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Transposing Problems: towards a decolonial based and (re)inventive Mathematics Education “doesn't go blank”

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Abstract: This article aims to theoretically discuss the practice of teaching mathematics under the order of structure and to take flights into comprehensive and propositional concepts related to the (dis)orders of invention. In other words, we will discuss (structured) Mathematics that assumes problem solving as a teaching methodology, as well as its conditioning in the face of a created, civilized and established “Humanity”. On the other hand, we will also seek to discuss and articulate possibilities of (re)inventing classroom practice and to give meaning to the conception of problem transposition as an action of the teacher who teaches mathematics (as a possibility of (re)invention) to go beyond the structure, in order to exercise/teach mathematics of decolonial bases, whose teaching is not established in fear or comfort, but evidences resistance, coherence, respect, social responsibility, political *hexis* and freedom as premises.

Keywords: Mathematics Education. Problem Solving. Decoloniality. Social Responsibility. Order of Structure.

Transponer problemas: para que una Educación Matemática de bases decoloniales y (re)inventiva “no se quede en blanco”

Resumen: Este artículo tiene como objetivo discutir teóricamente la práctica de la enseñanza de las matemáticas bajo el orden de la estructura y tomar vuelos hacia términos comprensivos y proposicionales relacionados con los (des)órdenes de la invención. En otras palabras, hablaremos de Matemáticas (estructuradas) que asumen la resolución de problemas como metodología de enseñanza, así como su condicionamiento frente a una “Humanidad” creada, civilizada y establecida. Por otro lado, también buscaremos discutir y articular posibilidades de (re)inventar la práctica de aula y dar sentido a la concepción de transposición de problemas como una acción de la/de/del profesora/profesore/profesor que enseña matemáticas (como posibilidad de (re-)invención) para ir más allá de la estructura, con el fin de ejercitar/enseñar matemáticas de base decolonial, cuya enseñanza no se asiente en el miedo o la comodidad, sino que evidencie resistencia, coherencia, respeto, responsabilidad social, política. hexis y libertad como premisas.

Palabras clave: Educación Matemática. Solución de Problemas. Decolonialidad. Responsabilidad Social. Orden de Estructura.

Transpondo Problemas: para que uma Educação Matemática de bases decoloniais e de (re)invenção “não passe em branco”

Resumo: Esse artigo tem por objetivo discutir teoricamente a prática de ensino de matemática sob a ordem da estrutura e alçar voos em termos compreensivos e propositivos relativos às (des)ordens de invenção. Em outras palavras, debateremos a Matemática (estruturada) que assume a resolução de problemas enquanto metodologia de ensino, assim como seus condicionamentos frente a uma "Humanidade" criada, civilizada e estabelecida. Em contrapartida, buscaremos também discutir e articular possibilidades de (re)inventar a prática de sala de aula e dar sentido à concepção de transposição de problemas como ação da/de/do professora/professorie/professor que ensina matemática (como possibilidade de (re)invenção); ir além da estrutura, de modo a exercer/ensinar matemáticas de bases decoloniais, as quais seu ensino não se estabelece no medo ou no conforto, mas evidencia a resistência, a coerência, o respeito, a responsabilidade social, a *héxis* política e a liberdade como premissas.

Palavras-chave: Educação Matemática. Resolução de Problemas. Decolonialidade. Responsabilidade Social. Ordem da Estrutura.

1 Starting the debate...

We begin this debate by dialoguing with the article by Giraldo and Roque (2021), which contrasts two conceptions of mathematics as a field of knowledge: what the authors refer to as *problematized mathematics* and what they refer to as *unproblematized mathematics*. The authors also discuss that these conceptions have repercussions in different ways of presenting mathematics as a curricular component in basic school and in university.

According to the authors, the concept of unproblematized mathematics, which we will refer to in this essay as *Mathematics* (with a capital letter), corresponds to the *order of the structure*, that is, its internal logical organization and its criteria of legitimation of truths that are conditioned and accepted today. Associated with this conception is a view according to which the teaching of mathematics should follow the same internal organization of the discipline, which seems to be quite widespread in professional teaching cultures and in curriculum policies related to the mathematics school subject in Brazil. For example, this view is manifested in the National Common Curricular Base — BNCC (Brazil, 2018) itself, which, through the establishment of a list of skills, continues to prescribe the fixed *a priori* "knowledge" that the school institution should or should not "transmit" to learners. Problematized mathematics, on the other hand, corresponds to the orders of invention that are referenced in the various paths of knowledge constitution, mobilized in culturally situated practices and that have historically manifested and manifest themselves in what we now identify as mathematics. In this text, we will refer to these practices as *mathematics* (with lower case letters and in plural).

Therefore, we seek to establish a criticism to what is conventionally performed as mathematics teaching and that is constituted, in our view, by practices that rigidly follow the order of the structure, are decontextualized from the problems that engender the ideals and that are not oriented to the production and mobilization of meanings by the subjects involved. In this article, we establish a parallel between the discussion presented in Rosa and Bicudo (2018), which identifies Mathematics (with a capital letter) and mathematics (with a lowercase letter), and the notions of order of structure and orders of (re)invention proposed by Giraldo and Roque (2021), in addition to proposing the (dis)orders and pluralizing practices.

In Rosa and Bicudo (2018, p.19), mathematics (in general) is identified "as a structured space of positions, whose properties depend on the their own positions in that space. These are political, social, cultural, religious positions... [...] the mathematical field puts into play definitions about what is good and bad mathematics [...]", in this case, the Mathematics identified with a capital letter is that considered as sovereign, Western Mathematics, legitimated as scientific Mathematics, which is structurally demonstrable and axiomatic. On the other hand, mathematics (with a lower case letter) do not correspond only to that which is disciplinarily institutionalized (although the importance of this is not disregarded), but also to a range of tasks that search for the meaning of what is being done, for knowledge that is prone to the new, to creation, to invention, to imagination, to revelation. Therefore, the origin, the ways of doing, the culture and the politics interfere in these mathematics.

Nevertheless, the capital letter that we put to identify Western scientific Mathematics, defined by the order of structure, does not indicate a evaluative distinction in terms of what is greater or lesser, but rather distinguishes an entity within a species or category, according to the very idea of proper noun in the portuguese language (Jovana, 2018). This distinction, in the case of mathematics, also makes up the power relation (im)posed throughout time, which we will treat in this study as valuing Modernity, structural thinking, the very order of structure as prescriptive methods to be followed to quantify, calculate, measure and solve problems. In this sense, in certain theoretical perspectives, Problem Solving is constituted as a methodology for teaching Mathematics that prescribes steps to be taken towards an answer that is already given *a priori* and, sometimes, assumes a character of "innovative" pedagogical practice that must be followed.

In this article, we will highlight the political dimension of the field of mathematics education as a region of inquiry and discursive and propositional practice of conflicts and clashes regarding the position of a historically Eurocentric, white, masculine, cis-heteronormative Mathematics. We present, on the other hand, the (re)invention, the imagination, the revelation, the dream of not only one, but of mathematics (in plural) possible to be (un)ordered and (re)invented. We will discuss the order of the structure as an oppressive practice and we will highlight the (un)orders of (re)invention as a problematizing alternative to the rigid and prescriptive structuring that, sometimes, is perpetuated in the schools themselves. We will discuss, then, the power relations historically built in front of conceptions of mathematics, humanity, progress, civilization, which are characterized as traces and effects of power relations that several authors have called *decoloniality* (e.g. Dussel, 1992). *Colonialism* is understood as the formal political and territorial domination of one nation over another, that is "a form of imposition of authority of one culture over another. It can happen in a forced way, with the use of military power or by other means such as language and art" (Araújo, 2022, n/p). Coloniality, on the other hand, as Maldonado Torres (2007) states, refers to the power relations that emerge from modern colonialism, but that survive it, manifesting in the ways in which "labor, knowledge, authority, and intersubjective relations manifest and articulate with each other" (Pinto, 2019, p. 26). For purposes of social and economic domination, coloniality naturalizes and imposes as "advanced" a single worldview, referenced in Eurocentric rationalities and cultures, and relegates all knowledges and bodies that are not aligned with this view, to a status of "primitive" and "savage". On the other hand, as Walsh (2017) proposes, alongside coloniality comes *decoloniality*, as permanent ways to make visible peoples, cultures, and knowledges subalternized by colonial oppressions, and to act from this visibility. Decoloniality refers, therefore, to positions, postures, horizons and projects of resistance, transgression, intervention and insurgency.

In contrast, we will highlight the problematization, the education through mathematics and the decolonial movements as sources of (re)invention. Thus, we move at the crossroads, going through imposing questions, positioning ourselves critically in relation to them and we incorporate the conception of problem transposition. Our movement focuses on ways of thinking mathematics as possibilities of tensioning colonial power relations, as practices of insubordination to what is (im)put in an unreflexively way as "natural", practices that do not follow any supposed normality, because they question the very idea of "normality" and, consequently, the intentionalities and the politics that emerge from this idea. Our ways of thinking do not accept naturalized truths and transpose the problem, tensioning colonial relations of being, knowing, power, and gender. Thus, it is up to us to discuss this order of normality, of what is naturalized, dialoguing about what we understand as orders of (re)invention.

2 The order of the structure — identifying a practice of oppressive naturalization

We start from a conventional view of Mathematics, which is revealed by Giraldo and Roque (2021, p. 2):

> Mathematics is socially recognized today as the science of logic, accuracy and certainty per excellence. Mathematical knowledge would then be characterized by the perfection of structure and the correctness of results. Such a view is common both among mathematicians and people who directly use mathematics in their professional activities, and among those for whom mathematics is merely a useful (and more or less accessible) tool for practical activities.

In this sense, the socially recognized structure facing what would characterize mathematical knowledge makes up the idea of what Williams (2015, p. 237, author's emphasis) calls our attention to for the meaning of the word:

> **Structure**, with its associated words, is a key term in modern thought, and in many of its recent developments it is especially complex. The word is from fw structure, F, structura, L, rw struere, L — build. In its earliest English uses, from C15, **structure** was primarily a noun of process: the action of building. The word was notably developed in C17, in two main directions: (i) towards the whole product of building, as still in 'a wooden structure'; (ii) towards the manner of construction, not only in buildings but in extended and figurative applications. Most modern developments follow from (ii), but there is a persistent ambiguity in the relations between these and what are really extended and figurative applications of (i). The particular sense that became important as an aspect of (ii) is that of 'the mutual relation of constituent parts or elements of a whole as defining its particular nature'. This is clearly an extension of the sense of a method of building, but it is characteristic that it carries a strong sense of internal structure, even while **structure** is still important to describe the whole construction.

In this perspective, to glimpse the order of the structure is to understand that Mathematics continuously seeks to sanction rules based on logic, organizing and chaining axioms, definitions, theorems, and demonstrations as a way to construct Mathematics itself as a final product. In the same way, since this organization and chaining are the only way to produce mathematics, even other ways that may eventually exist can only be recognized as Mathematics, the "true mathematics," if they fit into this form of production. As Giraldo and Roque (2021) warn, the unproblematized view in mathematics teaching situates the error as a mark of lack in relation to a fixed *a priori* knowledge. That is, if there is an error, the alert of correction is automatically triggered, for the sake of preserving the path toward the results. Thus, the more error-free, the more adequate are the learning processes, since they conform to the order of the structure. The correct organization and chaining, described by the mathematical constraints, demonstrate the structure of the internal relations and, consequently, their precise results. Both (organization and chaining) are constituents of this exact, ready and finished Mathematics.

This structural idealization of mathematics, which, in our view, defines it as "Mathematics" (with a capital letter), is a prevailing achievement of modern Western civilization, sustained in a historical narrative that idealizes Europe, in particular Greek antiquity, as the cradle of science and disqualifies practices from other peoples and cultures, which are not seen as mathematics per se for not adequately presenting this structure (Giraldo & Roque, 2021). Thus, through structuring lenses, such practices are relegated to a status of primitive versions of what contemporary Mathematics assumes. From this perspective, these practices should converge to this Mathematics in a linear and universal evolutionary process. Thus, the order of structure in mathematics, as in other so-called "exact" sciences, is established as a form of differentiation in the sense of hierarchization. Structure as a way of understanding the construction of something assumes an intimate character of that which is, that is, in this way, the structure of a gorilla and that of a human being is what differentiates them, separating them, hierarchizing them. The distinct structures establish mutual relations of constituent parts of a whole, particularly, emphasizing the identification of the arrangement and mutual relations of elements of a complex unit, which can help to understand the distinction itself. However, the distinction itself becomes under value judgment, as it considers, for behavioral reasons, the gorilla as an inferior being.

The order of structure, also in languages, especially in the case of the languages of the original peoples of America, was imposed, so that, with the invasions (called "discoveries"), to study each language, Europeans decided "to discard presuppositions and assimilations drawn from historical and comparative studies of Indo-European languages, and to study each language 'from the inside' or, as it was later put, structurally" (Williams, 2015, p. 238, author's emphasis). In linguistic terms, the structural study of the language of indigenous peoples was preferred because it emphasized a particular organization of relations. However, this approach disregarded the fact that what was being studied were not merely analytical descriptions of how a house is built or the structural elements of any civil construction, but of living processes.

In this sense, Mathematics is also unconcerned with living processes, because its delimitation to the order of structure, through its writing, disconnects it from its contexts and the people who produce it, disregarding their cultures, subjectivities, desires and affections. According to Giraldo and Roque (2021, p. 4):

> More than that, the common view of mathematics as a field of logic and certainty produces a confused image, according to which characteristics attributed to mathematics itself as a science are tacitly associated also with the social and subjective processes of production and diffusion of mathematical knowledge. This image reverberates, in particular, in conceptions about how mathematics is learned and how it should be taught at school and university, and, at the same time, it is crystallized and perpetuated by pedagogical practices based on these conceptions.

That is, also according to Skovsmose (2000), there are researches that reveal that the teaching of mathematics follows a model in which the teacher, at first, presents some ideas and mathematical techniques and, then their students work with exercises selected by them. Obviously, there are variations in this pattern, so that the teacher spends the most time with their exposition and the student spends the most time solving the exercises, which, many times, come from textbooks, developed by an author or by a group of recognized authors, but external to the classroom environment. Thus, Skovsmose (2000) defines this process as the exercise paradigm, which has as its central premise the existence of one, and only one, correct answer. In our interpretation, this perspective fits into the order of structure, since its meaning is not that of a procedure or set of procedures, but of a fixed and reproductive explanatory system that leads to a fixed *a priori* answer. Skovsmose (2000) continues his exposition dealing with the exercise paradigm versus the landscapes for investigation, both of which can be related to three distinct types of reference: pure Mathematics (*per se*), semi-reality, and reality. For the order of the structure, in our view, it is important to note that the exercise paradigm either involves structured exercises from the mathematical field itself (*Mathematics per se*), or it is intended to solve what they call "problems", which are said to be "real", but which have only the function of a supposed contextualization (semi-reality), or it only stops at the mathematical calculation to be solved, but from legitimate data coming from an everyday situation.

The citation of the exercise paradigm in all its references (pure Mathematics *per se*, semi-reality, as well as exercises or "problems" with data from reality), specifically, refers us to a methodological proposal that, in our interpretation, is inherently conditioned to the order of structure. In all three references, problem solving aims at structuring historically established mathematical knowledge. According to Giraldo and Roque (2021, p.4), in the unproblematic conception of mathematics, in which the order of structure predominates, "'knowing mathematics' means knowing and being able to reproduce the logical steps of the sequence of definitions, theorems, and demonstrations. According to such a conception, 'learning mathematics' would then be to become progressively more able to reproduce these steps".

Nevertheless, the structure of what Onuchic (2013, p. 101) calls the "Methodology of Teaching-Learning-Assessment of Mathematics through Problem Solving" resumes, to a large extent, this conception of teaching and learning of something already structured - and not something that is constituted in the very act of learning. That is, in essence, teaching and learning correspond to accessing mathematical knowledge that has already been consolidated and formalized historically. This perspective can be observed, first, when the author systematizes the defended methodology and, second, in certain actions that allegedly should occur progressively, whose structure makes explicit its focus on knowledge already produced, taken as mathematical content. Onuchic (2013, p.102-103) presents nine steps to be followed by the teacher in the methodology presented, namely: 1) Preparation of the problem; 2) Individual reading (by the student); 3) Reading together (form groups of students); 4) Solving the problem; 5) Observing and encouraging (the resolution); 6) Recording the resolutions on the blackboard; 7) Plenary (public debate); 8) Search for consensus; and 9) Formalization of the content. In addition to the structuring of the methodology itself under a sequence of "steps" or phases, we also draw attention to some specific steps that have objectives that, in our view, explicitly refer to the order of the structure. For example, the author states that step 1, "Preparation of the problem", corresponds to "Select a problem with a view to constructing a new concept, principle or procedure. This problem will be called the generator problem. It is good to emphasize that the mathematical content necessary to solve the proposed problem has not yet been worked in the classroom" (Onuchic, 2013, p. 102). The selection of what to call a problem with the goal of building a new concept, principle, or procedure stops at the Mathematics *per se.* Reinforcing this aspect, the action of searching for a mathematical content that has not yet been worked on in the classroom reveals that the focus is on the content itself and not on the meanings and other understandings that the problem may produce. Also, in step

4, "Solving the problem" Onuchic (2013, p.102) expresses the following orientation:

> [...] In possession of the problem, with no doubts about the statement, the students, in their groups, in a cooperative and collaborative work, try to solve it. Considering the students as co-constructors of the "new mathematics" that one wants to approach, the problem generator is the one that, throughout its resolution, will lead the students in the construction of the content planned by the teacher for that class.

Once again, the resolution of the problem matches the goal of building "new mathematics" and the problem itself is the one that will lead to the construction of the previously planned content. That is, building the content systematically keeps the same original idea of what historically constituted the meaning of structure. In addition, step 5, "observing and encouraging ", points to the need for the teacher to follow the explorations of the group of students, helping, when necessary, to solve the secondary problems that appear, because it is necessary to pay attention to notation, passage from vernacular language to mathematical language, related concepts and operation techniques in order to enable the continuing work. There is also the recommendation that the solutions that are made, regardless of being right, wrong, or made by different processes, should be presented for the whole class to analyze and discuss. In this way, the methodology explicitly provides for attention to unwanted complications that may arise, which must be eliminated in order to meet the objectives set for the class. These complications include notation, mathematical language, operational techniques, wrong and non-formal or usual resolutions that can hinder the acquisition of the mathematical knowledge which is the one that must be learned.

Moreover, step 9 deals with the formalization of the content, whose moment is called with this same nomenclature: "formalization". This moment, according to the author, is when the teacher records on the blackboard a "formal" presentation, organized and structured in mathematical language of the content, standardizing with mathematics the concepts, principles and procedures built by solving the problem. In this way, the teacher needs to highlight the various operative techniques and the demonstrations of qualified properties on the subject (Onuchic, 2013). We understand that this step, explicitly, expresses its attachment to the order of the structure, since the assumption of the full need for definitions, demonstrations, technical analysis at the operative level is enacted, in order to reach the substance itself. Under the aegis of a way of thinking in which only structures, codes, models, and paradigms assume qualified analytical importance, by implicitly or explicitly reducing all admissible processes to mathematical learning, categorization is imposed as a methodology that has content as its end — even disregarding, most of the time, the intentions, desires, wills, experiences of the subjects, which are reduced to formal and abstract relations (structural relations in the strict sense), not only in its analysis, but in its effective practice. Thus, from this perspective, the structural characteristic of the terms should, at the very least, be made conscious, as well as all their effects. For us, the structuring of the methodology of "teaching-learning-assessment through problem solving" refers to the conception of problem that

> corresponds to common sense meanings (used even in institutionalized educational spaces and times), which refer to a negative sense of something inconvenient, that hinders us in some way and that needs to be solved, or of some lack of knowledge that needs to be overcome. [...] we refer to a sense of problem as a specific type of task or exercise used in mathematics teaching (e.g., "fixing problems"), or even defining a teaching methodology (e.g., "teaching by problem solving") (Giraldo & Roque, 2021, p. 9).

The problem is put as a means to get to the mathematical content, that is, in the sense of Skovsmose (2000), has sometimes only the function of a supposed contextualization (semi-reality or reality), because the reflection on the "context" itself has no relevance in itself, but only as an artifice to get to the mathematical content. For us, this allows us to say that this process is given "to the proposition of artificial approaches, which can further alienate learners from the ideas discussed" (Giraldo & Roque, 2021, p. 5). That is, the problem implies, in this case, the obtaining of a solution and it is "through" the search for this referenced solution — which exists *a priori*, although it is not known yet — that the mathematical content can be evidenced, structured, reproduced and learned.

There is in the order of the structure, which can be appreciated in all disciplines (also inserted in a curricular structure), the organization of contents, the classification and categorization, the hierarchization of definitions, the fixed (and sometimes ghostly) establishment of a referent, which defines right and wrong, normal and abnormal or non-normal, natural and artificial (unnatural, factitious, anomalous, atypical, special, exceptional, unaccustomed, uncommon, unusual, irregular, strange). In this sense, we still understand the centrality for scientific thought to organize itself (in schemes, in taxonomies), breaking down the thinking into parts of a whole. We also recognize the importance of this way of thinking, especially in mathematics. However, our criticism is directed towards a way of thinking that categorizes itself in the face of a power relation, not admitting what escapes from the established order; not admitting what is understood as "error", as a deviation from the unique path towards a fixed *a priori* knowledge; classifying the subjects through this structural thinking, not as a form of understanding, but mainly as a hierarchization to a stigma of "being", as superior or inferior. As an example of this, Giraldo (2018, p. 10) already reveals to us that "mathematics is historically produced by the 'isolated inspiration of innate geniuses'" and this makes "its understanding only [...] [be] accessible to people with 'innate talent'. That is, in an ordering of right and wrong, those who are not born with 'mathematical talent' will never be considered "good" at Mathematics.

Closely linked to the idea of classification, definition, and framing, we highlight whiteness as a pathological psychosocial perception of "being white", based on the invention, by the white man himself, of the category "race" as a way of hierarchizing bodies. Thus, whiteness is based on the establishment of a standard of "normality" and the disqualification of that which diverges from it — as is the case of unproblematized Mathematics, which carries with it the mathematical truth, the "right", what is "normal" to know, the "correct" lenses through which to read and write the world. Whiteness, historically constituted, is not perceived, or assumed and, many times, "goes unnoticed" or is even denied. However, "this lack of attention to whiteness leaves it invisible and neutral in documenting mathematics as a racialized space. Racial ideologies, however, shape the expectations, interactions, and kinds of mathematics that students experience" (Battey&Leyva, 2016, p. 49). This means that the Mathematics that is taught in school is "white" — a "white Mathematics", presented as coming from the theoretical formulation of peoples of European origin — and reinforces the symbolic power (Bourdieu, 1989)[1] attributed to white men, when it is presented from a conventional historical narrative, from which and according to which the origin of theorems, the construction of Mathematics as a field and as a human achievement is fundamentally a consequence of the work of these white men. In this historical narrative, the contributions of non-European peoples and cultures — African, Arab, Oriental — are invisibilized, little

[1] "Symbolic power is, in effect, that invisible power which can only be exercised with the complicity of those who do not want to know that they are subjected to it or even that they exercise it." (Bourdieu, 1989, p. 7-8).

highlighted. Thus, the intention of subjugation of what is "naturally" and structurally not given importance or value is evidenced, as an act that passed unnoticed, that "went blank", a "neutral" act. In this direction, Powell (2002, p. 4) points out:

> [...] the mathematics presented in extant mathematical papyri from ancient Egypt most probably has preserved the mathematical ideas of an African elite. Nevertheless, mainstream, Eurocentric historians of mathematics have largely discounted these ideas. [...] the importance of Africa's contribution to mathematics and the central role of that contribution to the mathematics studied in schools have not received the attention and understanding that befit them. As an example, documentary evidence of insightful and critical algebraic ideas developed in ancient Egypt exists, but little of this information has been made available to students studying mathematics, at any level.

The fact that mathematics curricula generally do not highlight the achievements of African people makes mathematics subjectively perceived by students (black, white etc.) as a legitimately and exclusively white intellectual and cultural achievement. Moreover, "Mathematics" is commonly identified as a "difficult discipline", "accessible to the few", who would be endowed with a supposed "innate talent". The combination of these two aspects, together with the structural racism that shapes social and subjective relations in Brazil, produces a racial bias in the idea of mathematical talent, that is, an idealized image of the "good student" of mathematics as a white man, increasing the symbolic power (Bourdieu, 1989) over mathematics and over the intrinsic logic that subtracts African and Afro-diasporic cultures from this evaluative load.

Thus, the fact that the order of the structure is also the basis of the constitution of curricula, organizing and defining what should and should not be taught in the mathematics classroom, makes the Mathematics school subject an instrument of coloniality. Case in point,

> the coloniality of knowledge seen from a therapeutic-deconstructionist viewpoint manifests itself as the effect of a process of epistemological domination based on the hegemony of the European conception of knowledge, seen as the "rational subject". This epistemic *totalitarianism*, or such a unilateral diet of an image of knowledge, *denied, and still denies, other ways of knowing different from those in conformity with such hegemonic conception of knowledge, which permeates several disciplinary fields organized both in universities and in modern schooling systems, among which we find Mathematics* (Tamayo-Osorio, 2017, p.46, emphasis added).

Consequently, this manifestation of the coloniality of knowledge generates, in our view, social oppression. As Kivel (2017, p.282) reveals, for example:

> Our curricula also omit the history of white colonialism as colonialism, and they don't address racism and other forms of exploitation. People of color are marginally represented as token individuals who achieved great things despite adversity rather than as members of communities of resistance. The enormous contributions people of color have made to our society are simply not mentioned. For example, Arab contributions to mathematics, astronomy, geology, mineralogy, botany, and natural history are seldom attributed to them. The Arabic numbering system, which replaced the cumbersome and limited Roman numeral system — along with trigonometry and algebra, which serve as cornerstones of modern mathematics — were all contributions from Muslim societies. As a result, young people of color do not see themselves at the center of history and culture. They do not see themselves as active participants in

creating this society.

The fact that black, brown, and indigenous children and youth do not see themselves[2] at the center of history and culture, due to the absence of African, Afro-diasporic, and indigenous cultures in the curricula, characterizes school mathematics as a terrain of oppression.

Thus, for example, to abdicate to black students their legitimate representation in the history of culture and science and, in particular, of the constructed mathematical knowledge, is to impose on them the burden of absence; it is to compress them into a subalternized social position; it is to dominate for themselves the power of knowledge, practicing symbolic violence against that ethnic group relegated to a primitive and even dehumanized status. This discrimination, this dehumanization are structural, but according to Freire (2001, p.18):

> It is not the discriminated culture that generates the discriminatory ideology, but the hegemonic culture that does it. The discriminated culture generates the ideology of resistance which, according to its experience of struggle, sometimes explains forms of behavior that are more or less peaceful, sometimes rebellious, more or less indiscriminately violent, sometimes critically aimed at recreating the world. An important point to be underlined: insofar as the relations between these ideologies are dialectical, they interpenetrate. They do not exist in a pure state and can change from person to person. For example, I can be a man, as I am, and not be chauvinist. I can be black, but in defense of my economic interests, I can contemporize white discrimination.

The various forms of epistemicides, which correspond to the erasure of knowledge associated with a people or social group, as well as the various forms of structural discrimination, such as racism, xenophobia, misogyny, homophobia, and transphobia, are characterized by transcending the realm of individual actions, impregnating power structures and social and intersubjective relationships, and thus constituting aspects that sustain the very foundations of Brazilian society. In particular, this enables the creation of an environment conducive to the intention of legal, ethical, political, and social responsibility of those who practice acts of discrimination. Thus, marginalized and dehumanized people are conceived as members of the social system shrouded by structural discrimination as a form of power, which excels in terms of identifying one group over another. Freire (1987, p.16, author's emphasis), further points out:

> Dehumanization, which does not only occur in those who have their humanity stolen from them, but also, although in a different way, in those who steal it, is a distortion of the vocation of being more. It is a possible distortion in history, but not a historical vocation. In fact, if we were to admit that dehumanization is the historical vocation of men, we would have nothing else to do but to adopt a cynical attitude or one of total despair. The struggle for humanization, for free work, for de-alienation, for the affirmation of [...] [human beings] as people, as "beings for themselves", would be meaningless. This is only possible because dehumanization, even if a concrete fact in history, is not, however, a **given destiny,** but the result of an unjust "order" that

[2] From this point in the text, because we envision a walk towards what we understand to respect, consider, and value all human beings in a perspective of (re)invention, we position ourselves politically and also consider all the neutral gender of language, according to Cassiano (2019), in our writing.

> generates the violence of the oppressors to this, the **beingless.**

Therefore, we take a contrary and insurgent position towards mathematics teaching models in which pedagogical approaches seek to imitate the order of the structure. We oppose pedagogical approaches that are guided by the "error" as a mark of deficiency of the subject, as a hierarchizing parameter of bodies and, thus, we oppose a mathematics teaching that produces oppression and coloniality. Moreover, if we understand that the notion of "innate talent" in mathematics is biased by the structural racism that is at the base of Brazilian societies, we can realize that the "error" as a mark of deficiency is an instrument of dehumanization of bodies that contributes to the maintenance of subalternized groups susceptible to social and economic exploitation — similarly to the view of nature, as "resources" to be exploited (as denounced by Krenak, 2019). We verbalize, then, our political, epistemological, and also pedagogical position of struggle and resistance against the models of mathematics teaching that hierarchize and disqualify students based on their supposed marks of innate disability — as if the social positions to be occupied by the subjects were marked in their ethnic and social origin.

We understand that the classroom often reflects the structure of oppression, of power relations (oppressor *versus* oppressed, even without the perception of the people involved, sometimes) and places assessment in a central role in teaching. Grades or concepts are generally and sexist determinants of the "good student," especially of the "bad student" in mathematics. Nevertheless, the "error" is the referent of judgment of the degree of appropriation or not of the content, which is the product to be conquered and reproduced. Even though the error, in many educational/pedagogical strands, has already been ressignified, empirically, we observe the occurrence of the error as a judgment in different school practices of Mathematics.

This structure, then, does not take into account mathematical thinking itself, the plurality of ways of relating, comparing, ordering, locating, measuring, and so many other actions that constitute this thinking. It does not take into consideration that the center of education are people — and not a commitment to content. It does not consider the social contexts of the school, the slum that is in a gunfight and the school in the middle of bullets, the hunger and social vulnerability of the students, among many other aspects — because, in this perspective, what matters is "knowing the content". There is a fallacy that the more content, the better it will be and the teacher, because they need to know the content in order to transmit it, because that is what will solve "society's problems". The teacher is considered "competent" when they appropriate and supposedly manage to "transfer the content."

We understand the need to change this picture that has been historically perpetuated in a perspective anchored in modernity. Thus, we will discuss another pole, which is contrary to this reality. In our view, it is possible and needs to be the pole that guides the mathematics classroom. Like Giraldo and Roque (2021), we are also in favor of (re)invention orders, but we go further, because we do not want, as an order, to replace one rule for another rule to be followed. Thus, in this text, to be understood and at the same time to give freedom of criticism and revolution, we defend the (un)orders of (re)invention for a problematizing mathematics.

3 The (un)orders of (re)invention — for problematizing mathematics

We begin this section by stating what Giraldo and Roque (2021, p. 3) state:

> From the perspective of the orders of invention, the conventional writing and

> exposition of mathematics appear to be backwards. Axioms and definitions, which in the order of structure precede theorems, are in fact conditions that guarantee the validity of certain results, and which have generally been understood and formulated last, from explorations around the results themselves. In this sense, axioms and definitions are born from processes of invention that seek to encapsulate and formally organize ideas (in general, already familiar in some sense) and that contain an intentionality to express conditions that make possible the formal validity of these ideas.

In this sense, we call attention to the processes of invention, because they are the ones that lead to the formalization of Mathematics that today is presented in the order of the structure. The question here, then, concerns the inversion of the valuation of processes, that is, the order of the structure values definitions that are (im)put as an *a priori* category — as guiding principles of the mathematical doing itself. Thus, we put ourselves in a movement that consists in questioning which epistemological positions on mathematics, on mathematical knowledge and on the teaching of mathematics itself we assume (Giraldo & Roque, 2021). We refer to a social-political stance by which we mobilize our notions of research and teaching *praxis*. This stance is defined by invention, decoloniality, social responsibility (Rosa, 2022b) and political *hexis* (Rosa, 2022a) in mathematics education.

The invention, as stated in the philosophy dictionary Abbagnano (2007), comes from the verb to invent, which differs from discovery, because what is discovered is admittedly already pre-existent, although not known. For example, America before Columbus, that is, America in the sense defined in the dictionary, was *discovered* by Columbus and not *invented* by him, because it already existed. It is fitting, then, to question the idea of discovery presented here, for it is a "discovery for whom?" America as it is presented, was discovered, that is, a territory that was already inhabited, that already existed, but of which no one was aware, was discovered for the Europeans who were unaware of its existence. However, for the native peoples who lived in America, was this land discovered? Or was it the renaming of a territory, the expropriation of their spirits, therefore, *the invention of another territory*, by foreigners who sought to erase the ways of being in the world of those who had lived here before? That is, America (the territory) discovered (adjective) (Rosa, 2023). This shows that the very definition of invention, dealt with in a philosophy dictionary authored by a European, makes reference to the distinction between invention and discovery. However, decoloniality engages us in movements of struggle for the retaking of the expropriated land, its knowledge, spirits and ways of being in the world, movements of *(re)invention of the territory* — that will never allow us to reconstitute what was here before, nor erase the enslavements and genocides that constitute the invention of America, but that point us to ways to build, over the marks of colonial violence, other senses of life, to (re)exist, (re)invent.

In this sense, "To invent, then, is not to discover something existing, it is to create, it is to intentionally produce new meaning, different, diverse from what was previously possessed, defined" (Rosa, 2023). In this way, to create and create again (recreate, reinvent) is what we aim at for the teaching of mathematics, it is to give and produce meaning to it, in different ways, under different perspectives. According to Rosa (2023):

> [...] we discuss here the importance of inventing or reinventing and not simply discovering what is (im)posed as professional development in teaching. This invention deals with the daily problems in the classroom, which take on different aspects every day, in the various fields of teaching, that is, in the various dimensions of formation/action, the action of formation, which is continuous. We need, then, to start from our gaze as teacher, we need to debate collaboratively, in order to constantly

> invent and reinvent our process of acting and reacting in our practice, because by no means, through a colonizing heritage, will we discredit the teacher.

We say this because the school, the curriculum, the people responsible for the students, the school administration, the University, are conditioned by the historical structure of the production of knowledge. There is an insistence on discovering what has already been established, reproducing historically constituted and structured knowledge, mainly or fundamentally, by Europe. In this sense, right and wrong, good and bad, what belongs and what doesn't, the exclusion/inclusion of a group, field, or area, are conditioning factors for this structuring form of knowledge production, said to be the assimilation of knowledge. In this repertoire, the construction of the idea of humanity was also conditioned to the order of structure. According to Krenak (2019, p.12),

> how is it that, over the last 2 or 3 thousand years, we have constructed the idea of humanity? Is it not at the basis of many of the wrong choices we have made, justifying the use of violence? The idea that white Europeans could colonize the rest of the world was based on the premise that there was an enlightened humanity that needed to go out to meet the darkened humanity, bringing it into this incredible light. This call into the bosom of civilization has always been justified by the notion that there is a way of being here on earth, a certain truth, or a conception of truth, that has guided many of the choices made in different periods of history.

Enlightened humanity and obscured humanity, respectively, are posited by the distinction established by a structure that imposes a power relationship and (im)poses right and wrong. For us, humanity is configured by the various ways of being human, regardless of creed, race, ethnicity, gender, age, social condition, or sexuality. However, there is a "Humanity" (intentionally written with capital letters, that is, defined by the power of the order of the structure) that claims to be superior and is presented to us because of what is defined as "enlightened".

In this way, once again, orders are (im)posed, created, fixed. That is, they form relations between two or more objects that are expressed through rules. However, rules can be changed, claimed, reestablished, disobeyed, contested. Therefore, it is up to us to tense this order in order to question, in order to question that which obeys only one version of history, that is reduced to a dominant (im)position. It is up to us to dialogue about the (un)orders of invention, which can decolonize the structure. Thus, the questioning, the questioning, the criticism are paths to the (un)orders of creation and, in this sense, according to Krenak (2019, p. 13) it is very important

> to evaluate the guarantees given by joining this club of humanity. And I kept thinking: "Why do we insist so much and for so long on being part of this club, which most of the time only limits our capacity for invention, creation, existence and freedom?". Could it be that we are not always updating that old disposition of ours for voluntary servitude?

Do we not remain colonized? Why do we keep ourselves in this condition? According to Matos and Giraldo (2021, p. 878-879),

> how could we leave elementary school students out of this discussion for so long? Why weren't they present in our research if we were thinking, all the time, about who

> would train them, educate them through mathematics(s)[3]? It is necessary that your words go beyond the school walls, that they stop being silenced and are heard by more people. We don't need to speak for you, your words have strength!

How can we conceive, yet, models of initial and continued education that do not expose mathematics teachers to this discussion during their "teaching enculturation" (Rosa, 2023)? Thus, we do not want to and will not leave it, for, our writing and reverberation movement shows itself through political, social, struggle and resistance crossroads, evidencing epistemologies coming from minorities, grounding their pains, anguishes and aversions, but also joys, affections and meanings through mathematics, in order to listen and propagate their voices, echoing as loud as possible their cries for freedom. We propose a decolonial movement, or decoloniality, because,

> the decolonial — and decoloniality — are not new approaches or theoretical-abstract categories. They were, from colonialization and enslavement, the axes of struggle of the peoples subjected to this structural violence, assumed as an attitude, project and position — political, social and epistemic — before (and despite) the structures, institutions and relations of their subjugation. In fact, its genealogy begins, but does not end there (Walsh, 2008, p. 135).

Thus, we are guided by this movement, which cannot and will not end there, because we are aligned with Freire (2000, p. 21) in the position that "The critical reading of the world is a pedagogical-political action that can be identified with the political-pedagogical action, that is, the political action that involves the organization of groups and popular classes to intervene in the reinvention of society. In this perspective, our (re)invention seeks to rebel against the traces and effects of coloniality, as we listen:

> From Janaína, an affirmative message: *"My song is brave and strong, but it is a hymn of peace and love!* She points us to paths that echo Walsh's *decolonial pedagogy* (2008), "a praxis based on a propositional educational insurgency — therefore, not only a denunciatory one — in which the term insurgency represents the creation [...] of new social, political, cultural, and thought conditions" (OLIVEIRA; CANDAU, 2010, p. 28). Thus, challenging the structures and institutions is part of the decolonial and the search for other pedagogies (Matos & Giraldo, 2021, p. 884, author's emphasis).

These pedagogies and others, also, refer to mathematics, its understandings, the value attributed to it, its epistemologies, its teachings, or rather, its education, the bodies that perform this education and these epistemologies. Therefore, the shift of epistemological perspectives of mathematical knowledge can occur through the initiatives of teachers. However, even with these initiatives, practices may remain being reproduced with the same logic of the structuring

[3] "The word "mathematics", in the singular, is often associated with a single body of knowledge that is unchanging, evolutionary, and constituted from the scientific productions of mathematical researchers. The option for the term "mathematics(s)", in the plural, demarcates a political position that opposes this single - and Eurocentric - history of knowledge, indicating our recognition of the dynamism and diversity of the historical and social processes that go through the production of mathematical knowledge. Moreover, the option for the use of parentheses in this construction aims to highlight a permanent tension between the imposition of single epistemologies and the (re)existence of plural knowledges - in line with the position outlined by Walsh (2013), with the use of the term decoloniality (instead of discoloniality), that there is no neutral state of coloniality, as if it were possible to move from a colonial regime to one free of its traces and effects. Therefore, the option for this term expresses our political option for permanent movements of struggle, resistance and insurgency" (Matos & Giraldo, 2021, p.878-879 - footnote).

"Mathematics" (Giraldo & Roque, 2021).

However, even transformations in pedagogical practices may not produce any shift in the epistemological bias of mathematics education that places the content, the structure, the demonstration itself as final goals and that, thus, maintains the symbolic value of Eurocentric Mathematics, ready, finished, defining what is right and what is wrong. Thus, our movement is for a mathematics education guided by a political and epistemological position according to which teachers do not place themselves in a role of reproducers of culturally constructed and well-defined practices (for example, the idea that without exercises one does not learn mathematics). Our movement advocates that teachers are not merely passive transmitters of a pre-established Mathematics, but that, as Davis&Simmt (2006) advocate, they become agents of transformation in the (re)invention of mathematical possibilities, acting in the valorization of cultural mathematics, that is, not only in the presentation of formal Mathematics, but in the mobilization of a diversity of decolonial practices, of cognitive estrangement and situated learning (Giraldo & Roque, 2021).

This movement, then, does not act only through an *educate(-self) mathematically*, under the understanding of mathematics as a tool, as language, as a research field, in which one studies techniques, structures, demonstrations of the mathematical knowledge already produced; but, above all, through an *educate(-self) by mathematics*, which refers to a perspective for what is learned and that allows each one to produce senses in their collective humanitarian and non-excluding (Rosa, 2008, 2018, 2022), in which mathematics are understood as life processes.

Thus, we understand that both problem solving and problem proposition and teaching methodologies can fall into the same epistemological and educational bias of Mathematics referenced by the order of the structure, since, "the problem is proposed at the beginning of class activities, as a starting point in the introduction of a new concept or content, being the vehicle whose resolution the student will learn Mathematics" (Possamai & Allevato, 2021, p. 4) and/or the problem is thought with a purpose, since, "problem proposition also offers contributions for students: it promotes conceptual understanding and the development of the ability to reason and communicate mathematically; it increases interest in mathematics" (Possamai & Allevato, 2021, p. 5). Although there is a version of the exposition of the problem, or the way to propose it in each case, both objectives can remain in the search for the content ready *a priori*.

For us, then, to (re)invent these understandings and practices, it is necessary to assume the displacement of epistemological and educational perspectives of mathematical knowledge as a premise, understanding that there is no known point (mathematical content, for example) to reach. There are problems, not preexisting solutions. Therefore, we discuss the transposition *praxis* as an act of epistemological and educational mathematical displacement that carries with it the social, political, cultural dimensions of humanity (of life) and its in-between places, under a decolonial perspective and of (dis)orders of (re)invention.

4 Transposing Problems — decoloniality, (dis)orders and (re)invention

Mathematics education, in our perspective, cannot be thought of in a way that is dissociated from the political, social, and cultural dimensions that run through it. There is no mathematics education that is exempt from these dimensions, because mathematics is not neutral. In the same way, our positioning is not neutral. According to Shapiro (2021, n/p), Desmond Tutu, Archbishop Emeritus who received the Nobel Peace Prize in 1984, reveals, "If you are neutral in situations of injustice, you have chosen the side of the oppressor". In other words, implicit in any claim of neutrality is a choice for a side.

In this sense, even with Desmond Tutu's statement, it can still be argued that neutrality can be seen as not taking a position vis-à-vis both sides of the contradiction, or as taking both sides and creating a balanced and fair compromise between them. From this perspective, we understand that when neutrality itself seeks balance, a level playing field, and is embedded in a field that truly preserves these characteristics, the act of not choosing, of not taking a position, or of taking both sides, while it may be seen as neutral, in fact, is not. There are always other affinities, desires, wills, and subjectivities that, even though they claim to be neutral, echo towards a certain side. Especially when this supposed "neutrality" is in an evidently disproportionate field, marked by power supremacies. Any claim of neutrality is only a way to hide the position already taken, that is, on the side of the oppressor.

This is an initial problematization for what we understand as the need to transpose the problem. However, beforehand, we should explain our conception of problem and problematization. Thus, we agree with Giraldo and Roque (2021, p. 12) who reveal that,

> the problem exists in itself, dispensing with a solution in order to gain materiality as a problem. That is, a problem is not a lack that will be overcome by the knowledge of the pre-existing solution, but an invention, a novelty, a coming-to-be that creates something that never existed. [...] That is, a problem can have a charge of truth in itself, regardless of whether it receives a solution and whether it is correct.

Therefore, the author proposes the epistemological perspective of problematized mathematics, in which the problem category, as presented, is the only *a priori* of mathematics and constitutes knowledge itself. That is, problems have an epistemological status independent of their possible solutions. The mathematics, then, "as a field of knowledge and as a field of invention is constituted by problems and not by answers or solutions" (Giraldo & Roque, 2021, p. 15). Thus, this study defends the perspective of problematizing mathematics, which in mathematics education moves as the action of problematizing, as problem in action, as problematization.

Problematization, then, can be understood as the action of considering situations that engage the subjects in a plurality of possibilities of transformation of the situations themselves. This movement allows the deconstruction of common sense, through critical postures, dialog, and pedagogical processes. Instead of accepting common knowledge (myth) or knowledge (im)taken for granted, as absolute truth fixed a priori, the action of problematizing presupposes a view of knowledge in permanent questioning.

The purpose of the search for problematization is in the transformation of knowledge, of thinking, and of the problem itself that is perceived. This act of challenging, questioning, without presupposing a priori solutions, even problematizing the very perception of the problem, left under suspicion, is the movement that we also envision for mathematics in mathematics education. This movement of perception (as the primacy of knowledge — e. g. Seidel & Rosa (2014) based on Merleau-Ponty) from different points of view (practical, experiential, theoretical, cultural), assumes the opportunity for the reflection of whys, which may be subjective, but which gains other colors and flavors when shared, discussed, debated. The dialogue in the collective assumes real importance in this case. Furthermore,

> what is intended by dialog, in any hypothesis (whether around scientific and technical knowledge, or "experiential" knowledge), is the problematization of knowledge itself

> in its unquestionable reaction to the concrete reality in which it is generated and on which it focuses, in order to better understand it, explain it, and transform it (Freire, 1983, p. 34).

Thus, we return to the idea of "neutrality" to problematize it. What engenders the affirmation of a supposedly neutral Mathematics? Who cares about such a vision? What does this vision imply? Rosa (2021, p. 76) problematizes the resolution of a combinatorial analysis question from the National High School Exam (ENEM), advocating the need to:

> [...] to question the answer and the "naturalness" of solving a problem of the type that is presented in the ENEM Blog (2021, author's emphasis):
> In a room there are 3 girls (Adriana, Beatriz and Cleide) and 2 boys (Rodrigo and Sandro). How many different couples can we form with these 5 people?
> **Resolution:** — To form a couple we need to group 1 man and 1 woman, that is, we need to make a decision d1 which consists in the choice of a man and make a decision d2, which consists in the choice of a woman
> — Decision d1 can be made in 2 different ways (there are 2 men); — Decision d2 can be made in 3 different ways (there are 3 women).
> **Therefore, the total number of couples is 2.3 = 6.**
> Why is it necessary to group "a man and a woman" together to form a couple? Doesn't the answer already start from a fallacy? Is the answer, then, correct? What mathematics is this? What mathematical interpretation is this?

In this question, is there neutrality? Is the Mathematics presented in the resolution neutral? Certainly, a possible answer would be "yes, it is neutral," immediately justified by the fact that the account is correct, assuming the possibility that d1 is taken two ways and d2 is taken three ways, leading to the account of two times three equals six. However, taking solving a problem like this, what assumptions are implicit in the definitions that d1 and d2 are correct? Perhaps someone would say: it depends on whether the decisions are made from a conservative viewpoint or from a progressive viewpoint. Therefore, doesn't having a conservative or progressive position already imply a non-neutral mathematics? Doesn't taking a position already imply giving up neutrality?

Although, in our view, this problematization is important to do in the classroom, in order to consider situations from different political perspectives (in this case, the situations experienced in everyday life, including facts that sometimes involve conflicts between conservatives and progressives) as challenges that bind the people involved in a plurality of possibilities for dialogue, debate, and discussion, so that there can be a transformation of these situations for the common good, we want to go beyond, literally.

The prefix *trans*, according to the Priberam dictionary (2008, n/p), "means beyond, far beyond, in exchange for, across, behind, through", so, our movement is to go beyond, far beyond, cross, go behind what is shown or what is hidden, that is, what "goes blank". In this sense, we consider in terms of **problem transposition**, besides assuming the problem as *a priori,* to go beyond the position that the problem initially assumes, reflecting on it, transforming it and understanding its position in another place, or in between places. We want to problematize the problem itself, questioning it, inquiring what is shown in a first moment. That is, we need to consider different perspectives that are shown by the problem itself *a priori*. For us, then, this movement of problematizing the problem itself is what can make problematization different from other forms of criticism. We need to transpose the problem, challenge its target, question what is presented as context and also the details, rather than simply accepting the conditions presented beforehand through a structured argumentation.

In the case of the neutrality of Mathematics, before the problem presents itself in terms of "is Mathematics neutral or not?" and we spend a long time discussing its supposed neutrality, its problematization, that is, the problematization of the problem itself, needs to come up beforehand. We need to ask: Why is this question being asked, whether Mathematics is neutral or not? Who is interested in a possible answer to this question? This movement of problematizing the problem itself helps us to realize that this is not the problem (whether Mathematics is neutral or not), in fact. If we go through the problem, if there is a movement to go beyond, transposing it, we will know that the very idea of neutrality is a problem of structural order, of exclusion of who is neutral and who is not. The search for the understanding of this idea, the historical debate of value judgment and the measurement of what defines it would be the problem to be pursued. Neutrality as a standard of what we should be, or how we should behave in order not to manifest that which will place us outside Humanity, that is, in order not to be classified as uncivilized, if our posture does not align with the structuring, according to its values and customs, is the very problem to be faced and that, for many times, "goes blank". Transposing the problem of Mathematics as neutral is already, in our view, a movement to *educate ourselves through mathematics*.

For example, the combinatorial analysis question about counting couples must be transposed, because it asks, by putting the definition of couple under suspicion, which would be the correct answer? That of a conservative strand or that of a progressive strand? Transposing the problem, we need to realize that it is not, in fact, positioned there, because the ideas of conservatism and progressivism lead to the very impasse and conflict of a single correct answer for the holding of power that is implied therein. That is, what is the very definition of the mathematical concept being discussed aimed at? What do the ideas of conservatism and progressivism delimit? Why? To what end? What do they assume as values? Ethically, do they assume the common good of all? In what ways and on what cultural-historical relations, comparisons, parameters (mathematical concepts to be discussed) are they based?

We remember that the need for the transposition of problems, as a critical epistemological and educational movement, can "go blank," that is, not be noticed, remain invisible. This then causes the original context or argument to remain hidden, to stay behind, to remain static and supposedly invisible, unquestioned. We need to put ourselves in a critical position, re-evaluating what is presented *a priori*, as well as its meanings, in order to challenge ourselves to change the situation, instead of accepting it and letting only one worldview be taken into consideration.

Another example is found in the very maintenance of the order of structure as a social beacon, under naturalized images that, although unnoticed (white), constitute themselves as referential of what we decide and follow, besides being the standard that "justifies", in many cases, practices of homophobia, misogyny, racism, transphobia, and other structural issues such as the extinction of languages. As Krenak (2019, p.19) puts it,

> our time specializes in creating absences: of the meaning of living in society, of the very meaning of the experience of life. This generates a great intolerance towards those who are still able to experience the pleasure of being alive, of dancing, of singing. And it is full of little constellations of people scattered around the world who dance, sing, make it rain. The kind of zombie humanity that we are being summoned to integrate cannot tolerate such pleasure, such enjoyment of life.

The understandings of mathematics, sciences, and languages, reduced to the order of the structure, are increasingly placed as impediments to the transposition of the problem (in general), trying to erase, leave behind, the divergences from the (im)put. This, then, continues to preach that which excludes, which colonizes, and which seeks exemption from social responsability[4]. We do not think about what is behind the very structure, the whitening, the erasing of the languages of the original peoples of America (as mentioned). In other words,

> we all know that every year or every semester one of these mother tongues, one of these original languages of small groups that are on the periphery of humanity, is deleted. A few are left, preferably the ones that interest corporations to manage the whole thing, sustainable development (Krenak, 2019, p. 17).

In this sense, how do we mathematically discuss, for example, the seriousness of the fact that a country with the "dimensions" (a mathematical subject to be discussed) of Brazil has left "go blank" so many native languages? How can it be evidenced that deforestation in Brazil, as a problem of central relevance today, needs to be transposed in order to understand that the original problem is linked to a *modus operandi* of profiting above all else? How to discuss, through mathematics, that which remains as a problem? How to highlight that the extermination of those who are exploited (native peoples and afro-diasporic, above all) remains a problem to be debated? The problematization of the problem itself, of deforestation in this case, is a possible way. The problematization guides the transposition of the problem leading it to different perspectives, to debate, to dialogue, to reflection, to criticism that can and should be based on possible mathematics.

But, how many problems can be transposed? How many intersecting problems will we have? What about our problems — including classroom problems? How can we show, for example, that the problem in the classroom is not the discipline of the group of students, but the structure that we (im)put as a way of thinking and that stands as an impediment to the transposition of problems? How can we convince ourselves of this? We understand that the (im)position of language, religiosity, culture, values, beliefs, certain pedagogies, of Mathematics is justified by civility, by the "Humanity" created, structured and said to be better and greater (mathematical subject to be debated) than other humanities. This coheres with Krenak (2019, p. 14), who states:

> For a long time we have been lulled by the story that we are humanity. In the meantime — while your wolf is not coming — we have been alienating ourselves from this organism that we are part of, the Earth, and we have started to think that it is one thing and we are another: the Earth and humanity. I don't understand where there is anything that is not nature. Everything is nature. The cosmos is nature. Everything I can think of is nature.

In this sense, overcoming problems allows us to go beyond, it allows us to problematize the problem itself, noticing the nuances that we let "go blank". In mathematics education, in particular, it allows us to question what is presented by means of situations that lead us to social responsibility and to the disposition to freedom of all, that is, to the disposition to politics (political *hexis*) (Rosa, 2022), which takes place in the *praxis* of the very freedom of being, of

[4] We understand social responsibility as "the possibility to predict the effects of one's behavior in relation to society, in view of its structures or conditions, and to correct them, [...] in educational terms, specifically, mathematics education" (Rosa, 2022b, p. 30).

knowing, of power. We seek to think, for example, what mathematically supports the idea of gender? Is there a need to problematize this? One has to wonder what is structurally conceived in a binary way. However, as in Rosa (2021), it is important to problematize: Are there only binary positional number systems? What about decimals? What about octals? What about the hexadecimal ones? And all the other possible ones? Therefore, one can transpose the problem, the inquiry, the questions about gender in a mathematical universe and vice versa, because just as numbers can be presented in different bases, people present themselves in different genders and not only in a structuring logic. In this sense, from a decolonial gender perspective (Lugones, 2014; Sachet, 2019; Rosa &Sachet, 2021), we need to take on the transposition of the problem by problematizing the (im)posed binarity itself. Who is interested in perpetuating this binary idea? Continuously, our movement is towards problematization, estrangement (*queering*) (Rosa, 2021, 2022), continuous, fluid *trans*-position, de-structuring, possible (un)orders, invention of thoughts, hypotheses, decolonial critiques.

5 Final thoughts... it is possible to dream!

Our theoretical movement starts from an analysis of the structure order, identifying its meanings and relating them to Mathematics as a discipline. In this way, we move on to reflect on the paradigm of the exercise, which, in our view, is also situated in this order, as a form of teaching Mathematics. Regardless of the references to which this paradigm refers, which are pure Mathematics, semi-reality or reality, it aims at the content, the right answer and the structuring mechanics of Mathematics. Nevertheless, taking the goals assumed in the exercise paradigm, we understand that problem solving as a methodology is bound to the order of structure in the same way. Moreover, the structure itself imposed, through distinction, oppression from a white, colonizing Mathematics, disseminated by a Eurocentric historical narrative, leaving "go blank" the contributions of other peoples and cultures, such as the African ones. Thus, our movement requests an alternative to the structuring of mathematical thinking, also, to what this means and what it produces.

Therefore, we see the orders of (re)invention as epistemological and educational processes that understand the problem as *a priori,* without fixing an answer beforehand, without placing the "error" as an instrument of power by hierarchizing bodies. More than that, we position ourselves in favor of (dis)orders and against distinctions that become colonizing and, therefore, oppressive.

We take, then, in this vision of problematizing mathematics, the epistemological and educational proposition of *problematizing.* Thus, problematization as a proposal becomes the guide to what we understand as *problem transposition.* This action can permeate the ways of *educating through mathematics* as it generates new conflicts and challenges (problems), which are interconnected, as ways to go beyond, in relation to problems initially pointed out. Going beyond, crossing over, *trans*-posing, without necessarily knowing the possible paths to a supposed answer, marks the rejection of fixing an *a priori* "point of arrival" and refers to the problematization of the original problem itself. This movement of transposition allows criticism of the order of the structure, as well as transformation in epistemological and educational terms of the mathematics to be taught, since politics, culture, social aspects, and all the flows of life are considered, are perceived as between-places and become conditioners of the situated mathematics to be discussed.

> This is why the continuous problematization of the existential situations of the students as presented in the coded images is emphasized. The more the

> problematization progresses, the more the subjects penetrate the essence of the problematized object and the more capable they are of unveiling this essence. To the extent that they unveil it, their nascent consciousness deepens, thus leading to an awareness of the situation by the poor classes. Their critical self-insertion in reality, or rather their conscientization, turns their apathy into a utopian state of denunciation and announcement, a viable project. The revolutionary project leads to a struggle against oppressive and dehumanizing structures. Insofar as this project seeks to affirm concrete [...] [human beings] so that they can liberate themselves, every unthinking concession to the methods of the oppressor represents a threat and a danger to the revolutionary project itself (Freire, 1979, p. 45).

Consequently, the problematization of the problems, as an implicit action to its transposition, makes up the idea of an education through mathematics, which with the possible criticism and awareness is constituted as a movement of insurgence to coloniality, since it enables different worldviews, deconstructs the idea of a single answer, allows that the mathematical meaning given by these different perspectives be respected, heard, considered. However, perhaps, questions like: "to what extent can we escape from this colonial mathematics?", or even, "what would be the principles (from a structuralist perspective) of one or several decolonial mathematics(s)?"[5], still come to inhabit our imagination, even after all the discussion presented in this text. If this happens, fine! According to Bourdieu (1989), the *habitus* of our living in a structuralist system is not easily broken. Moreover, our movement here is not to answer these questions, but to transpose the problems they raise. Do we really want to escape from colonial mathematics (in the sense of not seeing it near)? Do we want to get rid of it by running away, by escaping? Does it add nothing to our different ways of being? Why do we want to escape?

This movement can be a beginning of rethinking this structure always (im)posed to annihilate what bothers us. Perhaps, the important thing is to reflect, more deeply, on what Matos, Coelho and Tamayo (2023, p.16, authors' emphasis) present:

> In a mathematics that claims universality in its DNA, there is no room for difference as a way of life. Treated as deviation here, to differ has the connotation of separating: teacher on one side, Iara and Kauê on the other. It makes no sense for one to devour the other, if there is no possibility and imminence of *Jaguar* (the jaguar) devouring *Jaci* (the moon).

In this case, the authors (respectively), indicate through what they call anthropophagic ritualizations in mathematics education, their manifesto in relation to the non-separation of the knowledge of a teacher and what her and her students, Iara and Kauê, bring to the surface, in terms of (re)invention of their knowledge. We agree that for a Mathematics in which universality is claimed in its DNA, there is no room for difference and, also, that it is not up to one to devour the other (in this case, teacher and students). However, is it not up to the mathematics that has difference, not in its DNA, but in its practices, to reserve a place for the ancestral knowledge, already produced (even if in a structuring sphere), to be dialogued? Although the *Jaguar* will not devour *Jaci*, would it not be the case of *Jaci* devouring the *Jaguar* in order to get closer to *Guajupiá*? That is, would it not be the case that mathematics education, for the sake of differences, should discuss, present, and evidence the different mathematics, from different cultures, encompassing structural Mathematics, simply as one more? Wouldn't

[5] We thank the reviewers of this article for the questions raised in the review.

it be a way to devour it, so that there can be dialogue, problematizations, comprehensions and, mainly, respect to differences without exclusion?

Thus, this mathematics education, in our view, can enable the cry "Caravels in sight!" as discussed in Giraldo and Fernandes (2019), since it refers us to the consideration and appropriation of other cries, coming from other peoples, especially those who were colonized and who are still conditioned to coloniality. This mathematics education seeks to overcome problems that present themselves *a priori* and that are presented uncritically, without searching for what lies beneath. It stands up against the cry — *Land at Sight!* — that was (im)put to us as the right one, as true, from a white european narrative. However, it does not fail to recognize that which helped the ways of being, that which helped safeguard lives. Therefore, we do take a position of insurgence against this cry, but we also claim its permanent remembrance, so that we will never forget the horrors of colonization, to make our reflections, our criticisms and relational, temporal, historical, cultural, political, social — that is, mathematical — searches. We must not forget, but learn in order to resist, to fight against xenophobia, racism, misogyny, homophobia, transphobia, and to know how to dialogue with those who are in fact willing to do so.

With that, the transposition of problems under the guidance of problematization is constituted as a process of educating oneself through mathematics that seeks reflection and criticism of what is presented to us as given and goes beyond in terms of invention or reinvention of other problems, which are situated in life processes. Thus, culture, society, politics, and all aspects of life intersect and situate mathematics in their processes. Therefore, these are the mathematics that we want to unveil, teach, produce — mathematics with decolonial bases, mathematics that recognize and legitimate the voices of people and groups made invisible by coloniality, of those who are excluded from the order of the structure in all its aspects. We wish, then, to dream and glimpse a world without structural discriminations, a world in which respect for the individual is not politically and socially dichotomous to collective living well — or, as Krenak (2019) teaches us, we want an education to postpone the end of the world, so that something will never, simply, "go blank"!

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Referências

Abbagnano, N. (2007) *Dicionário de Filosofia*. São Paulo, SP: Martins Fontes.

Araújo, F. (2022) *Colonialismo*. InfoEscola: Navegando e Aprendendo. Retrieved from: https://www.infoescola.com/historia/colonialismo.

Battey, D. & Leyva, L. A. (2016) A framework for understanding whiteness in Mathematics Education. *Journal of Urban Mathematics Education*, 9(2),49-80.

Bourdieu, P. (1989) *O poder simbólico*. Rio de Janeiro, RJ: Bertrand Brasil.

Brasil. Ministério da Educação. Secretaria de Educação Básica. (2018). *Base Nacional Comum Curricular*. Brasília, DF: MEC/SEB.

Cassiano, O. (2019). *Guia para "Linguagem Neutra" (PT-BR)*. Retrieved from: https://medium.com/guia-para-linguagem-neutra-pt-br/guia-para-linguagem-neutra-pt-br-f6d88311f92b.

Davis, B. & Simmt, E. (2006). Mathematics-for-teaching: An ongoing investigation of the mathematics that teachers (need to) know. *Educational Studies in Mathematics*, *61*(3), 293-319.

Dussel, E. (1992). *1492: El encubrimiento del Otro. Hacia el origen del mito de la Modernidad*. Madrid: Nueva Utopía.

Freire, P. (1979). *Conscientização*. São Paulo, SP: Cortez.

Freire, P. (1983). *Extensão ou comunicação?* Rio de Janeiro, RJ: Paz e Terra.

Freire, P. (1987). *Pedagogia do oprimido*. Rio de Janeiro, RJ: Paz e Terra.

Freire, P. (2000). *Pedagogia da indignação: cartas pedagógicas e outros escritos*. São Paulo, SP: Unesp.

Freire, P. (2001) *Política e educação: ensaios*. (5ª ed.). São Paulo, SP: Cortez.

Giraldo, V. & Roque, T. M. (2021) Por uma Matemática Problematizada: as Ordens de (Re)Invenção. *Perspectivas da Educação Matemática*, *14*(35), 1-21.

Giraldo, V. (2018). Formação de professores de matemática: para uma abordagem problematizada. *Ciência e Cultura*, *70*(1), 37-42.

Giraldo, V.& Fernandes, F. S. (2019). Caravelas à vista: giros decoloniais e caminhos de resistência na formação de professoras e professores que ensinam matemática. *Perspectivas da Educação Matemática, 12*(30), 467-501.

Jovana, S. (2018) O que é Substantivo Próprio? Entenda o conceito e aprenda a utilizá-los corretamente. *Talentnetwork*. Retrieved from: https://rockcontent.com/br/talent-blog/substantivo-proprio/.

Kivel, P. (2011). *Uprooting racism: How white people can work for racial justice* (3rd ed.). Gabriola Island, Canada: New Society.

Krenak, A. (2019). *Ideias para adiar o fim do mundo*. São Paulo, SP: Companhia das Letras.

Lugones, M. (2014). Rumo a um feminismo descolonial. *Revista Estudos Feministas*, 22, 935-952.

Maldonado-Torres, N. (2007) Sobre la colonialidad del ser: contribuciones al desarrollo de un concepto. In: S. Castro-Gómez & R. Grosfoguel. (Coord.) *El giro decolonial:* reflexiones para una diversidad epistémica más allá del capitalismo global (pp.127-167). Bogotá: Siglo del Hombre Editores/Instituto Pensar.

Matos, D., Coelho, F., & Tamayo, C. (2023). "Sou uma onça, devoro humanidades": ritualizações antropofágicas em educações matemáticas. *Revista de Educação Matemática*, *20*, 1-22.

Matos, D., Giraldo, V., & Quintaneiro, W. (2021). Por Matemática(s) Decoloniais: vozes que vêm da escola. *Bolema*, *35*, 877-902.

Michaelis, M., & Michaelis, H. (2022). Dicionário brasileiro da língua portuguesa. *Oprimir*. São Paulo, SP: Melhoramentos.

Onuchic, L. (2013). A resolução de problemas na Educação Matemática: onde estamos? E para onde iremos? *Revista Espaço Pedagógico*, *20*(1), 88-104.

Pinto, D. M. (2019) *Experiências com matemática(s) na escola e na formação inicial de professores: desvelando tensões em relações de colonialidade.* Tese (Doutorado em Ensino e História da Matemática e da Física). Universidade Federal do Rio de Janeiro. Rio de Janeiro, RJ.

Possamai, J. P. & Allevato, N. S. G. (2022). Elaboração/Formulação/Proposição de Problemas em Matemática: percepções a partir de pesquisas envolvendo práticas de ensino. *Educação Matemática Debate*, 6(12), 1-28.

Powell, A. B. (2002) Ethnomathematics and the challenges of racism in mathematics education. In.: P. Valero & O. Skovsmose, O. (Eds.), *3rd Proceedings of International Mathematics Education and Society Conference.* (pp. 1529). Copenhagen, Denmark: Centre for Research in Learning Mathematics.

Priberam (2008) Dicionário da Língua Portuguesa [em linha], 2008-2021, https://dicionario.priberam.org, consultado em 18 out. 2022.

Rosa, M. (2008). *A Construção de identidades online por meio do Role Playing Game: relações com o ensino e aprendizagem de matemática em curso à distância*. Tese (Doutorado em Educação Matemática). Rio Claro (SP): Unesp.

Rosa, M. (2018). Tessituras teórico-metodológicas em uma perspectiva investigativa na Educação Matemática: da construção da concepção de Cyberformação com professores de matemática a futuros horizontes In.: A. M. P. Oliveira & M. I. R. Ortigão (Org.). *Abordagens teóricas e metodológicas nas pesquisas em Educação Matemática* (pp. 255-281). Brasília, DF: SBEM.

Rosa, M. (2021). Teoria Queer, Números Binários e Educação Matemática: estranhando a matemática em prol de uma héxis política. *Educação Matemática em Revista-RS*, 2(22), 70-87.

Rosa, M. (2022a). Cyberformação com professories de matemática: a compreensão da héxis política à pedagogia queer. In. A. C. Esquincalha. (Org). *Estudos de Género e Sexualidades em Educação Matemática: tensionamentos e possibilidades* (pp. 206-246). Brasília, DF: SBEM.

Rosa, M. (2023) Aventuras, Dramas e Terror: os desafios compartilhados por gêneros cinematográficos na Cyberformação com professories que ensinam matemática. In. A. P. M. R. Barros; D. Fiorentini & A. H. A. Honorato (Org.) ***Aventuras e desafios em tempos de pandemia: (re)inventar a prática docente.*** **Porto Alegre**, RS**: Editora Fi** (**no prelo**).

Rosa, M.(2022b). Cyberformação com Professories de Matemática: discutindo a responsabilidade social sobre o racismo com o Cinema. *Boletim GEPEM*, 80, 25-60.

Rosa, M., & Sachet, B. (2022). Movimento de Decolonialidade de Gênero nas Aulas de Matemática: o trabalho com Tecnologias Digitais (TD). *Bolema, 35*(71), 1246-1274.

Rosa. M.& Bicudo, M. A. V. (2019). Focando a constituição do conhecimento matemático que se dá no trabalho pedagógico que desenvolve atividades com tecnologias digitais. In: R. M. Paulo; I. C. Firme & C. C. Batista (Org.). *Ser professor com tecnologias: sentidos e significados*. (pp.13-40). São Paulo, SP: Cultura Acadêmica.

Sachet, B. (2019). *Gênero na educação matemática: lançando-se a um movimento de decolonialidade com tecnologias digitais*. Trabalho de Conclusão de Curso (Licenciatura em Matemática). Universidade Federal do Rio Grande do Sul. Porto Alegre, RS.

Seidel, D. J. & Rosa, M. (2014). Possibilidades da percepção fenomenológica nos procedimentos investigativos da pesquisa qualitativa em Educação Matemática. *Educação Matemática Pesquisa*, *16*(2), 407-428.

Shapiro, C. (2021) Remembering Desmond Tutu, Tireless Champion of Animals and Others. *PETA — People for the Ethical Treatment of Animals*. Retrieved from: https://www.peta.org/blog/remembering-desmond-tutu/

Skovsmose, O. (2000). Cenários para investigação. *Bolema*, *13*(14), 66-91.

Tamayo-Osorio, C. (2017). A colonialidade do saber: um olhar desde a Educação Matemática. *Revista Latinoamericana de Etnomatemática*, *10*(3), 39-58.

Walsh, C. (2008) Interculturalidad, plurinacionalidad y decolonialidad: las insurgencias político- epistémicas de refundar el Estado. *Tabula Rasa*, *9*, 131-152.

Walsh, C. (2017) ¿Interculturalidad y (de)colonialidad? Gritos, grietas y siembras desde Abya Yala. In: A. G. Diniz & D. A. Pereira (Coord.). *Poéticas y políticas da linguagem em vías de descolonização* (pp. 19-53). Foz Iguaçu: Universidad de Integración Latinoamericana.

Williams, R. (2015). *Politics and letters: interviews with New Left Review*. Brooklyn, NY: Verso Books.