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The initial training of the teacher who teaches mathematics in the early years: a bibliographic research

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ABSTRACT. This article is an excerpt from the master's thesis in mathematics education, defended in 2021 and presents the results of a bibliographic research. Our objective was to identify how the teaching and learning process of mathematics in pedagogy degree courses, from 2016 to 2020, has been discussed in research, as well as, what are the main discussions carried out in relation to the difficulties faced by teachers of the Initial Years of Elementary School when teaching mathematics. This is a bibliographic research, developed from 49 (forty-nine) articles selected in national journals of Qualis A1, A2, and B1 and/or published in the Annals of the International Seminar on Research in Mathematics Education (SIPEM), of the National Meeting of Mathematics Education (ENEM) and the Paraná Meeting of Mathematics Education (EPREM). The research presents results that point to advances in the discussions about the teaching and learning of mathematics with the use of different methodologies during the Initial Education in Pedagogy, which has been providing resignifications of a personal and professional nature. However, there is still a predominance of difficulties arising from initial training, such as, for example, the little relationship between theory and practice, the lack of development and teaching of differentiated methodologies, concepts, and contents, which will be taught in the Initial Years, among others. Others that directly influence professional performance in the classroom.

Keywords: initial formation; pedagogy; math.

A Formação inicial do professor que ensina matemática nos anos iniciais: uma pesquisa bibliográfica

RESUMO. Este artigo é um recorte da dissertação de mestrado em Educação Matemática, defendida no ano de 2021 e apresenta os resultados de uma pesquisa bibliográfica. Nosso objetivo foi identificar como o processo de ensino e aprendizagem da Matemática, nos cursos de Licenciatura em Pedagogia, no período de 2016 a 2020, tem sido discutido nas pesquisas, bem como, quais são as principais discussões realizadas em relação às dificuldades enfrentadas pelos professores dos Anos Iniciais do Ensino Fundamental ao ensinarem Matemática. Trata-se de uma pesquisa bibliográfica, desenvolvida a partir de 49 (quarenta e nove) artigos selecionados em periódicos nacionais de Qualis A1, A2 e B1, e/ou publicados nos Anais do Seminário Internacional de Pesquisas em Educação Matemática (SIPEM), do Encontro Nacional de Educação Matemática (ENEM) e do Encontro Paranaense de Educação Matemática (EPREM). As pesquisas apresentam resultados que apontam avanços nas discussões a respeito do ensino e aprendizagem da Matemática, com o uso de metodologias diferenciadas durante a Formação Inicial em Pedagogia, que vem proporcionando ressignificações de ordem pessoal e profissional. Todavia, ainda há a predominância de dificuldades advindas da Formação Inicial, como, por exemplo, a pouca relação entre teoria e prática, a falta de desenvolvimento e ensino de metodologias diferenciadas e, de conceitos e conteúdos, que serão ensinados nos Anos Iniciais, dentre outras que influenciam diretamente a atuação profissional em sala de aula.

Palavras-chave: formação inicial; pedagogia; matemática.

Keywords: initial formation; pedagogy; math.

La formación inicial del docente que enseña matemáticas en los años iniciales: una investigación bibliográfica

RESUMEN. Este artículo es un extracto de la disertación de maestría en Educación Matemática, defendida en 2021 y presenta los resultados de una investigación bibliográfica. Nuestro objetivo fue identificar cómo

el proceso de enseñanza y aprendizaje de las Matemáticas, en las carreras de Licenciatura en Pedagogía, de 2016 a 2020, ha sido discutido en las investigaciones, así como, cuáles son las principales discusiones realizadas en relación a las dificultades que enfrentan los docentes de los Años Iniciales de la Enseñanza Primaria en la enseñanza de las Matemáticas. Se trata de una investigación bibliográfica, desarrollada a partir de 49 (cuarenta y nueve) artículos seleccionados en revistas nacionales de Qualis A1, A2 y B1, y/o publicados en los Anales del Seminario Internacional de Investigación en Educación Matemática (SIPEM), de la Encuentro de Educación Matemática (ENEM) y el Encuentro Paranaense de Educación Matemática (EPREM). Las investigaciones presentan resultados que apuntan avances en las discusiones sobre la enseñanza y el aprendizaje de las Matemáticas, con el uso de diferentes metodologías durante la Educación Inicial en Pedagogía, lo que viene proporcionando resignificaciones de carácter personal y profesional. Sin embargo, aún predominan las dificultades derivadas de la Formación Inicial, como, por ejemplo, la poca relación entre teoría y práctica, la falta de desarrollo y enseñanza de metodologías y conceptos y contenidos diferenciados, que se impartirán en los Años Iniciales. , entre otros. otros que influyen directamente en el desempeño profesional en el aula.

Palabras-clave: formación inicial; pedagogía; matemáticas.

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Introduction

This article is an excerpt from the dissertation "A Formação Inicial (recebida) e a atuação no ensino de matemática do ponto de pedagogos", defended in 2021, and aims to identify how the process of teaching and learning mathematics, in pedagogy degree courses, in the period from 2016 to 2020, has been discussed in research, as well as what are the main discussions held in relation to the difficulties faced by teachers of the early years of primary school when teaching mathematics.

At the beginning of the 21st century, several studies were carried out in Brazil. Among them, those of Nacarato (2000), Curi (2005), Gatti and Nunes (2009), and Gatti (2010, 2012) raised concerns about the mathematics subjects offered in pedagogy programs.

Among the concerns raised, Nacarato (2000) highlights the insufficient workload of these subjects and the lack of professionals with experience in this area of teaching to teach them.

In the same vein, Curi (2005) in his research indicated that more than 90% of the mathematics courses offered in education programs focus on methodological aspects, while the study and deepening of the content and didactic aspects of mathematics take a back seat. The research also points out that many of these subjects have a reduced workload, which makes it difficult for the subject teacher to fulfill the proposed curriculum.

Another concern, pointed out by Gatti and Nunes (2009) and Gatti (2012), is related to the curricular structure of pedagogy courses, most of which are oriented towards and concerned with political, psychological and sociological theories to contextualize the challenges faced at these levels and stages of education. As a result, the teaching of content and practical activities aimed at teaching are forgotten and/or relegated to the background.

According to Carvalho and Lima (2010, pp. 29-30), most initial training courses "[...] neglect a fundamental aspect: the teaching of the elementary mathematics that teachers will deal with in their teaching practice at school". This is probably because professionals in the field believe that the students (future teachers) in these courses already have this knowledge, as it is learned during their schooling in basic education, and from this, they end up developing a training that "[...] focuses on methodological processes, disregarding the foundations of mathematics" (Nacarato, Mengali, & Passos, 2009, p. 17).

Following this line of reasoning, Costa and Pavanello (2017) reinforce the overvaluation of theoretical aspects in pedagogy programs, directing them towards a general education that does not emphasize the development of essential skills for professional practice. In addition, they fail to prioritize the content to be taught in these teaching areas, in other words, forgetting to understand the object of knowledge and overvaluing procedures.

In addition to all these points about initial teacher training, it is interesting to note that various studies have shown that "[...] many of the children's difficulties in relation to the subject studied may be related to the teacher's didactic performance [...]" (Pavanello, 2000, p. 183), i.e., the teacher's failure to teach the subject [...]. Pavanello, 2000, p. 183), i.e., the teacher's lack of mastery of certain content can hinder the students' learning of the same content because "[...] we believe that the mathematics taught in the early years of primary school is the foundation for learning mathematics in subsequent years, as well as for building students' logical reasoning" (Bezerra, 2017, p. 39).

Given this context, through a bibliographic review, we sought to: identify how the process of teaching and learning mathematics has been discussed in research in pedagogy programs from 2016 to 2020, as well as the main discussions related to the difficulties teachers of the Early Years of Primary School face when teaching mathematics.

Methodology

According to Severino (2013, p. 106), "[...] bibliographical research is research carried out based on the available records resulting from previous research [...]", in which the researcher works under the considerations and contributions of studies already carried out, which can be found in books, articles, dissertations, theses, documents, among others. Thus, according to the same author, "[...] it uses data or theoretical categories already worked on and duly recorded by other researchers" (Severino, 2013, p. 106), considering them as sources for the studies to be carried out.

In this research, we first decided to identify articles published in Annals of events, in online format, with international, national and regional scope, that took place in Brazil during the period 2016 to 2020.

At the international level, we analyzed the International Seminar on Research in Mathematics Education (Seminário Internacional de Pesquisas em Educação Matemática - SIPEM), held in 2018, which aims to promote the exchange between research groups and research in the field of mathematics education.

At the national level, we analyzed the National Meeting of Mathematics Education (Encontro Nacional de Educação Matemática - ENEM), considered the most relevant event in Brazil in the field of mathematics education, which involves teachers and students of pedagogy and mathematics degrees, postgraduate students, researchers, and teachers of basic education, held in 2016 and 2019.

In addition, at the regional level, we chose the Paranaense Mathematics Education Meeting (EPREM), to be held in 2019 because it is considered a broad event in the state of Paraná (where the authors of the article live), in the field of mathematics education. It promotes reflection, dialogue, and exchange of experiences between researchers, university teachers, primary school teachers, and undergraduate and postgraduate students of mathematics and pedagogy.

To broaden our scope and to delimit our research topic, we also analyzed research published online in education and mathematics education journals.

For the selection of journals, in addition to the period established between 2016 and 2020, we chose those with Qualis A1, A2, and B1, according to the evaluation carried out by CAPES, in the quadrennium 2013-2016, and in which articles were published in full. With this initial selection, our scope became too broad, so we decided to select only journals with the words Mathematics Education and/or Mathematics Teaching in their name[1].

After delimiting the search field (events and journals), we read the titles and keywords and identified all the articles that dealt with mathematics in education and/or teacher training. As a result, we initially obtained 263 (two hundred and sixty-three) articles.

At the end of this selection, we read the abstracts of all the articles, and when it wasn't possible to understand the research from the abstract, we read the full text to see how mathematics was approached in pedagogy degree courses and/or teacher training courses[2]. In this process[3] we eliminated articles that were not available in full, those that focused exclusively on teacher training, and those that addressed specific mathematics content.

Table 1 below shows all the journals analyzed, their respective Qualis, and the number of articles found on the topic.

Table 1. Journals analyzed.

Journals	Qualis	Number of works identified
ACTA SCIENTIAE: Revista de Ensino de Ciências e Matemática	A2	0
AMAZÔNIA: Revista de Educação em Ciências e Matemáticas (Online)	A2	1
BOLEMA: Boletim de Educação Matemática (Online)	A1	2
BOEM: Boletim Online de Educação Matemática	B1	1
EMR: Educação Matemática em Revista (São Paulo) - SBEM	A2	1
EMR-RS: Educação Matemática em Revista - RS	A2	1

[1] The only exception was the journal Zetetiké, which, according to its website, "[...] aims to contribute, on the one hand, to the development of research in the area of Mathematics Education and, on the other, to the training of researchers in this area, through the exchange and dissemination of research and studies carried out by mathematics educators linked to Brazilian or foreign institutions" (https://periodicos.sbu.unicamp.br/ojs/index.php/zetetike/index).

[2] Training Course for Teachers of Early Childhood Education and the Early Years of Primary Education, at secondary level, in the Normal mode.

[3] We use the same process for selecting articles for events and journals

EMP: Educação Matemática Pesquisa	A2	0
Em Teia - Revista de Educação Matemática e Tecnológica Iberoamericana	B1	3
JIEEM: Jornal Internacional de Estudos em Educação Matemática	A2	0
PEM: Perspectivas da Educação Matemática	B1	2
REVEMAT: Revista Eletrônica de Educação Matemática	A2	2
RECM: Revista de Educação, Ciências e Matemática	A2	0
RPEM: Revista Paranaense de Educação Matemática	B1	4
ZETETIKÉ (Online)	A2	1

Source: Prepared by the authors, 2020.

Thus, after the whole process of reading, rereading and analyzing, we arrived at a total of 49 (forty-nine) selected articles. Eighteen (18) of them were in journals and thirty-one (31) articles were in the proceedings of the three (3) events (SIPEM, ENEM and EPREM).

Table 2 shows the articles selected from the proceedings of the events (SIPEM, ENEM and EPREM) and Table 3 shows the articles selected from the journals identified in Table 1.

Table 2. Articles from the proceedings of the events.

Event/Year	Title	Author (s)	Number of ID
ENEM/2016 (Silva & Burak, 2016)	The training of Pedagogues to teach Mathematics in the Early Years: Some notes from dissertations and theses.	Vantielen da Silva and Dionísio Burak	1
ENEM/2016 (Santos & Ghedin, 2016)	The initial training of teachers who teach mathematics in the Early Years in national and regional studies	Edlauva Oliveira dos Santos and Evandro Ghedin	2
ENEM/2016 (Araújo & Pereira, 2016)	Teaching Mathematics in Pedagogy Courses in the City of Campina Grande	Pedro Marinho de Araújo and Cicero da Silva Pereira	3
ENEM/2016 (Ribeiro & Albrecht, 2016)	Reflections on teaching mathematics in the early years of elementary school: teacher training	José Augusto Ribeiro and Evonir Albrecht	4
ENEM/2016 (Souza & Borges, 2016)	Mathematical training for elementary school teachers	Kelly Cristine Silva Souza and Marcos Francisco Borges	5
ENEM/2016 (Silva & Passos, 2016)	Future teachers' impressions of literacy and mathematics teaching: an analysis of autobiographical narratives produced in reflective diaries	Américo Junior Nunes da Silva and Carmen Lucia Brancaglion Passos	6
ENEM/2016 (Passos & Takahashi, 2016)	The training of Early Years teachers and their training needs in relation to Specific Pedagogical Content Knowledge in Mathematics	Éderson de Oliveira Passos and Eduardo Kojy Takahashi	7
ENEM/2016 (Oliveira, 2016)	Early Years teachers' mathematical learning	Raimunda de Oliveira	8
ENEM/2016 (Santos, Thiego, & Santos Junior, 2016)	Early Years teachers and their relationship with mathematics	Patrícia Corrêa Santos, Edmar Reis Thiengo and Clovis Lisboa dos Santos Junior	9
ENEM/2016 (Costa & Almeida, 2016)	Elementary school teachers and their relationship with math teaching	Manoel dos Santos Costa and Joemilia Maria P. Almeida	10
ENEM/2016 (Santos & Gusmão, 2016)	Social representations of Mathematics: contributions of Pedagogy training	Rosimeire Martins dos Santos and Tânia Cristina Rocha Silva Gusmão	11
ENEM/2016 (Cerva, 2016)	Teacher Professional Development and the teacher who teaches Mathematics in the Early Years of Elementary School	Dayana Machado Rosales Cerva	12
ENEM/2016 (Zortêa & Ciríaco, 2016)	Professional initiation of teachers who teach mathematics	Gislaine Aparecida Puton Zortêa and Klinger Teodoro Ciríaco	13
ENEM/2019 (Silva & Guérios, 2019a)	Mapping Southern Brazilian research on the Mathematical Education of the Pedagogue - A look	Larissa Barbosa Luiz Rodrigues da Silva and Ettiène Cordeiro Guérios	14
ENEM/2019 (Zeferino, 2019)	The curricula in question: are we going to talk about mathematics in pedagogy?	Joycimar Lemos Barcellos Zeferino	15
ENEM/2019 (Silva & Silva, 2019)	Micro aggressions related to mathematical content and the training of future teachers in a distance learning course	Sandra Maria da Silva and Guilherme Henrique Gomes da Silva	16
ENEM/2019 (Lima, Araújo, & Batista, 2019)	The relationship between Mathematics and Pedagogy students: an experience with students at the State University of Ceará	Tainá Salmito Cruz de Lima, Ana Kamyla Oliveira Araújo and Paulo César da Silva	17

		Batista	
ENEM/2019 (Giesel, Souza, & Soares, 2019)	Mathematics Education in the Early Years of Elementary School from the perspective of graduates of a Pedagogy course	Keily Regina de Lima Giesel, Helenara Machado de Souza and Fabrício Soares	18
ENEM/2019 (Botelho, & Carneiro, 2019)	Narratives of a future teacher who will teach Mathematics in the Early Years	Luiza Palmira Freitas Botelho and Reginaldo Fernando Carneiro	19
ENEM/2019 (Santos, Soares, Souza, & Nehring, 2019)	The gaps pointed out by a group of Pedagogy students regarding mathematical concepts inherent to the Early Years of Primary School	Paula Renata dos Santos, Fabrício Soares, Helenara Machado de Souza and Cátia Maria Nehring	20
ENEM/2019 (Rangel, & Alves, 2019)	Teaching Mathematics in the Early Years: with the word of the multipurpose teachers of a school in Bagé/RS	Darlan Maurente Rangel and Antônio Maurício Medeiros Alves	21
ENEM/2019 (Roth & Noguti, 2019)	A study on the teaching of Mathematics in the Early Years of Primary School: the view of teachers	Isadora Roth and Fabiane Cristina Höpner Noguti.	22
EPREM/2017 (Pinheiro & Araman, 2017)	Mathematics in the Early Years: an overview of theses and dissertations from Paraná in the last decade	Rafael Marques Pinheiro and Eliane Maria de Oliveira Araman	23
EPREM/2017 (Ricordi & Ricordi, 2017)	Mathematical literacy: theoretical analysis by undergraduates	Everson Luiz Ricordi and Jéssica da Costa Ricordi	24
EPREM/2019 (Silva & Guérios, 2019b)	Mathematical Education of Pedagogues in Brazil: a qualitative meta-analysis of stricto sensu studies	Larissa Barbosa Luiz Rodrigues da Silva and Ettiène Cordeiro Guérios	25
EPREM/2019 (Juvanelli, Coqueiro, & Hermann, 2019)	Aspects of the relationship that students on a teacher training course have with mathematics	Caio Juvanelli, Valdete dos Santos Coqueiro and Wellington Hermann	26
EPREM/2019 (Avanço, Herrmann, & Coqueiro, 2019)	Meanings that students on a teacher training course attribute to mathematics	Paula Renata Pedroso Avanço, Wellington Hermann e Valdete dos Santos Coqueiro	27
EPREM/2019 (Gonçalves, Rodrigues, Rizek, & Trevisan, 2018)	Knowledge of Content and Students mobilized by an Early Years teacher	Flávia Maria Gonçalves, Silmara Ribeiro Rodrigues, Henrique Rizek Elias and André Luis Trevisan	28
EPREM/2019 (Wirmond, Souza, Huf, & Pinheiro, 2019)	Conceptions and challenges faced by teachers who teach mathematics in the Early Years	Thamyres Karolyne Wirmond, Graziela Ferreira de Souza, Samuel Francisco Huf and Aparecida Maciel Pinheiro	29
SIPEM/2018 (Fiorentini, 2018)	Mapping and State of Research on the Teacher Who Teaches Mathematics as a Field of Study	Dario Fiorentini	30
SIPEM/2018 (Alencar, 2018)	The training of pedagogues to teach mathematics in institutions of the International Observatory	Edvonete Souza de Alencar	31

Source: Prepared by the authors, 2020.

After reading all the articles in their entirety, we used Bardin's (2011) approach (content analysis) to analyze the data. According to the author, this type of approach consists of "[...] a set of methodological tools that are constantly being improved and applied to extremely diverse discourses (contents and continents)." It considers three distinct phases: pre-analysis, exploration, and processing of the results. In our case, the pre-analysis consisted of defining the scope of the research and the first reading of the material selected for analysis. The second phase consisted of a complete reading of all the articles included in the scope, from which it was possible to create categories to group the articles according to their similarities.

Table 3: Journal articles.

Journal/Year	Title	Author (s)	Number of ID
AMAZONIA/2018 (Maffei & Sila, 2018a)	What is shown when trainee teachers write about their experiences with mathematics?	Letícia Queiroz Maffei and João Alberto da Silva	32
BOEM/2017 N.9 (Cabral & Carneiro, 2017)	Narratives of future primary school teachers: a look at memories of mathematics and the contributions of a subject in initial training	Wallace Alves Cabral and Reginaldo Fernando Carneiro	33
BOLEMA/2018 (Julio & Silva, 2018)	Understanding the Mathematical Education of Future Pedagogues through Narratives	Rejane Siqueira Julio and Guilherme Henrique Gomes da Silva	34

BOLEMA/2020 (Wanderer & Longo, 2020)	Statements that Constitute Mathematics Teaching in the Early Years of Elementary School	Fernanda Wanderer and Fernanda Longo	35
EM TEIA/2018 (Guimarães, Teles, & Santos, 2018)	Scenarios and challenges in Mathematics Education: from research to the classroom	Gilda Lisbôa Guimarães, Rosinalda Teles, Marilene Rosa dos Santos	36
Em TEIA/2018 (Wanderer, Longo, & Carneiro, 2018)	Mathematics teaching and the constitution of teaching in the Early Years of Primary School	Fernanda Wanderer, Fernanda Longo, Fernando Henrique Fogaça Carneiro	37
Em TEIA/2019 (Proença, 2019)	Analysis of the understanding of teacher training developed by postgraduate students in the area of mathematics teaching	Marcelo Carlos de Proença	38
EMR/2019 (Curi et al., 2019)	Teachers who teach Mathematics in Early Childhood Education and in the Early Years of Elementary School: a mapping of papers published in two representative events in the field	Edda Curi, Julia de Cassia Pereira do Nascimento, Priscila Bernardo Martins, and Edvonete Souza de Alencar	39
EMR-RS/2016 V. 2 N. 17 (Giusti & Justo, 2016)	Considerations on pedagogy students' feelings towards mathematics in a teaching internship context	Neura Maria De Rossi Giusti and Jutta Cornelia Reuwsaat Justo	40
PEM/2016 V.9 N.21 (Duarte, Ferreira, & Carneiro, 2016)	Teacher Training for Mathematics Teachers in the Early Years: subjects in a Pedagogy course	Bárbara Kelmer Müller Duarte, Hugo Lagrimante Ferreira, and Reginaldo Fernando Carneiro	41
PEM/2020 V. 13 N. 31 (Braga & Morais, 2020)	Challenges in Teaching Mathematics in the Early Years: a study based on three narratives	Nathália Cristina dos Reis Braga and Marcelo Bezerra de Morais	42
REVEMAT/2020 V.15 (Manfredo & Araújo, 2020)	The perception of teachers graduating from a degree course about their mathematical training	Elizabeth Cardoso Gerhardt Manfredo, Marcelo Marques de Araújo	43
RPEM/2017 V. 6 N. 11 (Paula & Cyrino, 2017)	Mapping research in Paraná on teachers who teach mathematics	Enio Freire de Paula and Márcia Cristina Trindade de Costa Cyrino	44
RPEM/2018 V.7 N. 13 (Maffei & Silva, 2018b)	Along the path of yellow bricks: affections in relation to mathematics in the initial training of pedagogues	Letícia de Queiroz Maffei, João Alberto da Silva	45
RPEM/2019 V. 8 N.17 (Hermann et al., 2019)	The math curriculum of a teacher training course and the students' manifestations: some contradictions	Wellington Hermann, Caio Juvanelli, Paula Renata Pedroso Avanço, Valdete dos Santos Coqueiro, Marinez Meneghello Passos	46
RPEM/2019 V.8 N.17 (Liell & Bae, 2019)	Mathematical knowledge and the vision of teachers in training who are studying Pedagogy about the 1st Brazilian Mathematical Olympiad - level A	Cláudio Cristiano Liell and Arno Bayer	47
REVEMAT/2020 V.15 N.1 (Ciríaco et al., 2020)	Between the lines of research into the Psychology of Mathematics Education and Initial Teacher Training	Klinger Teodoro Ciríaco, Ana Carolina Faustino, Cíntia Raquel Ferreira Mercado de Almeida and Fernando Schlindwein Santino	48
ZETETIKÉ/2017 V. 25 N. 1 (Abrahão & Silva, 2017)	Research on the initial training of teachers who teach mathematics at the beginning of schooling	Ana Maria Carneiro Abrahão and Sandra Aparecida Fraga da Silva	49

Source: Prepared by the authors, 2020.

In the third stage, the 49 (forty-nine) selected articles were grouped into 4 (four) different categories, considering their methodologies and the type of research carried out.

The 4 (four) categories defined for the analysis are:

1.) Category "Literature reviews already carried out on mathematics education in pedagogy," which includes articles 1, 2, 14, 23, 25, 30, 36, 39, 44, and 49, in which we examined: bibliographic research, literature review, mapping, and/or state of the art. Although they use different methodologies, all the articles aim to research and analyze articles, dissertations, and theses that deal with the mathematics education offered in pedagogy programs and/or teacher training programs.

2.) Category 'Discussion of the guiding documents for pedagogy courses', includes articles 3, 4, 15, 31 and 46, which used documentary analysis and/or research of the syllabi, curricula and/or flowcharts of different pedagogy degree courses or teacher training courses as their research methodology, with the aim of analyzing the mathematics training offered in the respective courses, based on official documents.

3.) Category 'Pedagogy students' view of their mathematics training', which includes articles 5, 6, 16, 17, 18, 19, 20, 24, 26, 27, 32, 33, 34, 40, 41, 45, 47 and 48, in which we conducted qualitative and/or quantitative-qualitative research with students who were studying for a degree in pedagogy and/or teacher training. Based

on different strategies and instruments used for data collection/production, such as interviews, questionnaires, solving activities, biographical and autographical narratives, and the focus was on identifying the perceptions and feelings of the subjects participating in the research in relation to mathematics and the mathematics training received in the respective courses.

4.) Category "Graduates of Pedagogy, Mathematics Training and Entry into the Profession", comprising articles 7, 8, 9, 10, 11, 12, 13, 21, 22, 28, 29, 35, 37, 38, 42 and 43, qualitative or quantitative-qualitative research with graduates of pedagogy and/or teacher training courses who worked in the early years. Through interviews, questionnaires, observations and narratives, they sought to identify the graduates' (teachers working in the Early Years) relationships and feelings towards mathematics, towards teaching mathematics, the difficulties they encounter daily in relation to mathematics and its teaching, and the contributions of their initial training to the performance of their role as mathematics teachers.

To carry out our analysis, we have chosen to discuss the works by category, pointing out and identifying convergences and divergences between them.

Presentation and discussion of data

We started our analysis with category 1, "Reviews of literature already conducted on mathematics education in pedagogy": of the ten articles analyzed, only 36 and 39 conducted their analysis at events in the field of mathematics education and teaching; all the others focus on dissertations and theses that have already been defended.

Articles 14, 23, 25, 30, 36, 39 and 44 focus on methodological aspects. Moreover, most of the dissertations and theses analyzed focus on the in-service training of teachers who teach mathematics in the early years. Considering that our focus in this article is neither on the methodologies used in the research nor on the professional development of teachers in the early years, we will not go into their considerations at this point.

Articles 1, 2, and 49, on the other hand, present more detailed general considerations of the dissertations and theses analyzed, highlighting the contributions of the research, the changes needed in the initial training of teachers who teach mathematics, and the gaps resulting from the initial training of these teachers.

And among the main recommendations of these articles (2 and 49), we can mention the need for pedagogy courses to reformulate the negative view of students in relation to mathematics so that they can overcome the difficulties stemming from basic education, in order to also reformulate the way they will teach it to their future students (Santos & Ghedin, 2016; Abrahão & Silva, 2017).

Similarly, according to Article Number 1, initial training courses need to bring together the realities experienced in Early Years classrooms and university classrooms, which can happen through internships, observations, and relevant links between training and research (Silva & Burak, 2016).

Next, in category 2, "Discussion of the guiding documents of pedagogy courses," which includes articles numbers 3, 4, 15, 31, and 46, we had research and/or documentary analysis of curricula, flowcharts, and/or syllabi from different courses.

Of the five articles classified in this category, number 46 differs from the others in that it analyzes the curricular guidelines and pedagogical policy projects of the teacher training course, while the rest analyzed the syllabi of the subjects, the curricular matrices and/or the pedagogical projects of the subjects in the pedagogical degree courses whose subject is oriented towards the teaching and learning of mathematics.

Regarding the subjects offered in both courses, the majority have only one compulsory subject, which is the minimum required by law (Ribeiro & Albrecht, 2016).Few institutions offer students a wider range of study options in the field of Mathematics, and those that do are optional and have not been offered for at least four (4) semesters or are even no longer offered, as presented in article number 15 (Zeferino, 2019).

Article number 31 highlights that of all the 26 (twenty-six) countries analyzed in the survey and participating in the International Observatory on Inclusion, Interculturality and Pedagogical Innovation (Observatório Internacional de Inclusão, Interculturalidade e Inovação Pedagógica - OIIIIPe)[4], most pedagogy courses have only one or two subjects dedicated to mathematics training, one of which is elective and the other optional, thus characterizing few hours of study in this area of teaching. The article also points out that among all the countries analyzed, the institutions with the highest number of hours dedicated to this training are European institutions, with an average of 130 to 150 hours (Alencar, 2018).

[4] The aim of the project is to "[...] identify, through different methodologies, the contradictions and perspectives on inclusion, interculturality and pedagogical innovation in the initial and continuing training of educators at national and international universities" (Alencar, 2018, p. 3).

Category 3, "Pedagogy students' view of their mathematics training", consists of articles numbers 5, 6, 16, 17, 18, 19, 20, 24, 26, 27, 32, 33, 34, 40, 41, 45, 47 and 48. All of these articles have a common target audience (students studying for a degree in education and/or teacher education).

Articles 5, 6, 16, 17, 24, 26, 27 and 34 identified the feelings, knowledge, memories, and relationships of these students with mathematics during their school years.

In short, it is possible to see that the majority of students studying education and/or teacher education have some negative feelings or traumas regarding mathematics, which originate from their basic education. However, these feelings and traumas are more related to the way their former teachers taught Mathematics[5] than to Mathematics specifically, that is, to the teaching methods used by their teachers (Julio & Silva, 2018). In most cases, these are methodologies based on repetition and memorization, among others (Silva & Passos, 2016).

Faced with these traditional methodologies, many students have developed a sense of inferiority throughout their basic education, feeling that they are not endowed with intelligence and are incapable of learning mathematical concepts and content, since these are only for a few people, people who are considered and classified by them as gifted with wisdom and intelligence (Silva & Silva, 2019). As a result, the vast majority of these students mention that they are not efficient in the exact field, but say that they are competent in the humanities and/or biology, in the sense that there is a trade-off between their knowledge and their abilities (Juvanelli, Coqueiro, & Hermann, 2019).

In terms of specific difficulties in learning mathematical concepts and content, among the 5 (five) thematic units presented in the BNCC, those most mentioned in the students' articles stand out: Numbers (division, fraction, percentage), Geometry (angles), Algebra, and Quantities and Measures (Lima, Araújo, & Batista, 2019).

On the other hand, although they are a minority, there are students who mention that they like and have a good relationship with mathematics, a feeling that is directly related to the environment in which they are inserted, that is, through the influence of parents and grandparents who are teachers, tradesmen or bricklayers, through private teachers, or also through teachers who made a positive impression on them during their student life, by using different methodologies during their lessons, making them attractive through classical music, making up songs, games, children's literature, dynamics, among others (Silva & Passos, 2016; Lima et al., 2019; Juvanelli et al., 2019).

Moreover, for all these students and undergraduates, a good teacher is one who cares about the students' learning, regardless of their knowledge of the subject, uses different methodologies and, above all, has a friendly relationship with the class because this student-teacher relationship significantly affects the student-content relationship (Juvanelli et al., 2019).

Articles 18, 19, 20, 32, 33, 40, 41, 45, 47, and 48 analyzed the contributions of different methodologies used in the subjects of their respective courses that dealt with the teaching and learning of mathematics.

All these articles mentioned that the course, through the use of differentiated methodologies, had already managed to create a sense of change in the students' conception of mathematics, or that it had even managed to (re)signify their negative conceptions, as they realized that their traumas were more related to their former teachers than to the subject itself. As mentioned by Giusti and Justo (2016, p. 11), "[...] there have been changes in conceptions and feelings about mathematics, especially when it comes to coping with traumas stemming from the student's trajectory".

Among the different methodologies used and presented in the different courses, we can mention The writing of autobiographical narratives, in which students begin to express their feelings and struggles through writing, and later, in conversations and discussions with the whole class, they can recognize and reflect on these marks and traumas, which are often the same among colleagues (Giusti & Justo, 2016; Maffei & Silva, 2018a; Botelho & Carneiro, 2019); The use of children's literature, games and manipulative materials to teach mathematical concepts and content; and the creation of study groups (Botelho & Carneiro, 2019); the completion of coursework that included mathematics education (Ciríaco, Faustino, Almeida, & Santino, 2020); the use of technology, internships, practical and investigative activities before the introduction of theoretical texts that made students reflect and think about solution strategies; and also the assessment through autobiographical narratives that made students organize and write about their learning (Duarte, Ferreira, & Carneiro, 2016).

There are countless mentions and contributions that make these future teachers more competent to teach mathematics, as highlighted by Giesel, Souza and Soares (2019, p. 12), for whom the undergraduates "[...] feel

[5] Only in article number, 34 did a single student mention that she was responsible for not liking and knowing mathematical concepts and content, and that she was responsible for not having the commitment and dedication to the subject.

prepared to develop a qualified teaching and learning process for mathematics in the early years, as they consider the sociocultural background and the learning already built by the student as important, considering the work with play and manipulable materials".

Despite these mentions, in which undergraduates perceive the need to use different methodologies during the teaching and learning of mathematics, the need to consider the reality of the students and, above all, to prepare their lessons based on their previous knowledge, there were still mentions in some articles (in their minority), such as Cabral and Carneiro (2017), pointing out that these subjects and methodologies are still not enough to prepare them for the classroom, and that some mathematical content is still missing in the initial training, noting the presence of a lot of theoretical background and little practice.

The fourth category, "Education graduates, mathematics education and entry into the profession," includes articles numbers 7, 8, 9, 10, 11, 12, 13, 21, 22, 28, 29, 35, 37, 38, 42, and 43, which report on research with early childhood teachers who have graduated from education and/or teacher education programs. According to the teachers participating in the research, the contributions of the initial training received in the respective courses can be divided into two perspectives: one that mentions various and different difficulties and gaps arising from the initial training and directly affecting their performance in the classroom, and the other that classifies the initial training as satisfactory in relation to their professional performance.

From the first perspective, which includes articles numbers 7, 9, 10, 11, 12, 13, 22, 28, 29, 35, 38, 42 and 43, most of the difficulties arising from initial training are the lack of mathematical knowledge and methodologies that help them work with mathematics and facilitate student learning (Manfredo & Araújo, 2020). They also point to an excess of theory and little practice, which frightens new professionals, since the reality studied in the course is often not the same as the reality they encounter in the classroom (Braga & Morais, 2020).

However, at no point did the teachers mention that these were the reasons they would leave the profession, or even that they would be discouraged from seeking new knowledge. On the contrary, these were the reasons that encouraged them to seek new knowledge and teaching methods through the Internet, continuing education, and study groups (Cerva, 2016; Braga & Morais, 2020).

In the classroom, the difficulties were different: students' lack of interest in participating in the class, families' lack of commitment to students' learning, families' difficulty in understanding that errors are part of the process of teaching and learning mathematics, that it is more important for students to perceive and understand the processes and means than just to reach the final result without understanding the concepts involved, the lack of resources in public schools and the overly extensive planning that has to be fulfilled with a small workload (Wirmond, Souza, Huf, & Pinheiro, 2019; Braga & Morais, 2020).

The second perspective, which characterized the initial training in their respective courses as satisfactory, to the point of providing them with the development of professional work with autonomy, is made up of articles numbers 8, 21, and 37.

These articles are similar in that the subjects participating in the research mentioned, in interviews and/or questionnaires, the importance of approaching mathematical concepts and content with different methodological strategies, using games, children's literature, manipulable materials, and games, and also the need to consider the reality and prior knowledge of the students to design and plan their lessons based on them, valuing playful aspects and activities related to the students' daily lives (Oliveira, 2016; Wanderer, Longo, & Carneiro, 2018; Rangel & Alves, 2019).

However, when the researchers and authors of the three articles analyzed the plans (Oliveira, 2016) and activities prepared by the teachers themselves (Wanderer et al., 2018), as well as the classroom observations (Rangel & Alves, 2019), none of the authors/researchers recognized that their teachers' speeches and/or writings were practiced daily. Thus, it can be seen that there is a contradiction between the teachers' statements and attitudes regarding the importance and validity of the use of differentiated methods in the classroom, in the teaching and learning of mathematics, and in classroom practices.

Final considerations

In this article, we try to find out how the process of teaching and learning of mathematics is discussed in the research of pedagogy courses, as well as what are the main discussions about the difficulties that teachers face in the early years of primary school when teaching mathematics. This discussion is based on the 49 (forty-nine) articles selected from the databases of 3 (three) prestigious events in the field of Mathematics Education

(SIPEM, ENEM and EPREM) and 16 (sixteen) journals selected based on criteria and having Qualis A1, A2 and B1, in the same field, from 2016 to 2020. Although our possible answers cannot be considered conclusive in relation to the question initially proposed, there are aspects worth highlighting.

Because of the selected articles (events and journals), it is possible to highlight some difficulties identified in the initial training of teachers working at this stage of education: The fact that the workload of the subjects offered in the teacher training and/or pedagogy courses for the training in mathematics is considered insufficient in most of the researches; the lack of complementary (optional) subjects related to the field of mathematics during the initial training; the lack of experience in the field of mathematics of the teachers who teach in these courses; The excess of theory harming little practice; The use of traditional and repetitive methodologies; The lack of approach to the mathematical concepts and content to be taught in the early years; The overvaluation of aspects related to pedagogical knowledge harming mathematical content.

While we have research that points to the difficulties and problems of teaching mathematics in teacher education and/or pedagogy programs, we also have research that points to overcoming these "difficulties and problems," as is the case with the research discussed in articles: 8, 18, 19, 20, 21, 32, 33, 37, 40, 41, 45, 47, and 48.

One of the changes mentioned in the articles (8, 18, 19, 20, 21, 32, 33, 37, 40, 41, 45, 47 and 48) is the possibility of future teachers having to (re)signify their negative feelings towards mathematics in initial teacher education through different methodologies such as autobiographical narratives, games, children's literature, music, differentiated assessments, etc., educators from the pedagogy and teacher training programs can extinguish and overcome negative feelings and traumas of students, future teachers, towards the subject of mathematics. This has enabled them to understand and learn new mathematical concepts and content, thus changing the view that the exact sciences are only for a few people who are considered to be highly intelligent.

In addition to the methodologies mentioned above, the articles also presented methodologies based on the use of technology, on the implementation of CBTs in mathematics education in the respective initial training courses (pedagogy and/or teacher training), on bringing the classroom and research closer together, on differentiated assessments based on autobiographical narratives, on the implementation of investigative and practical activities, among others, which were used and developed during the mathematics subjects in the pedagogy and/or teacher training courses and which were evaluated by the researchers and their research participants as satisfactory in the process of teaching and learning mathematics.

In relation to the specific difficulties in the classroom during the teaching and learning of mathematics in the early years of primary school, the teachers mention the lack of mastery of all the mathematical content, as well as different and diversified teaching methods that meet all the needs of the classroom. They also mention the students' lack of interest in the subject of mathematics, as well as the distance of the family from the school, which ends up directly influencing the students' approach and/or distancing (liking) from the field of exact sciences, as shown in articles 6, 17 and 26.

Finally, it is possible to see that the research shows that all the differentiated methodologies developed, implemented and evaluated in the pedagogy and/or teacher-training courses represent a significant advance in the studies and research produced on initial training in the respective courses in relation to mathematics, enabling new perspectives and learning for future early year’s mathematics teachers.

However, as mentioned in articles 8, 21 and 37, there is a gap between what teachers think and what they do in the classroom, which is why further studies, observations and detailed analysis of the teachers' standpoint and their reality in the classroom are needed.

This literature review has shown that progress has been made, but that many aspects of initial teacher education need to be reconsidered, including initial mathematics education.

As such, it is possible to see that the research highlights aspects that need to be overcome, aspects that have been overcome, and the need for future research to delve not only into the problems but also into the possibilities of overcoming them, such as the tendency to work on initial and continuing education in an articulated way.

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