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Dialogues with Paulo Freire in the research of the Grupo de Trabalho de Educação Matemática (GT 19) da ANPEd

Diálogos con Paulo Freire en la investigación del Grupo de Trabalho de Educação Matemática (GT 19) de la ANPEd

Dialogues avec Paulo Freire dans le cadre de la recherche du Grupo de Trabalho de Educação Matemática (GT 19) de l'ANPEd

Diálogos com Paulo Freire nas pesquisas do Grupo de Trabalho de Educação Matemática (GT 19) da ANPEd

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Resumo

Este artigo se refere a uma revisão sistemática dos trabalhos apresentados durante as 20 reuniões anuais da Associação Nacional de Pesquisa em Educação (ANPEd) no Grupo de Trabalho de Educação Matemática (GT 19). Evidencia-se a quantidade de trabalhos apresentados em cada ano e, dentre esses, quantos e quais trazem Paulo Freire como referência. Busca-se responder à questão: quais pesquisas, apresentadas no GT 19 ao longo dos seus 25 anos de existência, dialogam com Paulo Freire e quais os conceitos que se destacam nelas? Para tanto, com base metodológica nos elementos constitutivos de uma revisão sistemática, realizou-se a análise do conjunto desses trabalhos. Os resultados mostram que o GT 19 vem se consolidando ao longo dos anos com uma diversidade temática, teórica e metodológica, e estabelece um diálogo tímido com a perspectiva freireana.

Palavras-chave: Educação matemática, Revisão sistemática de literatura, ANPEd, GT 19, Paulo Freire.

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Abstract

This paper refers to a mapping of the works presented during the 20 annual meetings of the Associação Nacional de Pesquisa em Educação (ANPEd) no Grupo de Trabalho de Educação Matemática (GT 19). The number of works presented each year is highlighted, as well as how many and which of these have Paulo Freire as a reference. The aim is to answer the following question: What research studies were presented in GT 19 throughout its 25 years of existence that dialogue with Paulo Freire and which Freirean concepts stand out in them? To this end, based on the methodological elements that constitute a state of knowledge, an analysis of all these works was carried out. The results show that GT 19 has been consolidating itself over the years with a thematic, theoretical and methodological diversity, and establishes a timid dialogue with the Freirean perspective.

Keywords: Mathematical education, Survey, ANPEd, GT 19, Paulo Freire.

Resumen

Este artículo se refiere a un mapeo de los trabajos presentados durante las 20 reuniones anuales de la Associação Nacional de Pesquisa em Educação (ANPEd) no Grupo de Trabalho de Educação Matemática (GT 19). Se destaca la cantidad de trabajos presentados cada año, así como cuántos y cuáles de estos tienen a Paulo Freire como referencia. El objetivo es responder a la siguiente pregunta: ¿Qué investigaciones se presentaron en el GT 19 a lo largo de sus 25 años de existencia que dialogan con Paulo Freire y qué conceptos freireanos se destacan en ellas? Para ello, con base en los elementos metodológicos que constituyen un estado del conocimiento, se realizó un análisis de todos estos trabajos. Los resultados muestran que el GT 19 se ha ido consolidando a lo largo de los años con una diversidad temática, teórica y metodológica, y establece un tímido diálogo con la perspectiva freireana.

Palabras clave: Educación matemática, Estado del conocimiento, ANPEd, GT 19, Paulo Freire.

Résumé

Cet article dresse une cartographie des travaux présentés lors des 20 réunions annuelles de Associação Nacional de Pesquisa em Educação (ANPEd) no Grupo de Trabalho de Educação Matemática (GT 19). Le nombre de travaux présentés chaque année est mis en évidence, ainsi que le nombre et la nature des travaux qui s'appuient sur Paulo Freire. L'objectif est de répondre à la question suivante : quelles recherches ont été présentées au GT 19 au cours de ses 25 ans d'existence qui dialoguent avec Paulo Freire et quels concepts freiriens s'y distinguent ? À cette

fin, une analyse de tous ces travaux a été réalisée à partir des éléments méthodologiques constituant l'état des connaissances. Les résultats montrent que le GT 19 s'est consolidé au fil des ans grâce à une diversité thématique, théorique et méthodologique, et établit un dialogue timide avec la perspective freirienne.

Mots-clés: Éducation aux mathématiques. État des connaissances. ANPEd. GT 19. Paulo Freire.

Dialogues with Paulo Freire in the research of the Grupo de Trabalho de Educação Matemática (GT 19) da ANPEd

Throughout its 25 years of existence, the Mathematics Education Working Group (GT19) of the National Association for Graduate Studies and Research in Education (ANPEd) has produced unique and diverse scientific publications from various Brazilian teaching and research institutions.

This article presents a systematic literature review based on papers presented at annual meetings from 2000 to 2023 that reference Freire's perspective in their bibliographies. The core of the analysis for this systematic literature review is the works presented at GT19 during the aforementioned period. These works use Paulo Freire's ideas to discuss formative processes in mathematics education.

Table 1 shows the number of works presented at the meetings and how many of them referenced Paulo Freire.

Table 1.

Number of papers approved and presented at all ANPEd annual meetings in WG 19 (Prepared by the authors)

Meeting/Year	Number of papers presented at WG 19	Number of papers presented in WG 19 about Paulo Freire
23rd – 2000	20	1
24th – 2001	15	0
25th – 2002	8	2
26th – 2003	12	1
27th – 2004	16	2
28th – 2005	24	3
29th – 2006	20	1
30th – 2007	15	0
31st – 2008	16	1
32nd – 2009	10	1
33rd – 2010	*	*
34th – 2011	15	0
35th – 2012	12	3
36 th – 2013	20	2
37 th – 2015	15	0
38 th – 2017	9	1
39 th – 2019	11	0
40 th – 2021	21	2
41st – 2023	25	3
Total	284	23

* Works not available on the ANPEd website.

According to the ANPEd website, WG 19 was established in 1999 during the 22nd Annual Meeting of ANPEd. This occurred due to the increasing participation of students and professors from Brazilian postgraduate programs conducting research in mathematics education in previous meetings.

WG 19 is an important forum within the National Association of Graduate Studies and Research in Education where a significant portion of Brazil's mathematics education research is presented and discussed.

To highlight the connections between Mathematics Education research and the dialogues of ANPEd's WG 19 with Paulo Freire, we propose the following sections: 1) Mathematics Education and Paulo Freire, 2) Methodological Approach, 3) Survey of Articles Presented at ANPEd's Annual Meetings, 4) Data Analysis Using Word Clouds and Similarity Analysis, and 5) Considerations.

Mathematical Education and Paulo Freire

The Freirean perspective, developed by Paulo Freire, views education as an ongoing process of awareness and liberation. This process relies on dialogue and critical reflection. This pedagogy seeks to transform reality and promote learner autonomy by challenging traditional education, which reproduces the dominant ideology. A great deal of research has been conducted on the teaching and learning of mathematics in Brazil and internationally. For several decades, Freire's ideas have served as a reference point for research and practices that have shaped the field of mathematics education.

Starting in 1989—the same year Freire became Municipal Secretary of Education in São Paulo (Valle, 2019)—three key works by Ubiratan D'Ambrosio were published, bringing this educator's theoretical framework to the forefront of mathematics education: "Critical Mathematics Education: An Application of Paulo Freire's Epistemology," by Marilyn Frankenstein (1987); "Social and Cultural Aspects in the Design of Mathematics Curricula," by Sérgio Nobre (1989); and "Multiple Factors: Classroom Mathematics for Racial Equality and Justice," by Sharan Jeet Shan and Peter Bailey (1991). According to D'Ambrosio (1993, p. 13),

> These three fundamental works, through mathematics, echo the thinking of Paulo Freire, who proposed critical, non-alienating education. In essence, he saw education as a political act that is recognized and assumed. Paulo Freire's stance on literacy and ideology is similar to the concept of the hidden curriculum introduced by Michel Apple. This concept touches more closely on the interests of the developed world:

> the critique of implicit consumerism. This is where the great cultural distortions of mathematics education manifest and reveal its political dimension.

These three works introduced ideas that would later influence many other works in different countries. However, these ideas did not exhaust the possibilities for addressing the issues that define mathematics education. Consequently, the following decade saw an expansion of work in the field based on and inspired by Paulo Freire's ideals. Examples include Marcelo Borba's (1987) work on ethno mathematics in favelas, published in a collection organized by Freire, Nogueira, and Mazza; Arthur Powell and Marilyn Frankenstein's (1992) work linking ethno mathematics to the search for a liberating mathematics, echoing Paulo Freire's ideas on liberating education; Other examples include the work of Maria do Carmo Santos Domite (1993), who presented the results of her research with professors who taught mathematics in the São Paulo municipal school system during Freire's administration, and William Higginson (1997), who related Freire's ideas to those of D'Ambrosio to combat the oppression perpetuated by Western mathematics.

During Freire's tenure as the municipal secretary of education in São Paulo, Brazil's largest city, many mathematics educators contributed steadily. Following Domite's example, they developed research investigating how basic education teachers materialized the premises, concerns, and purposes of Freire's emancipatory education in their classrooms. This research focused on discovering ways to implement the author's ideas, especially those presented in his Pedagogy of the Oppressed (Freire, 1983), in mathematics classes. D'Ambrosio (2021, p. ix) discusses this contribution.

> It was important to have participated and collaborated with the Curriculum Reorientation Movement on several occasions. This was an innovative proposal by Paulo Freire during his time at the São Paulo Municipal Department of Education (1989-1991). His proposal aimed to give each school the right to develop its own curriculum rather than follow proposals issued by official bodies. The proposal aimed to provide public schools with the necessary resources for curriculum development and encourage the decentralization of decision-making power, school autonomy, and popular participation. In his doctoral thesis, Júlio do Valle (2019) analyzes how the movement unfolded from inception to implementation in schools and discusses Paulo Freire's emphasis on mathematics, elucidating its potential and weaknesses.

It did not take long for Freire to become recognized as a theoretical reference capable of supporting research in the field, pointing out interesting perspectives and paths for the development of works concerned with the maintenance of oppressor-oppressed hierarchies and dedicated to mobilizing school mathematics in a liberating and emancipatory pedagogical approach. In 1996, Ubiratan D'Ambrosio and Maria do Carmo Domite

conducted an interview with Paulo Freire[3] in which they explained many of the interests of mathematics education researchers in the educator's ideas. D'Ambrosio (2021, p. xvii) wrote about his memories of Freire and, in particular, about this moment:

> An important moment in the history of mathematics education occurred when the Organizing Committee of the 8th International Congress on Mathematical Education (ICME-8), to be held in Seville in 1996, extended an invitation. Paulo Freire readily accepted, creating great expectations among mathematics educators around the world. However, the summer of 1996 in Seville was unbearable, and doctors advised Paulo Freire not to attend. The heat was indeed intolerable, so this advice was very prudent. Given this unforeseen event, the Congress Organizing Committee invited Dutch mathematician Jan de Lange to deliver the opening lecture. However, they also planned to show a video recorded by Paulo Freire for the Congress participants several times during the event, with substantial support from Casio Calculators. The video was an interview, and I had the honor of conducting it. Professor Maria do Carmo Domite, his great friend, disciple, and collaborator, acted as mediator. It was a memorable occasion. We recorded it at Paulo Freire's home, and it was screened repeatedly in Seville during the Congress and was very well attended. The interview was transcribed and published in Portuguese and English in renowned international magazines. This event was a significant personal and professional experience for me.

The recognition given by the ICME-8 organization revealed the potential we have discussed in this text. This interview provides many fruitful reflections on mathematics education and is full of valuable lessons from Freire for mathematics educators. For example, Freire famously said, "There is a mathematical way of being in the world." Maria da Conceição Ferreira Fonseca (2022, p. 33) shows that this statement can be complemented by D'Ambrosio's idea that there are many (ethno) mathematical ways of being in the world.

Three decades after the movement to intensify Paulo Freire's presence in mathematics education, many works consider him a fundamental theorist who outlines methodological procedures careful with dialogue and the relationships between researchers and participants in the research. These works also support the analysis of produced data. This is evident in the works of Valle (2022), Valle, and Malheiros (2024). The former is a collection, and the latter is a special edition of a journal in the field. Both are dedicated to gathering and disseminating works from different perspectives and themes that draw on Freire's work. This allows us to understand how his work, ideas, and concerns have influenced the study of mathematics education. Ole Skovsmose (2021) also honored Paulo Freire by delivering the opening lecture at the II National Online Meeting of Mathematics Teachers (ENOPEM), addressing "Inspirations of Paulo Freire's Theory in Critical Mathematics Education."

[3] https://www.youtube.com/watch?v=O_TC3nSz3MM

Therefore, it is noteworthy to highlight the fruitfulness of Freire's work in the various approaches to conducting research in mathematics education. These approaches not only permeate the sociocultural perspectives of the field but also involve characterizing the subjects with whom we interact in our research and constituting ways of doing things, particularly methodological ones. This work teaches us about polysemy and the need to continually revisit his ideas. In this sense, this text builds on these efforts by examining how and to what extent ANPEd's GT 19 has incorporated this body of work.

Methodological approach

Given that our objective is to answer a specific question, we opted to conduct a systematic review. Which studies presented in WG 19 engage with Paulo Freire, and which Freirean concepts stand out in them? With a narrow focus, we aimed to synthesize specific evidence on the use of a theoretical framework. We sought to identify, locate, and describe research presented in ANPEd's WG 19 from 2000 to 2023 that refers to Freire's perspective at some point.

We consider the systematic literature review method to be a process based on predetermined criteria and consistent scientific evidence. It involves organizing, clarifying, and summarizing existing publications on a given topic to provide a historical overview of a field.

We accept the issues addressed in the research and the articulation of the objective of the studies carried out according to Paulo Freire's guidelines. In this particular production, however, we will not concern ourselves with the methodology and results presented.

The bibliographic survey conducted for this study was made possible by the ANPEd website, which makes available the texts presented in the working groups at the annual meetings. We searched the website for the complete works, but not all of them were available, which prevented us from analyzing all the information we sought.

This research's methodology consists of a systematic review of literature related to a specific objective (Barbosa, 2018). The analysis focuses on works accepted and published at ANPEd's national meetings in GT19 that incorporate Paulo Freire's concepts.

This type of survey goes beyond a formal description of the works, enabling reflection on the results and contributing to an understanding of the development of research in this field. We were struck by the fact that only about 8% of the research shared in GT19 referenced Paulo Freire.

To highlight the Freirean concepts considered by the authors, we used IRaMuTeQ (Interface R pour les Analyses Multidimensionnelles de Textes et de Questionnaires), software used for statistical analysis of textual corpora generated through text segments (Camargo & Justo, 2013). This software enabled us to produce a word cloud and a similarity analysis, both of which are presented in this article and provide a broader approach to the evidence gathered in the survey.

Our main objective in using the software was to highlight, in an introductory and illustrative manner with visual aids, the points of similarity and convergence that emerged in the analysis of the mapped texts. These points allow us to identify convergence in the arguments woven into each text and signal ways in which Freire's framework has been adopted and applied in mathematics education research.

Articles presented at the annual meetings of ANPEd Working Group 19

At the first meeting of Working Group 19 in 2000, Laudares and Lachini (2000, p. 15) based their arguments on Freire (1986, 1987). They opposed banking pedagogy and defended the dialogic teaching method, advocating for the implementation of computers in undergraduate calculus classes. Adopting Freire's perspective, they argued for moving away from "a conservative academic formalization" and toward "a conceptual understanding that considers the genesis of knowledge and the development of content in its critical, contextual, transdisciplinary, and cultural re-elaboration."

The following year, at the 24th Annual Meeting of ANPEd, no WG 19 work referenced Paulo Freire. In 2002, two studies referred to the author. Barbosa (2002) considered Freire and Faundez (1998) when discussing mathematical modeling as a learning environment in which students inquire about and/or investigate situations arising from reality. Zaidan (2002), meanwhile, researched issues related to teaching mathematics in the context of inclusive education. He contrasted this approach with banking education (Freire, 1983) and argued that professors of this discipline construct themselves as educators in contexts of inclusive and innovative practices.

Of the 12 papers presented at the 26th Annual Meeting of ANPEd, only one used Freire as a reference: the study by Fischer (2003). This study investigated how mathematics professors' conceptions influenced their pedagogical practices, particularly regarding assessment. The author cites Freire (1998, p. 44) and emphasizes the importance of monitoring students' learning beyond test results.

> The more I accept myself as I am and understand the reasons why I am this way, the more I become capable of changing, of promoting myself, in this case, from a state of naive curiosity to one of epistemological curiosity.

In 2004, two studies referenced Freire. Kessler's research problematized the exclusion caused by knowledge provided by mathematics. Kessler considered "the close relationship between the production of this process of exclusion and mathematics as a field of scientific knowledge and as a field of knowledge to be taught." Based on Freire and Shor (1986), Kessler emphasized the need to demonstrate that rigor is not synonymous with authoritarianism or rigidity because rigor requires freedom. Lopes (2004) also discussed the professional development of early childhood education professors who are challenged to work with children on stochastics. The author based her work on Freire (1996), who emphasized the importance of collective knowledge production with critical thinking.

Laudare's (2005) research aimed to present investigative experiences with mathematics in the classroom, considering the context of professional master's degrees. The study was based on the work of Freire and Shor (1986) and considered liberating pedagogy, in which professors and students engage in dialogue to confirm their understanding of the subject. Similarly, Anastácio's (2005) study sought to highlight invariants in his supervised research on mathematics in schools, based on professors' perspectives on school mathematics. The author based her argument on Freire (1987, p. 135), who claimed that when teachers clearly explain what they intend to teach, they encourage their students to develop an understanding of the knowledge rather than simply receiving it as a "gift" from the teacher.

Silva (2005), discussing a university extension program for the continuing education of mathematics teachers in public elementary schools, defended culture as a value. He also considered Freire's (1993a) warning that no one can educate another person, nor can one educate oneself.

The paper, "Investigating Critical Sense in the Interpretation of Graphs Among Teachers in Initial Training," written by Monteiro (2006, p. 4), discusses the notion of critical sense in interpreting graphs. Referring to Freire (1997), the paper indicates that critical sense "also encompasses the sensitivity of readers to reflect on their own ideas, beliefs, feelings, conceptions, and conjectures regarding the interpreted data."

Coelho and Carvalho (2008) presented a study aimed at understanding the meaning of problem solving as a pedagogical practice produced by professors and studying the conditions under which these meanings are produced. The authors based their work on Freire's perspective of problematization as a socio-ethno cultural trend based on education

as a practice of freedom and the dialogical relationship between knowledge and cultural context.

The following year, we only had one article, which was presented by Libertini and Passos (2009). It discussed the potential and limitations of using investigative tasks to teach mathematics in early elementary school. They identified changes in teaching practice and classroom dynamics based on a professor's actions and reflections.

To discuss the professor's challenges and insecurities, the authors considered Freire and Shor (1986) in a discussion about fear as part of the human condition, a manifestation of being alive that does not diminish humanity. The authors concluded that there is no reason to hide or deny fear, but it cannot immobilize us. They also referred to Freire's (1996) ideas, emphasizing the importance of listening to students to better understand their difficulties and the processes they use. They also pointed to Freire's (1987) warning that no one educates anyone else or themselves, but rather, people educate themselves in communion with the world.

We did not have access to the papers presented in 2010 because they were unavailable on the ANPEd website. In 2011, none of the presented papers referenced Paulo Freire.

Thees and Fantinato (2012), when discussing Youth and Adult Education (EJA), presented a text derived from the dissertation of the first author, in which she investigated how mathematics professors were developing their teaching and non-teaching practices in this modality. The authors pointed to education as a form of intervention in the world, as stated by Freire (1996), and defended dialogicity as essential for a liberating education (Freire, 1983). They considered that a practice in Mathematics Education should be active and inquiring, promoting the development of the student's reflective consciousness (Freire, 2011), particularly in EJA, when content should be linked to students' experiences to provide them with an education for critical consciousness so that they can attribute meaning to their lives (Freire, 1986).

At the 35th Annual Meeting of ANPEd, two other papers also drew on Freirean references. Medig (2012) presented a study that aimed to develop a collaborative investigative experience with two elementary school mathematics professors. The study aimed to verify the impact of a proposal for mathematical activities planned during collaborative study group meetings. Medig (2012) drew on Freire (1996) to emphasize that the group meetings were based on dialogue among participants, fostering relationships of equality, loyalty, and respect for critical thinking in a process of action and reflection. Thus, the meetings became a space for exchanging experiences and learning from one another to

improve pedagogical development. The other study, presented by Mendonça and Lopes (2012), examined student development in a mathematical modeling environment within the context of Statistics Education in two eleventh-grade classes. The authors based their work on Freire (1979) and advocated that educational actions must be redesigned to enable students to acquire the skills necessary to act in society as independent, transformative beings who can contribute to their world. This idea stems from Freire's belief that developing critical awareness enables people to transform reality. Furthermore, based on Freire and Faundez (1998), they argued that professors should teach students to ask questions and understand the importance of questioning when teaching statistics. This provokes students to question aspects of their reality.

These (2013) analyzed how mathematics teachers of young people and adults constitute non-teaching practices and highlighted their influence on ethical and political commitment to EJA. Revisiting Freire (1996, p. 57), he argued that professors must have "awareness of the world and awareness of themselves as unfinished beings" to participate in a movement for their education. At the 36th Annual Meeting of Anped, Moreira and Manrique (2013, p. 2) based their research on Freirean ideas, focusing on how mathematics teachers perceive the phenomenon of disability. They viewed the teaching and learning process as dialectical, believing that teaching and learning are inseparable (Freire, 1993b). Based on this premise, the authors argued that "working in the classroom with a student with a disability is an opportunity to begin anew and carry out pedagogical work focused on teaching and learning."

In 2015, no papers referenced Paulo Freire. At the 38th annual meeting, Pompeu and Santos (2017) presented a study that aimed to analyze the relationship that young and adult students establish with mathematical knowledge. They sought to understand the meanings attributed to this knowledge and the difficulties that emerge from such a relationship. In this study, they drew on Freire (1983), who considered that education enables a critical understanding of social, political, and economic reality. The authors argue that EJA students need an educational space that allows them to engage in a permanent process of liberation, self-knowledge, and personal and global transformation. They further considered that

> It is impossible to act in favor of equality, respect for the right to voice, participation, and reinvention of the world under a regime that denies the freedom to work, eat, speak, criticize, read, disagree, come and go, and the freedom to be. (Freire, 1994, p. 192)

Fantinato and Soares (2021) presented a study analyzing the impact of an Ethnomathematics course on future professors in an undergraduate program. The study highlights a paradigm shift regarding the universality of mathematics and its attribution as a human construct. The authors based their work on Freire (1987) to argue that awareness is a means of humanizing and de-alienating individuals and that this awareness permeates dialogue without hierarchizing teachers and learners. They referenced Freire's (1987) assertion that teaching is "an encounter between interlocutors who seek the meaning of meanings" (p. 69).

At the 40th Annual Meeting of ANPEd, Valle (2021) investigated ways to improve the teaching practices of professors of mathematics in Youth, Adult, and Elderly Education (EJAI). To this end, Valle (2021) described formative experiences whose guiding principle is action-reflection-action (Freire, 1996) and which are based on mathematics teaching practices constructed and shared by teachers.

Undoubtedly, Terruzi's (2023) paper strengthened the ties between mathematics education and Paulo Freire's perspectives by discussing how to bring them into dialogue with Freirean pedagogy. The author argued that without the dialogic dimension, emancipatory and critical education is impossible because education becomes distorted and turns into "banking" education (Freire, 1983). Linked to the dialogical dimension, Freirean considerations highlight the generative theme as a central element in liberating pedagogical construction, which is essential in mathematics classes. The study also emphasized that dialogue requires the active participation of students and professors, breaking with the unidirectionality of banking education.

Grando and Buehring (2023, p. 1) presented a study in which they argued that statistics should be studied throughout basic education. The authors sought to understand the "possible movements of statistical thinking in childhood" and demonstrate that statistical literacy is a continuous process — a way of reading, understanding, and interpreting the world; a way of listening to and telling stories with data. They pointed out that statistics can help children respond to their curiosities as they reflect on themselves, their place in the world, and their condition when interpreting the world without exempting themselves from childhood. The authors discussed learning about the world through questioning, data collection, and organization as a form of world-to-world movement (Freire, 2020). They concluded, "Education happens in the time and place of love for the world" (Freire, 1983, p. 5), "a love that connects people and the world."

Oliveira, Lima, and Tomé (2023) presented a theoretical essay in which they sought to understand the meanings and senses of collaborative practices in Study and Research Groups in the field of Mathematics Education. In this study, the authors based their work on Freirean perspectives, considering the importance of collaboration and dialogue in the experiences of group members when they problematize and critically analyze the surrounding reality (Freire, 1983).

Given this overview, in which we present the authors, the issues addressed in their research, and their Freirean approaches, we will now proceed to analyze them.

Data analysis using word clouds and similarity analysis

We used IRAMUTEQ to generate a word cloud, illustrated in Figure 1, to analyze the survey and highlight terms that stand out from the focus of the studies and references to Paulo Freire.

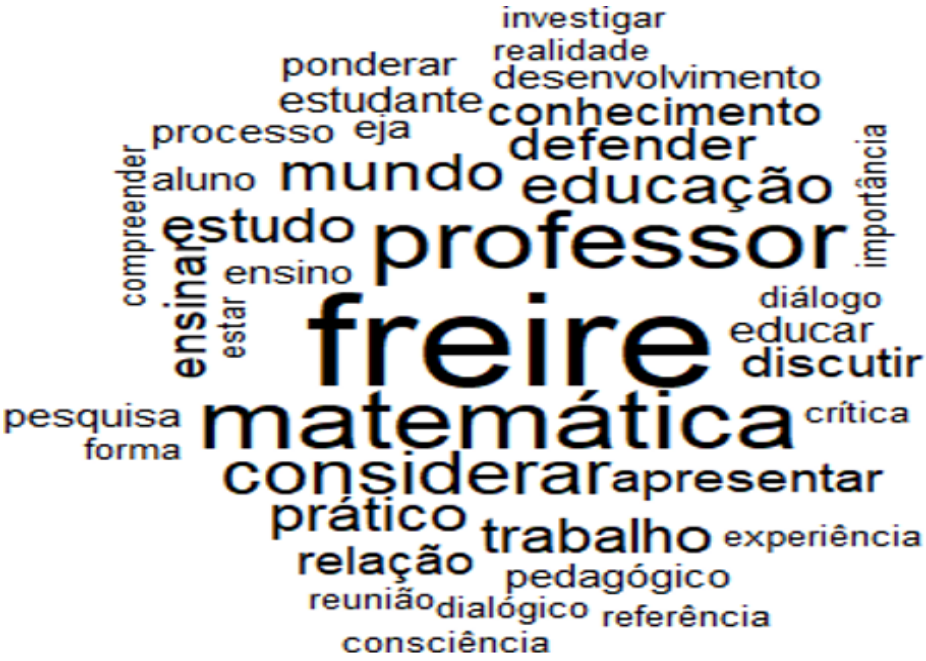

Figure 1

Word cloud generated from the survey of research presented in WG 19 that dialogue with Paulo Freire.

Based on this word cloud, we can see how relevant Freire's theory is to the educational process of teaching mathematics. This process is based on pedagogical work derived from experience and dialogue. This teaching and learning process aims to develop critical awareness through investigative activities about students' realities to enable them to see the world more broadly. The verbs discuss, consider, ponder, and understand, as well as the nouns awareness,

experience, criticism; world, meeting, relationship, and reality stand out as expressions belonging to a semantic field continuously mobilized by Mathematics Education research inspired by Freire and his work. The centrality of these verbs indicates some axiological principles with which we should teach mathematics in basic education, as evidenced by previous research. In other words, it is Freire's way of giving meaning to our students' school experience, particularly with mathematics, though not exclusively.

Figure 2 shows the graph generated by the similarity analysis, which allows us to identify co-occurrences and connections between words from the works cited as references in the studies resulting from the survey. We noticed that the studies are making a connection between Freire, Professor, and Mathematics. The similarity analysis reveals the strengthening of words previously indicated by Freire, such as consider, defend, discuss, dialogue, criticism, education, world, and student. When we look at what comes from the professor, study and investigation stand out. In addition, from the connection between the word professor and mathematics come research, practical, and pedagogical.

Thus, we reiterate what was observed in the word cloud from an educational perspective based on a liberating practice in which the professor listens to their students, promoting a classroom as a dialogical space in which the development of critical thinking is sought through investigation into the reality of sociocultural and economic contexts.

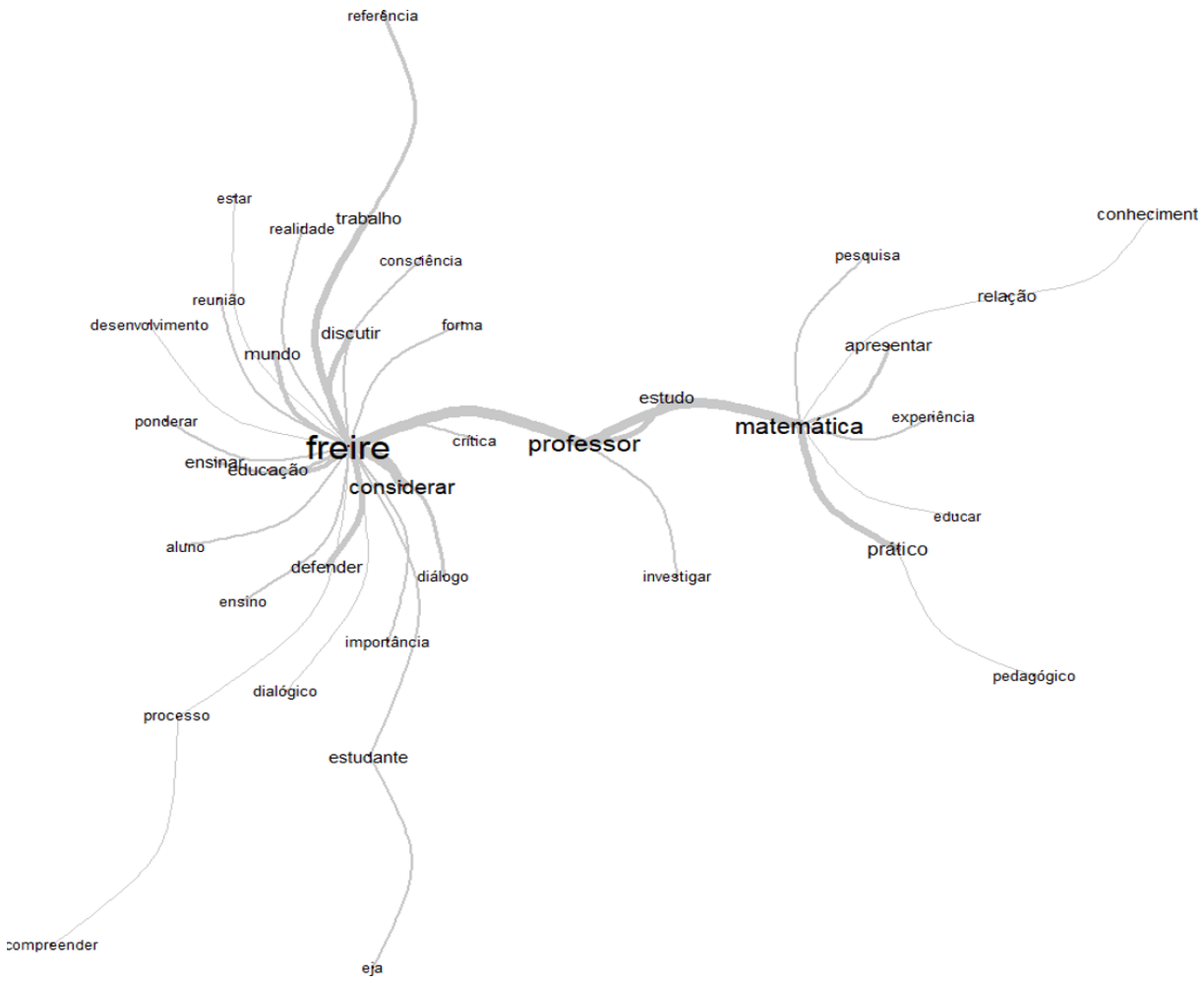

Figure 2.

Similarity analysis of searches

The graph illustrates recurring themes in the studies presented in WG 19 over 25 years at the annual ANPEd meetings. While the word cloud illustrates the frequency of words in the mapped works, the graph shows how the highlighted expressions in these studies are intertwined, revealing the relationships among the authors of these articles.

It is interesting to observe the relationship between teaching, represented by the figure of the "professor," and investigating as a part of their practice. This highlights our argument, contrasting it with banking education, which was criticized by Freire. Furthermore, mathematics appears linked to experience, research, relationships, and the practical knowledge of its functions in our daily lives. The name of the educator reveals additional ramifications that are not disconnected from teaching or, more specifically, from the relationships focused on

teaching and learning mathematics in its multiple dimensions. Rather, they reveal potential avenues for reinforcing Freire's influence on research in this field, particularly in the upcoming decades of GT19's existence. Finally, we weave together discursive considerations from our perspectives.

Some considerations

In pursuing the guiding question, "Which research projects presented by WG 19 over its 25 years of existence engage with Paulo Freire, and which Freirean concepts stand out in them?" we conducted a systematic review of the literature. This review revealed that few studies shared within WG 19 engaged with Freirean ideas. "

The most widely used works were Pedagogy of the Oppressed and Pedagogy of Autonomy: Knowledge Necessary for Educational Practice. The former is a seminal Freirean text that has been disseminated worldwide, while the latter synthesizes Freire's arguments in favor of an educational process that fosters human development and critical consciousness to overcome oppression.

Evident in the defense of an effective teaching and learning process of mathematics through critical reflection is the dialogue with Freire's perspective on education by the authors cited in the survey of publications in WG 19. Through this process, teachers and their students develop attitudes that are dialogical, open, curious, and inquiring, rather than passive, while they speak or listen.

The research presents similarities in the defense of a mathematical education based on critical educational practices, which result in a balance between authority and freedom. This type of education considers methodological rigor and investigation. It listens to students and encourages them to overcome naive curiosity in favor of effective epistemological curiosity. This type of education enables students to do mathematics, allowing them to understand the world in a way that can reshape their attitudes. This understanding is based on interventions in their realities with consistent arguments that contribute to democratic coexistence.

As discussed earlier, more than three decades have passed since the first works on mathematics education drew on Freire's ideas. This contrasts with our surprise at finding that

fewer than 10% of the papers presented at ANPEd's GT19 drew on Freire's work as a theoretical or methodological reference. Freire remains a relevant author for understanding the enormous inequalities and violence that constitute our society. We also believe that research in our field could benefit from incorporating this idea.

Furthermore, we believe mathematics and its teaching play a fundamental role in maintaining these inequalities and violence by materializing the oppressor-oppressed relationship in our field of knowledge. Therefore, mathematics itself can also be a potential tool in unveiling, confronting, and emancipating this unequal and violent society.

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