Sociedade Brasileira de Educação Matemática

RIPEM

Inclusive Mathematics Education: contributions and (inter)connections between Paulo Freire and Critical Mathematics Education

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2238-0345 ISSN

10.37001/ripem.v14i5.3745 doi

Received • 22/01/2024
Approved • 05/05/2024
Published • 20/12/2024

Editor • Gilberto Januario

Abstract: The increasing number of Brazilian students with disabilities has led to growing concerns, because of the uncertainties and the need for change that is imposed by this new setting. On the other hand, there has been a rise in the number of researchers who believe it is crucial to rethink paradigms for Inclusive Mathematics Education. Freire's ideas about a Liberating Education are resonating with the educational demands of learners with disabilities and they reflect the necessity of shifting beliefs, which has been widely discussed in Critical Mathematics Education. This theoretical essay is based on the relationship between Freire's thoughts and the issues addressed by Critical Mathematics Education, as set out by Skovsmose. The author, whose aim to reflect on Inclusive Mathematics Education, gives the following examples: the recognition of the individuals' reality, the subjects' personal development, their dialogical interaction, and inclusion as a way of bringing differences together.

Keywords: Inclusion. Paulo Freire. Critical Mathematics Education. Theoretical Essay. Inclusive Mathematics Education.

Educación Matemática Inclusiva: aportes y interconexiones entre Paulo Freire y la Educación Matemática Crítica

Resumen: Incrementos en el número de alumnos con discapacidad en las clases de educación regular en Brasil hacen crecer las preocupaciones por las incertidumbres y la consecuente urgencia de cambio. Compensatoriamente, aumentan los que consideran necesario revisar paradigmas para promover una Educación Matemática cada vez más inclusiva. Las ideas de Paulo Freire de una educación liberadora resuenan con las demandas educativas de los estudiantes con discapacidad, reverberando en la necesidad de romper paradigmas en la enseñanza de las matemáticas, como se discute en Educación Matemática Crítica. Por lo tanto, este ensayo teórico se basa en la articulación entre las ideas de Freire y las preocupaciones discutidas por la Educación Matemática Crítica, difundidas por Skovsmose, como la legitimación de la realidad de los sujetos, su transformación, su relación dialógica y la inclusión como encuentro de las diferencias, con el objetivo de discutir y fomentar la reflexión sobre la educación matemática inclusiva.

Palabras clave: Inclusión. Paulo Freire. Educación Matemática Crítica. Ensayo Teórico. Educación Matemática Inclusiva.

Educação Matemática Inclusiva: contribuições e entrelaçamentos entre Paulo Freire e a Educação Matemática Crítica

Resumo: Incrementos no quantitativo de alunos com deficiências em turmas regulares de ensino no Brasil fazem crescer as preocupações, fruto das incertezas e da urgência de mudanças, que esse novo cenário traz. Compensatoriamente, há o aumento de educadores e pesquisadores que entendem ser preciso rever paradigmas com o intuito de promover uma Educação Matemática cada vez mais inclusiva. As ideias de Paulo Freire de uma Educação Libertadora encontram eco em meio às demandas educacionais dos alunos com deficiência, reverberando na necessidade de quebra de paradigmas no ensino da matemática, tão discutida na Educação Matemática Crítica. Logo, esse ensaio teórico pauta-se na articulação entre as ideias de Freire e as preocupações discutidas pela Educação Matemática Crítica, divulgadas por Skovsmose, como a legitimação da realidade dos sujeitos, sua transformação, sua relação dialógica e a inclusão como encontro de diferenças, objetivando discutir e fomentar a reflexão sobre uma educação matemática inclusiva.

Palavras-chave: Inclusão. Paulo Freire. Educação Matemática Crítica. Ensaio teórico. Educação Matemática Inclusiva.

1 Introducing the context

For some time now, Brazilian's research has drawn attention to the fact that teachers feel unable to work with students who have learning difficulties (Fernandes & Healy, 2007). In addition, studies have also pointed to non-compliance with laws (Lirio, 2006), which have dealt with this issue since the 1950s. Inclusive education was legally supported by the Brazilian Education Law number. 4.024/61 and it was strengthened in the 1980s "by documents that were either used exclusively or supplementary to the legal system, such as Article 208 of our current Magna Carta (Federal Constitution of 1988) and Chapter V of the current Law of Guidelines and Bases of National Education - LDB (Law number 9.394, of 20/12/96)" (Conceição, 2019, p. 15).

According to the above author, later advances in legislation, such as Law 13.146 of July 6, 2015 (Brasil, 2015), have made it a legal issue for teachers to have access to inclusive practices during their in-service training. This understanding arises from the gap between the achievements brought about by technological-scientific and humanistic progress, whose results have led to a significant and continuous leap in the number of students with disabilities enrolled in regular schools and the lack of teachers trained to cope with them (Mantoan, 2003). As a matter of fact, data from the elementary school census has shown a gradually increasing in the number of students with disabilities in regular classrooms, rising from 800,000 in 2016 to 1.6 million in 2023 (Brazil, 2019; 2024). These figures point to the necessity of more training practices aimed at fostering inclusion.

Therefore, the goal of this essay is to explain how the Liberating Education concepts advocated by Paulo Freire are embedded in Inclusive Mathematics Education, associated with the principles of Critical Mathematics Education. This theoretical approach will foster findings on Mathematics Education grounded in equity and justice and, hence, we will be able to achieve teaching that enhances recognition and development of the individual's skills and abilities. Thus, the purpose of this paper is to encourage reflections on how these insights contribute to the design of Inclusive Mathematics Education in Brazil.

In the next section, we will discuss the definition of inclusion and its guiding tenets. We also intend to address: (i) inclusive practices and the teaching of mathematics; (ii) the role of

critical and liberating education connected to Inclusive Mathematics Education and then, (iii) we will problematize the role of teachers as focal points. After these arguments, to conclude, we will present considerations on possibilities that may foster Inclusive Mathematics Education.

2 The notion of inclusion

Inclusion is not something new to talk about, but fighting for it is even less so. Educators, political activists, sociologists and anthropologists are among those in favor of it, but researchers (Mantoan, 2003; Skovsmose, 2019) share the idea that this is a controversial matter because of the debates that uphold it. As such, it is crucial to set out in which context we intend to include them and who we are aiming to include, as this definition is extremely significant when it comes to discussing inclusion. Skovsmose (2019) argues that the controversy lies in the fact that, when the issue of including school children with disabilities in standard classrooms comes up, a narrative of 'normality' is broadly followed in which there is a group considered 'unable' that is placed in the same classes as those who are classified and seen as 'able'. However, what can be said about this dichotomy?

The idea of two groups sharing the same environment legitimizes 'a concept of partial integration, because the system is set up to provide segregated educational programs' (Mantoan, 2003, p. 15). This fragmentation of the school system assures the student's legal right to access and attend regular schools, but it does not give them the fundamental right to learn. In addition, it strengthens the teachers' sense of hopelessness in teaching students with disabilities (Couto & Ribeiro, 2019), since their professional training is focused on the common sense and not on the diversity that can be found in any classroom, regardless of whether they have learners with special needs (Mantoan, 2014). Inclusion is therefore an advance on social integration, as it promotes the bringing together of differences and drives changes in the school context, insofar as its concern is about students, with or without disabilities, having not only access to the school environment, but also the opportunity to learn (Skovsmose, 2019).

Despite the current laws laying down guidelines for changes (Brasil, 2015), people with special needs in the school environment are still seen as "[...] individual cases, they are a pathology of a healthy society, which needs, for this very reason, to fit them into it, thereby shifting the mentality of men who are unfit" (Freire, 2005, p. 35). The author was referring to how society has been seeing people who are underprivileged in economically terms, although this is also true of its view of people with disabilities. This fact is against the principle of inclusion called for by Skovsmose (2019) and endorsed in this paper - the " bringing together of differences" - whose perspective on inclusive education emphasizes the need to rethink school processes, by replacing the practice of banking education, in which the learner is seen as a container into whom knowledge is stored, with a stance of partnership in the teacher-learner interaction (Freire, 2005).

This attitude, grounded in acknowledging the student as being able to take the lead in their learning, agrees with the demands of Critical Mathematics Education and provides conditions that are more appropriate for inclusion. This theoretical approach sheds light on mathematics education, considering the subjects in their social, cultural, political and economic contexts and discussing the role that mathematics can play in these settings (Skovsmose, 2014). The subject's learning in a classroom that lacks lighting, ventilation, good seating and access to

teaching resources can take place in a different way from that in where the context is a *prototypical*[1], non-standard environment (Skovsmose, 2009).

The educational opportunities presented to students from economically favorable backgrounds are not the same as for people from less privileged conditions, and this has an impact on their later decisions and learning. Thus, looking at subjects with or without disabilities, but who are the same students learning mathematics, is a main concern of Critical Mathematics Education, as well as Inclusive Mathematics Education. For so doing, we will be addressing issues related to inclusion in the teaching of mathematics, even though we will be raising other matters of concern later in this paper.

3 Mathematics teaching and inclusion

Mathematics is seen in common sense as not being for everyone. Unfortunately, the prevailing practices in academia, even though they are changing, have over the years helped to consolidate the widespread opinion that mathematics is a field of knowledge which is only for a few people who are more intelligent than the average. Under this paradigm, not many people are able to grasp the conceptual dimensions required. Furthermore, this excluding view is still strengthened in most undergraduate courses in Brazilian universities, both because of the methodologies applied in pre-service teacher training, and because of the school board attitudes, which is set up as one of the future teacher's main references. As a result, this sequence consolidates a sad and damaging cycle of exclusion.

Most undergraduate mathematics courses in Brazil foster the belief that a good teacher is one who knows a lot of mathematics and does not encourage the acquisition of knowledge and methodologies that favor both teaching and learning; in this way, the teacher ends up encouraging a growing gap between academic theories and schools (Giroldo, 2018). This assumption tends to promote an attitude of exclusion, insofar as it blames the students entirely for their failure. This is particularly true for students with disabilities, as they associate their deficiency with an inability to learn, due to the different way they interact with knowledge.

There has been an increase in the number of research on Mathematics Education in Brazil, which has highlighted changes in attitude that goes against this prejudiced and exclusionary mindset. As part of this new educational setting, teachers are trying to embrace diversity and support students with and without disabilities so that they feel part of the learning process. In such a manner, this student will become able to self-direct their learning, building the knowledge he/she needs not only to make progress at school, but also to broaden her/his worldview (Manrique, Moreira & Mararanhão, 2016; Skovsmose, 2019).

Moura and Penteado (2023) draw attention to the lack of inclusive teaching practices in the context of math education for deaf students. The authors shed light on the need to build an inclusive research field in which the deaf student's interaction is not restricted to just the sign language interpreter but can also take place with the other children. Situations such as those described by the authors may also include students with other specific learning needs. For this reason, Moura and Peanteado (2023) underline the benefits of teachers reflecting on whether their performance in the classroom contributes to the diversity and inclusion of their students, with or without disabilities.

[1]. According to the author, prototypical contexts are those in which the school environment is characterized by conditions that are favorable to learning, such as those found in well-equipped schools, with healthy students raised by functional families who live in a peaceful and economically successful society.

This reflective process should allow us to "shift from a mindset of a standardized-teacher to a loving-teacher" (Brigo, Flores & Wagner; 2020, p. 62). The authors highlight the difficulty in making this achievable, since the main obstacle is the everyday school life with its demands, requirements and all the aspects that hold back individuality through the standardization of actions. Breaking with this systemic process that marginalizes people who are outside the established 'normality' requires efforts driven by a genuine determination to make a difference, based on respect for the dignity of each student. This paradigm shift "is not a privilege that we may or may not grant each other" (Freire, 1996, p. 59), instead it is an ethical issue, this is a requirement for teaching.

Furthermore, Lima and Ripardo (2023, p. 5) restate the importance of "a more humanizing way of teaching, which leads students not only to learn technical aspects, but also to reflect on their usefulness". Clearly, this humanizing teaching doesn't come out of nowhere, since the act of teaching is also the result of the transmission of learning that has been acquired over the life course. Thus, it is essential to encourage this humanizing education in teacher training, based on a practice that breaks away from oppressive rhetoric that contributes to the misconception that mathematics is for the very few people. In agreement with this idea, Martini and Godoy (2022, p. 30) argue that, for Freire, teacher development is about

> a process that goes far beyond training, a principle that is also applied to teaching, as the importance of developing critical education and epistemological awareness in pursuit of the human empowerment of everyone.

This critical education in search of human liberation, embodied in Freire's thought, aligns with some of the priorities supported by Critical Mathematics Education. These concerns can be addressed through some questions: how can the teaching and learning of mathematics take place in non-*prototypical* contexts? How do math classes shape the learners' foreground[2] at different stages of schooling? Which connections are there between communication types in math classes and learning? What is the relationship between mathematics and social responsibility? What kind of activities can develop critical thinking in math classes? What role does mathematics play in society? How does society influence the production of mathematical knowledge? We will reflect on some of these specific questions later in this paper.

In addition to these issues, there are other challenges regarding the inclusion of students with disabilities. Marcone and Milani (2020) were interested in studying a selected scientific production in the field of Mathematics Education in Brazil to understand whether Ole Skovsmose's inspirations were not lost in the research carried out after the 1970s when the concepts of Critical Mathematics Education were first introduced. The authors concluded that some of the social movements of that time, such as the student and women's movements, continue to inspire Brazilian research. In more than just these mobilizations, Marcone and Milani (2012) have noticed that new inspirations have contributed to findings grounded in Critical Mathematics Education, such is the example of Inclusive Mathematics Education. Nowadays, the subject of Critical Mathematics Education in Brazil requires that we consider the inclusion of students in Mathematics Education.

Similarly, although Freire does not refer to the inclusion of people with intellectual deficiencies, he argues that the path to effective education would be to work on building an environment of reciprocity that goes beyond understanding reality, but whose aim is to respect

[2] The author defines this term as the individuals' expectations of their future, taking into account their social environment and the socio-political context that surrounds them.

differences (Freire, 2014). Once this goal has been achieved, we can begin the progress towards knowledge, based on dialogues, which is, in a nutshell, the outline of a real inclusion process. This dialogical commitment is in line with the slogan of the pro-inclusion campaign: “nothing about us without us”, which relies on the idea of empowering the oppressed by truly listening to them. Undoubtedly, this new paradigm is not free of any conflict, but Freire (2005, p. 91) recognizes it as a potential agent of knowledge, since it unsettles pre-standing ideas and attitudes:

> The need for a dialogue is a crucial one. However, if it is an opportunity for the subjects to reflect and act in solidarity with the world to be transformed and humanized, it cannot be limited to an act of exchanging ideas from one subject to another, nor can it become a matter of simply 'trading' thoughts to be taken up by the participants.

This liberation allows people with disabilities to stand out in the society that stigmatizes them as a pathology. These individuals are validated by the fact that they see themselves as active subjects in the construction of their knowledge based on their strengths, rather than being evaluated by their weaknesses. Equally, the transformative power of the dialogue is considered by Alrø and Skovsmose (2006, p. 114) to be “a humble and respectful way of cooperating with the other in a relationship of reciprocal reliance”. Naturally, practicing this dialogic model requires an attitudinal mindset change in which the teacher-student relationship is freed from banking education, and it becomes a two-way teaching and learning experience.

This dialogical role of the teachers, before being methodological, it is also a political one (Milani, 2020). By taking an open conversation as a means of communication in math classes, the teacher will be able to realize that the students' shared experiences will contribute to the lesson's development, as they will become co-authors in the planning of activities that have been carried out or are about to be taken place. In this sense, students with disabilities could also help by telling us what, in terms of methodology and resources, is effectively enhancing their learning.

This change in attitude results in a more democratic math class, in the way that students' participation is legitimized. This legitimacy comes from the teacher's active listening to the students' contributions, verbal or otherwise. Alrø and Skovsmose (2006, p. 70) recognize active listening as the process of “asking questions and providing non-verbal support while trying to find out what is going on with the other person”. Once this approach is put into practice, especially with disabled children, it has the potential to be the breakthrough between a truly inclusive education and one that is exclusive and potentially excluding. Therefore, more than anyone else engaged in the process, disabled students know what leads them to be an active agent in their learning or someone who is often given meaningless instructions because their weaknesses and potential are overlooked.

Because active listening is one of the elements of the dialogue as a way of communicating, in which the process of understanding the other is essential (Milani, 2020), this guiding principle applies to any student, as it provides an opportunity to realize his or her strengths rather than focusing on his or her weaknesses. In agreement with the studies of Vygotsky (2021, p. 13), active listening may be helpful for interlocutors to understand their own development process as well as that of other students, since “De-pathologizing the education of children with disabilities helps us to de-pathologize the education of all children.” Having this quote in mind enables not only inclusion, but also a context that fosters learning based on respect and collaboration.

Alrø and Skovsmose (2006) also state that the dialogue is the means of communication that can be found in a learning environment based on investigative research scenarios. Such scenarios are set against the paradigm of the exercises, whose mathematical 'truth' is presented by the teacher or by the textbook, and the aim in math classes is to solve problems in order to train standard procedures and techniques that have a single answer. This paradigm is closely related to the banking education discussed by Freire. Moreover, in research settings, students are invited to develop hypotheses, make discoveries and interact with their peers and teacher in a dialogical way.

That encourages an environment of collaboration in which each student can develop his or her own strategies for achieving goals and making contributions, in his or her own way and pace. This learner will be able to appreciate his or her potential and respect the differences that are no longer a limiting factor, because this is not a mathematical innovation from a scientific point of view. In this instance, the subject in action is the main character. Actually, it is a matter of introducing something new to the student, the subject of the action, of the discoveries, because students and teachers learn according to their potential and at their own pace. In other words, teachers who are paying attention to their students' productions are learning about ways of thinking mathematics and how each student's learning can take place.

The scenarios for investigation can be related to the students' reality or to a similar context in which they live (Skovsmose, 2014). Inside this environment, critical learning may be developed, especially when the student engages in activities related to real issues. The learning process is tied to the notion of mathematics (Skovsmose, 2007a, 2009), which goes beyond the ability to calculate. In other words, it is the subject that makes it possible to reflect on situations in which mathematics is explicit or implicit, in this way questioning and transforming them. Mathematics is closely related to Paulo Freire's and D'Ambrosio's literacy[3] (1993). Literacy is more than just the skill of reading and writing, it also refers to "the ability to read and interpret social, cultural, political and economic situations and to understand them in order to carry out transformative actions" (Skovsmose, 2009, p.111).

From the perspective of Critical Mathematics Education, mathematics is perceived as a tool that allows the subject to see and act in their own reality. By understanding mathematical representations and concepts, individuals are empowered to read and interact with the information they receive through the media, enabling them to make decisions, act and transform the place in which they belong to. Therefore, using real situations in math classes that are part of different contexts contributes to building a non-static perception of mathematics s that enables everyone to fully participate. Skovsmose's mathematics and Freire's literacy are pivotal ideas when it comes to education that empowers learners.

4 Inclusion and the math teacher

Freire's perspective on education advocates a search for a new meaning in teaching practice, based on the understanding that the process of teaching and learning is unique and implies constant changes (Freire, 2005). Therefore, the lack of knowledge about practices that promote inclusion must be seen by the teacher as a "boundary situation", an obstacle that must be overcome and not something that can only be accepted and, consequently, this must drive them to seek to improve his or her lessons (Freire, 2005). The foundation for this continuous desire to overcome is the liberating nature of education, which goes further than the technical

[3] *Literacia* is the translation of literacy. This term can be found in Paulo Freire's literature in English. *Literacia* was the translation given to literacy in the context of Paulo Freire's liberating education. We have chosen to use the term *literacy* in this article because this is the term used by Ole Skovsmose in his texts.

idea of training for production. The author calls for the autonomy of the individuals based on their critical competence, so that they can not only read the world, but also rewrite it. In this way, the students become the protagonists of their own history (Freire, 1967).

The encouragement of people with disabilities to play a leading role in the construction of their own knowledge does not mean that society has no responsibility to take care of them, it does not free schools from their responsibility to break down the obstacles to children's learning, much less it does not excuse the teacher from being the point of convergence in the school environment when it comes to inclusion. In order to fulfill this task, the teacher will need the support of the school community as a whole, as well as being attentive to learning more about how to include students, taking into account their identities and also valuing their skills. Teachers should recognize the student's pursuit of autonomy as another motivating element, because becoming an autonomous individual requires a social and structural shift that stigmatizes learners as individuals who do not fit the pattern set by a society that sees them as unproductive and unable.

This behavior change has the school community as its productive place; however, in order to make this environment in a fruitful land, new paradigms must be cultivated to enhance school professionals to look at students as individuals and not as a homogenous group of people. There is perhaps no better opportunity to start a positive cycle of learning about differences in mathematics teaching than by promoting mathematics teacher training courses. In short, courses should be planned based on cross-curricular training, rather than condensing and splitting lessons into specific subjects (Borges, Cyrino & Nogueira, 2020). In this respect, given their mathematical, pedagogical and human knowledge, teachers are the best people to set the pace in the search for a balanced learning process.

Along with this reasoning, Manrique and Viana (2021, p.37) point out that "teachers need to become highly qualified in their field of knowledge" because there is nothing more human than being different and aware that there is always something to learn and/or improve. The same authors also state that teaching must be a commitment of all those who are engaged in it, and to this end, they must be based on study and research. Given this specific nature of the educational field, the math teacher, as well as everyone else, needs to break with excluding practices that contribute to stereotypes and highlight the weaknesses of the learners, instead of focusing on their potential.

As Freire (2005) argues, when drawing up their practice, it is essential that teachers take into account students' knowledge, their worldview, their ecological niche, and relate them to the content to be worked on in class. This is even more meaningful when it comes to students with disabilities, since neglecting the peculiarities of their access to learning may be a barrier that is impossible to overcome (Vygotsky, 2021). It is important to consider learners' context in mathematics classes and use situations from their daily lives as a pedagogical tool. Students' *backgrounds*[4] say a lot about how they can learn and how they handle math classes. This is associated with the idea of the *foreground* (Skovsmose, 2014), which refers to the way people conceive of their possibilities for the future. The way the teacher prepares the mathematics lessons, including the type of activity, its reference and the approach to mathematics, may influence the students' foreground much more than whether they have a disability.

Thus, as Skovsmose (2007b.p. 7) asserts, it is essential that the entire school body takes social responsibility for this individual as well, and that they should break away from the idea the children's "learning obstacles had nothing to do with the school's facilities". Blaming the

[4] The author employs this term to refer to the students' cultural background, history and traditions.

learner for their failure to learn is as outrageous and short-sighted as making the teacher the only person responsible for the process of school inclusion.

A banking education, aimed at memorizing techniques and algorithms and reproducing static and unquestionable truths, is in step with the exercising paradigm and it is mutually exclusive for many, especially for students with sensory and neurological disabilities. A liberating education that emancipates students to be able to act in their own realities, using mathematical knowledge as a tool, is in keeping with the research settings that can promote school inclusion in its fullest sense.

In the first context, the student just accepts the truths laid down by the teacher. In the second one, students produce knowledge and meanings, acting actively in a dialogue with their peers and teachers. Both speaking and listening are essential elements of a dialogic process, and everyone can practice them, as long as learners' particular characteristics are accepted and respected, just as a math class should be. Students explain their perceptions, try to understand other people's opinions, argue, change their minds and propose ways of approaching the pedagogical activity. These efforts make the student a producer of knowledge and an actor in the construction of the mathematics lesson, despite using alternative methods to communicate and socialize ideas.

Bringing the students' reality into education spaces legitimizes the students' culture and knowledge and makes them understand and act in their contexts. That means designing a lesson that takes into consideration the differences present in the class, regardless of whether they are cultural, social, physical, mental or sensory, as they contribute to the subject's own transformations through the knowledge produced and by their reality.

5 Closing remarks

The consistent increase in the number of students supported by special education in regular classrooms is a significant step forward from an educational perspective, insofar as their entry into schools requires a continuous redesign of teaching praxis. These changes are driving significant shifts in education by exposing students and teachers to situations that require them to overcome. The transformations are more significant in the context of math teaching, due to all the stigma surrounding the teaching and learning of this subject. The transformations are more significant in the context of math teaching, due to all the stigma surrounding the teaching and learning of this area of knowledge. It is generally associated with inflexibility and a profile of privileged intelligence, far from the majority, which highlights the need to break with old paradigms.

In addition, the intersection of differences definitively overturns the practice of banking education due to its proven inefficiency in the face of the new educational scenario. The replacement of processes helps to empower students with disabilities to become an active individual who is aware of their potential, as well as a constant re-examination of the teachers' role and performance as mediators of knowledge and the focal point of inclusion. It also emphasizes the need for greater attention to be paid to teachers' initial and on-going professional qualifications, to promote closer contact with contexts of inclusion. This approach should be a reality for future teachers and a continuous experience for in-service teachers, especially since this is set out in Brazilian educational laws.

It is recognized that the dissemination of truly inclusive mathematics education requires breaking away from the idea that people with disabilities accept the stigma of being unable to learn due to their condition. This must be replaced by the awareness that it is necessary to foster school reorganization based on awareness of the social responsibility of the school body and

each person who makes it up (Skovsmose, 2007b). The initial and on-going professional development environment is the ideal context both for discussing a change in attitude towards teaching mathematics to students and for encouraging new research findings on Inclusive Mathematics Education.

As such, changes in favor of mathematical inclusion for all require closer ties between academia and schools. However, this relationship should not be limited to the hours of compulsory internships for undergraduates and the visits researchers make to schools in order to collect information for their studies. There is an urgency to develop university-school integration practices that also give school workers the opportunity to learn and teach from their experience at school. One possibility for this exchange would be ongoing training, based on the practices of the participating teachers, who bring together newly acquired academic knowledge and their desire to learn about practice and the wide-ranging background of everyday professional life.

Yet another successful way of promoting new information and tackling the challenges that arise from inclusive practices is to hold discussions at academic events aimed at elementary school teachers. This would not only refresh the perspective of academics, which is often at odds with the reality faced by these teachers but would also allow them to be in touch with academic discussions and studies on teaching possibilities. Furthermore, by taking part in these debates, teachers will be able to bring theory and practice together in favor of Inclusive Mathematics Education. This relates more broadly both to the perspective of inclusion being the meeting of differences, as discussed by Skovsmose, and advocated by Freire.

As a result, the theory of Freire and Skovsmose can provide the basis for actions, proposals and/or reflections that underpin the tenets of Inclusive Mathematics Education, which are: respect for differences, a spotlight on each person's abilities, the use of methodologies and resources that promote everyone's participation and the knowledge that inclusion is only possible with the full engagement of all subjects, because we are all different.

References

Alrø, H. & Skovsmose, A. (2006). *Diálogo e aprendizagem em educação matemática*. Belo Horizonte, MG: Autêntica.

Borges, F. A.; Cyrino, M. C. de C. T.; & Nogueira, C. M. I. (2020). A formação do futuro professor de Matemática para a atuação com estudantes com deficiência: uma análise a partir de projetos pedagógicos de cursos. *Boletim GEPEM*, (36), 134–155.

Brasil. (2015). *Lei n.º 13.146, de 6 de julho de 2015*. Institui a Lei Brasileira de Inclusão da Pessoa com Deficiência (Estatuto da Pessoa com Deficiência). Brasília, DF.

Brasil. (2019). Instituto Nacional de Estudos e Pesquisas Educacionais. *Sinopse Estatística da Educação Básica 2016*. Brasília, DF.

Brasil. (2024). Instituto Nacional de Estudos e Pesquisas Educacionais. *Sinopse Estatística da Educação Básica 2023*. Brasília, DF.

Brigo, J.; Flores, C. R. & Wagner, D. R. (2020). Uma Pesquisa com um Grupo de Professoras que Ensinam Matemática nos Anos Iniciais: atravessamentos com a insubordinação Criativa. *Revista Internacional de Pesquisa em Educação Matemática*, *10*(1), 60-75.

Conceição, S. C. da. (2019). *Conhecimento especializado de futuros professores da Educação Infantil e Anos Iniciais sobre paralelismo quando a base é a visualização*. 2019. 141f. Dissertação (Mestrado em Educação). Universidade Estadual de Campinas. Campinas,

SP.

Couto, S. & Ribeiro, M. (2019). Conhecimento especializado de futuros professores da educação infantil e dos anos iniciais quanto às dificuldades de aprendizagem de alunos cegos e videntes sobre paralelismo. *ACTIO: Docência em Ciências, 4*(3), 701–721.

D'Ambrosio, U. (1993). *Etnomatemática. Arte ou técnica de explicar e conhecer* (2. ed). São Paulo, SP: Atual.

Fernandes, S. H. A. A. & Healy, L. (2007). Ensaio sobre a inclusão na Educação Matemática. *Revista Iberoamericana de Educación* (10), 59–76.

Freire, P. (1967). *Educação como prática da liberdade*. Rio de Janeiro, RJ: Paz e Terra.

Freire, P. (1996). *Pedagogia da autonomia*: saberes necessários à prática educativa. São Paulo, SP: Paz e Terra.

Freire, P. (2005). *Pedagogia do oprimido*. Rio de Janeiro, RJ: Paz e Terra.

Freire, P. (2014). *Pedagogia da tolerância*. (2. ed.). Rio de Janeiro, RJ: Paz e Terra.

Giroldo, V. (2018). Formação de professores de matemática: para uma abordagem problematizada. *Ciência e Cultura*, *10*(1), 37-42.

Lima, R. F. de & Ripardo, R. B. (2023). Entrelaces entre discurso matemático e Educação Matemática Crítica: desvendando relações entre o uso de palavras e *backgrounds* sociais na resolução de problemas. *Revista Internacional de Pesquisa em Educação Matemática, 13*(4), 1-18.

Lirio, S. B. (2006). *A tecnologia informática como auxílio no ensino de Geometria para Deficientes Visuais*. 2006. 115f. Dissertação (Mestrado em Educação Matemática). Universidade Estadual Paulista. Rio Claro, SP.

Manrique, A. L.; Moreira, G. E. & Maranhão, M. C. S. M. (2016). (Orgs.). *Desafios da Educação Matemática Inclusiva: Formação de Professores* (V.1). São Paulo, SP: Livraria da Física.

Manrique, A. L. & Viana, E. A. (2021). *Educação Matemática e Educação Especial: Diálogos e contribuições* (1. ed.). Belo Horizonte, MG: Autêntica.

Mantoan, M. T. A. (2003). *Inclusão Escolar: O que é? Por quê? Como fazer?* (1. ed.). São Paulo, SP: Moderna.

Mantoan, M. T. A. (2014). *A escola e suas transformações, a partir da educação especial, na perspectiva inclusiva*. Campinas, SP: Librum.

Marcone, R. & Milani, R. (2020). Educação matemática crítica: um diálogo entre sua gênese nos anos 1970 e suas discussões em 2017 no Brasil. *Revista Paranaense de Educação Matemática*, *9*, 1-20.

Martini, L. & Godoy, E. V. (2022). Incidências e influências de Paulo Freire nas pesquisas em Educação Matemática. *Revista Internacional de Pesquisa em Educação Matemática, 12*(1), 29-48.

Milani, R. (2020). Diálogo em educação matemática e suas múltiplas interpretações. *Bolema*, *34*(68), 1036-1055.

Moura, A, Q. & Penteado, M. G. (2023). Cenários para investigação, diálogo e inclusão sobre o encontro de surdos e ouvintes em aulas de matemática. *Revista Colombiana de*

Educación, 87, 31-46.

Skovsmose, O. (2007a). Mathematical literacy and globalisation. In B. Atweh et al. (Org.), *Internalisation and globalisation in mathematics and science education* (pp. 3-18). New York: Springer.

Skovsmose, O. (2007b). *Educação Crítica: incerteza, matemática, responsabilidade*. Campinas, SP: Cortez.

Skovsmose, O. (2009). Preocupações de uma educação matemática crítica. In M. H. Fávero & C. Cunha (Orgs.), *Psicologia do Conhecimento: o diálogo entre as ciências e a cidadania*. (pp. 101-114). Campinas, SP: Liber Livros.

Skovsmose, O. (2014). *Um convite a Educação Matemática Crítica*. Campinas, SP: Papirus.

Skovsmose, O. (2019). Inclusões, Encontros e Cenários. *Educação Matemática em Revista*, *24*(64), 16–32.

Vigotski, L. (2021). *Problemas de defectologia* (Trad. Z. Prestes & E. Tunes, 1. ed.). São Paulo, SP: Expressão Popular.