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The subject-área Mathematics in integrated High School of a Federal Institute: territory, interdisciplinarity and evaluation

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Abstract: *In this paper, we discuss the materialization of the subject-area Mathematics in High School at a Federal Institute based on the analysis of the curricular documents developed nationally in Brazil between 2000 and 2012. This analysis examine from the National Curricular Parameters for Secondary Education (PCNEM) to the National Curricular Guidelines for Secondary Education (DCNEM). We understand that policies are also constituted and reinterpreted by teachers in their practices in a non-linear way. To do this, we work with the narratives of teachers and curriculum proposal developers in the form of monads. Our objective is to show that, based on the experiences narrated, the Mathematics curriculum is marked by multiple influences, disputes and negotiations when dealing with interdisciplinarity and external evaluations for technical courses integrated into High School present in Federal Institutes. We discussed that this is not just a matter of implementing a policy that does not consider the teacher's productive space for action in their work environment, but highlights their role as a curriculum producer, even more so in an institution that works with the perspective of integrated education.*

Keywords: *Teaching of Mathematics; Curriculum documents; Teacher narratives; Monads.*

Introduction

This paper addresses some of the discussions presented at the 4th National Forum on Mathematics Curricula and published in its proceedings (Brazil, 2017), based on the doctoral dissertation by Gomes (2016) at UNICAMP. We find the publication of this excerpt relevant as it details part of the thesis analyses, which are broader in scope. In both that publication and here, we consider the analysis through the triad of territory, interdisciplinarity, and assessment to discuss the subject of Mathematics within a Brazilian high school curriculum.

Our work traces the trajectory of the development and/or reformulation of the Brazilian high school curriculum, particularly from the National Curriculum Parameters for High School (PCNEM) (Brazil, 2000), with regard to the subject of Mathematics. We consider it important to understand its placement within the curricula and the ways in which Mathematics teachers and curriculum developers have appropriated it.

From a methodological standpoint, our research is based on two sources: the analysis of curricular documents and the narratives of the developers of these curricular proposals, as well as those of teachers and administrators from the Federal Institute of Southern Minas Gerais (IFSULDEMINAS), the researcher's workplace.

The Federal Institutes of Education, Science and Technology (IFs) were established by Law 11.892/2008 through the transformation or integration of existing federal institutions, such as the CE

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FETs (Federal Centers for Technological Education), Colégio Pedro II, and agricultural technical schools, which is the case of IFSULDEMINAS.The starting point is the publication of the 1996 Law of Guidelines and Bases of Education (LDB), which led to the production of a large set of official curricular documents and guidelines. During this period, the creation and expansion of the National High School Exam (ENEM) also took place, which became a powerful policy for access to higher education, along with the expansion of the federal education network, whose most prominent institutions are the Federal Institutes.

We are also interested in examining the dynamics defined by the National High School Curriculum Guidelines – DCNEM (Brazil, 2012) and by the ENEM (Brazil, 2012), through which the subject of Mathematics is no longer part of the Natural Sciences area but instead constitutes a separate area, positioning itself as what we refer to as a subject-area (Gomes, 2016).

This excerpt does not include the enactment of the BNCC (National Common Curricular Base) and the subsequent discussions (from 2017 onward). However, it remains relevant as it highlights a model of curriculum policy implementation and discussion within teachers' practice contexts, which becomes a powerful foundation for further studies.

In the context of the Federal Institutes, in addition to the regulations already mentioned, technical and vocational education at the secondary level is offered in the integrated modality—that is, high school and technical education are carried out simultaneously, with students enrolled under a single registration. This structure suggests an interdisciplinary and integrated approach to content, which would imply considering not only intersections among subjects within the regular high school curriculum but also with the subjects of the technical courses offered.

Next, in addition to better outlining this landscape of curricular reforms, we aim to present and illustrate our research methodology, which considers narratives as having the potential for guidance (Petrucci-Rosa *et al.*, 2011) and for shaping new perspectives for action. We are also interested in problematizing the possible roles that the subject of Mathematics can occupy within these high school curricula.

Our objective is to highlight that, based on the experiences narrated by teachers and curriculum developers, the Mathematics curriculum is shaped by multiple influences, disputes, and negotiations, particularly in its approach to interdisciplinarity and external assessments within the technical courses integrated into high school programs offered by the Federal Institutes.

Curricular policies post-LDB and the subject of Mathematics

In the curriculum conception we operate with, we expand the view of it as a static, closed document or a schedule/timetable. When addressing the curriculum, we also want to consider the situations, arguments, and improvisations (re)invented by teachers, administrators, students, and the community, in a complex network of relationships.

Lopes and Macedo (2011, p. 19) argue that defining curriculum in contemporary times is not easy, and that its various forms are present in the everyday terminology used in schools. These authors highlight that what is common to all of them is "the idea of organizing, whether pre-planned or not,

learning experiences/situations carried out by teachers/education networks in order to carry out an educational process."

When defining curriculum in light of contemporary interests and perspectives, Lopes and Macedo (2011) approach it from a more fluid and less tangible perspective. It is considered as a discursive practice, one of power, meaning, and the attribution of significance, but it is still largely materialized in the selection of knowledge.

In Gomes (2016, 2017), we problematize that such selections imply disputes, "winning" and "losing" knowledge in different arenas, such as policy development, textbooks, and each teacher's planning. However, this knowledge does not necessarily follow a hierarchy of exclusion, nor is its presence/absence in the curricula accompanied by explanations. When considering the subject of Mathematics in vocational education curricula, these selections become even more visible, as other agents enter the arenas of dispute.

When Petrucci-Rosa (2007, p. 52) investigates interdisciplinary work in the context of high school, she highlights the strong presence of the school subject, especially from the final years of elementary school, consolidated in three ways: textbooks, timetables, and lessons separated by specialized teachers.

Her analysis shows, among other results, that disciplinary organization prevails over other alternatives for understanding knowledge: even if a group of teachers works on a "project" or "theme" in an interdisciplinary manner, this work is clearly defined, has a set time to finish, and everyone returns to their disciplinary and specific approaches.

If we consider Mathematics as a language or tool for understanding the world, it helps other subjects during interdisciplinary moments and verifies the accuracy of the data or problems being discussed. Popkewitz (2000, p. 163) offers a productive approach to Science and Mathematics and their presence in curricula by stating that these are viewed "as bodies of knowledge that provide authorized interpretations of various claims and data surrounding social issues."

In Gomes (2016), we discuss the aspects considered by the author from the beginning of mass schooling, where Arithmetic lessons had a strong disciplinary appeal, more so than the mathematical content itself:

> when things were organized in a regular way, the same applied to the expressions and bodily movements of the children. They learned to organize their behaviors, posture, reactions, and how to sit. The principles of instruction referred to what they should know and how to 'display' success (Popkewitz, 2001, p. 107).

Another example of disciplining through Mathematics is presented by Popkewitz in the creation of Statistics, a fundamental tool in data interpretation:

> The movement of studying the child was formed within a broader domain of knowledge that included the invention of Statistics [...]. The purpose of Statistics was mutually constituted by social and cultural governance. By applying a probability calculation, state reforms and policies on health and wealth constructed social groupings and interests through references to statistical aggregates of populations. Population reasoning divided people into specific units that could be calculated, organized, and upon which reflection was possible through state administration (Popkewitz, 2003, p. 159).

In this way, the formal, seemingly hierarchical and rigid structure of Mathematics (Gomes, 2016, p. 66) can gain significant space in the constitution of certain interests in an educational reform and curricula. This is even more so if we consider broader aspects of the recent reforms, such as citizenship education and preparation for the workforce, through competencies and skills.

The reforms based on the PCNEM (Brazil, 2000) aim to work with teaching content grouped into areas of knowledge, precisely based on assumptions such as contextualization and interdisciplinarity for this type of education. According to this document, pointing to a new understanding of high school,

> The organization of learning would not be conducted in isolation by the teacher of each subject, as the pedagogical choices made in one subject would not be independent of the treatment given to the others, since it is an interdisciplinary action that articulates the work of the subjects, with the aim of promoting competencies. Languages, sciences, and humanities remain disciplinary, but it is necessary to develop their knowledge in such a way that they simultaneously constitute general culture and a tool for life, that is, to develop, together, knowledge and competencies. (Brazil, 2000, p. 14-5)

This approach, as studied by various authors (Gomes, 2016), is not exclusive to Brazilian policy but rather part of an action agenda for developing countries. A key milestone in these policies is the publication of the UNESCO report titled *Education: A Treasure to Be Discovered*. In this work, Delors *et al.* (1998) draw on Perrenoud's thinking about the pedagogy of competencies as the main reference that will guide curricular proposals from that point onward. Here, it is not only from the sciences that the content taught by schools is selected, but rather from the practices and behaviors of students in everyday life or work, and the skills required for such activities (Gomes, 2016, p. 82).

In the documents that follow the PCNEM, the guidelines continue in this direction, with few changes. The *Curricular Guidelines for High School* (OCEM) (Brazil, 2006), for example, aim to be a synthesis of the parameters with more assertive indications regarding specific subject content, an aspect that the PCNEM did not prioritize. We also had the *PCN+* (Brazil, 2006), a document originating from the PCNs with the same objective, but which was also not widely disseminated.

The ENEM (Brazil, 2012), which started with the ambitious and somewhat vague objective of providing a global assessment of high school education, has transformed into a powerful means of access to higher education. It prioritizes the competencies and skills in its reference matrices in a very meticulous way, in addition to including the teaching content for each area.

In the ENEM reference matrix and the DCNEM, we find as an innovation the subject of Mathematics separated from the Natural Sciences: the subject-area Mathematics. From that year, 2012, the so-called High School Reform was even announced in the media. This major reform had two of its objectives as a new curricular organization and the creation of a new document, the National Common Curricular Base (BNCC), which was not included within the scope of the research detailed here.

In the text of the DCNEM (Brazil, 2013, p. 184), we continue to find the defense of the assumptions of interdisciplinarity and contextualization as a "theoretical-methodological approach with an emphasis on the integration of different areas of knowledge," fostering dialogue between these bodies of knowledge from different fields.

However, just as Petrucci-Rosa (2007) does, contrary to the trends of the reforms, Machado (2002, p. 188) emphasizes that both internally, in the daily life of schools, and in curriculum planning, the predominant organization is linear and disciplinary. This organization permeates the entire set of school subjects but is most pronounced in Mathematics. This complements our discussion based on

Popkewitz, both due to the strong presence of prerequisites, always highlighted in curriculum organization, and due to the authenticating power of truth that Mathematics seems to possess.

Inspired by Ball and Bowe (1992), we aim to analyze the production of curricula beyond a mere implementation process. We do not view teachers, in this perspective, as simple implementers of proposals. We understand that curricular documents or texts follow complex and non-linear development paths, linked to networks of meaning and power.

For these authors, there are different discursive contexts that are equally producers of policies, namely: the Context of Influence, the Context of Text Production, and the Context of Practice. These are permeable discursive contexts where a linear process of implementing a specific policy has no reason to exist.

The Context of Influence corresponds to the groups that compete to define the purposes of ed ucation, such as commercial and financial organizations, from local to global levels. In the Context of Text Production, policies are indeed materialized in the form of documents, statements, and analyses. In this context, there are groups of researchers, political groups, and other organizations that will engage in the writing of documents and laws.

We also consider, in Gomes (2016, p. 44), that the texts "are the results of disputes and agreements, and may be contradictory and internally incoherent," as they come from different groups and sources. Despite all these limitations, they have real consequences, experienced in the context of Practice, which refers to the school environments where teachers and management teams will work based on the curricular documents.

With special attention to this context, we find in Certeau (1998) the notion of the consumer. Teachers, the main actors in this context, can be referred to as consumers of curricular proposals. Such consumption occurs through tactics, in practices marked by cunning and resistance.

We argue that teachers and curriculum developers, in their discourse, will highlight these pro cesses of coexistence and experience with the curriculum and the subject of Mathematics in their working environments.

Mathematics Teaching at a Federal Institute: the Focus of the Research

"The Federal Institutes of Education, Science and Technology were established by Federal Law 11.892/08, as part of the expansion of the federal education network through Public Call MEC/ SETEC 002/2007. They are based on Presidential Decree 6.095/07, which equates them to Federal Universities in terms of offering higher education and postgraduate programs, as well as being administered through rectorates."

Among its noteworthy characteristics are the commitment to regional and local development, with a focus on addressing more specific demands, and the emphasis on the teaching of the Exact Sciences, both in the levels of education offered and in teacher training (Gomes, 2016, p.105).

IFSULDEMINAS, the institution where the research was conducted, is located in the southern region of the state of Minas Gerais, which borders the state of São Paulo. Its pre-expansion campuses —formerly known as Agricultural Technical Schools that merged to form the new institution—are based in the cities of Inconfidentes, Machado, and Muzambinho. It is from these campuses that our

narrators, teachers, and administrators come, bringing their experiences related to the teaching and curriculum of Mathematics. The other campuses, established as part of the 2008 expansion, are located in the cities of Pouso Alegre, Poços de Caldas, Passos, Três Corações, and Carmo de Minas.

The region's economy is primarily based on agriculture and livestock farming; however, it also presents significant potential for industrial and service sector development, due to its proximity to major highways and urban centers such as Campinas, São Paulo, and Rio de Janeiro. These regional demands are explicitly addressed in the institution's founding documents and serve as a foundation for the design and orientation of its academic programs.

In the present study, we focus on the interface of the Federal Institute that offers upper secondary education in the integrated modality—combining general and vocational education within a single enrollment, in three-year programs where students are admitted through a selective admissions process.

Studies such as those by Silva (2009) and Figliuolo (2010), published during the early stages of the new configuration of the Federal Institutes, already present case studies on the establishment of programs within these institutions. Silva (2009), for instance, in analyzing the implementation of an integrated curriculum in a technical program in Agriculture, highlights that the regulations were not sufficient to effectively integrate the curriculum or overcome the dualities between general and vocational education. According to this author, curricular integration was based on diverse conceptions, in which

> the subjects in the Vocational Area (...) were developed under the guidance of competency-based pedagogy and centered on the know-how methodology; whereas the subjects from the general education areas of upper secondary education were approached using a traditional, fragmented model, with objectives focused on achieving good results in external assessment exams." (Silva, 2009, p. 109)

The perceptions of teachers are also addressed by Figliuolo (2010) when analyzing the implementation of a secondary education program. Drawing on a history of perceptions regarding upper secondary education and polytechnic education, the study aims to analyze the meanings produced by the course instructors about Integrated Secondary Education.

Among her conclusions, she emphasizes that teachers have limited knowledge about integrated education, make interdisciplinary connections between their classes and others, and warns that integrated teaching is not being implemented in practice according to the guidelines of Decree 5154/04 (Figliuolo, 2010, p. 88). This decree, which the author refers to, along with Decree 2208/97, addresses the types of secondary education to be offered, including the integrated model. The author also considers it important to invest in teacher training and the development of the pedagogical projects of the programs.

Regarding upper secondary education in general, without focusing on any specific additional training, we already encounter a difficulty in defining its purpose: preparation for admission to higher education or the final stage of basic education? If we consider the vocational education present in our context of study, the question that could be clarified becomes even more complex.

According to the 1996 Brazilian Education Guidelines and Framework Law (LDB) (Brazil, 1996), it is considered the final stage of basic education, complementing and deepening the learning from elementary education. However, the complexity of the contemporary context cannot be easily addressed by such provisions.

Authors such as Pires (2008) and Costa (2011) argue that there is a growing concern in the legislation to adapt this stage of schooling to the multiple aspirations of young people, such as continuing education, preparation for the workforce, integration into the contemporary and ever-changing globalized world, preparation for citizenship, and other assumptions, many of which are characterized by some as outcomes of the neoliberal policies of recent decades.

In Gomes (2016), we discuss that one of the challenges of a curricular proposal aiming for integrated education lies in understanding the meaning of scientific knowledge, the criteria for its selection, and the way to organize and approach it. The National Curriculum Guidelines for Upper Secondary Education of 2012 (Brazil, 2013, p. 188), cited by Gomes (2016, p. 100-1), highlight the relevance of this knowledge in school education and affirm that

> The integration between the dimensions of work, science, technology, and culture (...) aims to provide an understanding of the scientific and technological foundations of social and productive processes, and should guide the definition of the entire curricular proposal, serving as the foundation for the selection of knowledge, subjects, methodologies, strategies, timeframes, spaces, alternative curricular arrangements, and forms of assessment.

On the other hand, even with a significant conceptual advancement, according to Ramos (2011, p. 780), the idea remains of relating situations from concrete social practices or simulations of these with the content of the subjects.

From the perspective in which the documents are presented and the hegemonic reading by academia, the concern shifts to issues related to content and methodology. The reflection made is: 'how to teach content X better?', instead of, as Popkewitz problematizes: 'why teach content X?' or even, 'what logics or discourses beyond the school or scientific realm underlie the teaching of content X?

The documents that guide the actions of teachers and pedagogical teams at IFSULDEMINAS, in addition to those already mentioned at the national level, are the Institutional Pedagogical Project (PPI) and the Institutional Development Plan (PDI). These documents emphasize that the establishment of curricula should align with the national curriculum guidelines and promote new evaluation methodologies that prioritize 'skills for practical work (projects), creativity, and both individual and team work,' 'transformative action of the regional reality,' and 'cooperation with the world of work' (IFSULDEMINAS, 2008, p. 29).

The following conception of the curriculum, in accordance with the national guidelines, is addressed in the PPI, emphasizing equality, sensitivity, and identity:

> For the IF, the curriculum is an integrated and articulated set of activities conceived pedagogically from the perspectives of humanity, the world, society, work, culture, and education, aiming to promote the construction and reconstruction of knowledge and the development of individuals and society (IFSULDEMINAS, 2008, p. 29).

In Gomes (2016, p. 111), we more appropriately state that the analysis of these documents allows for capturing similarities, ruptures, and reinterpretations of what is presented in the national curricular documents:

> Each institution, in its own time and organization, goes through the process of developing its curricular documents, which are, in a non-linear way, influenced by what is proposed in broader public policies. In particular, we highlight the importance of the recent years for the creation of the IFs themselves and the initial development of these documents.

The importance of Mathematics is highlighted in the PPI in two ways, by listing course plans, objectives, and content for both upper secondary education and technical education:

- as a language and procedure for students to communicate and understand the various relation ships in which they live;
- as a technical skill focused on the different courses, in their specific situations.

According to the authors already discussed, we observe a strong confluence with market, society, and citizenship issues in these specific documents from IFSULDEMINAS. On one hand, this was to be expected, as they are based on national guidelines and legislation. On the other hand, they carry a very strong mark of vocational education, which creates conflicts in the formation of upper secondary education students, who also oscillate towards entry into higher education.

The Benjaminian Narrative as a Methodology

Many studies in Mathematics Education adopt the methodology of narratives, particularly Oral History, epistemologically questioning what would constitute a 'research datum.' Souza (2013, p. 262), among other authors, highlights the notion of narrative as an experience structured in the form of a report. Thus, the narrative is not captured by the investigation but produced in the investigative process (Gomes and Petrucci-Rosa, 2016).

In our research group at FE/UNICAMP, we work with the narratives of teachers, administrators, and researchers, drawing on the theoretical contributions of Benjamin (1994b) and the studies of Petrucci-Rosa *et al.* (2011). For these latter authors, the narrative of each interviewee will consider the learning situated in each individual's life history: the aim is to understand it contextually and historically.

From this perspective, the narratives bring the experiences of each narrator, considering their plurality. According to Benjamin (1994b), we are not interested in the 'pure report itself,' but rather in the guidance that the narratives offer, as they are produced by the plurality of sensations and expectations of the narrator:

> The narrative, which for so long flourished in the midst of craftsmen – in the countryside, at sea, and in the city – is, in a certain sense, an artisanal form of communication. It is not interested in transmitting the 'pure in itself' of the narrated thing as information or a report. It immerses the thing in the life of the narrator in order to then withdraw it from them. (Benjamin, 1994a, p. 205)

In the perspective considered in the works of Petrucci-Rosa *et al.* (2011), as well as Okubo (2012), Gomes and Petrucci-Rosa (2016), among others, these perspectives can make the narratives more than communicable; they can make them experiential. Life narrative is approached with the possibility of re-signifying the experience itself in its everyday practice.

The evocation of experience provided by the narrative, under the interpretation of the reader, is still contingent, as Forster (2012, p. 59), cited by Gomes (2016, p. 121), addresses. This author believes that the original text is always being interpreted with remnants of the original and in an ongoing process: there is always something that escapes and always something that is subtracted.

Benjamin (1994b) makes use of these anachronisms and connections established between the past and present when stating, according to Forster (2012), that every relationship or connection with the past, the event, involves an interpretation. The past event is subjected to a new perspective, but it is not only that. For this author, it also implies...

> An update, that is, that event, that tradition, inscribes itself in an era, the present, which, by transforming the tradition it summons, even if unknowingly or unwillingly, finds itself transformed by the very tradition it has just called upon. Every interpretation moves the foundations of the text read but also moves the reader as well" (Forster, 2012, p. 58-9).

For Petrucci-Rosa (2017, p. 566), in a later analysis, we aim to invest 'in narrative as a theoretical-methodological approach, considering other possibilities for the constitution of subjectivities, regimes of truth, and (dis)stabilization of discourse in the field of Education, especially in teaching practices.' This proposal goes beyond (or even goes against) thinking of narrative in the sense of self-reflection, with a formative character and a certain normalization of practices. Thus,

> We do not work with narrative as a device for self-reflection or for revising practices. We do not consider an image formed in a mirror from which subjectivities would be constituted. On the contrary, there is no mirror; there is someone who tells a story, and by having lived it and being able to tell it, they are considered a counselor, someone who has something to say to a listener who, in turn, will learn from the narrator. It is this historical perspective that interests us, understanding that the investment in the narrative approach allows us to engage with gaps opened in individual stories, which enable the listener/reader to glimpse a social time and place." (Petrucci-Rosa, 2017, p. 566)

Considering reality as multiple and differentiated, our research group has conventionally presented the narratives in the form of Monads. These are narrative fragments, units of meaning that, in their singularities, hold the capacity to provide a visualization of the whole. When considering a monad, it is possible to glimpse a set of potential relationships that can form a totality (Gomes and Petrucci-Rosa, 2016).

To constitute the data set for analysis in this type of research, we begin with the invitation and conduct interviews where a single open-ended question is posed to the interviewee, such as: 'Tell your story about ...'. There is no concern with working with scripts or semi-structured interviews (Petrucci-Rosa, 2011).

The interview, recorded in audio, is transcribed and textualized. We understand the importance of textualization because, according to this same author, we are not concerned with orality or linguistic styles. Our focus is directed towards the regimes of truth present in the narrated stories.

From the transcribed and textualized interview, that is, from the full narrative made by the interviewee, we constitute the monads, which are fragments or excerpts of this total narrative with the potential to illuminate the issues that interest us. Still in the elucidation of Petrucci-Rosa (2017, p. 573),

> To work with narratives as monads means to work with an empirical field which, in our case, does not go through usual procedures of categorizing concepts, classifying ideas, nor through methods that advocate a separation between the participants in the research (the narrator and their listener). In this sense, there is also no incorporation of triangulation procedures in the contact with the narratives. What is intended is not to seek 'the truth,' but rather to consider the marshy terrain of the possible regimes of truth in the stories that teachers tell.

In the present work, we present a small set of monads extracted from the doctoral research (Gomes, 2016), in which we further expand the understanding of this analytical methodology. Eight professionals from IFSULDEMINAS were invited to share their experiences, including Mathematics teachers, a pedagogue, and a professor and educational manager from a campus, as well as six researchers who contributed to the development of the curricular documents based on the PCNEM. Each monad is identified by a pseudonym corresponding to its narrator.

This set of monads is presented continuously so that the reader can also experience uninterrupted immersion in the text, allowing them to view the entire data set and its potential interpretations. Below, we provide some of our reflections on the analysis presented in Gomes (2016).

Teachers and developers of proposals narrate their experiences

MONAD 1 - Invitations and Substitutions

"I worked on the development of the parameters for High School during the period when I was already retired from the University of São Paulo. My journey at the university was quite intense, focused on teacher training and understanding how people learn and how we can teach Mathematics so that more people can learn. Throughout this journey, I had close contact with other groups from different institutes that also had research in the field of teaching. We worked on some projects, events, and meetings funded by the World Bank. The professor initially invited to write the parameters was tasked with, or believed they should, write the section on Mathematics. However, he delivered a material that did not align with what the professor in charge of the DCNs considered appropriate. As a result, another researcher was invited to coordinate everything. A colleague and I were invited due to our proximity and shared ideas in the field of education." (Flagbearer Developer)

MONAD 2 - A Place for Mathematics

In the context of organizing the High School curriculum, the debate began about the role and place of Mathematics in the curricular design. Our initial definition was not to consider Mathematics as an isolated subject, separate from the other curricular contents. Similarly, it wasn't just about considering the other curricular components in isolation, as if Mathematics had nothing to do with Physics or Chemistry, for example. Our first conclusion was to consider that all these areas of knowledge maintain a constant dialogue with each other, which is essential. At that time, the Ministry of Education (MEC) was discussing the curriculum parameters for Elementary and High School. The National Education Council was deeply involved in this debate with the teachers who were working on defining

the national curriculum parameters, so that they wouldn't define isolated parameters, considering the subjects as something fixed and decontextualized, but rather work by areas of knowledge." (Master of Ceremonies Developer) (colocar nota indicando que os pseudônimos não serão traduzidos)

MONAD 3 - The Influence of ENEM
The documents end up being overlooked and don't have much influence on our classes. Sometimes, the reforms they make, which are used in ENEM, have a much greater influence on the way we work in the classroom. This is because the final goal regarding High School, since most focus on High School rather than the technical aspect, is to enter higher education. They don't want to leave and go to the job market as technicians. We end up bringing issues like interdisciplinary topics and use them in the classroom to motivate them as well. Perhaps it's our mistake as teachers not to be more familiar with these documents. (Professor Pierrô)

MONAD 4 - The World of Mathematics
I had a very interesting experience last semester when I went to a technical class. As a mathematics teacher, who usually stayed in my classroom teaching, I decided to attend a class on pig farming. I went there to learn, and everything I learned, I was able to bring back to the world of mathematics. This experience was a personal one. I made the decision to go there. I talked to the teacher beforehand, asked for permission, and went. It's not a program or guideline from the IF. But there is still not that connection, that moment to sit down and prepare a lesson together. It's still his class and my class. I didn't work with him, I just attended his class. And when I returned, I taught my class. (Professor Ritmista).

MONAD 5 - Similar Projects
At the time of the curriculum parameters for the Elementary School, we followed the entire development process and saw what was being done. We ended up going to Spain to learn about their project, which was very similar to what was being done here for Elementary School. At that time, it was still first to eighth grade. When we returned, some time later, we heard the news that there would be curriculum parameters for the High School. There was a discussion to see if natural sciences would include Mathematics or not. The person coordinating this discussion was also developing the National Curriculum Guidelines for High School in 1998, because it was this document that directed the High School Curriculum Parameters. Some people were invited to talk, and in one of those conversations, I was present. (Elaboradora Dirigente)

MONAD 6 - Work and Negotiations
In the development of the PCNEM (National Curriculum Parameters for High School), we truly worked as a group and tested the four subjects as a single area, discussing and studying the competencies and skills chosen. When we defined which content would serve as vehicles for the development of these competencies, it was a negotiation with Physics, Chemistry, and Biology, so that Mathematics would not be at the service of the others. The goal was to have integration. The construction of the parameters was much more than just saying: 'sit there and write Mathematics or Physics...'. And this movement was really cool because, on the other hand, since there was an area coordinator, he talked to the other coordinators. This way, we were also able to think about what other competencies were being discussed in the areas of Humanities and Languages and Codes, which we needed to include to help those areas develop, for example, the issue of communication. I don't think I know of another

story of constructing a curriculum proposal that took into account the things that were done this way. (Elaboradora Dirigente)

MONAD 7 - The Prerequisites
What we see nowadays here at the Institute regarding Mathematics is very concerning. Our students arrive with many gaps from Elementary School. There's something that's not working in Elementary School. There have been changes, and today maybe students spend more time in the classroom, they're more present at school. But they still don't know Mathematics. Few of them come here with that understanding of Mathematics, the dimension of things like space, volume, and area. So what worries me is what is coming to us. When they arrive here, we have to work with these students, of course, but the difficulty is very great. We have three years to try to recover eight or more years that were left behind. We don't always succeed. (Professor Arlequim)

MONAD 8 - Area of a Single Subject
The ENEM (National High School Exam) did not have the function it has today. Dialoguing with the ENEM did not mean being subservient to it, nor preparing students for the next school level, higher education. The ENEM did not define the parameters, nor was it defined by the parameters. It was a separate movement, a movement from INEP (National Institute for Educational Studies and Research), which gathered a group of specialists to evaluate High School, at the end of mandatory basic education. The ENEM was organized by competencies and skills. But here's the most contradictory thing: when they made the new ENEM in 2009, they removed Mathematics from the area of Natural Sciences. Our area coordinator at the time of the PCNEM (National Curriculum Parameters for High School) influenced this because he was also part of the ENEM committee. Mathematics thus became a specific area, of a single subject. (Elaboradora Dirigente)

MONAD 9 - A "Non-Mathematical" Theme
In a project with the computer science course, I asked the students to organize themselves into groups and develop a topic of their choice, a "non-mathematical" topic. One group went to research Coca-Cola, another researched Graphic Computing. Each group went and researched what they wanted, and they had to study and develop this topic, creating questions about it. They had to list and develop a project and then communicate the results to me both in writing and orally, presenting a seminar. And then, building on this initial idea, we would mathematize the topic with my help. It was very interesting, also a possibility to move towards this interdisciplinary approach. (Professor Colombina)

MONAD 10 - The Old Part of Fractions
I don't really worry too much about all those contents. Whatever I manage to teach is a gain for me. If necessary, I go back to content from the 5th, 6th, or 7th grade. That old part of operations with fractions, multiplication involving signs, those are still existing difficulties. Sometimes I go back to these concepts that they should theoretically already know, but if they manage to leave the first year having these previous deficiencies addressed, it's a win for me. For a long time now, I stopped holding myself accountable for the content. I really just want them to learn, that's all. (Professor Ritmista)

MONAD 11 - 300 Years
I was once very struck in a meeting when the people from a technical area told a Mathematics teacher that they really needed a specific content to proceed with a technical subject. I will never forget that. It

was a year-end meeting, and I don't exactly remember what the subject or content was. Then the Mathematics teacher picked up a very thick book and said: "It's been 300 years since someone thought this way, why should I do it differently?" The other teachers needed that content to be addressed, but the person couldn't pass on that content that was scheduled for the 2nd year to the 1st year... Why was that? (Pedagogue Passista)

Dialoguing with the Narrated Experiences

The documents published after the 1996 Lei de Diretrizes e Bases (LDB) (Brazil, 2016), upon which we base our discussion, namely, from the PCNEM (National Curriculum Parameters for High School, 2000) to the DCNEM (National Curriculum Guidelines for High School, 2012), constitute a set of actions unprecedented in terms of the quantity and variety of material published over such an extensive period. Various sectors of society have marked and continue to mark the constitution of these documents (Gomes, 2016). Starting in 2017, we witnessed the formation of the Base Nacional Comum Curricular (BNCC), which was not included in the research presented here but presents many points of convergence with our analysis.

In Gomes (2016), we propose an understanding of the trajectory of the constitution of these curricular proposals through assumptions such as the conception of the curriculum presented, the main elements that will guide the teacher's practice, notably the notions of competence, skill, interdisciplinarity, and contextualization, and the sectors of society involved.

Many studies bring results indicating a continuity of policies across different governments, as well as a commitment to a global agenda of reforms, issues of methodology and didactics in teaching Mathematics, and matters related to neoliberal assumptions about the state, education, and work. Regarding the Federal Institutes, although in smaller numbers, we also find research that addresses their constitution, the discussion of professional education offerings at the secondary level, and the creation of specific courses and curricula.

As Ball and Bowe (1992) and other authors who build upon their work explain, curriculum documents are constituted in different arenas and are re-signified in teachers' practices. By taking the policy cycle as a method and navigating through these different discursive contexts—via documents, research, and narrators—we can perceive the disputes, negotiations, interests, and diverse constitutions.

The eleven monads selected from the set presented in Gomes (2016) reflect a bit of this diversity in the ways of understanding the placement of the Mathematics discipline within the curriculum. In particular, they bring forth some fundamental aspects in the analysis we conducted.

Monads 1 (Invitations and Substitutions) and 2 (A Place for Mathematics) clearly show us the winding path of the discipline in High School. There is the presence of dialogue between teams responsible for the creation of different documents being developed simultaneously (PCNEM and DCN). Furthermore, the discussion about organizing the curriculum by areas of knowledge is highlighted, which was not predominant at the time but indicated the path that the creators intended to follow. In this perspective, the knowledge should maintain a dialogue among themselves, in order to enable interdisciplinary and contextualized work.

We observe, contrary to what the dissemination and implementation of the documents suggest, that their writing is not peaceful or linear, as we argue in accordance with Ball and Bowe

(1992), Okubo (2012), and Popkewitz (2000, 2003). There is the presence of a reform agenda involving funding agencies, other government sectors at various levels, as well as bureaucratic issues such as changes in collaborators and perspectives, shifts in the tone of the written text, and others.

The strong influence of the ENEM in the integrated courses of IFSULDEMINAS is present in Monad 3 (The Influence of ENEM). For this teacher, it is from the PCNEM that a movement to reformulate teaching content emerges, but it does not bring significant changes to their daily work routine, given the characteristics of the technical courses (Gomes, 2016).

Students demand an approach that prioritizes the ENEM and university entrance exams, as they also aspire to pursue higher education in addition to their technical high school training. In this context, reconciling different approaches to the content and the students' aspirations can pose a major challenge for teachers.

In Monad 4 (*The World of Mathematics*), we glimpse another challenge present in the integrated education model at IFSULDEMINAS. In the search for interdisciplinary experiences, the teacher recalls an episode that reinforces the predominance of a disciplinary curricular organization. Even in an attempt at interdisciplinarity and contextualization, the spaces remain clearly defined: *"his class"* and *"my class."*

In this monad, we find an important perspective on the identity of integrated education at IFSULDEMINAS. It presents an interdisciplinary proposal that also encompasses technical education subjects, going beyond just the high school disciplines (Gomes, 2016). The curriculum thus materializes through maneuvers involving the reorganization of teaching content and course syllabi, based on the institution's specific characteristics and within the framework of broader national regulations.

Monads 5 (*Similar Projects*), 6 (*Work and Negotiations*), and 8 (*A Single-Subject Area*) reveal aspects of how curricular documents are constructed through discussions, negotiations, and even disputes among groups, researchers, and government bodies. By working with Ball's policy cycle approach, we understand the non-linearity of these processes—particularly when engaging with these monads in the contexts of influence and text production.

Monads 7 (*Prerequisites*), 10 (*The Old Part of Fractions*), and 11 (*300 Years*) bring to light a very common discussion in the practice of Mathematics teachers: the role of prerequisites in shaping the structure of the subject and the sequencing of its teaching content within school curricula. Most notably, Monad 11 highlights the feelings of frustration experienced by both the pedagogue and the teacher as they position themselves in the construction of a new curriculum for a technical course at the Federal Institute (IF).

Monad 9 (*A "Non-Mathematical" Theme*), in turn, complements the discussion already introduced in Monad 4. Teachers seek out alternatives, taking a leading role in their teaching practices by reinventing the Mathematics curriculum within their specific spheres of action. According to these narrators, there are many possibilities for constructing a curriculum that makes sense to students and fosters more effective and meaningful learning.

As discussed in Gomes (2016) and Petrucci-Rosa (2017), questioning the curriculum beyond the well-known lists of content and procedures to be applied at a given stage of schooling aims to

break away from the notion of the progressive school and its community—teachers, administrators, and students—as mere cogs in a system designed to achieve the highest possible performance.

Nonetheless, as also highlighted by the monads presented here, we observe a range of curricular guidelines—and even academic approaches—geared toward efficiency, within an era dominated by systemic assessments.

Like any case study, this research does not aim to exhaust a view of reality or of its corpus. We acknowledge its natural limitations but highlight its potential to foster new discussions, both with the dataset presented in the full study (Gomes, 2016) and through a continuation of the research encompassing the most recent documents.

For the context presented at that time, there was a pursuit of understanding and implementing integrated education in the Federal Institutes, on the eve of the approval of the BNCC. Currently, the new challenges involve the implementation of that same BNCC, the New High School, and the constant reconfigurations of youth and the labor market (Brasil, 2017).

Final Considerations

For Ball, in our analysis (Gomes, 2016), policies are made for people. These people, in a simplified analysis, would implement or be affected by those policies. However, his Policy Cycle approach aims to go beyond this, identifying and attributing activity and creativity to teachers and the community as a whole.

Popkewitz (2003, p. 164) also suggests an alternative reflective attitude towards curricular changes, considering that teachers' discourses do not reflect isolated practices, but rather are mobilized by multiple discourses that converge to conceptualize schooling through regimes of truth.

The teachers and researchers briefly presented here are examples of education professionals who, as highlighted by Petrucci-Rosa *et al.* (2011), were able to re-signify their experiences. More than mere events, they shared with us their memories full of meaning, concerns, and expectations in the daily and conscious effort for a school that makes sense to themselves and their students.

In seeking an understanding of the paths that the Mathematics discipline has followed in different curricular configurations, we perceive the predominance of curriculum organization by subjects in various institutions, particularly in the Federal Institute considered.

Regardless of the focus that the curricular documents place on Mathematics, its constitution as a reference science remains intact. Whether as a subject within a broader area or as an isolated area, whether conceived in terms of competencies and skills for the world of work and citizenship, or even for success in external exams.

We understand, based on Ball's Policy Cycle, that these policies can be constructed in different contexts, including the school environment. The monads that illustrate this work show the potential of this discussion and the need to continue problematizing these issues with teachers and researchers.

This work, thus, can foster new curricular arrangements for Mathematics in High School and legitimize the work of teachers. It remains a work in progress if we consider the analytical perspective that collects fragments that cannot be placed together or fit into a single panel. The very constitution of

the Federal Institutes in their current configuration, even though it is close to 20 years old, is still under construction, given the frequent adjustments to operational demands and expansions of units.

Furthermore, the most recent national curricular discussions, such as the high school reform and the Base Nacional Comum Curricular (Brazil, 2017), further support our argument for the complexity and non-linearity of policy formation.

Thus, we present the triad proposed to analyze the subject-area of Mathematics in the context of the IF (Federal Institute), namely territory, interdisciplinarity, and evaluation, by bringing together the set of monads presented earlier and engaging with the authors who have followed our research thus far.

As the narrators and their life experiences indicate, the work of the teachers at the institution and the developers of the curricular proposals demonstrates the continuous movement of this subject and, at the same time, the area of knowledge, dialoguing and being constituted in different spaces and moments. This constitution takes place in terms of the search for a territory considered its own, working with the concept of interdisciplinarity, inherent to both the documents and the institution, and strongly marked by the presence of external evaluations such as the ENEM and entrance exams.

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