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Critical Mathematics Education and its contribution to the formation of the historical subject and its emancipation

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ABSTRACT
This article is the result of bibliographical research and literature review directed to Mathematics Education and Citizenship, from critical theory, but without losing the influences of analysis of other currents of thoughts that give possibilities for a dialogue between epistemologos. Thus, it is a brief theoretical reflection, from the thought of Theodor W. Adorno and together with other theoretical references such as: Paulo Freire, Bauman, Morin, and the Danish professor Ole Skovsmose. It is also noteworthy that these authors consider that, from pedagogical practices that stimulate criticality and dialogue, the subject's education will be active, reflective, critical, favoring the strengthening of citizenship. It is in this context that the present work aims to focus and bring the theoretical foundation to the debate of education that aims to provide the creation of a critical and democratic environment inside and outside the classroom. Finally, it is concluded that it is of paramount importance to look at mathematics, which should highlight and add practices of reflection and dialogue, in order to provide the creation of a critical and liberating environment.

Keywords: Education, Critical Mathematics Education, Subject, Citizenship.

1 INTRODUCTION

Starting from this assumption of evolution in the educational sphere, we can turn to some theorists of education to understand the object of study in relation to Mathematics Education and citizenship, from the perspective of an education that seeks and promotes liberation from society, through the bias of critical mathematics.

After studies, readings and research in the disciplines of the Master's Degree in Education, by the Federal University of Mato Grosso, in the Research Line: Education in Sciences and Mathematics Education and in the search to understand the line of thought that underlies critical theory, before the construction of an education that leads us to the formation of the historical subject within his community, we find several motivating theorists: in the Critical Theory of the Frankfurt School, Theodor W. Adorno, who read and reviewed the book Education and Emancipation published by the publisher Paz e Terra, for the first time in 1995, which has a preface by the translator of the work Wolfgang Leo Maar and offers an overview of the relationship between Adorno's thought and his vision of education.

These possibilities, according to the translator of the same work, are only possible through an awareness of the subjects reflected in history. The object of the debate between Adorno and the German jurist Hellmut Becker is education about the sphere of constant concern about the non-repetition of the atrocities committed in the Auschwitz concentration camp[1]. Therefore, in this article we will focus on the relevance with regard to education, from the Critical Theory focused by Adorno and other theorists who walk the path of emancipation, which is listed by Paulo Freire and other theorists, with regard to the relationship with Mathematics Education in the critical approach between education, the object of research, the Quality of Mathematics Education and Citizenship.

Moreover, the basis of the theory developed by Ole Skovsmose, Critical Mathematical Education, allows a certain interaction with Critical Education, based on the Critical Theory of the Frankfurt School, created by the Frankfurt philosophers, Theodor W. Adorno Max Horkheimer and Jürgen Habermas. This school was founded on June 22, 1924 in the auditorium of the University of Frankfurt at a time of great social and political conflicts spread throughout Germany, was a research institute and organ of dissemination of the productions of its associates. In this way, they are known as Critical Theory, which is opposed to Traditional Theory. The difference is that, while the traditional one is "neutral" in its use, the critique seeks to analyze the socio-political and economic conditions of its application, aiming at the transformation of reality.

Finally, Paulo Freire focuses precisely on his thinking for an awareness education that, in addition to knowing reality, seeks to transform it, that is, both the educator and the learner deepen their knowledge around the object to be able to intervene on it.

2 MATHEMATICS EDUCATION AND CITIZENSHIP

Mathematics Education and Citizenship have in their lines of approach that mathematics cannot be considered as an accumulation of information without objectives pertinent to daily life and detached from other areas of knowledge, but rather as a factor that integrates knowledge and according to the thought of Morin (2000, p. 93), "Educating to understand mathematics or a particular discipline is one thing; Educating for human understanding is another." Therefore, it is necessary, for contemporaneity, that education goes beyond the formation of contents, goes beyond simplicity, reaches the field of complexity, breaks down barriers and makes it capable of being worthy and important in the construction of union and social well-being, as well as sustaining structures that aim at the maintenance of culture and society.

In addition, Skovsmose (2008) raises the mathematical literacy called by him materacia[2], referring to the literacy of Paulo Freire, who considered literacy not only as an ability to read and write,

[1] A network of concentration camps, used by Nazi Germany for the extermination of countless Jews during World War II.

but also as a competence to read and interpret a social situation, subject to change. In fact, mathematics "does not refer only to mathematical skills, but also to the competence to interpret and act in a social and political situation structured by mathematics" (SKOVSMOSE, 2008, p.16). This thinking supports critical citizenship.

It is worth mentioning that the Brazilian educational society has experienced tense moments in recent years. In this bias, there is a distance between the logic that the actors of the school context defend for the objectives and purpose of school education and the logic of neoliberal models of public policies aimed at education, especially that aimed at the management of results and curricular standardization. Therefore, it is essential to break the barriers of the traditional teaching of mathematics education and go beyond the contents.

Although the proposals of these public policies are explicit and intentional, on the part of the developers, the way the decisions and documents reach the school leaves managers, teachers and students in despair, without understanding why so many changes and discontinuity of actions and programs that are interrupted without there being debates and reflections in the school space.

Moreover, access to social rights, such as education, has occurred in the context of "profound" changes in the social structure and in sociability itself. Critical theoretical perspectives have highlighted the profoundly contradictory role of rights arising from the relationship of individuals with consumer markets. In this sense, the notion of citizenship would be intrinsically related to the condition of consumer of products and services, finding support, including, in specific laws that regulate the relations between market and civil society. According to Bauman:

> Today, for many people, the actions of citizenship are limited to the acquisition and sale of goods (including for candidates for public life itself), rather than increasing the scope of their freedom and rights in order to amplify the acts of a true democracy. The consumer is an enemy of the citizen... In every 'developed' and rich region of the planet there are numerous examples of people turning their backs on politics, in political apathy and in a loss of interest in the ever-increasing political processes. (BAUMAN apud PORCHEDDU, 2009, p. 681).

From Bauman, we note that these changes are ways of reframing the space of struggles for citizenship rights that, in times past, was supported by politics, within the framework of a broader social participation. However, the devaluation of participation in the public sphere, as a support for the construction of collective identities, weakens social bonds and individualizes demands for rights. Thus, the construction of citizenship in the school environment goes through the search for a critical

[2]SKOVSMOSE, 2008 - "materacia does not refer only to mathematical skills, but also to the competence to interpret and act in a social and political situation structured by mathematics", that is, mathematics goes beyond the application of mathematical formulas; it encompasses a reflection on this application. It is not only concerned with operations and numbers, but also with how we can use and understand these numbers in the face of an economic, political or social situation.

formation in which the contents coming from the scientific, philosophical and artistic fields do not overlap, in an artificial way, in relation to the challenging daily life of people.

For Machado (2000, p. 40) "[...] in current times, no characterization of the functions of Education seems more adequate than the association of it with the formation of the citizen, with the construction of citizenship". Therefore, the education-citizenship relationship is also a theme intrinsically linked to critical education. In this perspective, citizenship is characterized by the construction of legitimate instruments of articulation between individual projects and collective projects, which stimulate individual actions, articulating them with greater intensity in society.

This articulation presupposes ordinary actions and an active participation in the community or society, assuming responsibilities in tune with the interests and destiny of the whole collectivity. According to Machado (1997, p. 47), educating for citizenship means "[...] to provide individuals with instruments for the full realization of this motivated and competent participation, of this symbiosis between personal and social interests", that is, an integration in an active way and with a mutual goal.

From this assumption, it is essential a reflection and the resumption of Mathematics Education in the approach of critical mathematics as a channel to understand and propose suggestions for the guidelines, which help in the pedagogical proposal for the formation of the historical subject, who interacts in his own environment, from the mathematical concepts and the dialogue with the world of uncertainties, of the contradictions and disorders of the system itself. For Morin (2011), "[...] to expect the unexpected and to work for the improbable", it is necessary, then, to work with significant themes that stimulate the subject to understand his planetarium and, at the same time, interfere in the actions that will produce a human conduct in the very space and time of the community.

In addition, Adorno (2020 p. 185), warns of the difficulties to be faced by those who intend to act in the transformation, through education. Thus, becoming aware of one's own impotence or of one's impotence is an aspect of the practice of critical self-reflection emphasized by Adorno and with a primary relevance in the process of teacher education.

Finally, it is inferred that education for emancipation provides a broad concept of formal and scientific knowledge, which understands thinking about reality in a dialectical process. Therefore, education must prepare the human being for the confrontation with real experience and not for experience alienated from the world.

3 THE THEORETICAL PATH AND MATHEMATICS EDUCATION FROM A CRITICAL APPROACH

For the foundation of this article and the walk in an epistemological perspective, we seek an approach that is closer to the demands of contemporary society, indicated for those who desire a more humanized world. From the theoretical references that point to Education in the context of liberating

practice, we will have as a basis for Critical Mathematics Education the theory developed by the Danish professor Ole Skovsmose, which is based on the Critical Theory of the Frankfurt School that, despite some contrary notes in relation to Critical Theory does not point out assumptions for the Education of Critical Mathematics, Skovmose defends the relevance of the theory to his thinking. Therefore, they are: Theodor W. Adorno, Max Horkheimer and Herbert Marcuse, Walter Benjamin and Jürgen Habermas, both from the Frankfurt School and who propose to form critical and reflective citizens in the face of society and its technologies.

It is essential to highlight that, for a democratic space within the school that defines in its projects the liberating practice, Skovsmose (2008) brings to the debate the term democracy, because for a critical education is of paramount importance a democratic space. In his theories, the author brings as main focus the issue of democracy and states that "democracy does not characterize only institutional structures of society with respect to the distributions of rights and duties. It also has to do with the existence of a competence in society." Therefore, if mathematics continues to be taught without the democratic aspect, it will be just another domesticating instrument in a society dominated by technology.

In his work "Critical Mathematics Education: the question of democracy", the author makes clear statements about the sources of inspiration in critical education and reports that:

> The basic axiom of Critical Education is that education should not serve as a passive reproduction of existing social relations and power relations [...]. Education must play an active role in identifying and combating social disparities. Of course, education does not have an important role in social and technological changes – such changes are not consequences of educational endeavors, but education must struggle to have an active role parallel to that of other critical social forces (SKOVSMOSE, 2013, p. 32).

Based on this thought, the author states that mathematics education, allied to critical education, can provide questions and possible foundations for the subsequent participation of children, young people and adults in a democratic life, as critical citizens.

In addition, we emphasize the emphasis on the thought of Paulo Freire, in relation to education with the focus on the emancipation of the subject through education that liberates, that questions, criticizes and that fights for the non-domination of being.

> [...] Critical education considers men as beings in transformation, as unfinished, incomplete beings, in a reality, and with an equally unfinished reality. Unlike other animals, which are also unfinished but not historical, men know that they are unfinished. They are aware of their incompleteness, and in this incompleteness, as well as in the consciousness they have of it, lie the very roots of education as a purely human phenomenon. [...]" (Freire, 2016, p. 133-134).

Therefore, before the author's gaze, we must direct the practices of education to an action that leads the subject to awareness education and should be understood as a process of dialogue. In this

perspective, Critical Mathematics Education must go through the thought of change and liberation and point out ways for a critical education, from mathematical knowledge.

Based on the analysis of the Critical Theory of the Frankfurt School, the German Habermas points out that the theory does not give an answer to the critical education of mathematics. However, from the approach that underlies Critical Theory itself, which emphasizes that the Education of post-war Germany should be guided by practices of emancipation, Skovsmose (2013) reports:

> In the philosophy of Jürgen Habermas, his interest in knowledge in the natural sciences is technical, and quite different from the emancipatory interest of the natural sciences. Obviously, an emancipatory enterprise such as the one worked in Critical Education, can ignore technology, even Mathematics. [...] in this way, one of the main challenges for Critical Education is to develop a more appropriate philosophy of technology, so that it can manage and interpret technical education, and so that Critical Education and Mathematics Education can be integrated, making mathematics education a Critical Education (SKOVSMOSE, 2013, p. 35-36)

Faced with the influences of Habermas in relation to the approach and the idea that the critical theory seen by him was Technique and not mathematics, Skovsmose begins to indicate structures by a broad dialogue, an important fact so that there is no exclusion of the student's opinion. Thus, he will not only be the receiver of the educational process and the teacher ceases to be a simple relay of contents and starts to mediate learning. In this perspective, Freire (2011) criticizes the relationship between teacher and student when they behave only as an announcer and listener and comments that:

> The more we analyze the educator-educating relations, in school, at any of its levels, it seems that the more we can convince ourselves that these relations present a special and striking character – that of being fundamentally narrating, dissertation relations. Narration of contents that, for this very reason, tend to petrify themselves or to do something almost dead [...] to speak of reality as something still, static, compartmentalized and well-behaved, when not to speak or lecture about something completely alien to the existential experience of the students, has been, really, the supreme inquisition of this education [...] in it, the educator "fills" the students with the contents of his narration (FREIRE, 2011, p. 79).

Therefore, for Critical Mathematics Education, education cannot only represent an adaptation to political and economic priorities, that is, educational practice presupposes engagement in the political process, including a concern for democracy.

It is relevant that Critical Mathematics Education has a critical and reflective position about the curriculum, taking into account issues such as the applicability, interests and limitations of the subject. For Skovsmose (2013),

> [...] it is important for Critical Education to interact with subjects of the technological sciences and, among them, Mathematics Education, so that critical education is not dominated by technological development and becomes an unimportant and uncritical educational theory. (SKOVSMOSE, 2013, p. 18).

In this thinking, mathematics observes the technological issue so that it is not only the instrument to leverage technology, but also a reflective discussion about its technological risks and benefits.

Moreover, for Adorno, in one of his radio interviews, we must think of a cultural formation that leads the subject to a level where he can deliberate and organize his thoughts, according to his own conscience and know himself to defend himself against the orders of the current situation of his country. Moreover, for the author "[...], the lack of decision and courage to use the understanding without guidance of others, so it is necessary a historical subject. (ADORNO, 2020, p. 185).

The idea of Critical Education spread to all levels of the educational system and also influenced Mathematics Education, giving rise to critical mathematics and the strengthening of the emancipated subject, who can dialogue and expose his ideas with critical positioning of the reality in which he is inserted.

Mathematics must be, therefore, thought in its philosophical and sociological aspects, in addition to being understood in its social responsibility to "lead the student from a state of mathematical ignorance to an appropriate state of knowledge that are useful to him to better intervene in the society in which he lives" (SILVA, 2002, p.65).

Given the above, it is essential to think about Mathematics Education, from the approach of Critical Mathematics, considering not only the critical basis, which it presents to the educational system and pedagogical practices, which reproduce the system of capitalist domination, but also in the property with which it reinforces the importance of the role and strength of education, beyond the reproduction of the historical forms of domination and alienation of individuals. For the theorists cited in this article, education alone cannot change society, but education must change society. Therefore, society will not change without education.

4 FINAL CONSIDERATIONS

The development of this article allowed us to study some of the characteristics of Critical Mathematics Education, which lead to a trend of research in mathematics education. Moreover, this study made it possible to list some points so that we could direct a different look at the teaching of mathematics, evidencing the importance of adding practices of reflection and dialogue in an education that aims to enable the creation of a critical and liberating environment.

Thus, it is up to the teaching of mathematics to provide an environment that provides opportunities for reflections and self-reflections through its contents, so that there is an awareness of our social commitments as human beings.

Thus, when we add responsibility to our teaching and learning, we contribute so that mathematics does not work exclusively with a single look in favor of current structures, which do not

always aim at the social and intellectual formation of the student. In addition, we enable the student to be a human being endowed with knowledge, possessing the ability to evolve culturally, becoming a citizen able and prepared to deal with the changes of society.

Finally, we believe that, based on the assumptions of the referenced theorists, dialogicity, problematization, criticality and reflection on practice are essential, articulated to the concepts of Critical Mathematics Education, which can offer a theoretical-methodological orientation to the Mathematics teacher, in a political-pedagogical perspective, in order to consider the specificities of each locality and enable critical learning situations.

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