

CRITICAL MATHEMATICS EDUCATION AND INSTRUMENTATION FOR THE TEACHING OF MATHEMATICS: A SYSTEMATIC LITERATURE REVIEW IN A BACHELOR'S DEGREE PROGRAM

A EDUCAÇÃO MATEMÁTICA CRÍTICA E A INSTRUMENTAÇÃO PARA O ENSINO DE MATEMÁTICA: UMA REVISÃO SISTEMÁTICA DE LITERATURA EM UM CURSO DE LICENCIATURA

LA EDUCACIÓN MATEMÁTICA CRÍTICA Y LA INSTRUMENTACIÓN PARA LA ENSEÑANZA DE LAS MATEMÁTICAS: UNA REVISIÓN SISTEMÁTICA DE LA LITERATURA EN UN CURSO DE LICENCIATURA

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ABSTRACT

This article presents a map on Critical Mathematics Education (CME), Teacher Training and Degree in Mathematics in Theses and Dissertations resulting from the research carried out at the CAPES Theses and Dissertations Base. To answer the research question: Is Critical Mathematics Education explored in the discipline of Instrumentation for Teaching Mathematics in the Degree in Mathematics in Higher Education? The methodological referrals followed the assumptions of a Systematic Literature Review through three moments. Initially, the productions referring to Critical Mathematics Education were selected, later a synthesis was elaborated in relation to the use of EMC in Teacher Training and finally in the Mathematics Degree course referring to the researched productions. The results point to different uses of CME in the undergraduate course of Licentiate in Mathematics, thus leading to a critical and reflective look at academics and future teachers.

Keywords: Critical Mathematics Education. Degree in Mathematics. Instrumentation for teaching mathematics.

RESUMO

Este artigo apresenta um mapeamento sobre a Educação Matemática Crítica (EMC), a Formação de Professores e a Licenciatura em Matemática em Teses e Dissertações resultantes da pesquisa realizada na Base de Teses e Dissertações da CAPES. A fim de

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responder à questão de pesquisa: A Educação Matemática Crítica é explorada na disciplina de Instrumentação para o Ensino de Matemática no curso de Licenciatura em Matemática no Ensino Superior? Os encaminhamentos metodológicos seguiram os pressupostos de uma Revisão Sistemática de Literatura por meio de três momentos. Inicialmente foram selecionadas as produções referentes a Educação Matemática Crítica, posteriormente uma síntese foi elaborada em relação ao uso da EMC na Formação de Professores e por fim no curso de Licenciatura em Matemática referente as produções pesquisadas. Os resultados apontam para diferentes usos da EMC no curso de graduação em Licenciatura em Matemática, levando dessa forma, um olhar crítico e reflexivo aos acadêmicos e futuros professores.

Palavras-chave: Educação Matemática Crítica. Licenciatura em Matemática. Instrumentação para o Ensino de Matemática.

RESUMEN

Formación de Profesores y la Licenciatura en Matemáticas en Tesis y Disertaciones resultantes de la investigación realizada en la Base de Tesis y Disertaciones de la CAPES. Con el fin de responder a la pregunta de investigación: ¿La Educación Matemática Crítica se aborda en la asignatura de Instrumentación para la Enseñanza de las Matemáticas en el curso de Licenciatura en Matemáticas en la Educación Superior? Los procedimientos metodológicos siguieron los presupuestos de una Revisión Sistemática de la Literatura a través de tres momentos. Inicialmente, se seleccionaron las producciones relacionadas con la Educación Matemática Crítica; posteriormente, se elaboró una síntesis respecto al uso de la EMC en la Formación de Profesores y, finalmente, en el curso de Licenciatura en Matemáticas, considerando las producciones investigadas. Los resultados señalan diferentes usos de la EMC en el curso de Licenciatura en Matemáticas, proporcionando así una mirada crítica y reflexiva a los académicos y futuros docente

Palabras clave: Educación Matemática Crítica. Licenciatura en Matemáticas. Instrumentación para la Enseñanza de las Matemáticas.



1 INTRODUCTION

Critical Mathematics Education (CME), considered as a Trend in Mathematics Education, emerged as a movement in the 1980s concerned with the political aspects of mathematics education. It is shown in the legal documents subtly, as a way of working the content of mathematics in a critical-reflective way in a democratic way of teaching and learning, without addressing only the traditional teaching method, but uses aspects of the students' daily life to work with mathematics in a contextualized way, thus promoting a differentiated view of mathematics to the student.

For Skovsmose (2015), the notion of "traditional mathematics teaching" suggests this practice as a reference for mathematics education, a set of terminologies to be transferred to students. The author points out that exercises play a crucial role in teaching. However, during the school period, a student can answer more than 10 thousand exercises, but this practice may not help in the development and mathematical creativity. (SKOVSMOSE, 2015, p.16)

In this aspect, according to D'Ambrósio, "[...] There is something wrong with the mathematics we are teaching. The content that we try to pass on through the school systems is obsolete, uninteresting and useless" (D'AMBRÓSIO, 1991, p. 1). For this, it is necessary to use means that can lead the student to an understanding of the importance of mathematics and its use in everyday life.

Guiding documents such as the National Common Curriculum Base (BNCC), the National Curriculum Parameters (PCN), Basic Guidelines Laws (LDB) and Curriculum Guidelines, are vehemently objective with regard to the different methodologies that can be used as tools in the teaching of mathematics in Basic Education. These methodologies can help students to better understand the importance of mathematics and how this discipline is present in everything.

However, when faced with the Undergraduate Course in Mathematics, for the academic who chooses teaching in Mathematics as a profession, it is verified that the Trends in Mathematics Education could be further explored during the course. In this way, the future teacher, at the end of the Degree in Mathematics, must be prepared to use his knowledge, and thus transmit it to future students. In this way

[...] the knowledge of mathematics necessary to teach is more than knowing mathematics for oneself, it is correctly understanding concepts, as well as performing procedures, but also being able to understand the conceptual foundations of these concepts and procedures (SERRAZINA, 2014, p. 1.054).



In this perspective, the Trends in Mathematics Education can serve as a methodological tool to assist the future mathematics teacher in the transmission of knowledge. When it comes to undergraduate Mathematics Teaching Degree, it is relevant that future mathematics teachers for Basic Education and Higher Education seek alternatives in methodological trends that can help them in their pedagogical practices as teachers.

Thus, for the present research, we sought to structure the publications on CME's experiences in the discipline of Mathematical Instrumentation in the Undergraduate Mathematics Degree course. The objective of this work is to verify the use of this methodological tool with undergraduate students of the Mathematics Teaching Degree course, in the discipline of Instrumentation for Mathematics Teaching and future teachers of this discipline.

Thus, this work was carried out from the methodology of systematic literature review, in which it follows strict criteria for the mapping of the field and is being increasingly adopted in investigations within the scope of Educational Sciences.

2 THEORETICAL FRAMEWORK

The theoretical framework of this study is based on discussions that articulate the assumptions of Critical Mathematics Education and the role of the discipline of Instrumentation for Mathematics Teaching in the initial training of teachers. It seeks to understand how the critical principles of Mathematics Education, inspired by authors such as Skovsmose, Freire and D'Ambrosio, can contribute to a more reflective and meaningful teaching practice, especially in the context of the training of Mathematics undergraduates. Thus, this section presents a conceptual basis that supports the analysis of the importance of the critical and pedagogical dimension in the process of teacher training.

2.1 CRITICAL MATHEMATICS EDUCATION

Critical Mathematics Education (CME) is an area of Mathematics Education in which there are concerns with mathematics in society, it emerged as an education movement from important names such as Marilyn Frankenstein, in the United States, and in Brazil with Ole Skovsmose. Other important names influenced EMC, which are the Brazilians Paulo Freire and Ubiratan D'Ambrosio.

For Skovsmose (2007), critical mathematics is related to the nature of the competencies that mathematics could support, and also emphasizes that:

Rather than discussing mathematics and reality in terms of possible references for mathematical concepts, I wish to consider mathematics as a resource for action. [...] I just take it for granted that these actions are effected in the real world. They occur in the world in which we drive and park our cars, old and new. It is the world that we read about in newspapers, and in which Brazil is playing soccer. (SKOVSMOSE, 2007, p.220)

In this sense, Skovsmose (2007) refers to the importance of mathematical knowledge, with regard to its use as a tool in all areas of the individual so that he knows what its applicability is and in what circumstances mathematics can help him in his daily life. For Skovsmose (2007) "Mathematics" does not need to refer only to advanced mathematics, or to applied mathematics, or to mathematics in packages that are part of the entire apparatus of reason.

Borba and Skovsmose (2001) point out the importance of combating an oppressive view in the teaching of Mathematics, that if something has been mathematically proven, then mathematics is above all. For the authors, the ideology of certainty in mathematics can be attributed to the fact that mathematics has superpowers to solve any situation. (SKOVSMOSE, 2001).

Thus, Mathematics can be worked in a democratic way, in which dialogicity is part of the educational environment and in a way that mathematics makes sense to the student, it can collaborate with a better understanding of the student, in the employability of an open and fearless dialogue between student and teacher. Freire (2018) indicates that teaching requires knowing how to listen, "[...] It is not by speaking from above, above all, as if we were the bearers of the truth to be transmitted to others, that we learn to *listen*, but it is by listening that we learn to *talk to them*." (FREIRE, 2018, p.115)

To this end, it is perceived through the citations of authors such as Skovsmose (2001), Paulo Freire (2018), Ubiratan D'Ambrosio (1991) and Marcelo Borba (2008) the great importance that mathematics can serve as a contribution to help students with regard to its applicability and not only for the teacher to fulfill his annual plans. Also remain in the comfort zone that the "content" was transmitted, but did this content make sense to the students? And will the Mathematics Degree student know how to approach his teaching techniques to his future students in Higher Education?

The discipline of Instrumentation for the teaching of Mathematics brings to undergraduate students important relevant topics about the applicability of mathematics and

the methodologies used to transmit this knowledge to future teachers in the area of Mathematics.

2.2 INSTRUMENTATION FOR THE TEACHING OF MATHEMATICS

The training of Mathematics teachers encompasses an articulated set of policies that range from initial training to the continuing education of teaching professionals in Brazil. Lima's doctoral research (2018) discusses the historical facts, pointing out the formative path that has been constituted in the midst of power relations with regard to bachelor's and licentiate courses, the dichotomy between theory and practice, and the distance between university, students, and Basic Education school. (LIMA, 2018, p.50).

Thus, there is a growing concern with the pedagogical dimension in the Mathematics Teaching Degree courses, which led to changes in the curriculum with the purpose that the training of the licentiate students would not be restricted to the training of the mathematician, but would effectively contemplate the constitution of the Mathematics teacher. Therefore, in this sense, according to Moreira and David (2010), the first changes in the curricular structure of the teaching degree courses occurred from the 1970s onwards, in which some disciplines such as Sociology of Education, Educational Policy, among others, were inserted in the course curriculum.

However, there was still a distance between the Mathematics teacher and the pedagogical dimensions at the time of his work in the classroom. Thus, as Cruz (2010) clarifies, the most significant changes for the Mathematics Teaching Degree courses arose with the specific legislation on teacher training from 2001 and 2002:

Opinion CNE/CP 009/2001 that presents the proposal for National Curriculum Guidelines for the Training of Basic Education Teachers, at the higher level, Licentiate course, full graduation. Opinion CNE/CP 28/2001 – establishes the duration and workload of Basic Education Teacher Training courses, at higher level, licentiate course, full graduation. CNE/CES Opinion 1.302/2001 – provides for the National Curriculum Guidelines for Mathematics, Bachelor's and Licentiate Courses. Resolution CNE/CP 01/2002 – Establishes National Curriculum Guidelines for the Training of Basic Education Teachers, at higher level, Licentiate course, full graduation. Resolution CNE/CP 2/2002 – Establishes the duration and workload of the Licentiate, full graduation, and Basic Education teacher training courses at higher level (CRUZ, 2010 p. 32-33).

After the publication of these opinions, some changes began to occur in the Mathematics Teaching Degree courses, with the perception of the importance of pedagogical disciplines for the course, thus differentiating the Bachelor's degree from the practice of the Teaching Degree.

Based on the Mathematics Teaching Degree course at the State University of Ponta Grossa (UEPG), it is observed that the curricular changes occurred from the insertion of the Instrumentation for Mathematics Teaching disciplines in the curricular structure, configuring themselves as components of specific and professional training, as shown in Figure 1, referring to the syllabus of the Teaching Degree course.

Figure 1

Layout of the discipline of Instrumentation for the Teaching of Mathematics

DISCIPLINAS DE PRÁTICA COMO COMPONENTE CURRICULAR		
CÓDIGO	DISCIPLINAS	CARGA HORÁRIA
101167	Instrumentação para o Ensino de Matemática I	68
101168	Instrumentação para o Ensino de Matemática II	102
101169	Instrumentação para o Ensino de Matemática III	102
101170	Instrumentação para o Ensino de Matemática IV	68
101171	Laboratório de Ensino de Matemática	68
509054	Didática	68
	Sub-total	476
DISCIPLINAS DE FORMAÇÃO ESPECÍFICA PROFISSIONAL		

Source: UEPG, Ementário-Lic.pdf.

In this way, the disciplines are distributed throughout the first, second, third and fourth grades of the Mathematics Degree course, whose minimum duration is four years and a maximum of six years for curricular integration. The discipline listed, continues in the four years of the course and assumes a role of great relevance for the undergraduate. It is there that the student will have the first contacts with the process of transmitting knowledge to his future students. According to the UEPG portal, in the syllabus of the Mathematics Teaching Degree course, the disciplines of Instrumentation for the Teaching of Mathematics are established as follows, in the first year, Instrumentation for the Teaching of Mathematics I:

The professional of the Mathematics Degree in the social context. Mathematics and Mathematics Education. Research and Teaching in the organization of teaching work. Interrelation of the mathematical contents that make up the subjects of the 1st grade of the Course and of these with Elementary and High School. (UEPG, Summary, p.58)

For the second grade, Instrumentation for the Teaching of Mathematics II, it refers to the organization of projects as described in the course syllabus:



Research and Teaching in the organization of teaching work. Interrelation of the mathematical contents that make up the disciplines of the 2nd grade and previous of the Course and of these with Elementary and High School. Analysis of mathematics textbooks for Elementary School. Organization of a teaching project for Mathematical content in Elementary School, High School and Youth and Adult Education. (UEPG, Summary, p.58)

In this process of the Teaching Degree course, students are faced with the different ways of working with mathematics in the classroom, and that undergraduate students have the most directed knowledge to Trends in Mathematics Education for educational practices with their future students.

For third grade students, the Instrumentation for Mathematics Teaching III course addresses questions about teaching methodologies and also practical knowledge in the Supervised Internship, with the following as instruction:

Research and Teaching in the organization of teaching work. Interrelationship with the discipline of Methodology and Teaching Practice I – Supervised Internship, in the study and discussion of pedagogical action projects, for Mathematical contents of Elementary, High School and Youth and Adult Education. Interrelation of the mathematical contents that make up the disciplines of the 3rd grade and previous of the Course and of these with Elementary and High School. Analysis of mathematics textbooks used in High School. Analysis of teaching and learning situations observed and recorded in Mathematics classes for elementary school. (UEPG, Summary, p.58)

At this point in graduation, the student is faced with classes in supervised internships and has the experience of the classroom and how the lesson plans will be and what practices they can use. In the fourth year of the Degree in Mathematics, the student will have his last discipline of Instrumentation for the Teaching of Mathematics IV, in the menu of the UEPG course there are the following topics covered for this series

Interrelation with the discipline of Methodology and Teaching Practice II - Supervised Internship, in the study and discussion of projects of pedagogical actions, for Mathematical contents of Elementary, High School and Youth and Adults. Interrelation of the mathematical contents that make up the disciplines of the 4th grade and previous of the Course and of these with Basic Education. Analysis of teaching and learning situations observed and recorded in Mathematics classes for high school. Application of teaching projects for Mathematical content of Elementary, High School and Youth and Adults in the schools of the community. Preparation of experience report. (UEPG, Summary, p.58)

At this stage of the course, the undergraduate student is closer to knowledge about the methodologies necessary for use in the classroom and probably the academic is closer to the classrooms and with some experiences carried out through the Supervised Internship.

3 METHODOLOGY

For the present article, an adaptation of the Systematic Review of Literature by Kitchenham (2004) was developed as a research methodology. For this author, the Systematic Review of Literature is a means of ascertaining, evaluating, and interpreting the available research relevant to a given research question, area of a topic, or phenomenon of interest, produced in a given period.

To conduct this process, the author suggested some steps in which they are decisive for the Systematic Review of Literature, which are: 1. Identification of research; 2. Selection of primary studies; 3. Study of quality assessment; 4. Data extraction and monitoring 5. Data synthesis.

To begin this methodological procedure, as a guiding question, the following question is asked: Is Critical Mathematics Education explored in the discipline of Instrumentation for Mathematics Teaching in the Mathematics Teaching Degree in Higher Education?

The selection of primary studies was established from a search in the List of CAPES journals, for the refinement of the research the Base of Theses and Dissertations (BDTD) was used. The filters used for this search were delimited with the options chosen for the works carried out in CME in the Theses and Dissertations for Doctorate, Master's and Professional Master's Degrees.

For this phase of the methodological referral, the search took place in three moments:

- At first, the keyword "Critical Mathematics Education" was used. After this choice, 107 (one hundred and seven) works between theses and dissertations were listed in the database. The works that stood out in this period of search are related to the critical and reflective view of the author Ole Skovsmose (2001).
- In the second moment, the refinement was carried out through the search for the keyword "Teacher Training". Which had 29 (twenty-nine) works between theses and dissertations.
- In the third moment of the search, to detail the refinement of the Systematic Review of Literature, the keyword "Teaching Degree and Mathematics" was inserted, the works listed for this keyword fell to 5 (five) works between theses and dissertations.

In the synthesis of the results, it was used as an inclusion criterion, the works that address the use of CME in the development of mathematics activities in a perspective focused on Teacher Training and for Mathematics Teaching Degree students.

The Study and Evaluation and the Extraction and monitoring of the data, as well as the validation of the results were carried out by the researchers of the present work of the Graduate Program in Science and Technology Teaching (PPGECT).

The synthesis of the data was composed of the articulation of the CME with the discipline of the Undergraduate course in the Mathematics Degree, in order to verify the use of this methodology in the Teacher Education of the undergraduate course.

4 DISCUSSIONS AND RESULTS

To meet the objective proposed in this work, table 1 presents the mapping of works focused on CME articulated with Teacher Training and with the Mathematics Teaching Degree course.

Table 1

Mapping of CME focused on the Mathematics Degree course

Topics covered	Doctorate	Masters	Total
EMC	19	88	132
Teacher Training	7	22	29
Degree in Mathematics	3	2	5

Source: CAPES. Accessed on: jul. of 2025.

To obtain a detailed perspective on the topics researched, table 2 presents a categorization of the areas in which CME, Teacher Education, and Mathematics Teaching Degree are situated. The separation of the works was selected from the searches carried out in the CAPES Theses and Dissertations Database and, for each topic addressed, the type of document, the title of the research and the year of defense are exposed.

Table 2

Categorization of papers addressing the topic of EMC

Document Type	Survey title	Author	Defense date
THESIS	Critical mathematics education in the perspective of educating in		2020

	Human Rights: connections between public policies and teacher training.	Vieira, Lygianne Batista	
THESIS	The relationship between mathematical content and the peasantry in the training of mathematics teachers in teaching degree courses in rural education.	Lima, Aldinete Silvino de	2018
THESIS	Critical mathematics education and the social implications of science and technology in the contemporary civilizing process: clashes for the training of mathematics teachers	Civiero, Paula Andréa Grawieski	2016
DISSERTATION	Interactive geometry: new media in a methodological proposal for high school.	Pereira, Geraldo Henrique Alves	2016
DISSERTATION	Solving spatial metric geometry problems using information and communication technology.	Bizinoto, José Henrique	2016

Source: The authors

Vieira's thesis (2020) presents Critical Mathematics Education from the perspective of Educating in Human Rights, the objective of his research is to answer the questions: Is it possible to develop the content and form of Mathematics Education in such a way that they can serve as a tool for Human Rights Education? To what extent are legal guidelines for teacher training and public policies involved in the process of building an education based on Human Rights?

Vieira's (2020) work was structured in *a multipaper format* based on the construction of scientific articles that are independently articulated to respond to the general objective of the research and was organized into three articles that correspond to the specific objectives of the thesis.

For Vieira's (2020) research, a Literature Review was sought through a bibliographic survey, using the systematic review methodology. For document analysis, the content analysis technique based on Bardin (2006) and Sá-Silva et al. (2009) was used.



Based on the constructions of the articles, Vieira (2020) points out that the teacher needs to resignify his role in the face of the challenges of contemporary society. It also emphasizes the need for teachers to think about their political and social positioning, their actions, their speeches, their affection, the way they see mathematics, their forms of evaluation, their posture in the face of injustices, diversity, always considering the students' learning difficulties.

The author highlights with the result of her research the identification of the inclusion that Human Rights themes can be incorporated into the training of mathematics teachers, but that the Pedagogical Projects of Mathematics Courses still need to advance a lot to achieve training in the principles of Critical Mathematics Education articulated with Human Rights Education.

In Lima's thesis (2018) the research aims to understand the relationship between mathematical content and the political, social and cultural dimensions of the peasantry in the training of Mathematics teachers in Rural Education Degree Courses. The theoretical foundation of Lima's (2018) research was based on the theoretical references of Rural Education and the aforementioned degrees, the training of Mathematics teachers and Critical Mathematics Education, which allowed us to delimit dialogue, investigation and criticism as analytical categories.

According to Lima (2018), the Political-Pedagogical Projects of the Courses (PPC) of three public universities located in the Northeast, Midwest and Southeast regions of Brazil were analyzed, we interviewed eight teacher trainers and observed classes of three curricular components taught in these courses.

The analysis of the PPC shows that the relationship between the mathematical contents and the political, social and cultural dimensions of the peasantry is present in the projects of the three courses, especially in the objectives, in the profile of the graduate and in the curricular organization. The interviews with the teacher trainers also reveal that this relationship is central to the training of Mathematics teachers and that dialogue, research and criticism are constituent elements of this relationship, according to Lima (2018).

For the analysis of the observed classes, it was evident that these elements are still treated in an incipient way in the mathematical activities proposed by the teachers, according to Lima (2018), pointing to the need for a better alignment between prescription and training.

According to the author of the research, the thesis concludes with the proposal of some learning environments that can be worked on in the training of Mathematics teachers of the



Degree in Rural Education, from the perspective of dialogue, investigation and criticism aiming at human and social transformation.

Civiero's (2016) doctoral work contemplates the propositions of Critical Mathematics Education (CME) and the social implications of science and technology in the contexts of initial mathematics teacher training. For this research, a qualitative approach was used with a historical-dialectical focus. The objective of this work was to investigate the dissemination of CME in Brazil and the possible contributions of CME to a change in the training of mathematics teachers, in view of the social relations of science and technology in the contemporary civilizing process.

According to Civiero (2016), the work initially brings a portrait of teacher training in Brazil, which shows that the teaching degree courses remain structured in the model of technical rationality, thus requiring transformations in a critical perspective. Next, historical elements of mathematics and mathematics education (MS) are presented, with emphasis on the power relations underlying mathematical knowledge.

This work presented influences from Critical Theory and Critical Education for CME. With the understanding that CME is the closest thing to critical thinking in the field of Mathematics Education (EM). To verify this influence, the author organized an inventory with international mapping of some readings on the area and another, national, with mapping of theses and dissertations from the period from 2000 to 2012, which showed that CME is disseminated worldwide, but that research in this regard is still isolated, especially in Brazil.

To collect the data for the thesis, Civiero (2016) organized semi-structured interviews with 17 teacher educators. With the help of analytical categories, possibilities, limits and obstacles, requirements and some proposals of these trainers for the insertion of CME in the training of mathematics teachers were identified.

The results point to the epistemology of the teacher as both a possibility and an obstacle, which highlights the need for epistemological and ideological-critical training. Civiero (2016) highlights the realization of a theorization movement based on the analysis of the data produced under the eyes of theoretical inspirations that discuss teacher training and the social implications of science and technology.

Thus, according to the author, the approximations with the field of Science, Technology and Society (STS) were observed and the discussions were broadened by emphasizing, together with the CME approaches, the variables of the new civilizational equation, intertwined with mathematical constructs, which can produce both wonders and horrors. It is



argued that it is urgent to emphasize, together with CME approaches, the social implications of science and technology to break the hegemonic model and thus instigate another education proposal that also values the human side.

In Pereira's master's thesis (2016), the research analyzes an important slice of Education: the teaching of Mathematics at the level of basic education. At the heart of his proposal is the study of the methodological trends that make up the current framework of discussions in Mathematics Education.

The author takes as a reference the teaching experience in which he aims to create possibilities for the resignification in the way of teaching and learning Geometry in high school courses, from the structuring of new media for the dynamics of the classroom that take into account Technologies and Ethnomathematics.

For the researcher Pereira (2016), necessary discussions were held, and in this way a proposal was presented that intertwines the two methodological tendencies making them dialogue with each other, and a contextualized activity was presented that takes into account this whole scenario.

The activity proposed by the author is configured as an alternative media to the Mathematics classroom, contemplating the use of a GeoGebra software in an environment with computers and the linking of contents to students' daily situations.

Bizinoto's master's thesis (2016) aimed at proposing an activity aimed at second-year high school students, with the purpose of teaching some concepts of Spatial Metric Geometry, specifically, calculating areas and volumes of geometric solids such as the cone, cylinder, sphere, pyramid and prism, with the help of technologies, through the GeoGebra software.

Bizinoto (2016) carried out a dissertation based on the elaboration of an activity, addressing some trends in teaching-learning of Mathematics, focusing on some Trends in Mathematics Education, mainly Problem Solving and Information and Communication Technology.

According to the author, the tendencies used in the dissertation, when worked together, are intertwined in such a way that it is difficult to verify which one is being used at each moment, Problem Solving starts from pre-acquired concepts for the teaching of new ones and Technologies help this construction at all times. The combination of the works generates a differentiated way of working with Mathematics, transforming them into a unique and effective teaching methodology.



The analysis of the mapping shows that, although there are advances in the insertion of CME in the initial training of teachers, there are gaps in the articulation between theory and practice. There is a predominance of conceptual approaches, with less emphasis on didactic experiences that promote critical reflection. These results point to challenges to consolidate teacher training aligned with the emancipatory principles of CME, indicating the need for strategies that integrate mathematical content, critical approach and contextualized pedagogical experiences.

5 CONCLUSION

This research aimed to map, through a Systematic Review of Literature, the approach of Critical Mathematics Education in the undergraduate course of Higher Education, especially in the Mathematics Teaching Degree. To structure this work, a guiding question was outlined: Is Critical Mathematics Education explored in the discipline of Instrumentation for Mathematics Teaching in the Mathematics Teaching Degree in Higher Education?

With the help of the search carried out in BDTD, it was possible to map works that portray the theme of CME, in which they present the works of Vieira (2020), Lima (2018), Civiero (2016), Pereira (2016) and Bizinoto (2016). These authors converge with regard to the use of Trends in Mathematics Education, but mainly on the relationship between critical and reflective thinking in which Skovsmose (2001) refers to Critical Mathematics Education.

Synthesizing the discussions presented in the cataloged works, several favorable arguments for the use of EMC can be perceived. The researchers' search for mathematics that makes sense to students is highlighted. In this way, it is linked to a concern that mathematics is not only for formal learning. But it can also be related to sociocultural issues, in which the student can correlate his learning with situations in his daily life.

It is noteworthy with the realization of research in the Base of Theses and Dissertations that the emphasis of this theme prevails in Basic Education. And it was noticed that after the refinement of searches for the keyword "Teacher Education" a drop in research papers about CME. When inserting a by the keyword "Degree in Mathematics" there was a low adherence to research on CME in Higher Education.

Studies aimed at future teachers in the Mathematics Teaching Degree course and especially in the discipline of Instrumentation for Mathematics Teaching were not mapped in this research. According to the syllabus of the institution chosen as a reference for this work,

UEPG, the discipline of Instrumentation directs students in the approach of contents through methodologies such as those listed in the Trends in Mathematics Education.

However, the bias of CME in the Higher Education course was little explored by researchers, there is low adherence to this methodology for Higher Education students in the Mathematics Teaching Degree. In addition, these are future teachers who will be channels for transmitting knowledge to students. Thus, the need for more research and work aimed at undergraduates is perceived.

To this end, it is observed the need for more studies related to the theme of CME in Mathematics Teaching Degree courses, so that, in this way, a more contextualized pedagogical practice can be integrated with future education professionals. In addition, a greater focus on the contributions of works involving the disciplines of Instrumentation for the Teaching of Mathematics may be to assist the praxis of teachers and academics of the course.

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