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Critical Financial Education in the interdisciplinary context in Science and Mathematics studies

Abstract: The aim of this study is to present a theoretical essay that integrates Mathematics Education, Financial Education and Critical Environmental Education to weave together, in an interdisciplinary way, strategies that give students access to fundamental skills, with a view to a healthy relationship between consumption, dealing with finances, decision-making and socio-environmental and socio-economic issues. From the studies presented, it was possible to highlight the relationship between environmental impacts, the lifestyle of the citizen-consumer and Critical Education, signaling healthy options for learning to take place more effectively, with possibilities for better harmony between individuals and the environment, through practical actions to build a more balanced society.

Keywords: Critical Education. Critical Financial Education. Critical Mathematics Education. Critical Environmental Education. Interdisciplinarity.

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Article

Educación Financiera Crítica en el contexto interdisciplinario de los estudios de Ciencias y Matemáticas

***Resumen*:** Este estudio tiene como objetivo presentar un ensayo teórico que integre la Educación Matemática, la Educación Financiera y la Educación Ambiental fundamentales para tejer de manera interdisciplinaria estrategias que permitan a los estudiantes acceder a habilidades fundamentales, con miras a una relación sana entre el consumo, el manejo de las finanzas, la toma de decisiones y los problemas socioambientales y socioeconómicos de la sociedad actual. A partir de los estudios presentados, se pudo evidenciar que la relación entre los impactos ambientales, el estilo de vida del ciudadano-consumidor y la educación crítica puede ofrecer opciones saludables para que el proceso de enseñanza y aprendizaje suceda de manera más efectiva, posibilitando una mejor armonía entre el individuo y el medio ambiente, generando acciones prácticas para la construcción de una sociedad más equilibrada.

Palabras clave: Educación Crítica. Educación Financiera Crítica. Educación Matemática Crítica. Educación Ambiental Crítica. Interdisciplinariedad.

A Educação Financeira Crítica no contexto interdisciplinar nos estudos de Ciências e Matemática

***Resumo*:** Este estudo tem por objetivo apresentar um ensaio teórico que integre a Educação Matemática, a Educação Financeira e a Educação Ambiental Críticas para tecer, de forma interdisciplinar, estratégias que possibilitem aos alunos acesso às habilidades fundamentais, com vistas a um relacionamento saudável entre o consumo, o lidar com as finanças, as tomadas de decisão e as questões socioambientais e socioeconômicas. A partir dos estudos apresentados, foi possível evidenciar a relação entre os impactos ambientais, o estilo de vida do cidadão-consumidor e a Educação Crítica, sinalizando opções salutares para que a aprendizagem aconteça com mais eficácia, com possibilidades de uma melhor harmonia entre indivíduos e meio ambiente, por meio de ações práticas para a construção de uma sociedade mais equilibrada.

Palavras-chave: Educação Crítica. Educação Financeira Crítica. Educação Matemática Crítica. Educação Ambiental Crítica. Interdisciplinaridade.

1 Introduction

Criticality is a fundamental part of the learning process in which the student plays a leading role by questioning and intervening in the subjects covered in the classroom. Furthermore, developing criticality encourages students to become researchers, with the ability to reflect, analyze situations in which they can make decisions, solve problems more effectively and better understand the society around them, identifying challenges and generating assertive solutions.

Through Critical Education (EC), this paper will follow the path of Mathematics Education and Environmental Education, with the aim of finding a link between them, in order to verify the points of intersection with Critical Financial Education (EFC) and look for options to direct the teaching of Science and Mathematics.

Interdisciplinarity promotes very pertinent possibilities in the construction of student knowledge, in order to enhance knowledge and allow new comprehensions in the practical applications of the objects of study. According to Japiassu (1994, p. 5), "interdisciplinarity allows us to open up a new level of communication and abandon the old paths of traditional rationality".

From this perspective, the construction of an interdisciplinary pedagogical practice creates options for strategies to provoke student interest, corroborating an increase in the quality of the teaching and learning process. It will also be possible to see records of some educational practices produced by researchers and applied in their classrooms, confirming the possibility of using EFC as an interdisciplinary tool in science and mathematics[1] studies.

2 The Critical Education

In reviewing the main milestones of Brazilian pedagogical trends, Saviani (1986) establishes some of the main educational currents in Brazil, such as Traditional Catholic Pedagogy, developed by the Jesuits until around 1759. After this period, Lay Pedagogy gained a foothold in the country's educational scene until 1932. New Pedagogy, for its part, was born in the 1930s as an attempt to overcome the limits of Traditional Pedagogy.

In 1969 (to the present day), there was the development of the Productivist Pedagogical Conception, which tends to link education more strongly to the demands of the market, a characteristic of capitalist societies. In contrast, the Critical Education approach establishes a new paradigm in the face of bourgeois educational practices.

EC evokes a transformative perspective on the formation of subjects. In addition to reproducing the *status quo*, this approach highlights the opposition to maintaining social relations, leaving education with the role of denaturalizing the social relations of capitalist society, in order to train people for a new world paradigm.

The critical educator doesn't tell students that the current capitalist model is the only possibility for social organization. On the contrary, the aim of the training is to qualify the subjects so that, even if they are adaptable to the current system, they are able to act for social

[1] This paper is part of a master's thesis defended in the Programa de Pós-Graduação em Educação em Ciências e Matemática (Postgraduate Program in Science and Mathematics Education) at the Universidade Federal Rural do Rio de Janeiro (Marinho, 2023), written by the first author and supervised by the second author.

transformation.

In the history of pedagogical thought, sociologist Émile Durkheim analyzes social relations as they are, without considering the prospect of change, which is seen as a dysfunction in his way of thinking. Dewey, a great philosopher and pedagogue, despite discussing the formation of citizens, emphasizes that the proposed approach has always been to adapt to the intricacies of the prevailing society.

Unlike bourgeois perspectives on education, which focus on the development of the individual, so that each individual can find their own alternatives, the critical perspective emphasizes collective progress and critical education. The main challenges are: how can we commit the new generations to a collective project for society? What is the possibility of such a project actually happening in an extremely stratified and capitalist society?

In this sense, Saviani (1986) discusses the formulation of concrete and objective bases and assumptions for an effective critical education, as a critique of dominant education, which would link education to social transformations, since the New School, despite its desire for transformation, reproduced the conditions of society. In the spectrum of non-reproductive critical theories, the author advocates the need for a differentiated educational approach that goes beyond the contradictions of capitalist and traditional theories. He then drew up the principles of Historical-Critical Pedagogy, which will form the basis of studies and training on Critical Education.

Table 1 compares the concept of *criticism* and the approach to school content in each conception.

Table 1: Conception and approach to school content

Traditional Pedagogy	Historical-critical pedagogy
They are uncritical	They are critical
Detached from the context in which the educational process takes place	They emerge from the social practice lived in the educational context, from social contradictions
They disregard “common sense” and “popular knowledge”	They take “common sense” and “popular knowledge” as the starting point for the educational process
They affirm “social harmony” and seek to reproduce it	They question the supposed “social harmony”
They refer to the “classics” in order to maintain tradition	They refer to the “classics” as: − Historically produced and systematized knowledge in the form of science, philosophy, art, etc; − Necessary for understanding oneself and the world; − A form of appropriation by the subaltern classes so that they know what the dominant class knows.

Source: Adapted from Saviani (1986)

This pedagogical theory, according to the author, starts from the empirical to the concrete through the mediation of the abstract and conceives subjects as historical beings. As a result, in the educational process, the individuals of each generation incorporate human historical production developed over time. As it is basically a historicist conception, in addition to understanding man as a historical being, it also allows reflection on the contradiction between the dominance of capital and labor.

This conception is constructed as an instrument for the struggle against the domination of capital. In this way, the aim is to equip subjects, based on their training, to be active in the process of changing the current social structure for their own benefit and not that of a dominant class that exploits them.

On the other hand, especially in Brazil, Paulo Freire is considered one of the main representatives of a transformative pedagogy. This perspective envisages a different kind of society, based on the assumption that capitalist society creates and reproduces inequalities. Freire's postulates are based on the premise that education should prepare new generations for social participation, seeking the mutual development of the community.

Banking education, which Freire fought so hard against, is one of the many challenges of a didactic-pedagogical nature: the passive, horizontalized relationship between the student, the teacher and their relationship with knowledge. In contrast, Freire (1996) advocates a teaching and learning process that is permeated by dialog, interaction, criticality and meaning.

Freire (1996) then proposes a dialogical relationship, in which both participants in the process teach and also learn, thus putting the role of teacher and student under discussion: dialogue presupposes recognizing the other, in communion, for mutual formation, this *other* being someone with whom we share, exchange, interact for the sake of collective development.

Problematization, reflection-action-reflection, reading the world and education as a practice of freedom are other key concepts in Freire's postulations. In relation to reading, the Brazilian philosopher opposed the mechanistic and castrating practices of the literacy process by questioning the way students were literate: through repetition, contrived contexts and minimal possibility of critical expression.

Learning to read, for Freire (1989), is not decoding. It is reading the world in which one lives, in a problematizing way. In addition to this premise, what set Freire apart on the national and world educational scene was his political struggle for adult literacy, in the context of the 1960s, based on the voice of the people.

In Freire's view, education is now demanded as a right and seen as a process, both political and pedagogical, of forming awareness of reality. This education should enable people to understand the historical context of the dilemmas that directly affect them and, equipped with a conceptual repertoire, to formulate political responses based on their own questions.

Freire therefore advocates the politicization of the people, in the sense of their awareness of being a socio-historically constituted subject, so that their actions or omissions have repercussions on current and future social life. As such, there is no neutral education or citizen training that is dissociated from positions or options. By asking *Which student do we want to educate?; Which school do we want to build?; Why this content and not that?; Why this task and not that one?*, the multiple biases indicated by the answers to these questions highlight the problematizing power in which teachers, students and schools should continually be inserted.

Paulo Freire documented his revolutionary ideas in favor of Critical Education in several books that have become known and read worldwide, one of the main ones being *Pedagogy of Autonomy* (Freire, 1996). Divided into three chapters which, already in their titles, sharpen the readers' reflection: *There is no teaching without discourse; Teaching is not transmitting knowledge and Teaching is a human specificity*, they point out, in a clear and practical way, the author's opposition to school practices, traditional and without a reflexive link in the relationships within the school.

Based on Freire's (1996) studies, central questions of pedagogical practice, such as *What*

to teach?, How to teach? and *What to teach for?*, began to form part of initial and continuing teacher training programs, as well as the pedagogical proposals of education departments across the country. This led to a major change in the way teaching content was conceived, in the relationship between this content and practical and social life, in the implications of this content for possible social change and in the dynamism of the exchange of experiences within the school structure.

Both Saviani (1986) and Freire (1996), in relation to Critical Education, despite their epistemological differences from a theoretical point of view, agree in conceiving man as a being of *praxis* and reality as human historical production, which develops through overcoming contradictions, and face education as non-neutral, highlighting the immanent relationship between education and politics.

For the authors, the elementary educational object is something *concrete* (objective and subjective): the liberation of the subaltern classes from the conditions of economic exploitation and social alienation to which they are subjected. The method of both presupposes social practice, particularly of the subaltern classes, as the starting and finishing point of the educational process.

3 Critical Mathematics Education

Critical Mathematics Education (EMC) emerged in a European context, conceived by Ole Skovsmose in the 1970s, through student movements that pointed to a more meaningful university education to the detriment of scientific knowledge dislocated from pragmatism. In other words, there was a movement for changes within institutions, to enable students to play a more active role in the teaching and learning process, by encouraging critical thinking about social issues.

Under this umbrella, Skovsmose coined the term *Critical Mathematics Education*, looking at mathematics education practices from a biopsychosocial perspective. Subsequently, CME was re-signified based on Skovsmose's experiences in Brazil and South Africa, in order to question possible ways to achieve an education aimed at social justice in a globalized, diverse and complex world, questioning what the social role of mathematics would be in this context.

By considering mathematics as a field of teaching, research and extension practices, it becomes essential to think about the tensions that emerge from society. In these terms, EMC looks at the conflicts that exist in contemporary times, such as exclusions, globalization, chauvinism, xenophobia, racism, exploitation, etc.

Another focus of EMC is the students, their differences, the unique possibilities of access and conditions of permanence in school and other social spaces, their economic realities, previous and lived experiences during the study period, their interests and opportunities: the multiplicity of contexts and experiences of students.

Mathematics itself, as a curricular component, is one of the main focuses of CME: mathematics that is put into action. When faced with social reality and different contexts, one can question the possibilities of this mathematics' action in the world, where it is found, why it is present in certain spaces, control, automation, barriers and progress. Skovsmose (2001, p. 101) argues that,

> for education, both as practice and as research, to be critical, it must discuss the basic conditions for obtaining knowledge, it must be aware of social problems, inequalities, suppression, etc., and it must try to make education a progressively active social force.

> A critical education cannot be a simple extension of the existing social relationship. It cannot be an accessory to the inequalities that prevail in society. To be critical, education must react to social contradictions.

The role of CME is also to question mathematics education itself: reflections on practices that often consider stereotyped classrooms in which all students are *the same*. The challenge of CME is to think in real classroom contexts, for example, with regard to teacher training, discussion of real classroom situations and reflection on how the mathematics teacher's pedagogical practice can consider all students based on differences in learning rhythms, in order to promote significant changes in the field.

When it comes to teaching mathematics, pedagogical practices, in general, were (or are) defined by pre-formulated exercises, based on the following *exercise paradigm*: all the information is present in the statement, with exact numbers, without the possibility of questioning; all the information presented in numbers is sufficient and necessary and the exercises have only one correct answer. The question is not whether these practices should be annulled, but rather why there is no expansion of the ways of teaching and learning mathematics.

Skovsmose (2000) contributes with *scenarios for investigation*, presenting reflections on the various ways of creating different learning environments in the mathematics classroom. He divides them into six scenarios, relating either pure mathematics or contexts of application and semi-reality or reality, both in exercise and in these scenarios of investigation, understood as practices that break with the paradigm of exercise and allow the student to assume the position of investigator of their own learning and of reality.

Inquiry scenarios establish a different communication pattern in the classroom, overcoming the *sandwich pattern* of communication of the exercise paradigm, in which the teacher asks a question, the student answers and the teacher then validates or corrects the answer.

In a more investigative context, space is opened up for questions of other kinds to be asked in classroom interaction situations. The teacher takes on the role of questioner, encouraging the student to investigate and expand their knowledge about a particular problem, encouraging creativity and discovery.

Skovsmose points to six models based on the combination of Pure Mathematics, semi-reality and reality. Table 2 summarizes the possibilities indicated by the author.

Table 2: Learning environments

References	Exercises	Research Scenarios
Pure Mathematics	Exercises presented in the context of Pure Mathematics	Numerical or geometric investigations with paper and pencil or computer.
Semi-reality	Artificial situations. The sole purpose is to arrive at a single solution.	An artificial problem, but one that allows for exploration and justification. They can generate other questions and solution strategies.
Reality	Exercises based on real life, but the questions that arise from them are not investigative.	Investigation activities that can use technological resources and manipulative materials. The problems are related to the students' everyday lives and can be proposed as projects.

Source: Adapted from Skovsmose (2000)

Within the field of research scenarios, Moura (2020), in his research entitled *The encounter between deaf and hearing people in research scenarios: from uncertainties to possibilities in Mathematics classes*, developed research scenario practices with 5th grade students. In one of the activities, the students (5 deaf and 15 hearing) had the challenge of preparing a fruit salad. They brought an agreed amount of money to contribute and, based on the budget collected collectively, went to the grocery store near the school to make the purchase.

In this context, the students were involved in price negotiation situations, as well as selecting the types of fruit they would like to buy based on the amount they had available. They also discussed the possibilities of using other ingredients (condensed milk, honey) and what the possible benefits or harms might be in terms of the calorie content of sweets and fruit, as well as preparing the salad and dividing the portions. Through this practice, the researcher noticed that dialogue was valued. The students put themselves in the position of researchers and investigators, facilitating communication between the deaf and the hearing.

Another important concept in EMC is that of *foregrounds*, which refers to the opportunities that social, political, economic and cultural conditions provide for the individual, bearing in mind that the opportunities given to different people are disparate, influencing the idealized possible futures. Despite not being immutable social facts, these conditions interfere in the way people interpret their future possibilities and recognize themselves in their expectations, hopes, frustrations and perspectives.

Foregrounds are important for understanding the location of the students' intentionality (past, present or future). In addition, they allow us to reflect on what it means to promote contextualized mathematics lessons. The concept has been developed by researchers such as Soares (2022), *Dreams of socially disadvantaged adolescents: life, school and mathematics education;* Roncato (2021), *Meaning in Mathematics Education and students with disabilities: possibilities of encounters and concepts*.

Another relevant concept of EMC arises from Freire's (1989) ideas of reading and writing and asserts the importance of students understanding society: reading and writing the world with mathematics. Thinking about society and engagement are the keynotes of reflecting on reality and the future that we want to build:

> Reading the word is always preceded by reading the world. And learning to read, to write, to become literate is, first and foremost, learning to read the world, to understand its context, not in a mechanical manipulation of words, but in a dynamic relationship that links language and reality (Freire, 1989, p. 7).

Frankenstein (1983) was responsible for initiating correlations between Paulo Freire's postulations and Mathematics Education by thinking about the democratization of mathematical knowledge - an area traditionally understood by a few. The researcher proposed the teaching of mathematics from an emancipatory perspective and the knowledge underlying the area as a way of reflecting on social justice because there is no intrinsic neutrality.

In this context, Gutstein (2006) states that reading and writing with mathematics involves understanding power relations, analyzing the different opportunities and resources offered to different people and the prejudices that generate discrimination based on differences such as gender, sexuality, class, among others. Mathematics therefore plays a fundamental role in investigating these phenomena and how they are dealt with by the media, politics and society.

In this context, writing the world with mathematics suggests possible transformations

produced by actions that seek a fairer society and guarantee the rights of all. From this critical perspective, transformations become visible and actions can be taken.

Barros (2021), based on this theoretical-methodological assumption, developed the research *Reading and writing the world with Mathematics and the LGBT+ community: the struggles and representation of a social movement* in a social project that sheltered LGBTQIAPN+ people who had been thrown out of their homes because they were not accepted by their families. During the time these people were housed at the project, they had access to courses and training aimed at getting them into the job market, so that they could establish themselves socially in an autonomous way, overcoming their situation of abandonment.

The researcher proposed reflections and activities (conversation circles, for example) on how mathematics was present in that context and how the area could contribute to the process of understanding these people in the world, in search of their spaces as citizens.

CME is made up of concerns about mathematics education, breaking with the discourse of neutrality and allowing the area to be seen with its potential to foster discussions about society. Some of the concepts discussed briefly in this section, such as scenarios for investigation, *foregrounds* and reading and writing about the world with mathematics, help to promote the visibility and participation of different groups in the educational context, as well as making fundamental discussions about the formation of critical citizens part of mathematics classes.

4 Critical Environmental Education in Science Studies

The relationship established between the individual and the environment can determine the paths and consequences that each individual will have throughout their existence.

As well as being an effective element of the environment, man has a connection of total dependence, given that his actions are very important if the harmony between the two is to be preserved. However, with an anthropocentric attitude, individuals place themselves in a superior position and make indiscriminate use of natural resources.

According to Guimarães (2007), when we talk about Environmental Education (EA — Educação Ambiental), we recognize that there are problems in the human-nature relationship, confirming that there is an environmental crisis resulting from a historical process in which man and nature live in an antagonistic relationship, which has intensified the exploitation of the environment and the distance between the parties, thus generating the degradation of both.

> The environment is a whole, it is systemic, it needs to be perceived in its complex reality, in its totality. They are interrelated and interactive parts of a whole, at the same time as it is the whole interacting with the parts. It's "all together at the same time now", a complex thought that is somewhat strange for a Cartesian and anthropocentric rationality that tends to reduce and simplify the understanding of reality, of the whole (Guimarães, 2007, p. 85).

In the quest to find solutions to such a complex problem in which nature is seen in a fragmented way, resulting in serious consequences, as well as to find a way in which the parties create a more integrated and sustainable relationship, environmental education has emerged. Guimarães (2007) points out that local and global environmental problems are interrelated, as they are not isolated aspects of each reality. Therefore, the problem lies in the current model of society.

EA becomes responsible for showing ways forward through a pedagogical process that is engaged with socio-environmental needs, understanding that the biggest problems are not just related to their consequences, but mainly to their origin.

Pedagogical action is essential in order to encourage discussion of school actions to transform individuals into participants and protagonists in conservation and preservation. This change can have an impact on the entire school community, in a dialogical relationship between society and the environment.

According to Layrargues and Lima (2014), political ecology, at the end of the 1970s, contributed, through the social sciences and humanities, to deepening the ecological debate, which had previously been based solely on biological paths, detached from public policies and distant from socio-environmental problems. Issues that had previously been omitted, such as cultural and ideological models, class conflicts and dominant political impositions in society, and issues between the state, society and the market, were incorporated into this debate.

By analyzing environmental education and the notions of the social field, we can see that it is made up of a diversity of social components and institutions with a core of common values and norms. However, its actors differ in their ideas on environmental, political and pedagogical issues, as well as in their epistemological views on environmental approaches. These diverse social groups seek to dominate the field in order to guide it so that their interests prevail, which oscillate between tendencies towards conservation or transformation in relation to the way society interacts with its environment. This diversity of interests gave rise to a broad discussion about minimizing environmental impacts in the face of a recognized environmental crisis at the end of the 20th century.

With the possibility of broadening the world view and a new social practice, environmental education emerged as a multidimensional pedagogical field, linked to the practices established between the individual, society and nature. It was necessary to delve deeper in the search for more substantial knowledge, analysis and action, demanding a pedagogical practice that was closer to reality.

Initially, there was an effort to define environmental education in a single way, common to all educational approaches. However, this search for a universal definition was discarded due to the diversity of visions and fields of action. Thus, faced with the multiplicity of factors, efforts have focused on differentiating the universe of knowledge, pedagogical practices and the relationships between individuals, society and the environment, confirming a plural field. In this sense, Layrargues and Lima (2014) point out

> today it is clear that it was impossible to formulate a concept of Environmental Education that was comprehensive and sufficient to encompass the entire spectrum of the field; but it is also clear that these different conceptual proposals were nothing more than the search for an interpretative and political hegemony of this socio-educational universe (p. 26).

The diversity of conceptual proposals showed this internal plurality which, at the beginning of environmental education, was not perceived. It was only as studies progressed and the field consolidated that it became possible to understand. The object did not change, but the views and perspectives did, through the perceptions of the field.

Conservationist practice predominated in the initial studies of environmental education, guided by a movement of "ecological" awareness, based on ecological science. According to

Layrargues and Lima (2014), this conservationist practice was due to the environmental degradation caused by inevitable modernization and the lack of perception of the complex relationship between society and nature, due to the lack of an adequate structure in the environmental sciences for such perceptions.

Environmental problems were seen as something momentary, which would be corrected over time by increasing information and education about the environment or by technological resources. Carvalho (1989) points out that

> the choice of education as the main instrument for change contains a certain misconception. Values cannot be constructed pedagogically and disseminated didactically in educational programs. Values are built up in practices and knowledge that are reciprocally involved. What's more, they are contextualized in a unique network of power that gives them a place of meaning. Thus, to produce values is to engage in practices that dispute, very concretely, in everyday social life, access to the social imaginary and the production of knowledge. Education is not outside this movement. It is also a social practice, engaged in a historical moment and a formation of power. And it is from this place that it engenders a particular production of knowledge. However, this knowledge is no more legitimate than others, since we are not talking about formal knowledge, organized into content. In this sense, all practices generate knowledge and are therefore educational. A similar movement takes place in the opposite direction: there is no knowledge that does not have an effect on social practice. By this we mean that knowledge and practice, thought and action, are intimately involved and cannot be disconnected from power relations (p. 111).

Studies by Carvalho (1989) point out that the institutionalization of environmental education took place mainly in the environmental field and not in the educational field, characterizing a certain distance between these fields.

From the 1990s onwards, in 1991, close to the Rio de Janeiro Conference — ECO 92 — the two fields came closer together and began to produce some fruit, such as the Coordination of Environmental Education, drawing up proposals for formal Environmental Education, which would later become the General Coordination of Environmental Education.

According to Layrargues and Lima (2014), movements to tackle environmental problems started late, such as the creation of the EA working group within the Association for Postgraduate Studies and Research in Education in 2005. All actions were guided by natural scientists from the field of environmental education, to the detriment of professionals from the humanities and social sciences, which meant that only an *ecological* view of environmental problems was applied, discarding the relationship between society and nature.

Over the years, environmental educators have realized that, just as there are different ways of understanding fields and society, there are also different conceptions of environmental education. It has come to be understood in a more pluralistic way and its pedagogical practice is no longer monolithic, gaining greater applicability and development possibilities according to its agents. In this sense, Layrargues and Lima (2014) point out

> if the field of education includes various pedagogical currents; if the field of environmentalism has developed a diversity of currents of thought over its forty years; if the very concept of society contemplates different approaches, it is not difficult to imagine that the confluence of these countless interpretative bundles that shape Environmental Education would produce a broad spectrum of possibilities for conceiving the relationship between Education and the Environment (p. 28).

In view of the internal diversities revealed in the process of developing environmental concepts, it is possible to understand the need for a self-reflective study of environmental education, thinking about its practice and application.

Based on this self-reflection, the conservationist strand lost strength, giving way to two paths: the critical strand, with a bias contrary to the conservationist path, in which environmental discussions and practices go hand in hand; and the pragmatic strand, known as a veiled version of the conservationist strand, with a dialogical stance, but with fewer practical actions of socio-environmental interventions. The latter was characterized by individual educational practices, in a more private way, without considering the historical and political issues of society.

Without social engagement, the pragmatic approach would not break with the hegemonic thinking that placed man as the total cause of environmental problems, disregarding the socio-economic issues involved in the development process. This strand goes against the critical position by stressing that a micro-change in a few social sectors is not enough, but rather the transformation of society as a whole, altering cultural and ethical behaviors through new approaches, affecting social and political relations.

The maturing of the critical strand has transformed the identity of environmental education, giving it new adjectives such as: emancipatory, transformative, fueled by Freirean thinking based on Popular Education and criticality.

However, during the 1990s, a method of combating local environmental problems spread internationally, aimed at individual responsibility for solving such problems, as if it were enough for each individual to do their part to minimize the impacts of the environmental crisis. As a result, the pragmatic approach gained strength even among environmental educators, expanding the focus that was once solely on waste, recycling and selective collection, so that it reached sustainable consumer relations, based on expository pedagogical actions and educational campaigns, similar to the conservationist approach, in which proximity and contact with natural environments were non-existent. In this way, it led to a great distancing from socio-economic relations and the real causes of environmental problems. Loureiro (2007) shows us that:

> it's not enough to point out the limits and contradictions that exist and make accusations. We must calmly accept that we live in a society and that, therefore, even when we try to go beyond the reality in which we are immersed, we often end up repeating what we want to overcome (p. 67).

The critical macro-trend, according to Layrargues and Lima (2014), was driven by ecological and social activism, resulting in the emergence of new social movements that took advantage of a favorable environment due to the Rio de Janeiro conference in 1992. The maturing of this critical development triggered debates involving cultural, individual and subjective issues, arising from the evolution and transformation of society over time.

Reductionist solutions are not enough for environmental challenges. What is needed is dialog, a willingness to see the new and seek new answers linked to changes in attitudes. There is no learning without a change in outlook. Einstein (*apud* Sterling and Orr, 2001, p. 7) says that “no problem can be solved from the same consciousness that created it. We must learn to see the world anew”.

Critical Environmental Education (EAC — Educação Ambiental Crítica) has therefore

grown substantially in recent years, strongly tending to occupy its place of prominence to the detriment of the pragmatic macro-trend. However, the forces of dominant pragmatism act to weaken EAC movements due to their systemic pairing with the economic trend. As a result, all efforts towards critical environmental development in favor of citizenship take a back seat, overshadowed by incentives for consumption, from job creation onwards, which hinders the necessary breakthroughs towards new paths.

5 Critical Financial Education

The study of PE is relatively recent and there was no discussion of it in the documents guiding basic education. In 2018, with the approval of the Base Nacional Comum Curricular [BNCC — Common National Curriculum Base] (Brasil, 2017), the topic appears as a cross-curricular theme, passing through some curricular components, such as mathematics and sciences, and brings possibilities for discussions on the subject in the school environment.

It can be seen that Critical Financial Education (EFC — Educação Financeira Crítica) has the function of raising awareness, alerting and practicing socio-environmental and socio-economic issues. With its interdisciplinary scope, it creates the possibility of dialogues that make learning more meaningful and contextualized, as suggested by the BNCC (Brasil, 2017):

> Another aspect to be considered in this thematic unit is the study of basic economic and financial concepts, with a view to educating students about finance. Thus, subjects such as interest rates, inflation, financial investments (profitability and liquidity of an investment) and taxes can be discussed. This thematic unit favors an interdisciplinary study involving the cultural, social, political and psychological dimensions, as well as the economic one, on the issues of consumption, work and money (p. 269).

Society deals with financial issues on a daily basis through consumer relations and various ways of paying for products and services. These financial relationships highlight the importance of knowing how to deal with money and its various forms of representation.

Failure to observe this need will possibly lead to financial problems, paving the way for debt. No less important, distancing oneself from this knowledge can have a disastrous environmental impact.

Based on studies by Kistemann Jr. (2011, p. 29), the following question arises: “To what extent, in a liquid-modern scenario, do individuals-consumers make consumption decisions and what meanings do they produce when dealing with financial-economic objects?”. The researcher discusses the importance of individuals having knowledge about financial situations in order to make decisions, so that they are not misled when negotiating.

In the context of this research, we believe that Kistemann Jr.'s (2011) question can go beyond financial issues to environmental issues. The author points out that consumption situations, through a cascade effect, have an impact on questions about the use of natural resources, environmental degradation, pollution, climatic conditions, waste issues, among other factors involving the production chain.

Based on the studies described above on Critical Education, EMC and EAC, we can see the intersection between them, fostering a dialogical relationship that enriches the study of EF, bringing it closer to the student's reality. A macro analysis of everyday situations that interfere in the economic, environmental and social relations of the student-citizen becomes possible.

Taking Bauman's (2007, p. 45) words as a reference, when he states that “there is an

instability of desires combined with an insatiability of needs, due to the consequent tendency towards instant consumption, as well as the rapid obsolescence of the objects consumed", we can see that society has maximized consumerist practices, without worrying about the future consequences of this destructive lifestyle.

There are two types of product obsolescence: programmed obsolescence, in which products are produced with a certain expiration date to fall into disuse, based on the impossibility of updates or defects. Another way of making something obsolete is through perception. Perceptual obsolescence, with a personal bias and collective implications, encourages the disuse of products even before they have problems. This occurs on the basis of the personal judgments and evaluations of others, forcing or convincing the other to get rid of something through a mere speculative process. Rossini and Naspolini (2017) show that

> it was in the aftermath of the Second World War (WWII), with a new moment of economic crisis, that programmed obsolescence was really put into practice, because it represented a tool that made it possible to achieve the objectives of developmental economic theory: economic growth. It was given an additional concept, known today as perceptual obsolescence, and thanks to advertising consumers were encouraged to want new products before the old ones reached the end of their useful life [...] The strategy of waste is the sum of programmed and perceptual obsolescence. It wasn't enough to reduce the useful life of products and generate the need for new purchases. Consumers had to want the new product even before it became useless (p. 55).

It is clear from Bauman (2007) and Rossini and Naspolini (2017) that the EFC can bring great benefits to society by addressing important contexts for citizens, especially with regard to financial and environmental issues. Thus, there is no way to debate environmental impacts without considering an economic context that minimizes aggression to the ecosystem, given the interface of the issues in question.

Conscious consumption, positive decision-making, waste management, better use of financial resources and freedom from debt are some of the results that the EFC can provide for individuals. These actions reverberate throughout society, as well as providing a socio-economic and socio-environmental balance for citizens.

6 Critical Financial Education in an Interdisciplinary Perspective from Critical Pedagogical Practices

Interdisciplinarity is an approach that involves integrating multiple disciplines or fields of knowledge to address a problem or issue. This approach recognizes that many challenges faced by society are complex and multifaceted, so that they require the combination of different perspectives and skills to be understood and solved.

Interdisciplinary didactic-pedagogical approaches, as in the case of this research, seek to break down the traditional boundaries between curricular components, allowing different areas of knowledge to be combined and integrated to obtain a comprehensive understanding of the problem in question.

On a larger scale, interdisciplinarity can also involve collaboration between different sectors of society, including governments, non-governmental organizations, companies or individuals, with the aim of finding effective and sustainable solutions to complex problems, applied in various areas, from the Natural Sciences and Technology to the Social Sciences and Humanities. In this sense, according to the National Curriculum Parameters [PCN+ — Parâmetros Curriculares Nacionais] (Brasil, 2002),

> interdisciplinary work, before guaranteeing a thematic association between different disciplines — an action that is possible, but not essential — must seek unity in terms of teaching practice, in other words, regardless of the themes/subjects dealt with in each discipline in isolation. In our proposal, this common teaching practice is centered on work that is permanently geared towards developing competences and skills, supported by the teaching-research association and work with different sources expressed in different languages, which include different interpretations of the themes/subjects worked on in the classroom. Therefore, these are the factors that give unity to the work of the different disciplines, and not their association around themes supposedly common to all of them (p. 21-22).

This work is interdisciplinary, proposing reflections on the theme of Financial Education involving the areas of Science and Mathematics. In this way, these postulations refer to the theoretical-methodological constructs that guide and guide all pedagogical work based on the analyses and correlations produced and shared with the academic community.

7 Analysis of Pedagogical Practices

By revisiting some of the dissertations analyzed, it was possible to highlight two of them for the observation of relevant pedagogical practices, with the possibility of contributing to the teaching of EFC.

Faria's dissertation (2020) offers the possibility of rich and critical dialogues with the students in her 5th grade class at a federal public school in the city of Uberlândia (MG).

Using questionnaires with questions that dealt with the students' daily family life, a sequence of discussions began on subjects such as: family budgets; financing; decision-making and various expenses, always with a critical and realistic focus, in line with Skovsmose's (2000) studies on research scenarios. In his study, Faria (2020) shows us that

> the tasks proposed for the workshop were designed with everyday financial situations in mind, with the aim of achieving some specific objectives. These are: a) To provide learning environments that are potentially structured as scenarios for investigation; b) To lead students to critical reflections and the production of understandings about financial matters; c) To value the sharing of experiences, dialogues, the defense of arguments and the flexibility to rethink them; d) To instigate curiosity in understanding the concepts and ideas present in the tasks, as well as the questioning and exploration of strategies; e) To encourage participants to take ownership of the topics discussed, of possible future situations and to apply them to their lives and families (p. 60).

The pedagogical practices proposed by Faria (2020) show the possibility of leveraging a dialogical tendency in the classroom, in order to encourage critical reflections among her students and contemplate their families, once these dialogues have been taken into their homes. This enables the EFC to go beyond the school walls, strengthening critical thinking and actions throughout the school community.

Freitas (2020), in his assumptions that guide his educational product, argues that teaching Financial Education is a fundamental tool to help people manage their finances properly and achieve financial stability. It asserts that this theme should start at an early age, in schools, and continue throughout life, through structured teaching and learning strategies. With Financial Education, people can make informed decisions about their finances and avoid serious financial problems.

Based on these basic reflections, the author presents a series of activities aimed at 9th grade students, with the aim of raising their awareness of the principles of Financial Education inherent in social practices, such as budgeting and planning for researching product prices in supermarkets and analyzing water and electricity bills, focusing on the basic elements of bill reading (code, month/reference, due date, total amount to be paid, consumption in m^3 or kW, unit value of m^3 and kW, taxes and charges).

The proposed activities focus on the author's creation of tables, using the information contained in water and electricity bills, with the aim of familiarizing students with basic consumer bills so that they can read them critically and manage their spending more responsibly and consciously. In addition, students are encouraged to calculate estimates in relation to reducing consumption and expected spending.

Based on this approach, the students realized that part of the amount charged on energy bills was made up of charges and taxes, causing the amount to be paid to rise.

We believe that the author's work touches on the subject of environmental impacts by focusing on conceptual issues of energy consumption and the concept of tariff flags. It is not always easy for consumers to understand tariff flags. Individuals often don't understand why there is such a variable factor in the electricity bill, which can consequently result in financial problems, such as spending over budget.

As a result, the students realized the importance of taking action to save energy, since, with this attitude, the family budget benefits and environmental impacts tend to decrease. According to Freitas (2020),

> the aim of this activity is to get to know the electricity bill and its basic elements: code, month/reference, due date, total amount to be paid, kW (Kilowatt) consumption, unit value of kW (Kilowatt), taxes and charges. With the bill in hand, the students will construct a table with the amount of electricity, tariff/price, value, charges and taxes, checking the total amount, as well as the percentage of consumption and taxes/charges (p. 60).

This is where the teaching of Financial Education becomes essential. Freitas (2020), through the activities proposed in his educational product, believes that school can be a suitable environment for learning Financial Education, since the subject is a demand of the Base Nacional Comum Curricular (BNCC — Common National Curriculum Base). The aim is to develop socio-environmental, socio-emotional and socio-economic competences, as well as mathematical skills.

8 Final considerations

Through critical thinking about consumer and power relations, the EFC plays an important role in society. When citizens start to think about the consequences of their behavior and the way they consume, they make use of their power of criticality. The EFC therefore aims to enable people to discuss, understand and practice more sustainable models in their attitudes to everyday life situations. Under this aegis, the EFC also seeks to encourage citizens to reflect on possible alternatives for minimizing the environmental and social impacts of their financial decisions.

Based on the studies discussed so far, we can see that the EFC goes beyond calculations and technical knowledge. It seeks to create a critical attitude in the individual, with a responsible and committed approach to money, its use, destination and consequences for the community.

Through the interdisciplinary studies suggested in this work and corroborating the postulations made by Japiassu (1994) and present in the PCN+ (Brasil, 2002), a dialogic path is opened up between theory and practice, enabling the student, citizen-consumer, to invest in socio-educational actions, with the aim of encouraging the dissemination of a culture of self-control, care and maintenance of the environment, based on changes in habits and lifestyle. These changes are directly reflected in their finances, with the support of teachers who follow a critical curriculum proposal, capable of forming autonomous citizens and protagonists in the various social interactions.

In this way, the relationship between Critical Financial Education and Critical Mathematical and Environmental Education occurs through the understanding that financial decisions generate consequences and influences in the environmental field, being shaped by the power structures that dictate the pace of environmental degradation.

The two aforementioned educational approaches seek to develop a critical vision so that citizens are able to analyze these power structures and adopt more conscious and transformative environmental and financial attitudes, with the aim of building a fairer and more sustainable society.

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