

## Mathematics Fairs: the externalization of critical mathematics education from exhibiting students

## Feiras de Matemática: a exteriorização da educação matemática crítica a partir dos alunos expositores

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### ABSTRACT

In this work, we aimed to investigate, first, the critical specificity in Mathematics Fairs (MF), in such a way that this specificity was contrasted with mathematics in action, transversally to Skovsmose (2014); and, secondly, to identify if there is really coherence between the different points of representation coming from inside the MF. Imbued with the principles of qualitative research, we analysed the enunciation sets, with the caution provided for in the discourse conception formulated by Foucault (2014). We categorise such sets as either relatively close or relatively far from the conceptual group that governs the Critical Mathematical Education (CME). The discussions fostered in this work showed us that there is a certain approximation between the work of the MF and the CME. Therefore, it is necessary to implement and strengthen, in teacher education, the critical dimension founded within the MF.

**KEYWORDS:** Mathematics Fairs. Critical Mathematical Education. Mathematics in action. Teaching practice.

### RESUMO

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Procurou-se, neste trabalho, investigar, em primeiro lugar, a especificidade crítica nas Feiras de Matemática (FM), de tal modo que essa especificidade fosse contrastada com a matemática em ação, transversalmente a Skovsmose (2014); e, em segundo lugar, identificar se realmente há coerência entre os diferentes pontos de representação advinda do interior da FM. Imbuídos dos princípios da pesquisa qualitativa, analisamos os conjuntos de enunciação, com a cautela prevista na concepção de discurso formulada por Foucault (2014). Categorizamos tais conjuntos ou como relativamente próximo ou como relativamente distante ao grupo conceitual que rege a Educação Matemática Crítica (EMC). As discussões fomentadas, nesse trabalho, mostraram-nos que há certa aproximação dos trabalhos das FM com a EMC. Portanto, é preciso implementar e fortalecer, nas formações de professores, a dimensão crítica fundada no interior da FM.

**PALAVRAS-CHAVE:** Feiras de Matemática. Educação Matemática Crítica. Matemática em ação. Prática docente.

## Introduction

The understanding of an object, whether clear and remarkably reputable, is submitted no less than to a rigorous investigation process. Above all, in the face of a desire to know that ostensibly overcomes its historical denial. Historical, because it is known that there are, in the objects to which we can interact physically and on those we cannot, linked to their own nature, a disposition that houses the need as a cause. Precisely, in the sense of having in itself the status of its finitude. In other words, they are conditions not always well defined a priori, anchored either in their own deterioration or in understanding the movement of things and to accommodate to them, or to accommodate them at their own will. In line with what would have formulated the pre-Socratic philosopher Heraclitus of Ephesus (between 540 B.C. and 470 B.C.), about the world being primarily dynamic, everything is in constant movement and transformation.

Nietzsche (2000, p. 10-11) adds on this subject:

They (philosophers) will not learn that man has become, that the faculty of cognition has become; while some of them would have it that the whole world is spun out of this faculty of cognition. [...] The philosopher, however, sees "instincts" in the present man and assumes that they are among man's unchanging facts, and that they can then provide a key to understanding the world in general: all teleology is based on the fact that the man of the last four millennia is treated as an eternal being, to whom all things of the world are addressed naturally from the very beginning. But everything has become; there are no eternal facts, just as there are no absolute truths. — Therefore, a historical philosophizing is necessary as of now, and the virtue of modesty as well.

This is no other than a criticism diametrically opposed to that idea that displaces the subject, or whatever is the cognizable object, until a state of being in itself that turns all the time to its origin, without that, not for a moment — paradoxically —, had he even gone away from what he always was. In other words, the cause does not completely guarantee the reason for being, and nor does it have

the function of claiming a destiny that is part of the genetics of all the things that have become one day, and also of those that are yet to come. Even because the investigation that deprives itself of the historical gaze must understand that its cognizable object has not become but has been conclusive since its birth. As if the time and all the other things from which they share some kind of interaction with that object were, to a certain extent, insignificant both for its constitution and for its significance (this being: the same, eternally)<sup>5</sup>.

From this perspective, the process of teaching and learning mathematics is also equipped with this need for transformation. It was thus through one of those recurrences that the Critical Mathematics Education (CME) arose. Even with a special feature of re-affirmation in relation to the full exercise of freedom. For we must be under the possession of ourselves so that genuine questioning can be formulated and so that the first condition of those who polish an unwavering conscience about the reality that surrounds them can be achieved. As an echo that shouts a restricted will.

These are some of the points that place us in the path of inference of an investigation concerned with a clear and remarkably reputable understanding about some fruition that happens throughout the Mathematics Fair (MF) design. In other words, about the nature of the CME that is being cultivated within boundaries of the fairs. However, we do this in a way that we deprive ourselves of questions like: such and such aspect, which refers to the CME, how it is represented in its genealogy; or, further, to sound like the ancient Greeks, what this is — CME. It means saying, therefore, that this very nature we will embrace here will tell us no more than what they are telling us from their peripheral localities. None the less, this will not make our understanding gradually clear and reputable, since the ultimate goal of this research is to present an introductory notion to the subject. What is more synthetic in itself is all that is needed. So that in a forthcoming investment, exclusively from it, it constitutes the understanding to be overcome.

In view of this, still about the MF, we also believe that its advent has taken place as a response and as a necessary result of an archaic paradigm in the field of teaching and learning mathematics. As well as of the scope that had been reached regarding the foundations of this mathematics in society in general. Moreover, “in the

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<sup>5</sup> In this passage, we are referring either to objects that derive from a human effort (such as the manifestation of its singular nature) or to objects that assume the figure of the subject himself. This, however, does not mean that this same reflection cannot be useful to other natures that are, for the time being, cognizable objects.

1970s, one could still observe, in the Elementary and High School, that Mathematics was untied from the reality of the students and, why not say, from the reality of the teachers themselves” (ZERMIANI, 2014, p. 15). In large part, this probably corroborated the amplification of the feeling of dissatisfaction in how school education, without getting into details, was understood. Above all, regarding the practical decontextualization of mathematics and its insistence on formulating a highly fictional theory — trapped in the times of an ancient society, as a devotion to a nostalgic feeling. Remaining rigid and unquestionable in its way of being about the sequence of programmatic content: “definitions, examples, lemmas, theorems, corollaries, exercises and, again, a mechanical reproduction of exercises, algorithms and formula demonstration.” (ZERMIANI, 2014, p. 15).

It is, then, based on those considerations and the understanding that FMF “[...] instigates criticism, reflection and discussion of social problems and integration between school and society, with reference to humanizing education” (OLIVEIRA, CIVIERO; GUERRA, 2019, p. 20), that this study will be based on the CME concept formulated by Skovsmose (2007; 2014). In considering the above, the objective is to investigate the critical specificity of the Maths Fairs (MF), so that this specificity is contrasted with the mathematics in action, transversally to Skovsmose (2014); and, to identify whether there is any consistency between the different representation points from the within the MF, aiming to establish some contrasts that may occur, concerning the MF process, when we look side-by-side at its critical formulation, with regard to the mesh that houses and disposes of the Mathematics Education (ME). In such a way that its notion of mathematics in action fuses the analysis criteria. — Which will tell us, briefly, the distance between the ME cultivated by the fairs and the role itself, within a process of criticism, which is given to that performatic mathematics.

### **Methodological paths**

Throughout its construction, this article is provided with a clear awareness, with circulation by spaces in which its social role is, as far as possible, a motivator for the reflection of pedagogical practices in a broader context, such as CME. Even because we agree with Faria (2006 *apud* SCHIRLO and DA SILVA, 2013, p. 16), when she says that “in a society dominated by science and technology, a humanization of technology is needed, i.e., education must be based on ethical values, in responsible and fraternal relations, valuing the human person”. Thus, “when mathematics is considered an instrument of social intervention, it can

contribute to the humanization of actions, especially when it is conditioned to the uncertainties produced by the technological society” (CIVIERO; BAZZO, 2020, p. 84). To this end, we must consider, at first, that each subject does not derive entirely from the discourse that goes through it and that it itself reaffirms, strengthens, and distributes.

Firstly, we focused on a bibliographical study on the concept of the CME provided by Skovsmose (2007; 2014). Our objective was the systematic compilation of foundations that could sustain our hypothesis positively or authoritatively. The same was true about the first steps of the MFs.

Later, we engaged with structuring the interview that would be conducted with the exhibitors. As for the structuring of the interview, we were under a provision that showed us whether the pedagogical practices developed in the context of the MF had a relatively close bias toward the CME’s practices. To this end, we thought that we must investigate this pedagogical practice in a central element. In other words, the exhibitors, since they become the cause and effect of all teaching practice. The period chosen was year 2019, when the 23rd Regional Mathematics Fair of Rio do Sul/SC was held. Among the MF categories, we decided to focus on High School and/or the Vocational category. In all, 13 (thirteen) studies of this category were exposed in MFs. We interviewed four of the students representing three works.

The four students were the ones who accepted the invitation to participate in the interview. The semi-structured interviews were conducted at different moments, without the presence of the advisor, and were recorded and transcribed.

Hence, the analytical process that resulted from the interviews was under specific care: first, that our point of view should not be absolute, in the sense of bringing to light a hidden truth; second, that the discursive set should not become the exact representation of those who appropriated it, and that, to the same extent, it should be equipped with the complex knowledge that the subject of the discourse carries in itself, according to Foucault (2014). In full alignment with what was said earlier, two categories of analysis were set up: relatively close to or relatively far from the notion of CME, under Skovsmose (2007; 2014).

Relatively close: It refers, briefly, to all kinds of practice that do not end in itself; it possesses a desire to overcome, so that there is a constant assessment of itself, of the other and of the collective; It acts largely in the jurisdiction of itself, where the other is not reduced or simply ignored, i.e., it treats the elements of the world



conscientiously, decoding its trends — approaching Skovsmose's critical conception (2007; 2014).

Relatively far: It concerns an attitude that strictly demarcates the limits of the subject, the world and knowledge itself. In other words, in theory, that for every undertaking achieved, within this conception, a door closes before our eyes, as if access were usurped from us. Yet otherwise, it is a process by which the subject becomes unaware of him/herself and starts to be unaware of the world in its complexity, no longer appropriating a critical epistemological conception.

### **Critical Mathematics Education**

It would be interesting to know, at first, concerning EMC, what the content of its question would be, or rather, in response to what or who it is needed. This approach allows us, for example, to extract more accurately the very nature of its motivation and what are, perhaps, the attributes that bind to it — thereby patenting its own form.

In this sense, our curiosity is given a first indication:

The approach of the empirical-analytical sciences incorporates a technical cognitive interest; that of the historical-hermeneutic sciences incorporates a practical one; and the approach of critically oriented sciences incorporates the emancipatory cognitive interest [...]. (HABERMAS, 1987, p. 308).

This is the expression that removes from the ME the right to estimate, commonly, the possibility of employing a kind of transposition from within the spectrum of Critical Education (CE). In this view, the ME would have to incorporate a founding posture of concepts that, in turn, would weave a theoretical framework for the formulation of CME. For, as we have just seen just, the mathematics credited by many, including Habermas (1987), simply serves a technical interest, i.e., far from and inaccessible to an emancipatory interest of knowledge. In other words, the CME does not fall properly from the interior of the CE — as a kind of inexorable and therefore natural effect whose cause is pushed between the boundaries of the CE. However, we do not mean that the CME, as the content of its foundations, is not impregnated of the representation<sup>6</sup> managed by the CE, which had its movement, in general, also fed by the Critical Theory.

In view of this, we can only know now, considering the provisions of the CME— also understood as the need to becoming — under which urgency it arises. A

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<sup>6</sup> See p. 853 in ABBAGNANO, N. Philosophy Dictionary.

first indication of this fundamental issue is given by Skovsmose (2008, p. 12), who asks to himself, “how to achieve an education geared to social justice in a complex, globalised and ghettoful world?”

Aligned to this, mathematics in action, in principle, is established as the primary device, or rather, the basis by which a specific action becomes legitimate or justified; It makes use, therefore, of mathematical resources in its tooling form, i.e., as a beacon structure that is understood to the exercise of the best deliberative recollection — “as a basis for planning and making decisions” (SKOVSMOSE, 2007, p. 117); in theory, it criss-crosses a whole environment where the capital game, in the quality of economic structures, is of a natural character<sup>7</sup>; also, mathematical modulation certainly does not only embeds representation of reality, but also carries in itself a force that focuses so much on reality that makes it a new thing.

Moreover, this idea instilled in the CME that events taking place from interactions between individual-individual and individual-object-individual in the spaces of society, to some extent, are related to content of a specific interest. Thus, it means to say that part of the CME's concerns is linked to the fact that mathematics agree, above all, with some conformation or formatting of society — in most of its attributions. According to Civiero and Bazzo (2020, p. 78), “mathematical knowledge is involved as part of the foundation of this society, thus emerging the need to question its position in this laborious civilising equation.”

Meanwhile, Skovsmose (2014, p. 81) lists five of these performative aspects that move mathematics into action, which are:

1. Technological imagination, which refers to the possibility of exploring technological possibilities;
2. Hypothetical reasoning, which addresses the consequences of technological initiatives and constructions not yet carried out;
3. Legitimation or justification, which refers to the possibility of validating technological actions;
4. Realization, which happens when mathematics becomes part of reality, for example, through the processes of design and construction;
5. Dissolution of responsibility, which manifests itself when ethical issues related to actions taken disappear.

Otherwise, the technological imagination is the vent to the hypothetical reasoning. Furthermore, it is compressed from a process of a priori compiling of situations that are not verifiable in reality, the objective of which is to establish organisms and motivators of particular actions within an equally particular socio-economic context. Without necessarily all the attributes that concern the proper

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<sup>7</sup> Given the historical context. In other words, the capitalist economic system makes possible, within itself, conditions of its own nature.

aspects of human beings being implemented, in this case. Since, according to Skovsmose (2007, p. 124), “however, this space may contain serious limitations. It may be unique in the sense that it is not established by common sense.”

It would therefore be the ability to exploit a certain range of potential in the plan of imagination. In this case, based on mathematics. As a first step in the development of a project. In short, being held as a kind of digression on a reality that exists only as an idea. This reality is made the prototype, with the maximum conditions and feasible situations, so that the laws of the world-life and all its archetypal set are highly considered in the execution of this project. What demonstrates how fundamental it is for any technological initiative that seeks to transcend an already established paradigm — technological development, for example, “is based on imagination” (SKOVSMOSE, 2014, p. 81).

Yet “hypothetical reasoning is something that is not accomplished. It is in the form ‘if p then q, although p does not happen’” (SKOVSMOSE, 2014, p. 83). This is precisely the rational apparatus made of foundation for a given action to be definitively justified. (The justification is given in a space created by the hypothetical reasoning itself and, because of that, all its interpretation takes place within that space.) In other words, it is a process of establishing conditions/aspects taken to its scatological level over a finite number of possibilities developed within a representative universe. This finitude, in turn, implies that “some minor aspects are even ignored, since mathematics does not serve to represent all facets of reality” (SKOVSMOSE, 2014, p. 84).

In this respect, there is a problem that arises from an inaccurate hypothetical formulation, since, as has been said, a limited space of consequences ends up being considered. In other words, although in some cases mathematics will be the only research resource that precedes a prototype, it ultimately generates, to some degree, risks that are not calculated by mathematical models. It can make the previously calculated margin of error untenable when diluted in the world-life. In the sense that the implications expected within a very well-defined space are, in view of this, overcome by the limiting factor that is inherent in the process understood by the hypothetical reasoning.

Then, the notions of legitimation or justification draw apart exactly in the articulating character that is implemented within each of these notions. In other words, while justification, committed to validation, must necessarily assume logical responsibility, legitimation, also committed to validation, does not take that



responsibility for itself, although disguised as justification. That is, “trying to legitimise an action, in fact, is trying to make it look like it had been justified” (SKOVSMOSE, 2014, p. 85).

Realisation, in its most direct form, understands that mathematics in action is established in some sense in our world-life. It means to say, from this point of view, that mathematics is not exclusively a social fact, but also economic, historical, cultural, political, and technological fact. In addition, mathematics is not only an integral part of our most immediate world-life, but also of technonature. This makes mathematics, at the same time, become the necessary cause for the world-life, as we know it and imagine it, and create some idea of what it is and what it may become.

And finally, the dissolution of the responsibility deals briefly with the disappearance of the agent subject as a necessary means for a deliberative direction to be an extension of itself, too. Thus, every action that crosses the subject does not require it as a rational space geared toward the improvement of coexistence. In this context, there is no freedom of choice, but the submission of a decision which transcends it.

In view of the above, we would also like to propose a synthetic reflection about mathematics in action. So that the discussion does not close too much in itself, to give preference to a specific posture that powers the “goal point of view” (MORIN, 2011), to the detriment of one point of view. That is to say, it is the very idea that mathematics should not — as it cannot — establish autonomy in the sense of containing in itself all the necessary means from which the true understanding of the world-life begins.

From this perspective, from an interpretation that crosses us, we understand that mathematics in action, in general, is a field where we study the unfolding that come from a strictly deliberative, strategic, tactical content, or simply a principle of action. Demanding an understanding such that in its own course, and increasingly deeper into itself, it would be necessary to disclose, in principle, which devices are installed in society that are responsible for creating a specific sovereign idea of reality.

For Morin (2011), in the common field of ethics, there is a question that arises in the form of a paradox between intention and action. For, according to the author, there is an inconsistency that is established based on the motivation of an action. In other words, it cannot be said for a fact that good action in intent will not suffer a contrast that opposes itself, from the networks of relationships and transformations.

Better to say, it is really complicated to establish what reactions an action can generate even before its enterprise. Or, according to Morin's words (2011, p. 42), "it is therefore absolutely not certain that the purity of the media reaches the desired ends or that impurity is inevitably harmful."

The most punctual implications of this are strongly embedded in mathematics in action. Firstly, because it is in fact intricate, not to say unlikely, that it will be possible to equip an action to the extent that it is immune to networks of affection (ESPINOSA, 2004), or rather to have an absolute domain over the various branches that the action can generate in different contexts, even more so because events, which happen in the world-life dimension, are invariably unprecedented; secondly, because of the possibility, on the one hand, of standing a whole process, whether educational or not, strictly aiming at its final product — even as a consequential ethic — and, on the other hand, of a deontological ethic, where action itself is fixed as the primacy of the whole process.

Moreover, within the understanding of the ecology of the action, Morin (2011) raises, in this context, a principle that is related to a kind of penetrating domestication that flows into the subjects. That is, according to "Miligram: 'Common people, deprived of all hostility, can, simply by carry out their tasks, become agents of an atrocious process of destruction'" (MORIN, 2011, p. 46). When blind, obedience seems to tend to a type of moral dissolution about the agent who accepts orders. However, it does not mean that there is no moral responsibility attributed to this agent, but that its behavioural motivation is not necessarily in full alignment with its more internal provisions; not to mention that there is an imminent possibility that there is an unconscious desire buried deep inside to do assiduously what has always been done — and, at least in one of the cases, may be in harmony with the concept of the banality of evil, by Hannah Arendt (2006).

This is a spinal issue to be closed in any critical diligence, in the sense that, at the end of an arbitrary process, the demand that dispenses, in the agent's dimension, the consciousness of itself and its autonomy as a thinking being, is transfigured into a grafted process of subjects atrocious by mediocrity (MORIN, 2011).

This is linked to one of the performative aspects of mathematics in action, which is precisely the dissolution of responsibility. Since that, in the context of technological processes, according to Skovsmose (2014), there is the fading of a moral processing under a line of authority.

### **Mathematics Fairs - principles and critical locus**

We will take these aspects presented so far as a starting point to discuss not only what the critical specificity is at the bottom of the MF but also, in the background, to understand the coherence installed within its representativeness. To this end, we must bear in mind its principles, from which, as it were, its criteria of being and of always being made by its intermediary emanates. In other words,

The Maths Fair is understood as an extension of the classroom work and/or a research project by the collective of students and teachers, and not as a moment of presentation of isolated works carried out by those who stand out in Mathematics, practice adopted in many scientific events promoted by schools and universities. (ABREU, 1996, p. 19)

About the above quote, let us consider the inclusive disjunction linking two propositions directed solely in favour of an objective understanding (in the form:  $p$  or  $q$ )<sup>8</sup>. For the case in which proposition  $p$  receives the true logic value and the proposition  $q$  a false value, the MF understanding is exclusively defined in the displacement of the core of the entire pedagogical activity performed. In such a way that no direct transformation is given by the MF organisation prior to the event itself. For this specific context, we understand that the MF, through its action plans, should not be understood only as an extension of classroom work, but rather as the process itself developed within this classroom. Since “there are regional offices that conduct teacher training in the first half of the year about the organisation of works in fairs, the continuous record, the project and the writing of the extended abstract for the annals” (OLIVEIRA; PIEHOWIAK; ZANDAVALLI, 2015, p. 42). This means, in theory, that the MF is a space that promotes the articulation between guiding teachers, students and event. So that there are a series of transformations in the understanding of those teachers about their practice, of students regarding the varied connections between scientific/technological content and society, and of the event about the understanding of its own capacity of increment among the possibilities of teaching, research, science, technology, and socialisation. This demonstrates that the MF is somehow mistaken for the process that happens from the classroom.

We see, moreover, that the Standing Committee<sup>9</sup> on the MF Network Movement is much more integrated into the perspective construction of approach and execution of the works than can be observed, for example, if it were owned

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<sup>8</sup>  $p$ : extension of classroom work;  $q$ : a research project by the collective of students and teachers.

<sup>9</sup> “[...] it is a group that is constituted by collective interests, the main of which is the maintenance of the guiding principles of the Mathematics Fair: the public character; the socialisation, the sharing and the publicising of mathematical knowledge; the extension of the classroom to the community and vice versa” (OLIVEIRA; CIVIERO; POSSAMAI, 2019, p. 128).

purely as an extension of classroom works. This understanding is also appropriate, not to say consistent, when an investigation like ours seeks to understand, within the framework of the development of the works of the fairs, what type of CME occurs, such as the actual pedagogical representativeness of the MF. For it would be senseless to employ some kind of research, testifying an organisation's best understanding, based on elements that are outside the network of relationships that concern its own constitution. If, on the contrary, we were to implement an antagonistic understanding of this, we would certainly be limited to taking MF as the mere gathering of the pedagogical processes developed in the respective educational institutions. What, in turn, would be the least effective way to align with its first cause. Whatever it may be, “the idea of the Mathematics Fair emerged from the first proposals — inspired by several criticisms and questions regarding the teaching and learning of Mathematics, especially in basic education [...]” (BIEMBENGUT; ZERMIANI, 2014, p. 27). It would be the idea that there was a need for a new approach to be installed at the threshold of the mathematics teaching and learning process — one that ostensibly diverged from the current paradigm.

Another notion of extreme importance is linked to its democratic principle<sup>10</sup>. Since the MF process is associated, in all its scope, with an interconnection precept — “this interconnection has characteristics of openness or permeability, which makes possible horizontal and nonhierarchical relationships among participants, but with a common identity” (OLIVEIRA; PIEHOWIAK; ZANDAVALLI, 2015, p. 43). It is the idea, as we understand it, that among the different layers of attributions, within this organisation, its members are always under a provision that wants to go increasingly deeper in their own plan of action, in such a way that all this submersion is not simply an isolated experiment in itself, but that it can be diluted throughout the whole dimension of that organisation in the future. Leading to the better accommodation of freedom among its people, i.e., of their sharing and, from it, initiating a unification

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<sup>10</sup> Democracy according to Tocqueville (2000, p. 113): “It is possible to imagine an extreme point where freedom and equality can touch and be confounded with each other.” For Tocqueville (2000), there is no strong prominence between freedom and equality in the abstract functioning or even objective of the democratic process. It means, therefore, that the freedom of the individual must be protected and preserved as much as equality between them. Freedom, in this sense, will be all the more possessed of itself the greater the autonomy of the individual over the deliberative content that will directly mark his/her reality and his or her equals. This, in turn, presupposes the decentralisation of power, i.e., of its effective — distribution - it is up to the State, in this context, to guarantee the freedom of their people, i.e., it is removed from its role as sovereign, from the figure of the all-powerful State, as Thomas Hobbes's (1651) apology in the book *Leviathan* — the centralisation of power is the very figure of the aristocrats, of the imperialists who usurp the power of mobility among the formers of a nation.

process— committed to the empathetic inclusion of heterogeneous individuals, although fixed in a common goal.

### **Critical Mathematics Education in the discourse of the students-exhibitors**

I hope, however, that we are now far from the ridiculous claim to declare that our narrow corner is the only one from which one has the right to have a perspective. The world for us has become “infinite” again; we cannot deny it the possibility of receiving endless interpretations (NIETZSCHE, 2017, p. 251).

It is quite possible that, by facing our object of study, we rest on a will, an almost blind desire to remove the bark that covers everything that separates us from the glimmer of its truth — provided that this truth is multiple and therefore inexorably in perspective. What make us think that this knowledge process is now incorporated into our “critical spirit” (NIETZSCHE, 2017) in those few moments when blindness is not absolute. In other words, there is a question in us that leads us, in theory, beyond its probable resolutions. It means, therefore, that this path will hardly, if ever, fit into the things that are finite. Rather, it will launch its vision on a horizon that extends to all sides whenever we try to approach its edge. Perhaps that is one of the greatest challenges of those who are venturing out of the misunderstood issues. To possess in this game a single conformation: for every pair of eyes, and, different eyes, a new world comes to life, and at every new encounter between different worlds, another one is formed.

Definitely, this is one of the attributes that binds together and forms a body of understanding. Indeed, the whole boldness of the discourse analysis will go through, from end to end, this fluctuation that is an inherent characteristic of the criticism, to constitute, through interviews with exhibitors, named by character codes E1, E2 and E3, of the 23rd Regional Mathematics Fair of Rio do Sul, a critical knowledge of the pedagogical processes promoted in the MF axis.

In this sense, it was in response to a better understanding of those issues that a questioning action addressed the exhibitors. From these inquiries, we obtained some evidence, including on the teaching practice. For it is reasonable to understand that teaching practice is not known in its entirety in the closed study about who designs, executes and redesigns, but, first, in its founding cause, and, second, about its objective product. Or better to say, both the cause and the objective product are compressed, in such a case, in the exhibitors. For this reason, any study on teaching practice or on teacher education should establish beforehand at least a

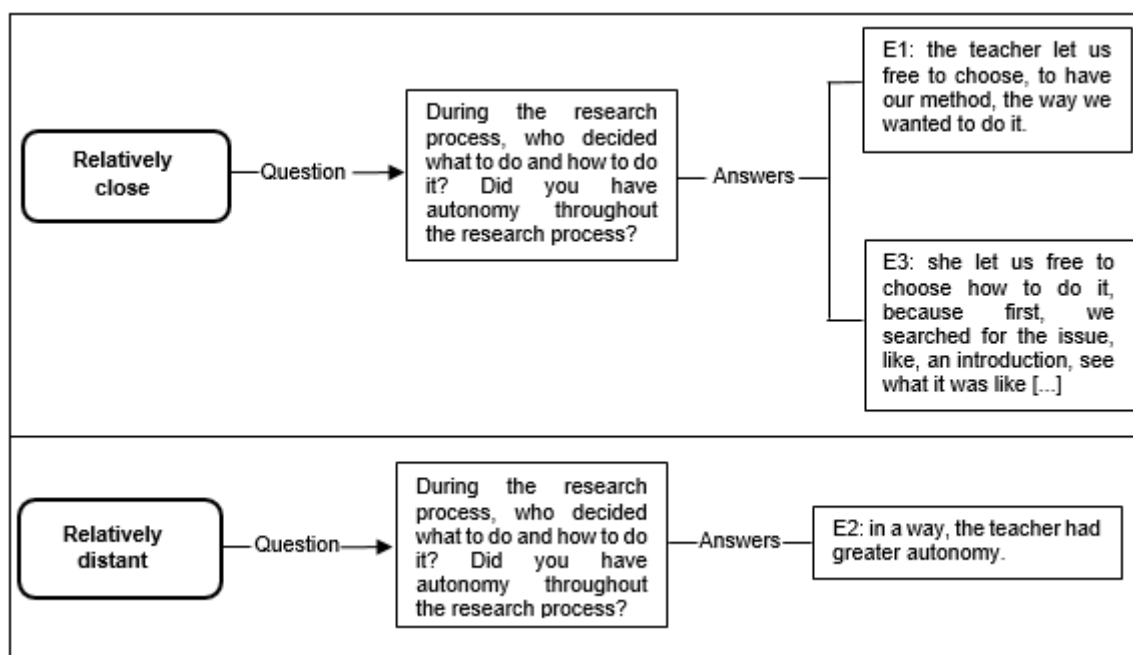


comprehensive contact about the nature that is the cause and the product to the same extent.

Initially, the two first questions of the interview were firmly linked to the discovery of the context in which the respective themes of the projects were considered. This context, in turn, would indicate to us — as it did — whether, on the one hand, students had a concern about some paradigm, until then veiled to them — to see in society a principle of order headed by mathematics; or, on the other hand, whether there was an invitation for researching by the guiding teacher, and, if it has, how it was presented to students. Since, for Alrø and Skovsmose (2010, p.29), this is an extremely important factor to start any investigation process, so the students “[...] become active drivers and participants of the investigation process.” Also because “this is a mutual process where the student, realising that he is no longer there to be corrected and punished, is bolder at the creation of hypotheses, conjectures, and new ways of thinking and communicating mathematics” (BRITTO *et al.*, 2017, p. 389).

Next, we elaborated questions that could reveal specific information about a possible pedagogical incorporation — events, within the mathematics teaching and learning process, that could establish direct links with the CME perspective advocated by Skovsmose (2007; 2008; 2010; 2014). Otherwise, we chose to follow paths that would take us forward with the plan of action of the projects and promptly put them into existence with the movements that are proper to that of mathematics in action. As a result, we categorise, as stated in the methodology, the different pedagogical dimensions defined for the execution of the project, or as relatively close to the dimensions conceived at the limit of mathematics in action; or as relatively far from this critical nature. It follows that proximity is built by the foundations of mathematics in action and CME's almost purifying ritualistic. Later, we have the following landscape (Figure 1):

Figure 1: Autonomy



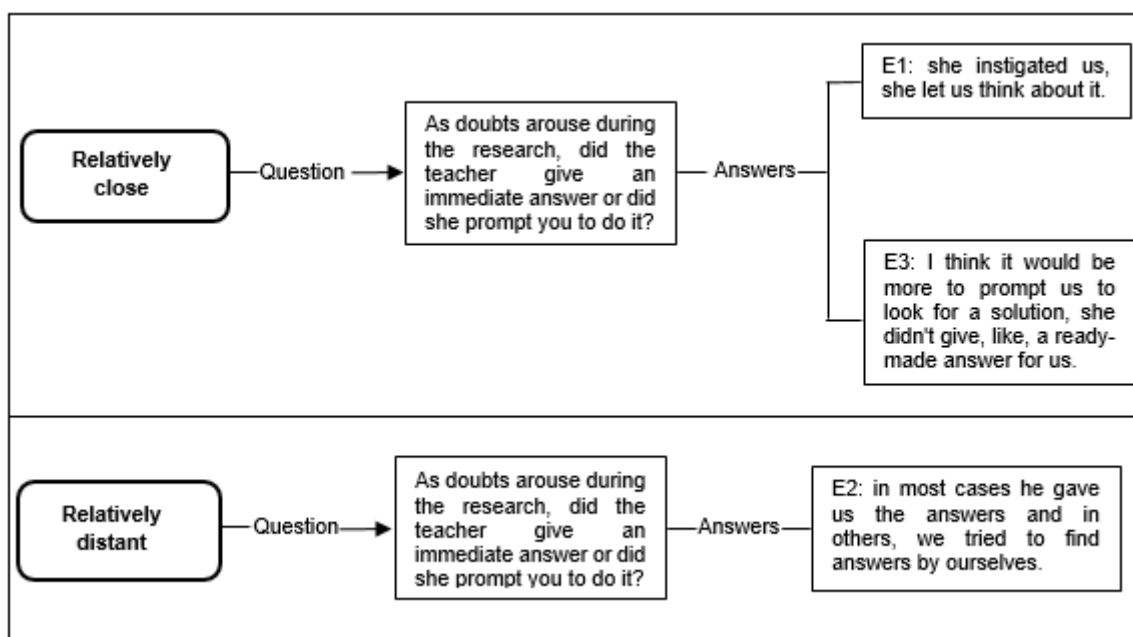
Source: Elaborated for the research

In the face of the figure, we can see that, in general, the exhibitors acted, in terms of the project, in their own jurisdiction. It means saying, on the one hand, that they had an elementary attribute of the critical spirits; and, on the other, that the result of the reflections managed by the project is but the multifaceted expression that, in turn, became directly biased almost entirely by the exhibitors. On the other hand, we observed that, in E2's context, its performance was apparently closed in a restricted access space — as opposed to the idea that the CME:

[...] advances beyond the development of cognitive abilities, seeking to focus on the preparation of critical and participatory subjects. Its objective is that mathematical knowledge can be used as instruments that contribute to the freedom and autonomy of the students, to the defence of the individual and collective interests of the subjects and to the effective understanding of their social, economic, political, and cultural reality. In short, that mathematical knowledge is an instrument of citizenship. (ROSEIRA, 2004, p. 2)

In view of this, during the interviews, we observed that there was a very clear division regarding two pedagogical provisions close to each other and a third with diametrically opposed tendencies regarding the other two. For example:

Figure 2: Watering or pruning?



Source: Elaborated for the research

We will analyse the above statements a little closer to reasonably reduce possible illusions that are proper to situations where the observer is too far away from his/her object. Having said that, let us consider the fact that we are dealing with a landscape where dialogue is highly exposed. Allowing us to know about the representation that both sides emanate. Thus, in the first two cases we can observe that there is the student's appreciation, since his questions are not treated by the teacher as a tense moment. In which the question itself is taken by an overwhelming desire to destroy curiosity — “the exercise of curiosity makes it more critically curious, more methodically ‘pursuer’ of its object. The more spontaneous curiosity intensifies, but above all, pursuing more ‘rigour’, the more epistemological it becomes” (FREIRE, 2018, p. 81-82).

In this sense, the teacher is usually attributed not simply the very denial of a knowledge that derives from spontaneity, but the recognition that there is, coupled to the centre and the edges of this spontaneity, a essence that binds to it and to the epistemology. Namely, curiosity itself. It is also necessary that within the dimension of the subject's conscience, the teacher, in the quality of a specific object, is supported by some principles: one to which the theory is able to say something about a world that is; and, also, on a practice that says something about the potential that lies in its reality. The maximum harmonisation of these measures is generally in favour, opposing the immobilization of those who, by definition, are always moving in the content of the knowledge of the sciences. And more, it is the rejection of the dogmatization of its practice that benefits the need to put the conditions arising from

it in a constant state of evaluation. Causing, in this context, the subversion of the student's denial.

Aligned to this, Freire (1972, p. 16-17 apud ENGUITA, 1993, p. 103), for example, believes that:

The humanist and liberating conception of education [...] never dichotomises the man of the world. Rather than denying it, it affirms it and is based on permanently changeable reality. [...] It stimulates human creativity. It has a critical view of knowledge; it knows that all knowledge is subject to historical-sociological constraints. [...] It recognizes that man is made to the extent that, in the process of his humanisation to his humanization, he can admire the world. It can, by breaking loose from him, to keep it in him and with him; and, having him as its goal, transform him. It knows that it is precisely because he can admire the world that man is a being of praxis or a being that is the praxis. It recognizes man as a historical being. [...] Instead of man-thing, adaptable, it fights for man-person, transformer of the world.

It is basically that, having some mobility that does not exclusively generate unfounded incidences in the world, i.e., all incidence must be considered, first and foremost, about the real conditions that bind it; second, what is perhaps the interactive dynamics of this incidence in the place where it has become necessary; and finally, to join a practice that establishes the subversion of the denial of the other, of the world and of itself.

In some of the speeches, in the first analysis, we observed the manifestation resulting from a teaching practice that puts the student in front of reality and more, of total impassivity in the face of the questions that interlink his object of study and the world in which he lives. In fact, this is a central point where the full functioning of mathematics is verified in action. Since the establishment of the awareness process through critical reflections permeates a strictly technological environment.

Another topic of outstanding relevance to the intensification of our discussion is the notion that the CME is predisposed in parts, to implement an assessment of the world or the elements of the world in such a way that it is committed to bringing together as many points of view on the same subject (in various ways), places mathematics fairs within a spectrum in which different themes are put into showcases to be looked at by multiple eyes — not simply as the communication of something, but also as the vent to overcome the limits of its own cradle. It means to say, from what has been exposed, that there is in fact a democratic principle at the base of the MF.

Finally, it was possible to learn from everything that has been said so far about the MF is that, despite its strong critical inclination, its democratic principle also

ensures the openness to divergent conceptions. Thus, “if an education is to develop critical competence, such competence cannot be imposed on students” (SKOVSMOSE, 2001, p.18). Therefore, the creation of educational possibilities that would transform not only students and teachers, but also the community as a whole, has been vigorously demonstrated. In other words,

Through dialogue, the teacher-of-the-students, and the students-of-the-teacher fade, giving place to a new term: a student-teacher with teachers-students. The teacher is no longer merely the one-who-teaches but someone who is also taught in dialogue with the students, who, in turn, while teaching, are also learning. They become jointly responsible for a process in which everyone grows (FREIRE, 1972a, p. 53 apud SKOVSMOSE, 2001, p.17).

The multilateral or simply horizontal dialogue is supported as the means by which the subjects, in their field of action, manifest their own representation not so that they overlap the others, but rather so that each of them, in total respect and admiration, can give rise to ever higher leaps toward collective growth.

### **Final considerations**

We believe that the investigation process must be taken entirely, rigorously, from facts and from the notion of mutability of things and from their multiple perspectives, above all, in the face of the same theme. Furthermore, this fluctuation in a serious investigation process is, as we saw here, within the CME and the MF. That is why we have had to pay attention to some specific conditions. As, for example, the discourse. However, the spread of the discourse can only reveal, in the first analysis, its very strong bias toward homogeneous things. That is why it was not possible in this work to say something precisely about the subjects in their specificities, but only about a symbolic set traversed by the discourse.

Thus, we confronted, in this research, a discourse that, in our opinion, in two of the three cases, presented trends regarding their operation regarding the CME. Going gradually, and increasingly deeper, within the CME — taking ownership of its principles and in its uncertain form, which moves constantly and brings to itself as many foundations as possible, such as an epistemology of distrust. Or rather, it established a direct link with a critical specificity: the criticism, contrary to what common sense venerates, is absolutely not opposed to natural, but rather ensures that some strategic aspects are not naturalised in order to be placed in an uncritical location, in which it disarms any kind of subversive and innovative action.

In short, all the discussions fostered in this work showed us that it is necessary to implement and strengthen, in the teacher education, the critical dimension founded



inside the MF. It also reveals, in this context, the cultural, social, historical, and technological implications embedded in a strictly critical ME.

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