ALEXANDRIA
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Context-Mediated Didactics (CoMeDi): a proposal to expand the didactic model inherent in the Theory of Mathematics in the Context of Sciences

Didática Mediada do Contexto (DiMeCo): uma proposta de ampliação do modelo didático inerente à Teoria A Matemática no Contexto das Ciências

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Abstract: To contextualize the teaching of mathematics based on situations in the student's area of training, the Theory of Mathematics in the Context of Science (TMCC) and the Didactics of the Context linked to it advocate working with problems that integrate mathematics with different areas. From our experiences with designing and implementing these problems, it was observed that they were complex and demotivating forstudents, which led us to experiment with other strategies, such as prior preparation, proposing guiding questions and activities for final reflections. This experience gave rise to what we call Context-Mediated Didactics, presented in this article, based on and articulated with the assumptions of TMCC and the Theory of Structural Cognitive Modifiability (TSCM), with a focus on the Mediated Learning Experience. The procedures that differentiate it from Context Didactics proved to be fundamental to the learning of concepts and to the students' understanding about the links between different areas.

Keywords: mathematics teaching, service courses, contextualization, mathematical theory in the context of science,mediated learning experience.

Resumo: Para contextualizar o ensino da Matemática a partir de situações da área de formação do graduando, preconiza-se na Teoria A Matemática no Contexto das Ciências (TMCC) e na Didática do Contexto a ela vinculada, o trabalho com problemas integrando a Matemática a diferentes áreas. Das experiências com a elaboração e a implementação destes, percebemos que eram complexos e desmotivadores para os estudantes. Tal percepção nos levou a experimentar outras estratégias, como momentos de preparação prévia, proposição de questões norteadoras e atividades de reflexões finais. Essa vivência deu origem ao que denominamos de Didática Mediada do Contexto, apresentada neste artigo, de forma fundamentada e articulada aos pressupostos da TMCC e da Teoria da Modificabilidade Cognitiva Estrutural, com foco na Experiência de Aprendizagem Mediada. Os procedimentos que a diferenciam da Didática do Contexto revelaram-se fundamentais para a aprendizagem dos conceitos e para a compreensão dos estudantes acerca das vinculações entre diferentes áreas.

Palavras-chave: ensino de matemática, cursos de serviço, contextualização, teoria matemática no contexto das ciências, experiência de aprendizagem mediada.

Introduction

Since 2015, we have taken on as one of our research lines the teaching and learning of Mathematics in courses that do not aim to train mathematicians or Mathematics teachers, especially in Engineering. That same year, three of us participated in the XIV Inter-American Conference on Mathematics Education (CIAEM), held in Mexico, and had our first contact with Mexican researcher Patricia Camarena Gallardo, responsible for developing the Theory of Mathematics in the Context of Sciences (TMCC). This theoretical framework was especially developed to support reflections on the teaching and learning of Mathematics in university courses in which this science is included, as a tool, in service disciplines (Howson et al. 1988).

We then established an ongoing dialogue with the researcher and began to use the framework she developed as one of the main theoretical subsidies for our studies related to Engineering Education. In these dialogues, which were mainly aimed at exchanging materials and providing more specific guidance on the use of some TMCC topics that were still unclear to us, Camarena was able to validate the development we had made of a first problem situation (which will later be defined in this article, in the TMCC terminology, as a Contextualized Event - CE), developed with the aim of revisiting, in a context closer to the students' future professional area, the real exponential and trigonometric functions of a real variable in a first Differential and Integral Calculus discipline included in an Engineering course.

The way we proposed to organize, from a didactic point of view, the work with this situation significantly differed from what Camarena had conceived in the didactics linked to TMCC, called Context Didactics. The researcher advocated presenting a problem in a completely implicit way to students, without any guidance on how to conduct the problem-solving process. However, in our proposal, after a Prior Preparation stage aimed at familiarizing students with the context in which the problem would be inserted, the students would receive, in addition to the CE statement that they should solve, a series of questions, which we call *guiding questions*, aiming to lead them, even if indirectly, to fundamental reflections for solving the CE and also to provide an opportunity for the objective sought in the elaboration of the event, in terms of learning or revisiting certain mathematical concepts, to be achieved. Finally, we inserted into the work with the problem a moment that we called *Final Reflections on the Implementation of the Contextualized Event*, in which students, through various strategies, should reflect on what they had experienced and learned, both in relation to the problem to be solved and the experience of solving it in a different way than usual.

When analyzing our proposal, Camarena ratified the proposed approach method, arguing that, in her perception based on many years of working with similar problems, but in the way she had originally conceived when formulating the TMCC, these problems were too complex and, consequently, demotivating for students who, on many occasions, ended up by not seeing themselves as capable of solving them and gave up on the challenge or did not engage in it with due commitment.

Based on Camarena's approval, we began to conduct our teaching experiences with engineering students, incorporating the previously mentioned procedures into the proposed problems. According to previous analyses, this insertion has proven to be fundamental both for learning the mathematical concepts and for the students' understanding about the links between Mathematics and Engineering (Gomes et al. 2021a; Pinto, 2021; Silva, 2022; Gomes et al. 2022; Philot, 2022; Bianchini et al. 2022; Bianchini et al. 2023; Lima et al. 2023). Since, at first, our objective was for students to be able to reach the end of the event resolution, despite the promising results, we had not yet focused on the theoretical basis for the incorporation, in a duly justified manner, of such procedures as new components of Context Didactics, highlighting why they do not contradict the assumptions used by Camarena when structuring TMCC, but rather enhance the use of this didactic.

In this article, the aim is precisely to present, in a well-founded and articulated way with the assumptions of TMCC, an expanded version of the Context Didactics, which we call Context-Mediated Didactics (CoMeDi), contemplating, from the perspective of Reuven Feuerstein's Theory of Structural Cognitive Modifiability (TSCM), the teacher's mediation through a *Prior Preparation stage, guiding questions* (nomenclature that we adopted inspired by the term guiding questions used by Sahin and Kulm (2008)) and *Final Reflections* activities about the Implementation of the *Contextualized Event* – as a central element of the aforementioned didactics.

The option to support the new components inserted into the Context Didactics by TSCM proved to be viable after reading the doctoral thesis by Leopoldo Zúñiga Silva, supervised by Camarena herself, entitled "Cognitive Functions: Qualitative Analysis on Learning Calculus in the Context of Engineering", a research project that used this framework in conjunction with TMCC.

To effectively begin the reflections that will be carried out in this article, it is necessary to first present the central aspects of TMCC and TSCM, which are the aims of the next two sections.

A Brief Overview of the Theory of Mathematics in the Context of Sciences

We will begin this section by highlighting that its writing was based on Camarena (2021). According to the author, TMCC was born in early 1980s within a multidisciplinary line of research called Social Mathematics, also established by Camarena, bringing together knowledge from Education, Psychology, Sociology, Anthropology and Mathematics to address a problem related to the teaching and learning of Mathematics. The purpose of establishing the aforementioned line of research was to support strategies aimed at building meaningful Mathematics for university students who do not have this science as their primary goal, in order to allow them to develop thinking skills and prepare themselves to act critically, creatively and analytically in different social spheres and to be able to mobilize mathematical knowledge in the social praxis of their profession.

The line of thought (i.e., the ideological tendency) shared by the community of researchers in Social Mathematics is: focusing especially on three specific problems, conducting research and influencing teachers and researchers themselves to be reflective in relation to their professional mathematical activities. These problems include: the abstract nature of Mathematics, the fact that students, in general, do not perceive the links between Mathematics and their daily practices, and, finally, the fact that university graduates often do not present the behaviors and attitudes required today.

In the ideological current to which researchers in Social Mathematics adhere, it is advocated that: teachers should be aware that they do not teach Mathematics simply by following a given program; researchers should be fully aware that they do not only conduct research on the difficulties of learning Mathematics; and that, in order to address issues related to the teaching and learning of Mathematics, they also delve into other areas of knowledge, even if their professional training is outside of these.

At the core of Social Mathematics, TMCC is developed with the main aim of supporting well-founded educational actions to be implemented to deal, in an objective manner, with the three problems mentioned above through a framework constructed specifically with the focus of addressing problems related to university teaching of Mathematics, based on the specificities of this educational level. TMCC has a marked social character, focusing on the analysis of Mathematics that is useful to scientific, technical and civil society and on the development of a mathematical culture[1] and mathematical thinking[2] that help the individual to move in a scientific way in the professional spheres and in everyday life.

The philosophical or ideological positions – referred to by Camarena (2021) as *educational paradigms* – that enable the scientific community affiliated with TMCC to explain, justify or substantiate the educational phenomena studied based on this framework are the following:

● mathematics is, at the same time, an area of knowledge that plays a formative role and is a tool for solving problems in different contexts, which must be taken into account when structuring the approach to this science in university courses;

● the function performed by Mathematics is different at each educational level and, therefore, the researcher and the teacher must have perceptions about the fact that educational processes are not the same at different levels;

● knowledge is born integrated and this fact demands didactic processes that favor, in courses in which Mathematics is at the service, the integration between this science and the student's future area of professional activity.

In this context, it is understood that the learning environment and the TMCC configure a complex system, that is, a system composed of five subsystems that continuously interact with each other and any variation in one of them alters the final behavior of the entire system, even though some of the subsystems have greater influence on such changes than others. This systemic perception allows, according to Camarena (2021), that the problems related to the teaching and learning of

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[1]A set of mathematical knowledge, skills and abilities that enable an individual to apply and contextualize mathematical knowledge, think mathematically and use mathematical language to communicate in different contexts (Camarena et al. 2022, p. 75).

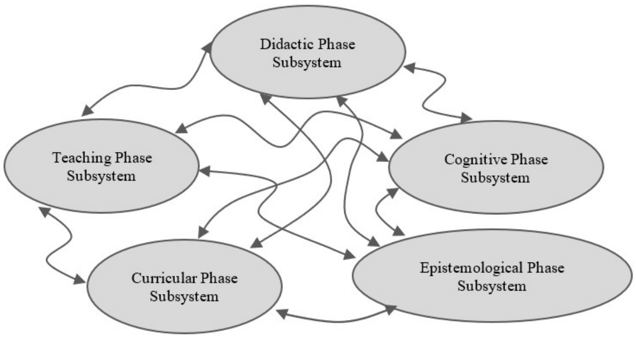
[2]Result of rational processes of the intellect or abstractions of the imagination carried out from the observation and scientific reflection of phenomena of different natures through the systematization and contextualization of mathematical knowledge, the ability to perceive visually and spatially, represent, memorize, think creatively, objectively, logically, analytically and critically (Camarena et al. 2022, p. 71-72).

Mathematics in university courses that do not aim to train mathematicians or Mathematics teachers, to be addressed in a holistic way.

The five subsystems referred to in the previous paragraph are understood, within the scope of the theoretical framework, as phases of TMCC and are called *curricular, epistemological, didactic, teaching and cognitive*, as illustrated in Figure 1.

Figure 1

Interactions between phases of TMCC



Source: Camarena (2021, p. 89).

Note. [Image description] The image contains a diagram representing a model of interconnected subsystems. Each subsystem is represented by an oval figure with a label and arrows indicating the relationship between them. The five subsystems are: Didactic Phase Subsystem (located at the top), Teaching Phase Subsystem (on the left), Curricular Phase Subsystem (on the bottom left), Cognitive Phase Subsystem (on the right) and Epistemological Phase Subsystem (on the bottom right). The arrows show interrelationships between subsystems, indicating mutual influences. The Didactic Phase Subsystem seems to play a central role, with several connections with the other subsystems. [End of description].

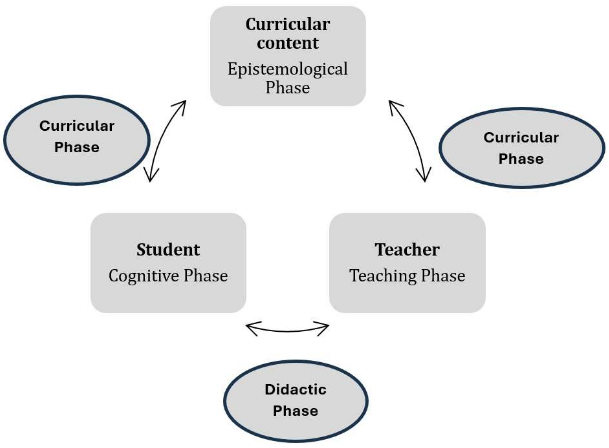
To address each of the problems related to Social Mathematics – and, therefore, to TMCC – knowledge from different areas is required, in addition to Mathematics, namely: Education (for reflections on didactic, curricular and teacher training aspects); Psychology (for analyses related to students' cognitive processes, their motivations and attitudes); Philosophy (for the treatment of epistemological issues and aspects related to ethics and values); Sociology (for discussions about the professional performance expected from university graduates) and Anthropology (for considerations related to students' characteristics).

According to Camarena (2021), when addressing the problematic characteristics of teaching and learning Mathematics in higher education courses that do not aim to train mathematicians or Mathematics teachers, making use of knowledge not only from Mathematics and the target professional area, but also from Education, Psychology, Anthropology, Sociology and Philosophy, is what gave the theoretical framework she created the name of Mathematics in the Context of Sciences, in this context being understood as the diversity of intertwined sciences that allows addressing issues related to the abstract nature of Mathematics, the lack of perception by students of the links between Mathematics and their future professions or daily practices, and the lack of manifestation, by graduates of courses in which Mathematics is at the service, of behaviors and attitudes required of professionals today.

As illustrated in Figure 2, the phases of TMCC become evident when we simultaneously analyze these sciences involved in addressing the aforementioned problems and the so-called *pedagogical triangle*, with the teacher, the student and the curricular content[3] as its vertices, which at the time of the development of TMCC, was the representation commonly used to outline the teaching and learning processes, as well as the interrelations and interactions between its main components.

Figure 2

Phases of TMCC and the *pedagogical triangle*



Note. [Image description] The image presents a diagram with elements organized to represent a pedagogical model based on different phases. The diagram contains boxes and ellipses connected by arrows, indicating relationships between concepts. Diagram structure: at the top, there is a gray rectangular box with the text: "Curricular Content - Epistemological Phase". From this box, two arrows come out downwards, connecting to two lateral ellipses. On the sides, there are two ellipses with the same label: "Curricular Phase" and both are connected to the "Curricular Content - Epistemological Phase" by bidirectional arrows. At the center of the image, there are two rectangles representing the main agents of the pedagogical process: on the left: "Student - Cognitive Phase", on the right "Teacher - Teaching Phase". Between them, there is a bidirectional arrow, indicating interaction between student and teacher. At the bottom, there is an ellipse with the text: "Didactic Phase" which is connected to the "Student - Cognitive Phase" and "Teacher - Teaching Phase" by arrows. The relationships represented are: the Curricular Content (Epistemological Phase) influences the Curricular Phase; the Curricular Phase is linked to the Student and the Teacher, showing its importance in the learning process; the Student (Cognitive Phase) and the Teacher (Teaching Phase) interact directly. The Didactic Phase is linked to the teaching-learning process involving students and teachers. This diagram represents an educational structure based on teaching phases, emphasizing the relationships between curriculum, students, teachers and didactics [End of description].

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[3]Regarding this third vertex, it is worth highlighting that in the Didactics of French Mathematics, especially in works by Guy Brousseau, this is called *savoir*.

As outlined in Figure 2, related to the curricular content vertex and the interactions between such contents, students and teachers are, obviously, concerned with issues in the area of Education related to the curriculum. This is how the curricular phase of TMCC arises, in which the main aim is to develop a Mathematics curriculum that is in line with the area of professional training in which it will be practiced. This phase includes the Dipcing methodology, specifically developed for the elaboration of Mathematics curriculum to be implemented in undergraduate courses in which this science is not a goal in itself.

To specifically analyze the interactions between students and teachers, the didactic phase is used, which includes the so-called Context Didactics, of a constructivist nature, having as theoretical subsidies the following approaches:

> (i) Piaget's Psychogenetic - “for the construction of knowledge, the person must move from the concrete to the abstract”; (ii) Vygotsky's Sociocultural - “for learning, there must be special emphasis on collaborative learning, which requires a mediating teacher”; (iii) Ausubel's Theory of Meaningful Learning - “learning is a substantive relationship between new knowledge and prior knowledge; learning is essentially active”. (Lima et al. 2019, p. 137).

Context Didactics, which when directed at teaching Mathematics is called *Mathematics in Context*, is structured through a methodological process for its implementation in the learning environment, which aims to establish the link between mathematical and non-mathematical disciplines of a given undergraduate course, based on problems or projects integrating different areas of knowledge – the so-called Contextualized Events (CE) – which are solved through collaborative work in teams composed of students with different learning styles. More details about this phase will be presented later in this article, since it is directly related to the formulation of Context-Mediated Didactics.

The relationships between different curricular contents, both among mathematical ones and between these and those specific to the student’s area of future professional activity, are objects of analysis in the epistemological phase of TMCC, in which teaching materials are developed linking Mathematics with the student's future professional area, taking into account the knowledge that the student is expected to build. These materials are called CE, and as already explained, they are problems or projects that play the role of integrators between different areas of knowledge. The events can be developed based on three sources of contextualization: (i) the other subjects studied by the student in a given undergraduate course; (ii) the activities of professional and work life; and (iii) situations of everyday life.

The identification of epistemological obstacles linked to the mathematical content that is intended to be worked on in a given CE is also the objective of this phase. According to Brousseau (1983, p. 178), such obstacles are “those that we cannot and should not avoid due to their constitutive role in the knowledge sought. They can be found in the history of the concepts themselves.” Finally, the epistemological phase includes a central theoretical construct in TMCC, which comes from the Didactic Transposition proposed by Chevallard (1991), called *Contextualized Transposition* by Camarena (2001), which shows that the mathematical knowledge taught is not always directly applied professionally: it will undergo transformations to become applied knowledge.

The cognitive phase is linked to the characteristics, difficulties, beliefs, competencies and prior knowledge, skills, attitudes and values of students. In addition, it aims to analyze how the construction of knowledge is established and, consequently, the learning of Mathematics in a specific context. According to Camarena (2021, p. 86), in this phase, based on specific methodological processes, “the student's cognitive structures and mental representations when studying contextualized Mathematics are investigated, determining whether they construct structured and integrated knowledge rather than fractional knowledge, resulting in articulated mental structures”. Furthermore, within the scope of the aforementioned phase, research is conducted on the results of research on the cognitive difficulties that a student may face in the process of learning a specific mathematical content, which is an aspect that should be taken into consideration when developing CE.

Finally, in the teaching phase, issues related to problems faced by the teacher are studied, as well as their best practices when teaching a specific content. In addition, in this phase, strategies are developed to prepare the teacher to work with Mathematics in a specific context, which take into account their beliefs, their difficulties with certain scientific concepts and the need to count on the support of teachers from specific areas involved in a specific CE. Teacher training aimed at the work of linking Mathematics with a specific professional area must include, as recommended in this phase of TMCC, four cognitive categories: knowledge about concepts directly related to the professional training in which the teacher works; knowledge about the link between Mathematics and the specific area; knowledge about the use of Digital Information and Communication Technologies (DICT) as cognitive tools for student learning and knowledge about the teaching and learning processes of Mathematics.

Having presented this overview on TMCC to support the proposal in this article, that is, to include mediation as a fundamental element of the didactics inherent to this theoretical framework, some of the main ideas of Reuven Feuerstein's TSCMwill be now discussed.

Central Ideas of the Theory of Structural Cognitive Modifiability

The TSCM and, linked to it, the Mediated Learning Experience (MLE) were, according to Philot (2022), developed by the Romanian psychologist of Jewish origin, Reuven Feuerstein, who, after surviving the Holocaust during World War II, immigrated to Palestine and began teaching children who were also Holocaust survivors and classified as mentally disabled in IQ tests. In reality, these children

> had severe intellectual, cognitive, physical and emotional disorders, but Feuerstein did not accept that these children were mentally limited and believed that they could modify their intelligence if there was correct mediation and if they used their cognitive functions efficiently. This fact, together with the opportunity to work with Jean Piaget, in studies on cognitive development, and Andre Rey, encouraged and provided the necessary support for Feuerstein to feel motivated to think about the process and potential for intellectual change and cognitive functions, and influenced, to a certain extent, the development of his theory (Feuerstein et al. 2014, p.18)

In this sense, as pointed out by Lima et al. (2023) based on the ideas of Prieto (1989) and Feuerstein et al. (2014), TSCM was developed with the aim of analyzing how to assess and enhance the intelligence of individuals with low academic performance and in situations of vulnerability of different kinds.

> The researcher sought to answer, among others, the following questions: is it possible to cognitively modify individuals in order to help them develop strategic skills that could enable them to identify problems and transform them into opportunities for development; when necessary, shape their environments so that learning is more effective; and, consequently, go beyond learning a set of facts and procedures? Is it possible to modify individuals' thinking, equipping them with essential tools for adequate adaptation to life, even when these are lacking in some way? (Lima et al. 2023, p. 43)

The assumptions of TSCM are:

that subjects are capable of modifying themselves and the environments that surround them;

that the cognitive modifiability of a subject concerns the acquisition, by oneself, of new cognitive structures not originally contemplated in the set of one's previous skills and knowledge;

that such modifications are possible regardless of barriers related to deficits or dysfunctions, age, physical, sensory and mental disabilities;
that intelligence is not something static and immutable, but a dynamic, energetic agent that responds to the needs of a subject to modify itself in order to adapt to situations and face them appropriately.

It is worth highlighting that TSCM is a broad theoretical framework, contemplating a series of theoretical constructs. However, in this article, we focus especially on the issue of mediation and its effects on the cognitive modification of a subject who experiences an MLE. It is therefore important to explain what is understood in this framework by the terms: *structural cognitive modifiability*, *mediation* and *Mediated Learning Experience*.

By *structural cognitive modifiability*, we mean a change that is not random or limited in time or space, but

> that will affect learning and behavior in a profound, sustainable and self-perpetuating way. [...] if a structural change is created, it will not be confined to the event itself, but will manifest itself in several additional events that have similar elements [...]. A structural change tends to continue operating even after the initial factor that caused it is no longer directly experienced (Feuerstein et al. 2014, p. 43-44)

Structural changes have the following characteristics:

- permanence: they are long-lasting and, consequently, are not lost over time;
- resistance: they persist even when there are changes in the situations that originated them;
- flexibility/adaptability: they adapt to new situations;
- generalizability/transformability: structural changes can be continued, independently, by subjects.

One of the central concerns in TSCM, specifically in relation to interactions between teachers and students, is to identify how the former can provoke structural cognitive changes in the latter. The idea of mediation stands out, understood as “an intentional interaction with the learner, with the purpose of increasing their understanding beyond the immediate experience and helping them to apply what is learned in broader contexts” (Feuerstein et al. 2014, p. 21). According to the aforementioned authors,

> the human mediator does not impose himself continuously or constantly on the person being mediated and the world. He does not cover the entire territory between

> them, but leaves the mediated a large area of direct exposure to the stimulus. However, in the area in which the mediating agent acts, he is active in several ways. He delivers to the mediated the components that will be responsible for his ability to understand phenomena, seek associations and connections between them and thus benefit from them and be modified (Feuerstein et al. 2014, p. 65)

In other words, by playing the role of mediator, the teacher moves away from the archaic and obsolete role of knowledge transmitter, becoming the one who provokes, encourages, triggers and enables students to construct their own knowledge (Meier & Garcia, 2008). It can be said, therefore, that mediating means

> enabling and enhancing the construction of knowledge by the mediated. It means being aware that knowledge is not transmitted. It is intentionally being between the object of knowledge and the student in order to modify, alter, organize, emphasize and transform the stimuli coming from this object so that the mediated learns by itself (Meier & Garcia, 2008, p. 72)

Based on the notion of mediation, in the field of TSCM, the Mediated Learning Experience (MLE) is defined, which "occurs when a person (mediator) who has knowledge, experience, and intentions mediates the world, makes it easier to understand, and gives it meaning by adding direct stimulus" (Feuerstein et al. 2014, p. 60). As Philot (2022) points out, in TSCM, it is important to differentiate MLE from the Direct Learning Experience (DLE), in which:

> the human being comes into contact with the stimulus and interacts with it only in a sensory-physical way, while the thought functions necessary to understand these interactions are practically not involved. The human being momentarily explores the stimulus, but does not observe the results obtained with that action and, therefore, does not develop insights or structural knowledge of the lived experience. This fact means that humans learn very little from the connection between their action/operation and its result, that is, there was experience, but the learning was not very effective. For Feuerstein et al. (2014), simply observing and handling objects is not enough to learn (Philot, 2022, p. 92-93).

Therefore, it is important that, in addition to DLE, subjects also experience MLE, since it is this type of learning "that creates flexibility and sensitivity in human beings, readiness and desire to understand what is happening and the ability to generalize beyond the isolated phenomenon being experienced" (Feuerstein et al. 2014, p. 92). The authors add that "MLE is necessary to add to direct experience and fully materialize human development. Human beings who do not receive sufficient MLE during the course of their development are deprived of essential aspects of the developmental experience" (Feuerstein et al. 2014, p. 51-52).

It is important to emphasize that not every interaction is mediation. To be considered as such, it must have three fundamental characteristics:

● Intentionality and reciprocity: everything that is part of the interaction has a reason for being – planned and intended by the mediator – who highlights the stimuli that will be highlighted and organizes them in a way that makes them more understandable to the mediated, continuously evaluating this organization during interactions with the subject, modifying it whenever necessary and even changing their mediation methods in order to guarantee efficient learning. Reciprocity arises from the fact that mediation causes changes in the three elements considered in this action: mediator, mediated and stimulus. Furthermore, it concerns the need for the mediated person to be available to learn through mediation;

● Transcendence: related to the fact that the aim of mediated interaction goes beyond teaching something just in its action, providing conditions for the mediated person to learn for themselves in the future, developing their metacognitive capacity, in addition to making them curious to search for information and to understand the world more effectively, inspiring them to learn continuously;

● Meaning mediation: the mediator is concerned with the reason for teaching something to the mediated person, providing him / her with the opportunity to perceive that there is a reason to learn and apply what is being learned and, in this way, feel motivated.

Once the central ideas of TMCC and TSCM have been presented, in the next section, we will discuss our proposal – the central focus of this article – called Context-Mediated Didactics, an expansion of Context Didactics – formulated by Camarena throughout her different works – and we will base it, from a theoretical point of view, on the precepts of TSCM.

An Expansion of Context Didactics: The Genesis of Context-Mediated Didactics

To begin this section, we believe it is essential to emphasize that the proposal to expand Context Didactics can be understood as a coordination between elements of two distinct theoretical frameworks: TMCC and TSCM. The coordination of theories or precepts of two frameworks is discussed by Prediger et al. (2008), among other authors. According to researchers, coordination of theories is used, above all, when seeking a networked understanding of a given phenomenon. In the case of the proposal presented, such a phenomenon is the workin classroom, with CE linking Mathematics with specific undergraduate's future professional areas. We understand, as also highlighted by the aforementioned authors, that coordination between precepts of two theoretical frameworks makes it possible to deepen understandings about the phenomenon, since it can be analyzed from different perspectives through the conceptual framework resulting from such coordination.

An essential care to be taken when applying the strategy of coordination between theoretical frameworks is to accurately analyze the relationship between the different elements of theories. Such coordination can only be carried out with theories in which the core precepts are compatible. It is especially fruitful when components are complementary (Prediger et al. 2008). Next, to demonstrate the coherence of the coordination between aspects of TMCC and TSCM, we will explain the core precepts of Context Didactics (inherent to TMCC) and MLE (inherent to TSCM).

The Context Didactics, presented by Camarena (2013), as already highlighted in the section of this article in which TMCC was discussed, is constructivist in nature, supported by Piaget's Psychogenetic, Vygotsky's Sociocultural and Ausubel's Theory of Meaningful Learning approaches. Therefore, it is not an empirical proposal, but rather a theoretically based construction.

In view of the aim of this article, it is pertinent to emphasize that TSCM, and particularly MLE, is also supported by constructivist assumptions. Feuerstein himself emphasizes that the development of TSCM occurred, especially, from two encounters: “firstly, my approach to Jean Piaget [...] and, [secondly], I met Professor Andre Rey [from whom] I received encouragement and support to develop my work” (Feuerstein et al. 2014, p. 17-18). These ideas related to constructivism, added to his involvement with child survivors of the Holocaust, whom, as a teacher, he sought to rehabilitate from their traumatic experiences, led Feuerstein to “recognize the need to give thought – the mind is an active and interactive intelligence that organizes the world and plans in advance – a central position in peoples’ lives” (Feuerstein et al. 2014, p. 20) and, consequently, develop TSCM.

MLE, in particular, is strongly guided by Vygotsky's ideas, which value interpersonal relationships, from the collective to the personal, and this is how the author conceives of mediation. For Vygotsky (1991, p. 41), “all higher functions originate from real relationships [that is, with a clearly defined intention] between human individuals”. Meier and Garcia (2008), when presenting reflections on mediation in the sense proposed by Feuerstein, emphasize that:

> Based on this Vygotsky an conception that higher functions first originate at the social level and are only then incorporated by the individual, it is possible to sustain the idea that teachers need to mediate intrapersonal processes, need to interact with their students so that they can learn through this interaction. (Meier & Garcia, 2008, p. 79).

Context Didactics is structured around two axes: *contextualization* and *decontextualization*. In contextualization, work is proposed linking Mathematics with extra-mathematical contexts, which is done through CE. In the decontextualization axis, objects are presented in purely mathematical contexts, with the level of rigor and formalism appropriate to the objective of the course in which the aforementioned science is being worked on (Camarena, 2013; Lima et al. 2021). The Context-Mediated Didactics proposed in this article, although it also has repercussions on the decontextualization axis, is especially present in contextualization. Therefore, our analyses are focused on the latter axis.

First, it is important to emphasize that, according to Camarena (2021), CE, which is the main didactic strategy in the contextualization axis, is not an exercise, a problem or a routine project, but a situation in which concepts never appear in isolation, but in a network, in an interrelated way. CE must have significant potential to provoke cognitive conflict in the student, who must feel motivated, challenged and interested in resolving it.

In the author's view, CE must be implicit and students should not be told what to do; they are the ones who will identify their next actions when they understand the event. However, Camarena herself, in dialogues established with us from 2015 onwards, based on her experience of over 30 years in the development and implementation of CE, demonstrated her perception that these, as they were originally planned by her, were too difficult and discouraging for students. This perception was in line with what we, as teachers and researchers interested in contextualizing the teaching of Mathematics in Engineering and, consequently, in developing CE, were conceiving based on the knowledge of the reality of our students and even the awareness of our own weaknesses regarding the concepts of the specific areas of Engineering present in the events.

When we began the process of constructing a first CE, when Engineering teachers presented us with a problem situation that could potentially lead to it, we felt the need to first understand the central aspects and concepts related to the context in which this situation was inserted. In other words, we needed to perform a prior preparation to work with the event and we understood that the students would also need to experience this stage. When we finished the preparation and felt that we had the minimum knowledge to solve the event, we began to solve it by putting ourselves in the position of our students, reflecting on the path they would take and the possible questions that would arise and that they could ask us, teachers, or themselves in order to advance in the resolution.

In this process, we observed that some of these questions, because they were too complex, especially for students in the first semesters of Higher Education, if not mediated adequately by teachers, could cause a blockage in students, demotivating them and possibly even leading them to give up on continuing to solve the problem. We then understood that the teacher could anticipate these possible obstacles for students and, at the appropriate time, if necessary, propose guiding questions to them, also in an appropriate manner, with the aim of making them reflect on essential points for resolving the event, leading them to move forward on their own towards the desired solution. These guiding questions can be considered as exploratory activities, understood in the sense formulated by Martins Junior (2015), namely:

> a set of activities, didactically planned, with the objective of allowing exploration, conjecture, logical deduction, induction, intuition, reflection in action and mediation in relation to the content covered to enable the construction of knowledge carried out by its actors, whether these activities are free or guided and, for this purpose, using the necessary means that can dynamize the relationship between theory and practice and teaching for learning (Martins Junior, 2015, p. 58-59).

Furthermore, we understand that, once the process of resolving a CE has been completed – which also includes carrying out the prior preparation activity – it is essential to analyze, through a moment that we call final reflections, the students' perceptions about what they experienced and the possible impacts of this experience on their learning and on their professional training paths.

When presenting to Camarena the proposal for the inclusion of a preparation stage prior to the proposal of the CE itself, the idea of asking students to answer a series of guiding questions throughout their resolution process and, at the end of the process, to make some final reflections, the researcher considered that such strategies seemed relevant, interesting and pertinent from the point of view of the didactic organization.

We then began to carry out a series of experiments with CE using these strategies and improving them with each new application. Reports resulting from the analysis of these experiments can be consulted by the reader, among others, in: Pinto (2021), Silva (2022), Philot (2022), Bianchini et al. 2022, Bianchini et al. 2023, Gomes et al. (2022) and Lima et al. (2023). In parallel with this path, we continued our studies on TMCC and came across Zúñiga's thesis (2004), under Camarena's guidance, in which the theoretical framework used is constituted by assumptions of Feuerstein's TSCM.

In order to better understand the ideas used by Zúñiga (2004), we began a study of TSCM and, by appropriating one of the central aspects of this theory, *mediation*, we realized that the precepts of TSCM could support, from a theoretical-methodological point of view, the procedures we were adopting in our experiences with CE. Given this perception, we began to formally reflect, with the theoretical support of TSCM, on the strategies we had added to Context Didactics, with the aim of structuring didactically and methodologically what we came to call Context-Mediated Didactics.

Methodological Procedures of Context-Mediated Didactics and their Respective Theoretical Subsidies

In Context-Mediated Didactics, it is understood that a *didactic strategy* is composed of both teaching strategies (used by the teacher) and learning strategies (used by the student). Associated with such strategies are teaching activities (performed by the teacher) and learning activities (performed by the student). When proposing Context-Mediated Didactics as an expansion of Context Didactics, we chose to use this same terminology.

Within the scope of Context Didactics, Camarena (2021) emphasizes that, when preparing the activities that will be performed by students, the teacher must take some aspects into consideration. In the activities, it is necessary to:

provide opportunities for students to move between the different semiotic representations, in different registers, of the concept to be constructed;

consider the different approaches to the mathematical topics and concepts to be explored;

explicitly link the knowledge to be constructed with prior knowledge;

provide students with the opportunity to be encouraged to overcome obstacles of different natures;

consider the possibility of knowledge being constructed in a spiral;

when appropriate, use DICTs with the aim of mediating or reinforcing learning.

In our proposal – Context-Mediated Didactics – we also consider these elements as fundamental, but we add others to them that, inspired by the ideas of Grimson and Murphy (2015), we understand them as constituting the epistemological basis of any profession that requires the mobilization of mathematical knowledge and that, therefore, is linked to an area of training in which this science is at the service. The elements we have added are explained below. It is considered that, in the activities, students can:

recover and mobilize basic knowledge about languages, Mathematics, Physics, Chemistry, etc., constructed before entering university and in the disciplines preceding the one in which the event will be worked on;
understand and apply scientific and mathematical principles relevant to their field of study, as well as key concepts in this field;
understand the multidisciplinary context of the field for which they are training and develop the skills required for analyses that are characteristic of the field;
apply their knowledge and understanding to plan solutions to problems that they have not previously encountered and that may involve other areas;
develop investigative skills by conducting research, using databases and other sources of information, identifying, locating and obtaining the required data, critically evaluating them and then drawing conclusions;
integrate knowledge from different areas and levels of complexity;
understand their effective role in a team, both individually and collectively, exercising group leadership when necessary;
use different methods to communicate effectively;
perceive the need to learn continuously, independently, throughout their lives.

According to Camarena (2021), the strategies used by teachers in Context Didactics are: the implementation of CE, worked on by students in collaborative teams, and the proposition of activities, using technology as a learning mediator, aiming at the abstraction of concepts involved in the events. Such activities are proposed at two distinct moments: when, during the resolution of the event, students face difficulties that prevent them from continuing towards the desired solution and to the end of the work, at the moment called by Camarena (2021) as decontextualization, when such activities play the role of presenting the concepts worked on in a purely mathematical context, with the level of formalization required by the undergraduate course in which the discipline is being taught.

In our proposal, in Context-Mediated Didactics, before working with CE, another teaching strategy must be used, which, in turn, will also give rise to a learning strategy: the proposition of a prior preparation activity. Furthermore, unlike what is proposed in Context Didactics, in which work with CE initially occurs without proposing any questions that may contribute to the student carrying out fundamental reflections to obtain the solution of the event, in Context-Mediated Didactics, working with CE occurs in an intertwined manner with learning activities, which are what we call guiding questions. Thus, such activities are not proposed based on an obstacle faced by students at the time they are working with the event, which is the original proposal in Context Didactics, but are already planned with the intention of avoiding it, without however eliminating the cognitive conflicts essential for the construction of new learning, presenting, in a targeted manner, through an MLE, subsidies for students to reflect and face such conflicts successfully and to modify themselves structurally.

In Context Didactics, after the work with CE is completed, activities are proposed to institutionalize the concepts worked on in purely mathematical contexts. In Context-Mediated Didactics, such activities are also planned, but only after a stage of *final reflections* on the student's experience when engaging in work with CE.

The aims of such reflections are to identify:

the students' perceptions of what they experienced and the possible impacts on their learning and professional training paths, their involvement in the process;

whether the aims proposed by the teacher when proposing the event were achieved or not; whether the situation motivated the students, whether it interested them, whether, in their views, it enabled them to mobilize knowledge already internalized, attributing them new meanings, whether it highlighted connections between Mathematics and their area of training and future professional activity, etc.

In Context-Mediated Didactics, we chose to institutionalize the concepts targeted only after the final reflection activities because we understand that, just like all the observations made by the teacher based on the students' productions during the work with the event, the results of these activities can also, in some cases, provide important clues for the adequate formalization of the targeted concepts. Such formalizations can be performed not only in purely mathematical contexts, but also using extra-mathematical situations distinct from those focused on CE, and can even use those usually present in textbooks.

As originally proposed by Camarena, in Context-Mediated Didactics, the evaluation is also continuous and occurs from the moment students carry out the prior preparation activities, and is only completed after the institutionalization of the targeted concepts when working with CE. In Context Didactics, there is no mention of the instruments used to evaluate the work developed or how these are prepared. In this article, we do not delve into our evaluation proposal inserted in Context-Mediated Didactics, but we emphasize that this is designed using rubrics that make it possible – based on the students' responses to the guiding questions and other questions asked by the teacher during the work with the event, as well as in the activities of institutionalization of the targeted concepts encompassing a purely mathematical context or extra-mathematical situations different from that contemplated in the event

– to identify, in a global way, the learning, both conceptual and attitudinal, as well as the aspects that still need to be better developed or internalized by them and, therefore, will need to be emphasized in the next events or activities, as well as possible needs for reorientation in the teaching work.

In order to evaluate how, in addition to providing an opportunity to learn new mathematical content, the contextualized event may have contributed to the mobilization of cognitive functions, to the explanation of cognitive dysfunctions (denoted by deficient functions in TSCM) and to the development of previously deficient functions, we used instruments developed in line with the Instrumental Enrichment Program (IEP), also developed by Feuerstein and collaborators within the scope of TSCM, instruments that will not be detailed in this article.

According to Camarena (2017), Context Didactics is organized into three key moments: *opening, development* and *closing*, as shown in Table 1.

Table 1

Moments according to which Context Didactics is organized

OPENING	Students solve, in classroom or outside it (as the case may be), CE with diagnostic, motivating or knowledge reinforcement functions. Outside the classroom, students carry out learning activities on prior knowledge that they may not have mastered.
DEVELOPMENT	Students solve CE to build knowledge, to reinforce it, or to overcome obstacles. The teacher evaluates the inclusion of learning activities when necessary. The teacher begins the evaluation of students.
CLOSING	The student, upon completing the CE, carries out activities with the support of technology as a learning mediator. The teacher proposes CE or other instruments to evaluate learning.

Source: Camarena (2017, p. 15).

Context-Mediated Didactics was organized into five moments, which we call Prior Preparation; Implementation of the Contextualized Event; Final Reflections on the Implementation of the Contextualized Event; Institutionalization of Targeted Concepts, and Final Evaluation. Each of these moments will now be described in detail.

Prior Preparation

In this first stage, the teaching strategies include prior preparation activities (generally, research activities), which can be carried out in or outside the classroom, aiming to familiarize students with the context in which the event will be inserted and, consequently, with the specific concepts linked to such context. In addition, depending on the objective of the event, such preparation may include familiarization with prior mathematical concepts necessary for the successful development of its implementation.

Performing prior preparation activities will require:

• research aimed at familiarizing students with the context of the event to be implemented and/or with mathematical content necessary for this work;

• answers to questions proposed by teachers about specific concepts that will be present in the context of CE and/or related to mathematical content necessary for this work;

• elaboration of a product (podcasts, videos, texts, slide presentation, poster, etc.) resulting from the actions indicated in the previous items, a product that will guarantee the teacher that the activity was carried out.

The learning strategies required from this first moment of Context-Mediated Didactics are: collaborative work, individual work, use of technologies and out-of-class research.

The proposition of these activities is supported, from a didactic-methodological point of view, by one of the stages of the instructional strategy called Team-Based Learning (TBL), namely the Preparation stage (Oliveira et al. 2016; Bollela et al. 2014).

The elaboration and proposition of prior preparation activities by the teacher are directly related to the CE objectives that will be implemented. Thus, the first activity required by the teacher in Context-Mediated Didactics is the elaboration of such an event or the choice of it, if the teacher chooses to work with an event that has already been produced. It is necessary to determine what role such an event will play: whether motivating, diagnostic, knowledge-building, knowledge-reinforcing or obstacle-facing. Once again, we can associate this procedure with an aspect of TBL:

the preparation of activities aimed at the *Application of Concepts*, which will be the moments in which students, gathered in teams, will reflect on problems whose solutions depend on the mastery of the knowledge built in the prior preparation stage and which, at the initial moment of the *Implementation of the Contextualized Event*, as will be detailed in due course, will be verified by the teacher.

The teacher will also need to build the history of the CE that he or she has designed or selected, determining, in relation to this event: (i) the role to be played; (ii) the mathematical knowledge; (iii) the knowledge of the context that intervenes in it; (iv) based on a targeted competence, identify which of its components - knowledge, skills, attitudes and values - are related to CE; (v) its possible forms of resolution; (vi) the time needed to develop it with the students; (vii) the obstacles that they may face; (viii) the most frequent questions that may be asked during the implementation; (ix) the questions to be asked by the teacher to encourage students to reflect on their doubts, so as not to present them with the answers directly; and (x) the different possible discussions for the proposed situation.

In Context-Mediated Didactics, we understand that, when constructing the history of the CE, special attention should be paid to the production of guiding questions that will be proposed to students at the time of Implementation of the Contextualized Event to guide them in the process towards the desired solution and analyze how DICT and different software can contribute to the answers to such questions.

As also recommended by Camarena (2021) in Context Didactics, it is important for the teacher to analyze, based on the implementation of the CE developed or selected with a small group of students or through alternative procedures, such as, for example, considering the experiences arising from the practice of the teacher who developed or will use the event; or carrying out reflections with an interdisciplinary group of teachers, the reliability and validity of the developed or selected event.

According to Camarena (2021), the reliability of an event is related to its potential to explore the targeted concepts and, to ensure that the event is reliable, the teacher must analyze whether it is understandable, unambiguous, whether the notation used is clear, whether it is appropriate in relation to the level of prior knowledge of students so that the learning generated can be meaningful and whether the time provided for its resolution is adequate.

On the other hand, an event is considered valid if it actually plays the role for which it was designed. Such validity must be analyzed from three perspectives:

content: whether the event really includes the topic with which one wants to work; construction: whether what is expected from the student, in terms of knowledge construction, can actually be carried out by him/her based on the developed CE; resolution: whether the resolution given to the event by an expert in the context in which it is inserted coincides with that presented by a teacher who knows the content, but who is not an expert in the area.

At this Prior Preparationstage, the teacher, in addition to designing the activities to be carried out by students, will also identify, using a specific instrument for this purpose (for further details, see Gomes et al. 2021b; Hernández & Alonso, 2013), their respective learning styles, which will make it possible to form heterogeneous groups for the next stage of the work – *Implementation of the Contextualized Event*.

Another teaching task inherent to this stage is the holistic conception of how the process of continuous assessment of the students' learning and overall development will take place during the work with the event and, in particular, and based on which rubrics, how the students' productions in the prior preparation activity will be evaluated.

Implementation of the Contextualized Event

Firstly, the teacher analyzes the products prepared by students in the prior preparation stage and, if necessary, revisits some concepts that have not been properly understood and that are essential for the successful implementation of the CE. For this first stage of this moment, teachers from specific areas of knowledge present at the event, in addition to Mathematics teachers, may be invited to dialogue with students, clarify any doubts they may have and correct misinterpretations of the concepts expressed in the results of the *Prior Preparation* moment.

The presentation and discussion with the teacher who will implement CE, other colleagues and, when applicable, with teachers invited from different areas, of products prepared during the *Prior Preparation*stage will play the role, again referring to the TBL, of ensuring that due preparation for the subsequent work was carried out in an appropriate manner.

After this *ensuring preparation* stage (Oliveira et al. 2016; Bollela et al. 2014), the teacher presents the CE that will be solved to students. The work with such events is intertwined with what we call *guiding questions*, which are not proposed based on an obstacle faced by the student when working with the event, but are already planned with the aim of avoiding it, without, however, eliminating the cognitive conflicts essential for the construction of new learnings.

The teacher constantly observes the students' work with the *guiding questions* and, based on this observation, the students' dialogues and comments or the doubts they present, elaborates, whenever necessary, what Viseu and Oliveira (2012) call *competent questions*, with different natures and intentions, which, together with the *guiding questions*, will act as instruments for the MLE.

These *competent questions* are, in general, *factual questions*, since they require a predetermined answer. They can be, according to Tienken et al. (2009), *productive questions* - which provide students with the opportunity to create, analyze or evaluate - or reproductive questions - which encourage students to imitate, remember or apply the knowledge and information taught by the teacher through a simulation process. They can be, as Fazio (2019) points out, questions that require *recovery* - aiming to recover prior knowledge - or that require metacognition - demanding reflection on the reasoning adopted - or even questions that involve reasoning - requesting the deduction of something from one or more premises.

According to Boaler and Brodie (2004), the factual questions proposed to students can also be of different types, namely those that allow:

compiling information and guiding the student through a method; and, because they require an immediate response, students can, based on known facts or procedures, resort to trial and error and the establishment of statements;

using or introduce terminology and provide an opportunity for mathematical language to be correctly used for the ideas under discussion;

enabling mathematical relationships and their meanings to be explored and highlighted and for connections to be established between mathematical ideas and their representations;

requiring explanations of ways of thinking and enabling students to articulate, elaborate or clarify ideas;

generating discussions and provoking contributions from other students in the classroom, in addition to the one answering the question;

providing an opportunity for the relationship and application of mathematical ideas, making it easier to relate them to those from other areas of study or life in its different spheres;

broadening ways of thinking, allowing the student to extend what is being discussed in a given situation to others in which similar ideas can be used;

serving as guidance and focus tools, helping students to pay attention to key elements or aspects of the situation that enable solving problems;
establishing contexts, motivating the discussion of extra and intra-mathematical issues.
The role of the *guiding questions* and other questions that can be proposed to students during the resolution of the event is to provide, in a targeted manner, through MLE, support for them to reflect and successfully face the cognitive conflicts they encounter and to change themselves structurally.

Another task that the teacher must perform during the Implementation of the *Contextualized Event* is to continue the evaluation process. To do this, the teacher must develop rubrics that allow, based on the students' answers to the guiding questions and other questions asked by the teacher, to identify, in a global way, the learning, both conceptual and attitudinal, as well as aspects that still need to be better developed or internalized and that therefore, will need to be emphasized in the next events or activities, as well as possible needs for reorientation in the teaching work.

Final Reflections on the Implementation of the Contextualized Event

At this stage of the Context-Mediated Didactics, the teacher proposes final reflection activities with the aim of identifying the students' perceptions about what they experienced and the possible impacts of this experience on their learning and on their professional training paths. Such activities can be of different natures and favor different learning styles, and may require the elaboration of a text, answers to a set of questions, production of a video or a podcast, etc.

The evaluation process continues at this stage and, for this, the teacher prepares rubrics that make it possible, based on the products of final reflection activities, to identify learning, both conceptual and attitudinal, as well as aspects that still need to be better developed or explored.

Institutionalization of Targeted Concepts

The aim of this stage is to formalize, with the levels of detail and rigor inherent to the student's education, the mathematical contents that were directly or indirectly explored during the resolutionof the event. This is a stage of Context-Mediated Didactics whose main aim is to enable students to incorporate the mathematical content worked on into their knowledge bases and to understand it as concepts that can be used in different situations, in different contexts, and not only as a necessary tool to specifically solve the proposed problem.

To carry out the *Institutionalization of Targeted Concepts*, the teacher will design and implement learning activities, and may even select and indicate questions – in purely mathematical contexts or contemplating extra-mathematical contexts different from those present in the event – that exist in books or other teaching materials used as references in the discipline in which the event was developed. To carry out these activities, if necessary and to contribute to a more comprehensive understanding of the students about what is being worked on, different digital technological resources can be used. The evaluation process also continues at this time.

Final Evaluation

In this last stage, the work developed is finalized through the conclusion of the evaluation process. The teacher develops and implements evaluation instruments that make it possible to identify, in different contexts, mathematical and extra-mathematical, learning and non-learning about the mathematical concepts under study.

The instruments used for the *Final Evaluation* can be of different types: a conventional test, an activity evaluated by rubrics, a seminar carried out by the student, a video produced individually or in a team, a podcast, etc. Such instruments can be developed with the aim of evaluating both constructed mathematical knowledge, as well as general and specific skills and aspects related to cognitive functions and dysfunctions, in accordance with IEP.

Having concluded the description and justification of each of the moments that make up the Context-Mediated Didactics, we move on to the considerations that can be inferred from what was presented throughout this article.

Concluding Remarks

Based on the first experiences with the development and implementation of CE in line with what had been originally proposed within the scope of TMCC, it was observed that these were excessively complex and often demotivating for students who, in general, considered themselves to be below what was necessary, from a cognitive point of view, to face a CE and solve it. This perception led us to seek other strategies, such as moments of prior preparation, proposition of guiding questions and activities of final reflections, not explicitly recommended by the Context Didactics, aiming to make the work with CE, despite being challenging, accessible to students and more feasible for teachers.

In view of the successful experiences using the work with CE associated with these strategies not contemplated by TMCC, in a second moment, we began to worry about justifying them based on different theoretical references. We then observed that the precepts of TSCM, especially those related to MLE, proved to be adequate for our purposes.

We then focused on establishing coordination between TMCC and TSCMelements, which resulted in our proposal to expand Context Didactics, which we call Context-Mediated Didactics, whose main premise is not to eliminate the cognitive conflicts faced by students, since these are essential for the construction of new learnings, but rather to provide them through the MLE experience with resources to reflect on and face these conflicts in an effective and productive way, allowing students to change themselves structurally.

The ability to change themselves structurally, which can be developed by students when experiencing classes conducted according to Context-Mediated Didactics will enable them to be more aware of their difficulties and how to overcome them, as well as to have greater clarity regarding the cognitive functions that they have already developed. Furthermore, a teaching strategy like this, based on mediation, on working with prior preparation activities and guiding questions, allows the development of greater protagonism on the part of the student, who will not depend exclusively on the teacher, but will have the teacher as a partner in the process of constructing their knowledge.

As for teachers, the procedures of developing prior preparation activities and guiding questions based on CEthat they constructed or selected will provide them with a deeper and more detailed knowledge of both mathematical concepts and the specific areas present in CE, which will give them greater confidence when implementing them with students.

Although Context-Mediated Didactics has proven to be a promising tool for improving the teaching and learning processes of Mathematics in undergraduate courses in which this science is not the central objective and for overcoming some obstacles observed when adopting only the assumptions of Context-Mediated Didactics as originally foreseen in TMCC, its potential can only be achieved with the effective engagement of teachers in preparing the strategies present in each of the CoMeDi moments, of students, who must commit to their own knowledge construction processes following the guidelines presented by teachers and the institutions in which the relationships between these actors and the targeted knowledge will take place, which must support the teachers in this differentiated work and offer them the necessary conditions so that it can be developed.

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