Universality and essentiality: elements of a mathematical discourse*

Lucas dos Santos Passos[1]
ORCID: 0000-0002-5181-1765
José Pedro Machado Ribeiro[2]
ORCID: 0000-0002-9227-3908
Vânia Lúcia Machado[2]
ORCID: 0000-0003-3486-0837

Abstract

The present article resulted from data collected during our Master's Degree investigation, which was concluded in 2017. Most of the time, this investigation assessed the discourse typologies in the sub-project in Mathematics of Programa Institucional de Bolsas de Iniciação à Docência (Institutional Program of Scholarships to Professors). The investigation gathered specific sets of utterances, drawings and comments from five students granted with scholarships, which featured effective references to images of the universe, the world and/or nature. Thus, based on the research corpus, the aim of the present study is to track the discursive functioning of the referred formulations, by taking mathematics itself as the referential object of the discourses. In order to do so, and based on Foucauldian concepts, the idea is to make an enunciation analysis of what was actually said by describing the vertical domains of enunciation productions to expose their formation rules based on their own mathematical dispersion. One can see that the assessed utterances concern an externality ruled by a written historicity in which images of nature, world and universe work among the mathematical dispersion essentiality, totality and universality vectors. Starting from such dispersion, the utterances are featured by an exhausting monism and structuralism whose objects always regard absoluteness and universality, as well as the structural closing of the very discursive game.

Keywords

Mathematical discourse – Absoluteness-logocentrism – Universality of mathematics – Institutional Program of Scholarships to Professors – Education in Mathematics.

* This article was translated by the Good Deal Language Consulting. We thank the *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* (Coodination of Academic Personnel Enhancement/Capes) for promoting this translation.

1- Instituto Federal Goiano, Urutaí, Goiás, Brasil. Contact: lucassantospassos@gmail.com.
2- Universidade Federal de Goiás, Goiânia, Goiás, Brasil. Contacts: zepedroufg@gmail.com, vania_machado@ufg.br.

DOI: http://dx.doi.org/10.1590/S1678-4634201945201342

Main considerations

The aim of the present study is to track the functioning of universe, world and nature categories inside the mathematical discourse based on the given mathematical context in Mathematics itself. In order to do so, we start from our Master's Degree investigation, which was carried out between 2015 and 2017, in the Institutional Program of Scholarships to Professors (Pibid/Capes)[3], which is a sub-project in Mathematics that initially counted on 13 students who were granted with scholarships, 2 supervisor professors and 1 area-coordinator professor. Such investigation was in compliance with the overall proposition of describing discourse typologies associated with this context by turning Mathematics into the object of the discourse, as well as of sighting a field of expectations limited to the initial education of Mathematics teachers, mainly when it comes to ethno-mathematical and discursive terms. Therefore, most of our investigation focused on the formulation of actions over actions[4], i.e., actions planed based on the actions of these specific contexts in order to draw the discourses that compose the context itself. Since our investigation was focused on the communal aspect of the group, rather than in the individual one, these actions took place among weekly meetings of the group, most specifically among discussions triggered in the group about books published in the Education Field (Mathematics). By the time we got to this context, the group was starting the discussion about the book *Pedagogia do oprimido* by Paulo Freire, which composed the *socius textual* we aimed at getting close and integrated to.

Thus, the analysis came after part of the first activity carried out within this *socius*, the so-called *O que a matemática significa para mim?* (What does Math mean to me?), which encompassed the following proposition: draw a picture to depict the best way possible your idea about the meaning of Mathematics; next, write a title to the drawing based on the idea you wanted to express (drew). This action was based on the Freirean concept of culture and word generating circles (FIORI, 2014; FREIRE, 2014)[5], that have circulated in the discussion groups. By observing the drawing by the subjects of our investigation, as well as their titles and comments (whenever there was one), we gathered a specific set composed of drawings that depict images of the universe, the world and/or nature in order to interpret their proper meaning/representation. In total, of the 16 participants, 12 were teased by our activity and made their own drawings; of these 12 students, 5 comprised the investigation group – all students were granted with the scholarships, from the ones who were in the project for more than 1 year (who were often attending the 4th semester of the teaching major in Mathematics, or the later semesters) to the ones who had been in the group for less than one year (often attending the 3rd semester - or latter semesters - of the teaching major in Mathematics). It is worth

3- In order to know the programs' rules, check on Capes (2013).

4- Just as the strategic mimicking of the Foucauldian productive power.

5- By using the word 'generating", Paulo Freire refers to the words belonging to the universe of words used by students "that became constructed or reconstructed meanings in their behavior that "are constructed or reconstructed meanings based on their behaviors, that configure existential situations or, within them, they are configured" (FIORI, 2014. p. 14).

highlighting that the investigation was approved by the Ethics Committee of the Federal University of Goiás (CEP/UFG) and the use of all the produced material was approved by the participants. The informed names are fictional in order to respect the ethical and moral principles of the investigation.

Based on the aforementioned *corpus*, the aim of the present study is to reach its goal by analyzing the discourse of the referred sample. It is clear that there are many ways to analyze a discourse; as for the current article, we chose the theory by Michel Foucault as reference, as well as what he has pointed out as enunciative analysis in his famous book "Archeology of knowledge" ([1969] 1995). In strict terms, this analysis type refuses to end up with hermeneutics but, actually, it describes the discourses. In order to do so, such analytics can only happen based on what was effectively said, its object is what was said, written, drawn or recorded. Starting from what was effectively said, the idea is to find the minimal unit of the discourse, the utterance – a function that goes beyond any structural unit (be it a logical position, a sentence or an act of speech) and that makes such structures possible. It means

> [...] a function of existence that properly belongs to signs and on the basis of which one may then decide, through analysis or intuition, whether or not they "make sense", according to what rule they follow one another or are juxtaposed, of what they are sign, and what sort of act is carried out by their formulation (oral or written). [...] [the statement] is not in itself a unit, but a function that cuts across a domain of structures and possible unities, and which reveals them, with concrete contents, in time and space. (FOUCAULT, 1995, p. 99).

Accordingly, the enunciative analysis aims at describing the dispersion systems in the discourse, i.e., the repletion ways and regularity of these elements, but it "does not mean isolating and featuring a horizontal segment, but defining the condition in which the function that gave birth [specific] to a series of signs took place (but this function is not necessarily grammatical, nor logically structured)". (FOUCAULT, 1995, p. 125). According to Foucault (1995, p. 43):

> Whenever one can describe, between a number of statements, such a system of dispersion, whenever, between objects, types of statement, concepts, or thematic choices, one can define regularity (an order, correlations, positions and functionings, transformations) we will say, for the sake of convenience, that we are dealing with a *discursive formation*. [...] The conditions to which the elements of this division (objects, mode of statement, concepts, thematic choices) are subjected we shall call *rules of formation*.

Thus, the descriptive study on formation rules should lead to the individualization of discourses and to discursive formations that they inscribe and/or define, and vice-versa (FOUCAULT, 1995, 2010).

The description of discourse-object formation rules points towards a normative and productive field through which discourses become possible. It is the description

of this normative possibility that is in check in the enunciative analysis, rather than considerations about whether the discourse is a final structure. Therefore, these rules are the ones that must be exposed in the current study, i.e., the discursive rules based on Mathematics itself, in which images of nature, world and universe emerge with limited specific use in order to compose a game that goes beyond the propositional and grammatical one. Thus, the final game goes from the linguistic to the extra-linguistic aspect, which is placed on what we call a constitutive exteriority. Describing the utterances means, in a certain degree, describing the dispersion that these utterances gain in relation to the exteriority from the placed object to Mathematics. The present article aims at using these specific terms to contribute to the transdisciplinary field of education in sciences and Mathematics - such approach is always analytically promising to a field such as the discourse. In its own critical dispersion, one can see that the study takes to an incipient formation-process issue faced by Mathematics teachers inserted in the pibidian context of institutionalized Mathematics.

Representations of Mathematics: the universe, the world and nature, are they endless richness?

Drawing 1, by Andrea (a student who is granted with the scholarship) gains imagistic materiality within the set of the herein addressed *corpus* by starting from the center, a set of light beams between defined lines and the misty parts, as well as by the dark and light shades. The disposition of these elements makes it clear that the graphic representations happen through the recovery, at image level, of what – within the scientific discursive memory – could be considered the representation of the universe or, at least, of a significant part of it. Therefore, in iconographic terms, representation brings along elements crystalized as the cosmos and star dust, as well as stars, planets, all the elements around a central galaxy. By associating the imagistic production to the explicative formulations, one can see that the enunciative function of representation is given by the following statement: from the most remote star dust, Mathematics is found everywhere in the total universe, including the widest and more distant (i.e., the best place) places that can be observed. It is not a coincidence that the referred drawing, called “The universe of Mathematics”, covers an entire sheet of paper, so that the title and the name of the author are written on the back of it. Notice that the drawing moves from an exhausting dissemination, and it does not allow any empty space on the sheet: the lines expand, move and cover all the way to the edge of the surface. The use of preposition “in”, of the transitive verb “cover” and of the adverb “within”, and of their respective complements “all places”, “the world”’ and “all corners” testify the impossibility of reference to the external, to what is outside, and even of the “relative”.

Drawing 1 – The universe of Mathematics (by Andrea – who is granted with the scholarship)

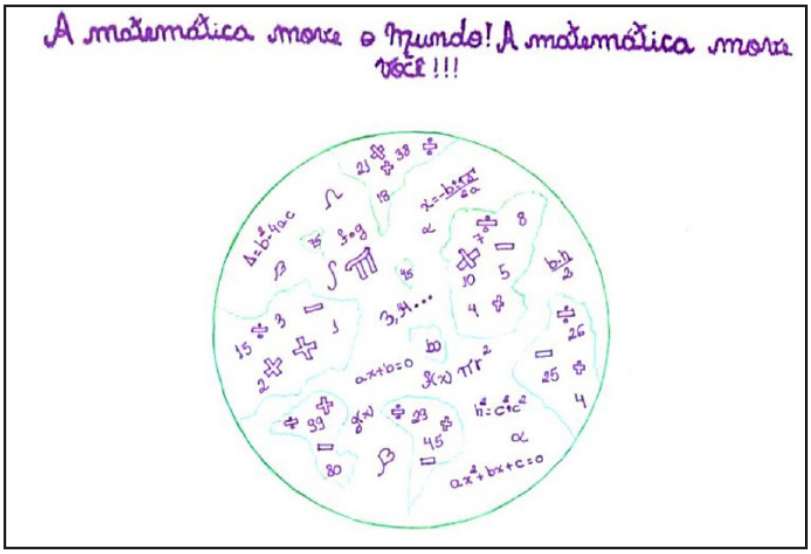
Andrea: Well, I tried to draw the universe, with a galaxy in here and all the rest and... well, for me... the title of the drawing I wrote "The universe of Mathematics", because, for me, Mathematics is a... I think that for everybody as well, for most people... I believe that... I think that *Mathematics is everywhere, it covers the world... this is why I drew the universe, you know, what is inside... kind of, it is in every corner... so, I tried to depict the universe this way, as if Mathematics was everywhere... we look at, we perceive, we pass by... things we even think do not exist, we later observe that they exist, we study and see that they are there.* So, it was kind of this meaning that I wanted to highlight with the drawing. (griffin applied by the authors).

Source: Files of the author (2015).

From the cosmos to the terrestrial atmosphere, Drawing 2 is called "Mathematics drives the world! Mathematics drives you!!!", by Florzinha (who is granted with the scholarship) and Drawing 3 "Mathematics: a world of possibilities" by Álvaro (who is granted with the scholarship) in their own focus Planet Earth. Actually, these representations depict a plane figure of the globe, which is highlighted by the circular shape of the drawing, by the geographic limits and by the textual reference to the noun "world". Besides, there were mathematical objects in the two drawings that cover the inner circular space, such as the signs of the four basic operations, numbers, Greek letters, the symbol of the integral and of the derivative, the Bhaskara formula, the symbols of the numerical sets, the notations for domain and the image of a function *f*, any type 2x2 matrix, as well as some geometric forms. With regards to the second drawing, these objects appear in smaller number over the continents and oceans of the planet, and such image gives the same meaning of totality to the mathematical knowledge. The third drawing clearly repeats the same regularity of discursive materiality; similarly, the produced signs get dispersed throughout the globe and, by occupying the planet, they allow it to be (re)written.

Therefore, the drawings 2 and 3 open room for a materiality, according to which Mathematics is in the world, in each corner of it, in each part of the continents and oceans, it is the power that drives the world and the human beings and, after all, it is Mathematics that opens a whole world of possibilities. Similar to the first drawing, Mathematics is described at the order of exhaustion, it can occupy the whole as its necessary condition and, at the end, it is the element that enables all the necessary conditions. Thus, by using an

Drawing 2 – Mathematics drives the world! Mathematics drives you!!! (by Florzinha, who is granted with the scholarship)



Source: Files of the author (2015).

Drawing 3 – Mathematics: a world of possibilities (by Álvaro, who is granted with the scholarship)

Álvaro: I tried to draw the world and inside of it I put a lot of mathematical symbols to show the diversity that Mathematics... that Mathematics is everywhere. *It is hard to try to think of something that Mathematics is not involved in.* (griffins applied by the authors)

[...]

Álvaro: My title is "Mathematics: a world of possibilities".

Source: Files of the author (2015).

element similar to the image of the universe, these drawings, by depicting the world, give Mathematics the same dispersion of the totalizing and absolute object, a self-identical and founding essence. The same dispersion emerges from the materiality of drawings 4 and 5, below, as the conditions for existence. The first drawing is called "The idea of Mathematics in the world by a good teacher" by Gustavo (who is granted with the scholarship) and the next one is "The queen" by Nina (who is granted with the scholarship).

Actually, the fourth imagistic production depicts a subject-professor in order to recover the Mathematics that is found worldwide (pay attention on how, similar to the previous cases, the marks of adverbs of place and time in the utterances-explanations, mainly in here, "in nature" and "every time") and that, at the same time, turns this human figure into the transmitter (pay attention to the use of verb "to pass") of this Mathematics, which was made transparent. Notice that, at imagistic level, the arrows link each part of this world to their mathematical correlates (numerical relations, mathematical operations, geometric forms, among others), in order to indicate the unquestionable presence of Mathematics – its *ad infinitum* presence – all around the world/nature/universe. With respect to the fifth imagistic production, mathematics is revered and crowned since the title, which introduces it as the very command of the universe. The title "The Queen" recovers, from the very case of mathematical knowledge, the statements by Gauss, according to whom, Mathematics would be the queen of all sciences. This statement was later taken by Gilberto Geraldo Garbi to name his master piece about the history of Mathematics[6]. It is not a coincidence that the sentence is placed beside a crown. Moreover, one can also see that the drawing, similar to the one before, keeps on inserting the 'human' at its materiality level. Therefore, this drawing opens room for a young woman at the bottom of the paper sheet, who is assumingly the very author of the picture, and she asks herself, but the answer is drafted inside the circle that, in its turn, represents the universe as whole, from a mathematical viewpoint. Just as in the last herein presented productions, again there are symbols of the four basic mathematical operations, some numbers, formulas, names of famous mathematicians, among others, within the space of the universe.

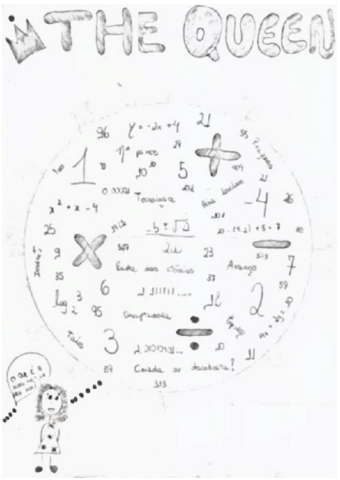
Drawing 4 – "The idea of Mathematics in the world by a good teacher" (By Gustavo, who is granted with the scholarship)

Gustavo: Mine looks like Nina's, but there is difference. Here (pointing at the drawing), there is a teacher of... here, very small, I placed to explain his thinking... he is teaching and he is thinking here that Mathematics is in the world, moreover, the title was "The idea of Mathematics in the world by a good teacher". *He has to make students understand that Mathematics is everywhere in the universe, in nature, at all moments*. I put some operations, some fractals, that represent nature, I put a symbol of the infinite. (griffins were applied by the authors).

Source: Files of the author (2015).

6- In his *A rainha das ciências: um passeio histórico pelo maravilhoso mundo da matemática*, published by Editora Livraria da Física, in 2007, one can clearly see that Gilberto Geraldo Garbi not only recovers the passionate sentence by Gauss, back in 1796, but echoes it and its reverence. It is worth highlighting that the book by Garbi (2007) has significant circulation in the Mathematics history domain, mainly in Brazil. The book is part of the basic literature in Mathematics teaching courses and in courses related to the pibidian project.

Drawing 5 – "The Queen" (by Nina, who is granted with the scholarship)



Nina: I put in these... in this lens... which is the whole, which is the universe, I put TECHNOLOGY, I put the name of some... PITAGORAS, TALES, this kind of thing. If it was CREATED OR DISCOVERED, numbers, the symbols of the four operations, LOG. Then, I put a person asking "What is Mathematics?" and that is about it.

Source: Files of the author (2015).

The universe, the world and/or nature are recovered pictures at representation level in the present study and, even more, they emerge in strict terms and drawings with determined lines. We could start from highlighting, for example, that when the world is drawn, it recovers a specific representation, which is not, for instance, a representation of common sense or religion, since the position of the continents and of the globe itself reuses a modern version that is made possible by sciences and by technology, and, therefore, by mathematical Cartesianism. Thus, based on an advantageous and imposing view of a satellite, which is centered on Planet Earth (and it can mean a certain geo-centrism, even a certain anthropocentrism), these utterances aim at introducing a new understanding about the globe based on mathematical articulations. Although the paper sheet allows the person to work the three dimensions, Earth appears plane and drawn like a circle, and it seems to suggest that the planet is spherical; at the same time, it is circumscribed (maybe, in order to explain all that surrounds it) and occupied, above all, by mathematical symbols, as if they were its natural expression. Even in the case of the first drawing, in which the cosmos remains as the core element, the unknown is not effectively read in its textual materiality, for example, as a myth[7], because the idea is to have a whole organized in mathematical ways and, therefore, rationally explained. Thus, the represented universe can even be infinite, but it is not defined at the level of its enunciative materialization, which disperses itself to a mathematical rationalization.

Accordingly, the world to be represented in the set of cut drawings is no longer a Pangea, but a contemporary version of the continents – whose unifying element, though, keeps on being Mathematics itself. So, it is certain that the set of drawings invariably uses

7- The myth can work as an explanation model that gets farther from the scientific and mathematical. In order to know how part of the Greek civilization used the myth, we suggest the text "O mito explica o mundo" by Andery, Micheletto and Sério (2014).

concepts of the mathematical and scientific fields to reinforce the idea of an organized *logos*: lines, curves, points and mathematical symbols are quite clear; but it is also possible tracking how certain scientific implications about the Earth and the universe are, even if in a thin and inconsistent way, functioning in these utterances; either by following the Euclidean mathematical model and/or the Cartesianism, in order to shape the imagistic production, or a Aristotelic, Ptolomaic, Copernican or Galilean scientific model (which is not always clear) about the universe, Planet Earth (which sounds like world) and nature. These utterances cannot be understood in separate from the very models that compose them, and make them possible, i.e., the several mathematical and scientific models that cover the world and the 'human', either as object or as the subject of knowledge. Within these last lines, one can observe, even if the human figure rises as one more element in drawings 4 and 5, that such figure does not scape this limited circle, which is regulated by a mathematical dispersion. This image depicts that the human category itself can only occupy a specific position inside sciences and Mathematics, as well as be in specific relation to units of the universe, the world and/or nature.

Nature, the world and the universe (which, sometimes, can mean the same) seem to have always been objects of science and Mathematics, they became more central in these same fields, similar to the great units science and Mathematics sometimes state to discover. At first, it seems that the human being is always trying to learn about, and act over, nature, the world and the universe, therefore, these elements become objects of the scientific knowledge, even if at different perspectives throughout time (cf. ANDERY et al., 2014). Thus, one can see that the rationality model, which remains and guides modern sciences, is strongly marked by studies about the moves by nature and space and, even more, by a paradigm that is more and more defined in totalitarian terms, based on the idea that a single method and knowledge type can be considered true (SANTOS, 1988). Modern sciences set a new dominating paradigm that, in its turn, presents a new view about the world and about life; moreover, it is getting more distant from the observation and the 'immediate experience'; moreover, one can observe a severe separation between nature and 'human':

> Nature is not only extension and movement; it is passive, eternal and reversible, mechanisms whose elements can be shown and later related under the form of law; they do not have any quality or dignity that stops us from revealing their mysteries, this revealing is not contemplative, but active, since it aims at knowing nature in order to dominate and control it. As Bacon used to say, science will make humans "the lords and holders of nature". (SANTOS, 1988, p. 49).

According to Santos (1988), all this particular trajectory of science is ratified in what is historically understood as the Mechanistic determinism, which had its peak on the 18th century. The Mechanistic determinism was mainly based on the Newtonian mechanics, and it states that the material world works as a great machine, i.e., in a mechanical way, and the operations can be revealed by the laws of Mathematics and Physics. Thus, the mechanism bets "[on] a static and eternal world that floats in an empty space, a world that the Cartesian rationalism makes knowable through its decomposition into the elements

that constitute it" (SANTOS, 1988, p. 51). This sense of world-machine, of course, lies on the "idea" a world of order and stability, the idea that past repeats itself in the future (SANTOS, 1988, p. 51). In other worlds, the world (or yet nature or the universe) represents a static and unchangeable unit inside science and Mathematics, which is mechanically functional, stable and repeatable. As a result, the world represents itself, it is always identical to itself, mainly because it holds laws that cannot be changed, which are though universal. As we have seen, science, through mathematics, replaces the internal coherence of the world, given the rigorous translation of its laws, i.e., it introduces the world in its stability and eternity through the powerful mathematical language.

Based on all the literature, we must recall D'Ambrosio (2001), according to whom, the mechanism is responsible for what he calls the ideological impoverishment of the concepts of universe and man. Based on this author, the Mechanistic determinism produces a mechanical view of the universe, which is strictly limited by mechanical laws, whereas man emerges as just a gear inside a bigger machine, rather than a free and creative being connected to the universe as a whole. It is essential highlighting that D'Ambrosio (1998, 2001, 2011), by proposing a critical analysis of Mathematics' constitution in the West (a Western production), provides us with a valuable understanding about how the images of nature, the world, the universe and the 'human' are inserted in this process. According to D'Ambrosian critics, given that Mathematics is a kind of knowledge that results from the expansion of the Western society, it cannot be understood in separate from the power structures that made it possible, i.e., from a history of geopolitical domination. At this point, Mathematics is not just the consequence of this domination, but it remains one of this domination's main instruments: within the Western expansion process – which is not limited to the past at all -, Mathematics limits a view of the universe and the world, where human beings can have total power to explore nature and material assets.

According to D'Ambrosio, the single rationality model (the one provided by the institutionalized Mathematics) is part of the globalization process; it rationalizes ethical values, as well as the property, production and division of labor variables. The history of Mathematics, in its turn, is linked to, and made possible by, the history of capitalism, colonialism and cultural imperialism; therefore, it is a constitutive and active part of the history of expansion and invasion of territorial borders, of nature's representation and exploration, of the world and the universe, as well as of colonization and reification of peoples throughout the planet. Santos (1988) also provides a perspective about how the scientific paradigm matches the bourgeois model by stating that:

> It might seem surprising, and even paradoxical, that a form of knowledge that lies on such view of the world, became one of the pillars of the idea of progress, which gained power in the European thoughts from the 18th century on and which is the great intellectual sign of the bourgeois ascension. But truth is, the order and stability of the world are the pre-conditions for the real transformation. (SANTOS, 1988, p. 51).

Bishop (1990) also seem to share this viewpoint and to get closer to the perspective by D'Ambrosio, to the extent that he places Mathematics among, and as the result of, cultural imperialistic processes.

Overall, how can all this historicism help to think about a historicity that is the very discourse and that emerges through utterances that are introduced as part of its own materiality? How is it possible, based on such historicism, to think of an associated[8] domain occupied by a specific memory through the assessed utterances? Nature, the world and the universe are, at great extent, the elements that science takes care of – through Mathematics – and the ones it aims to describe while it advocates to be the only entity capable of making such description and of offering a meta-knowledge about them. However, it is possible observing that, besides the elements of a single description – such as the elements inside a mechanism that makes more than a simple description -, nature, the world and the universe remain the objects of exhausting textual and discursive operation; at the same time, they work as the signs of what Foucault (2012), by recalling Nietzsche, called the will of truth. In other words, these elements are received within a matrix that is centered on knowing the truth, i.e., on producing and holding the single and unquestionable truth of nature, of the world and of the universe, which makes man the fundamental agent of such knowledge. It is not a coincidence, though, that whereas Mathematics and science are represented, the referred elements are drawn in the representation scene. Besides, in most cases, the whole scene, and the whole representation scene, represent much more than the objects of the scientific and mathematical knowledge, they represent a historically given pulse to dominate and control, to write – based on an essential and universal language – about the exhausting and total truth of these elements within the referred fields. According to science and Mathematics, natural, as well as the immediately material - which is embodied by the units of nature, of the universe and of the world -, are, all together, the tropos and the top to produce and reinforce the absolutely fundamental and central elements, namely: science and Mathematics themselves.

In discursive terms, the images of the world and the universe (or even of nature) are not, as we have said, only objects of a single description – a description, actually, accidental -, although that is exactly (and only) what the hegemonic rationality model states to be. They are not just objects of a single knowable act or of an unlimited knowledge; however, they can also be just objects that only reflect ideologies, ideas, class struggles and mentalities. Yet, they are not part or constitute an integrated whole linked to the dialectics between nature and culture, survival and transcendence. The previous readings - as farther from the dialectic logics they are as lesser performed as a simple history of ideas or representations – were good enough to evidence an associated domain in which either nature or the world and the universe are put to work by articulating a natural and essential, total and universal mathematics and science (often, also in the singular). More than objects of knowledge they are sites occupied by humans, faced by them and sites humans will to know - the referred elements are the objects of an additional field whose own objects are essentiality, totality and universality; consequently, their objects remain the absolute, linear, stable, static, eternal and unchangeable truth. It is, besides, an ultimate and self-sufficient knowledge, the only one able to ascend to the truth, to the only truth of all things.

8- According to Foucault (1995), the associated domain tends to refer to the space inhabited by the rules of utterances and by their relations, in which one utterance presupposes the others. Navarro (2008) believes that this domain, as it presents itself, is linked to the discursive memory.

As states Pêcheux (2015), the domain of science and Mathematics aims at calculating a logically stabilized universe by producing and regularizing discursive spaces where utterances seem only to describe the structural properties of the universe in a transparent and appropriate way. According to him, these domains try to reduce the hegemony of the world to a logic of homogeneity, by implementing terms such as rigor, law and principle, as well as logical-practical evidences – not mentioning the construction of authorities (specialists, scientists, among others) and the employment of material techniques. Yet, according to Pêcheux (2015), the referred domains are motivated by the need of a semantically normal world – the heterogeneous regions of real that, due to logical propositions, massively contribute to such world, but these propositions, in their turn, produce some type of real.

Accordingly, with respect to the presented formulations, they are not the objects of an eternal representation; nature, the world and the universe are objects of the discourse and, mainly in this case, they form the object of the mathematical discourse; therefore, of a strictly specific discourse. These objects produce the place for the repartition of the discourse in the Foucauldian sense, since it is through them that one can say that Mathematics is in nature, in the world and in the universe and; therefore, it is natural, world and universal – or yet, absolute and total. Actually, when previous utterances try to represent Mathematics, this representation only happens because it recovers the utterances that, in their turn, are bond to the discourse that Mathematics is everywhere (part by part), that it is the essence of all things (element by element), that it was discovered by humanity from nature, that it reveals a world with stable and identical functioning. Thus, once more, the series of herein presented utterances make a systematic identification of nature as Mathematics, at world and universal level. It is possible reinforcing the great imperious unit able to deal with the great totality of the universe, because it is capable of ordering a logically stabilized and universal universe. It is this discursive regularity that is testified and updated by the herein assessed utterances – a regularity that is not in the order of representation or of meanings, but in the order of the discourse.

Actually, it is right saying that the utterances in question are related to a historical exteriority; however, more than that, to an exteriority that exceeds the mere historical reflection and places itself in the very discursive historicity[9]. It is not a coincidence that the formulations are inscribed in the same enunciative/discursive repartition, which defined the same grouping, beside the historical correlates. It is impossible saying anything else to replace these utterances based on Mathematics, since the sayings are always oriented by this normative and constitutive dispersion. Thus, this series of utterances define a specific discursive formation in which, as we said before, mathematics is seen as an entity found all over the universe, all over the world, at any time; it is the whole universe, the world, the whole space and time. Thus, what is in check is a discursive regularity in which utterances disperse to the great units of the universe and the world and, at the same time, to small units such as their corners, i.e., to anywhere in the whole, even to the smallest

9- As explains Judith Butler, the historicity of the discourse does not only regard the discourses, they can be simply located in history, but much more like history constitutes the discourse itself, in a sediment and non-structural way (cf. BUTLER, 2002).

spots. The universe, the world, each corner of the universe or of the world, are always an essential correlate to these utterances; therefore, the enunciative function in question concerns the representation of each mathematical space, it means writing every place as the place of the unquestionable presence of Mathematics.

Essentiality, totality and universality: dynamic conclusions about an absolutist and logocentric discourse about Mathematics

The description has shown that, more than this coincident feature, these utterances remain subscribing themselves to a strict dispersion through the same enunciative and discursive rules concerning Mathematics. Thus, these utterances highlight that Mathematics is (found) in nature, in the universe and in the world, that it is in each part of these great units, that it composes each moment of the human history, whenever it does not seem to get lost from the real world in order to generate its own. Nature, the world and/or the universe almost always rise in these utterances as planification and quantification marks, besides, they are always inserted in the domain of mathematical symbolism. Thus, we tried to show that Mathematics gains dispersion through these utterances, which inscribe it in a discursive modality, in the limit of the very representations, by following essentiality, totality and universality vectors. By crossing possible domains, the objects of these utterances and their associated fields are not nature, nor the world or the universe, but, actually, the natural, the world (total) and the universal. It happens in such a way that the referred utterances were guided by an enunciative function of naturalization, totalization and universalization. Moreover, we tried to evidence that the aforementioned elements are always the object of textual and discursive operations in a game of power that tries to reach and close the absolute, and the end, throughout the history of science and Mathematics. Thus, nature, the world and the universe, in different ways, and with different meanings, rise in Mathematics and in science as the specific objects that are not only about to be described, but that compose a permanent recovery and update process of a domain of relationships aimed at producing the whole absolute and universal.

We could, of course, place the assessed utterances beside other discursive events that compose the history of science and mathematics, whose rules and objects are the same, such as, for example:

> [...] Pythagoreans have also noticed a fact that called their attention: although Mathematics is something ideal and abstract, its presence in the physical world was perceived everywhere, in the skies and on Earth. It made them consider *God the Great Geometer of the Universe, when he says that the world was made of numbers* and by having a truly religious veneration to them. (GARBI, 2007, p. 27, griffins applied by the author).

> Just as Archimedes and others, Galileo was sure that the Universe followed mathematically enunciable rules and he expressed such conviction through a known thought: "*The Universe is a great book that cannot be understood unless we first learn to understand the language and to*

> *read the letters composing it. It is written in the language of mathematics*". (GARBI, 2007, p. 171, griffins applied by the author).
>
> According to Galileo, the book of nature is inscribed in geometric characters and Einstein does not think different from that. (SANTOS, 1988, p. 50).

Thus, as we are showing, the expressed utterances, within the pibidian context of the institutionalized Mathematics, suppose other utterances and textual operations that, far from the given context and as part of the given context, are dispersed in the history of science and Mathematics. Actually, these utterances take to other ones and to a historical exteriority. However, more than a historicism (by the way, a coercive one) and, clearly, more than a nominalism, 'psychologism' and idiosyncratic geniality (actually against these three last factors), these series of utterances and discursive events disperse through a historicity that takes place through, and in, language; a historicity that is, after all, productive and constitutive. As we have highlighted, this dispersion leads to the rules of formation, according to which, the images of the world, nature and universe, based on mathematics, can be materialized and gain specific shapes, besides, they can compose a written game. These rules act on the limit of the context and of the anonymous shape, they even scape a dialectic apprehension. Therefore, the evidenced rules can be pointed out in a productive and insidious anonymity, in a spacing where mathematical universalism and absoluteness become historical *a priori*. Thus, it is evident that these rules move in an overall game that is given by an exhausting monism and structuralism, in which objects are always absolute and universal; moreover, by following this line, the structural closing of the discursive game itself.

Notice, though, that it would be possible saying that the collected utterances, and the discourses they are bond to, clearly have their continuities in the overall historical moves of Mathematics, through which:

> In the tradition of the Western science, which has its roots in the Ancient Greece, mathematical objects are conceived as having an objective and real existence, as perfect and perennial. This view reflects Platonism and, in a simplified way, bonds among the mathematical conception, the platonic world of ideas and the way to know them; consequently, the mathematical objects can be established. The reality of these objects can be compared to that of perfect forms, whose existence disregards the human action. [...] This conception, also called the absolutist view of the mathematical knowledge, is under the most important mathematical thinking: formalism, logics and intuition, as well as remains between contemporary mathematicians. (BICUDO; GARNICA, 2011, p. 40-41).

Of course, by taking away the phenomenological weight of a single conception, we could talk about the absolutist discursive formation of Mathematics. Moreover, by following Derrida (2001, 2011), we could name a logocentric discursive formation of Mathematics, based on his critics to logocentrism as the sign of Western history, which is kept by centrality in truth as the *logos*. Certainly, Mathematics is responsible for a

great project that seeks the transcendental truth in the Western history, mainly in non-phonetical and ineradicable characters (DERRIDA, 2001, 2011). By taking into account the critics provided by History, Philosophy, Sociology and by the epistemology of science and Mathematics, it would be possible to consider that Mathematics emerges as the most contemporary and insidious version of logocentrism. In all cases, it would not be wrong to mention an absolutist and/or logocentric discursive formation of Mathematics (PASSOS, 2017) if the utterances in question do not accomplish to define this formation themselves, it is evident that, since the very beginning, they concern utterances whose constituting utterances are absolutist and logocentric discourses of Mathematics.

Accordingly, a final question would be: what happens with the pibidian context in face of these discourses? Actually, how does this context remain specific in a similar discursive description? Clearly, utterance descriptions indicate that the context works as, and is simultaneously followed by, a written discursive formation. Since this formation works as a dispersion, the context seems to be away from itself. It shows that the context is always taken to its outside, to a historicity, a temporality that is not of its own. Of course, the utterances are expressed by specific subjects, within a specific context and temporality, but, in themselves, they keep on working before, and despite of, these elements in order to make them possible. Thus, the utterance exceeds the context, it sediments the context and turns it into a *socius textual*, which is crossed by many constitutive texts (discourses). Periodically, utterances remain disperse within exteriority; however, at the same time, they keep on composing the given context, so they disregard the context and provide part of its singularity. Accordingly, although it would be possible considering that the pibidian context of the institutionalized Mathematics would present itself not as absolutist or logocentric from the very beginning, notice that, even against its own purpose, it emerges as discursively absolutist and logocentric. It happens because, based on Mathematics itself – as an object of dispersion -, an absolutist and logocentric discourse keeps on acting in one of the most insidious ways (maybe the most insidious form of all): through the constitutive and productive anonymity. However, any possible discursive change will only happen from these discourses, and such change would be potentiated by the pibidian context of institutionalized Mathematics. Describing and re-describing these utterances become part of a strategy that confirms an agency to come; an agency that will provide other uses, certainly much more productive, to the discursive structuralism of Mathematics.

Overall, with respect to education in sciences and Mathematics, strictly to education in Mathematics, the herein recorded results bring up some relevant considerations to this field. At first, the problematic of the discourse seems to have no guarantee and to be little pragmatic; however, as we have said previously, it is where the discourse emerges as the smallest and residual object and where it states its power and strength: it constitutes to be an anonymous and doing element; therefore, it is not pernicious and promising. If the assessed utterances take to a discursive dispersion of Mathematics itself, Mathematics would act discursively and, as we have seen, act as absolutist and logocentric vectors. The qualification of mathematic teachers cannot get rid of this constitution once and for all, because it is productive, and the same happens with correlated contexts. However, the context of Mathematics teachers' formation, as well as their correlates', such as the pibidian context,

not only reflects the discursive rules of the constitutive object, such as the cited ones, but the differences in other terms and differential possibilities that are equally constituted. We could consider that education in science and in Mathematics itself, as a discourse, can be placed in this problematic. It is right saying that the field becomes real as long as it recovers its previous absolutist and logocentric discourse, as it reinforces such discourse, but also residually differentiate it. Although the discourse means such inflection, it points towards a deeper question for education in science and mathematics.

References

ANDERY, Maria Amália Pie Abib; MICHELETTO, Nilza; SÉRIO, Tereza Maria de Azevedo Pires. O mito explica o mundo. In: ANDERY et al. (Org.). **Para compreender a ciência:** uma perspectiva histórica. 4. ed. Rio de Janeiro: Garamond, 2014. p. 23-32.

ANDERY, Maria Amália et al. (Orgs.). **Para compreender a ciência:** uma perspectiva histórica. 4. ed. Rio de Janeiro: Garamond, 2014.

BICUDO, Maria Aparecida Viggiani; GARNICA, Antonio Vicente Marafioti. **Filosofia da educação matemática.** 4. ed. Belo Horizonte: Autêntica, 2011.

BISHOP, Alan J. Western mathematics: the secret weapon of cultural imperialism. **Race & Class**, London, v. 32, n. 2, 1990, p. 51-65.

BUTLER, Judith. Críticamente subversiva. In: JIMÉNEZ, Rafael M. Mérida. **Sexualidades transgresoras:** una antología de estudios queer. Barcelona: Icária, 2002. P. 55-79.

CAPES. Coordenação de Aperfeiçoamento de Pessoal de Nível Superior. **Portaria Capes nº 96**, de 18 de julho de 2013. Brasília, DF: Capes, 2013. Disponível em: <http://www.capes.gov.br/images/stories/download/legislacao/Portaria_096_18jul13_AprovaRegulamentoPIBID.pdf>. Acesso em: 02 fev. 2017.

D'AMBROSIO, Ubiratan. **Etnomatemática:** arte ou técnica de explicar e conhecer. 5. ed. São Paulo: Ática, 1998.

D'AMBROSIO, Ubiratan. **Etnomatemática:** elo entre as tradições e a modernidade. 3. ed. Belo Horizonte: Autêntica, 2011.

D'AMBROSIO, Ubiratan. **Transdisciplinaridade**. 2. ed. São Paulo: Palas Athena, 2001.

DERRIDA, Jacques. **Gramatologia**. São Paulo: Perspectiva, 2011.

DERRIDA, Jacques. **Posições**. Belo Horizonte: Autêntica, 2001.

FIORI, Ernani Maria. Aprender a dizer a sua palavra. In: FREIRE, Paulo. **Pedagogia do oprimido**. 58. ed. Rio de Janeiro: Paz e Terra, 2014. Prefácio.

FOUCAULT, Michel. **A arqueologia do saber.** Tradução de Luiz Felipe Baeta Neves. 4. ed. Rio de Janeiro: Forense Universitária, 1995.

FOUCAULT, Michel. **A ordem do discurso:** aula inaugural no Collège de France, pronunciada em 2 de dezembro de 1970. Tradução de Laura Fraga de Almeida Sampaio. 22. ed. São Paulo: Loyola, 2012.

FOUCAULT, Michel. Resposta a uma questão. In: MOTTA, Manoel Barros da (Org.). **Repensar a política.** Rio de Janeiro: Forense Universitária, 2010. p. 1-24. (Ditos & escritos; VI).

FREIRE, Paulo. **Pedagogia do oprimido.** 58. ed. Rio de Janeiro: Paz e Terra, 2014.

GARBI, Gilberto Geraldo. **A rainha das ciências:** um passeio histórico pelo maravilhoso mundo da matemática. 2. ed. São Paulo: Livraria da Física, 2007.

NAVARRO, Pedro. Discurso, história e memória: contribuições de Michel Foucault ao estudo da mídia. In: TASSO, Ismara (Org.). **Estudos do texto e do discurso:** interfaces entre língua(gens), identidade e memória. São Carlos: Claraluz, 2008. p. 59-74.

PASSOS, Lucas dos Santos. **Movimentos etnomatemáticos e pós-estruturais do discurso: (re)construindo caminhos em um contexto pibidiano da matemática institucionalizada**. 2017. 264 f. Dissertação (Mestrado em Educação em Ciências e Matemática) – Universidade Federal de Goiás, Goiânia, 2017.

PÊCHEUX, Michel. **O discurso:** estrutura ou acontecimento. 7. ed. Campinas: Pontes, 2015.

SANTOS, Boaventura de Sousa. Um discurso sobre as ciências na transição para uma ciência pós-moderna. **Estudos Avançados**, São Paulo, v. 2, n. 2, p. 46-71, maio/ago. 1988.

Received in May 29, 2018
Approved in August 08, 2018

Lucas dos Santos Passos has a Major in Mathematics at Federal University of Goiás (UFG) and Master's Degree in Science and Mathematics education, also at UFG. Nowadays, he is substitute teacher at Goiano Federal Instute – Urutaí Campus. He develops research in the education and Mathematics education fields.

José Pedro Machado Ribeiro has a major in Mathematics at Federal University of Goiás (UFG), and a Master's Degree in Mathematics at Brasília University (UnB) and a PhD Degree in Education at São Paulo University (USP). Nowadays, he is a Professor at the Institute of Mathematics and Statistics of Federal University of Goiás (IME/UFG). He develops research in the Education and Mathematics education fields.

Vânia Lúcia Machado has a Major in Pedagogy at Federal University of Goiás (UFG), and a Master's Degree in Education at the Catholic University of Goiás (PUC/GO) and a PhD Degree in Education at Federal University of Goiás (UFG). Nowadays, the is a Professor at the Institute of Mathematics and Statistics of Federal University of Goiás (IME/UFG). She develops research in the Education and Mathematics education fields.