class activities.	**Contextualized Mathematics.**		
Relationship with contextualized situations in the real world.			
Contextualized teaching activities that improve information retention.			
Connections between new knowledge and previous experiences and knowledge.			
Use of mathematical knowledge in their daily life, outside the school environment.			
Construct mathematics within a real context.			
Mathematical characteristics to solve contextualized teaching situations.	**Mathematical thinking.**		
Pose and solve problem situations inside and outside the school environment.			
Development of creativity and imagination in glocal and global contexts.			
Learning environments with significant situations.			
Increasingly complex levels of knowledge.			

Gradual development of skills such as thinking, proposing, arguing, explaining, interpreting, communicating, reasoning and proposing			

Own elaboration (García, T; 2024).

Table 2. Design of Teaching Situations.

CODES	DIMENSION	SUB-DIMENSION	CATEGORY
Changes in epistemological approaches and teaching methods.	**Significance of Context.**	**Nature of mathematical knowledge.**	**Design of teaching situations.**
Contextualization of teaching.			
Historical-epistemological construction of school mathematical knowledge in the contextualized teaching situation.			
Teacher-Mathematical Knowledge-Student-Context Interaction.			
Environments that surround the student.			
Sense of mathematics that learn.			
Difficulties in teaching mathematics.	**Didactic obstacles**		
Knowledge of the sequencing of the school mathematical knowledge to be taught.			
Previous knowledge of the student.			
Modification of the schemas of knowledge.			
Social construction of mathematical knowledge.			
Student limitations in the development of the typologies of ontogenetic, epistemological and didactic obstacles.			
Student researcher (research seedbeds).	**Mathematical knowledge.**		
Critical-reflective-argumentative students.			
Scarce previous knowledge.			
Competencies in mathematics and for mathematics.			
Establish relationships between new knowledge and existing knowledge schemes,			
Origin of mathematical knowledge in the school context.			

Own elaboration (García, T; 2024).

Table 3. Contextualized Teaching Process.

CODES.	DIMENSION	SUB-DIMENSION	CATEGORY
Knowledge in the everyday context.	**Integration of knowledge.**	**Contextualized teaching situations in mathematics.**	**Contextualized teaching processes.**
Transformation in educational systems and processes.			
Intersubjective construction of teaching theory and practice.			
Construction of the invariant of the sequentializations of planned knowledge.			
Teaching oriented towards the construction of meaning.			
Need to rethink mathematical knowledge in school and school.			
Coherent didactic strategies of the teacher.	**Didactic strategies.**		
Organize teaching in an articulated way with the context.			

Reposition yourself in the face of mathematical knowledge.			
To promote processes of integration of mathematical knowledge in students.			
Coherence of educational practices.			
Process of didactic transposition of school mathematics.			
Situate themselves within a glocal and global context.	**Contextualization of teaching**		
Intersubjective reflection in the institutional context.			
significant intersections related to knowledge in the context.			
Contextualized teaching.			
Contextualized situations problems linked to the context in which it is produced and used,			
Teacher-school mathematical knowledge-student-context interaction.			

Own elaboration (García, T; 2023).

6. Theoretical Contributions of the Research.

CONTEXT OF THE CONTEXTUALIZED SITUATIONS OF THE TEACHING OF SCHOOL MATHEMATICAL KNOWLEDGE.

From the perspectives, in the questioning, discussions, arguments, reflections and interpretations of the teaching of school mathematical knowledge; through the contextualized teaching situations in the initial training of the mathematics teacher of the Popular University of Cesar, it was possible to visualize that the students are immersed in the advances of the new knowledge society; since they have at their disposal, a systematized set of opportunities, strategies, means and resources, which allow them to be an active part of the process of construction and deconstruction of their own school mathematical knowledge, which contribute directly to their glocal and global and integral formation of the knowledge under study.

Therefore, it is a transcendental contribution to research in mathematics education and its teacher training, as a Bachelor of Mathematics, since it is up to him to assume the challenge of a significant contextual teaching in constant evolution, in correspondence with the speed of the changes of the XXI Century, in order to respond to the requirements, expectations, and responsibilities that have been assigned to them due to their training and to discover the answers to their questions, which have remained unresolved by the agents responsible for their university education.

From the point of view of the students of the Bachelor's Degree in Mathematics of the Popular University of Cesar, the reality is different, they present difficulties and cognitive conflicts converted into ontological, epistemological and didactic obstacles, which limit the improvement and strengthening of their role as future graduates; since, mathematical activity continues to be developed in a traditional way, linear, rote and abstract.

Consequently, the contents of the invariants of school mathematical knowledge are presented in a decontextualized way as a body of knowledge concluded, finished and finished in a compact whole of knowledge, thought by others, which does not allow a resignification based on previous knowledge, much less, the relationships with its environment and the plurality of epistemological and methodological approaches to mathematics education; the same as the different procedures of the students.

For this reason, their fears and acculturation in the face of mathematics lead them to an inappropriate attitude, since a competitive human talent is required, ready for a contextualized teaching that has a connection with the sociocultural, economic and political needs of society, which will be met by these new mathematics teachers.

Consequently, the critique of the process of construction of school mathematical knowledge focuses on the scarce research studies from the historical, epistemological and didactic components that the mathematics teacher carries out in the teaching process; likewise, the algorithmic, rote and behaviorist form that guide the classes, since their concern is to finish in any way the systematizations of the institutional knowledge proposed by each Educational Institution; throwing overboard the interactions of the triad Teacher-School Mathematical Knowledge-Students in the development of the sequentializations of school mathematical knowledge with the context. Therefore, students are not given the opportunity to make the analysis and understanding and interpretation of contextualized situations of mathematics in their training (Alvarez et al, 2024).

DESIGN OF CONTEXTUALIZED TEACHING SITUATIONS IN MATHEMATICS.

Education, understood as a process that contributes to the development and integration of intellectual faculties, mastery of knowledge and promotion of human values, and in some cases, visualized as the way or path that the student needs to go through the different stages of human growth, in the direction of overcoming ignorance for the practical development of man in a world of arguments; consequently, this training process is the result of the combination of a series of elements, among which we can mainly mention the design of contextualized situations in the teaching and learning of school mathematics. (Alvarado, 2019)

Hence, the relationship that exists between the activity carried out from the interaction of teachers, students and the knowledge of school knowledge, known as teaching, is evident; and pedagogy, which despite its conceptual multiplicity, is the one that possibly guides the teacher in his task, because as he comments, pedagogy "... it is a sustained process through which someone acquires new forms of behavior, knowledge, practices and criteria, or develops those already acquired,...". (p. 106). (Bemstein, 1998)

For this reason, the design of contextualized situations in mathematics is understood as learning in the context of the application of knowledge, where in turn new learning scenarios appear; that is, contextualization is the process that gives meaning to a class activity since it considers the relationship with the students' own reality and their familiarity with its content. In this sense, contextualized teaching originates and causes the relationships of knowledge with the real context of the students, to cement the meaning of the mathematics that is learned, helping to explore the situations of other contexts to analyze their contradictions and encounters.

In view of this, the perspectives and conceptions of the social and cultural fabric of the didactic-pedagogical practice of the teacher, in terms of contextualized teaching situations, in the initial training of the mathematics teacher of the Popular University of Cesar, can be interpreted as an insufficient action, since in view of the characteristics of the social scenario of the XXI Century, A prototype of demands is then formed that incite change in traditional teaching models.

In this sense, these changes confirm that the design of contextualized situations for the teaching of school mathematics compromises the effectiveness of the student, generating the expected learning processes; The contextualized teaching situation in mathematics becomes a learning microenvironment in which the general learning processes, the sequentializations of school mathematical knowledge and the context that can come from everyday life, mathematics and other sciences are taken into account. This means that in the design of contextualized situations of school mathematics teaching, they are conditioned to a greater or lesser degree by the constituent factors of each context.

TEACHING PROCESSES IN CONTEXTUALIZED SITUATIONS.

Mathematics education as a field of knowledge requires the systematization of teaching and learning; where social practice is present in a context permeated by the problems that attract epistemological approaches and methodological foundations that differ from the traditional, however, promote possibilities for the teaching of mathematics in different contexts.

Based on this, it is the task of the educator to enable students to be introduced to a community and programs of knowledge of school mathematical knowledge. Based on this framework of ideas, society expects that education in general and specifically mathematics education will contribute to forming citizens capable of promoting a fair, humane and inclusive development of all its members and thus face the complexity of changes, inequalities and social problems.

In concomitance with the above, they propose that it is necessary to redirect the analysis of teaching and learning as a process associated with didactics, orienting it towards theoretical and practical proposals, which integrate the knowledge of researchers with their experiences to focus on it. (Abreu, Gallegos, Jácome, & Martínez, 2017)

Hence the need to assume the didactics of mathematics, as a knowledge in the process of intervention where theory and practice are combined, to develop sequences of specific mathematical knowledge; Under these manifestations, practice is shown as the only condition for the teacher to crystallize the curricular requirements, in attention to theory and practice, in this regard, it is pertinent to assert what is stated by:(Rajadell, 2010)

In this science of teaching and learning, the combination of doing and didactic knowledge, that is, theory and practice, is necessary. Practice is very important since it is known that you learn through experience. It is also normal to teach from it. However, it is important not to rely exclusively on teaching through this technique. That is why it is so important to complement it with theory. It is elementary to emphasize that a good theory must be able to be carried out; that is, it must be applicable to reality. It is not necessary to fall back on the dichotomy of theory and practice, which must go hand in hand, since praxis itself is both action and reflection. (p. 32).

On the other hand, it is necessary to emphasize that the traditional teaching methods in the initial training of mathematics teachers at the Popular University of Cesar, through which decontextualized information is processed, are in a lag with the sociocultural need of the student and his mental model to process the information; causing confusion when it comes to understanding mathematical concepts and assimilating their abstract nature, consequently it is difficult for them to visualize the usefulness they have in their daily lives and for their professional future.

Therefore, the context of the contextualized situations in the teaching processes of school mathematics needs to be addressed through epistemological paradigms, of a constructivist nature and with the methodological approaches of mathematics education, promoting the approximation of contextualized knowledge in the ecosystem where the educational act is present.

Finally, contextualized teaching and learning reflects the importance that the social dimension is acquiring in the construction of mathematical knowledge, as well as the value of significant knowledge; in other words, it is necessary to consider the environment, context and the socio-historical and cultural environment, assuming the active role that the teacher has to accompany the student to recover previous knowledge, develop new knowledge and implement it in their daily lives.

In this way, it will be an active and dynamic part of the development, implementation and evaluation of the process of construction of the mathematical knowledge under study; fundamentally, taking charge of their function by promoting an environment of cooperative leadership, which leads to greater autonomy of students, in the face of school mathematical knowledge taking into account their habitat.

In addition, the teacher will have the opportunity to enrich the academic environment and build contextualized situations, conducive to strengthening its structure through the posing of questions and reflections on the models of mathematics education; as well as their epistemological and didactic orientations and approaches. Therefore, to stimulate informal and multiple representations, which at the same time gradually promote the acquisition of higher levels of formalization and abstraction, impacting the design of contextualized situations for teaching school mathematics that generate cognitive conflicts, in the contextualized situations proposed in the activity: Getting to know the Department of Cesar, I study mathematics. (Padrón, La estructura de los procesos de investigación, 1998)

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