


THE HISTORY OF MATHEMATICS AND THE NEW HIGH SCHOOL

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ABSTRACT

The New High School brought several changes in the curriculum and structure of this stage of basic education. Along with these changes came numerous challenges. One of these great challenges faced by teachers is the preparation of elective subjects. Elective courses aim to provide a more personalized and flexible education, allowing students to deepen their knowledge in areas of their interest or develop specific skills. For this reason, the definition of the objects of knowledge to be addressed in these disciplines requires a careful analysis of the needs and interests of the students, as well as the integration of contents that are relevant and significant for the integral formation of the students. Thus, the present work aimed to carry out bibliographic research to justify the use of the history of mathematics as an elective subject. The history of mathematics provides students with a broader perspective on mathematics, showing that it is an ever-evolving discipline influenced by human thought and social needs. Finally, a grid of topics to be addressed in this discipline is proposed, taking into account the competencies and skills present in the BNCC (National Common Curricular Base) and seeking to fill possible gaps in the teaching-learning process of basic knowledge objects of mathematics. This grid includes, among other topics: The numbering systems, the origin of the main mathematical symbols, the history of fractions, functions, numerical sets, and contemporary mathematics.

Keywords: History of Mathematics. New High School. Elective Course. Teaching. Apprenticeship.

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INTRODUCTION

In 2022, all high schools in Brazil had to adapt their curricula to align with the New High School (NEM). As a result, teachers had to dedicate themselves intensely to defining, planning, and selecting the training itineraries, the deepening tracks, and the elective subjects that would be offered to students. In addition, it was necessary to integrate projects, prepare syllabuses for these new disciplines, and also deal with all the demands of the existing mandatory disciplines.

With this in mind, this work proposes as a final product a syllabus for an elective course focused on the New High School. The discipline will be directed to the area of mathematics and its technologies, considering that, historically, this is an area where students face more learning difficulties.

The elective course that we suggest here aims to arouse students' interest in mathematics by addressing its history, in addition to offering a more comprehensive view of the subject, showing it as a field in constant development, shaped by human thought and social demands.

In addition, this discipline seeks to demystify the idea that mathematics is a difficult area to understand and that only people with advanced intellectual abilities can learn it.

Therefore, the present work has as its general objective to offer high school teachers in Brazil a syllabus of an elective subject for the New High School.

Additionally, the specific objectives of this work are:

1. To present a concise analysis of the purposes of High School the teaching of mathematics, in the light of the National Common Curricular Base (BNCC).
2. To carry out a bibliographic review on the use of the history of mathematics in the teaching-learning process of mathematics;
3. Develop the syllabus of an elective course that is based on the history of mathematics.

METHODOLOGY

To understand the purposes and objectives of the training itineraries present in the New High School grid, detailed research was carried out in the documents that regulate this new educational structure.

In the new high school in Brazil, it is the training itineraries that allow students to choose part of the curriculum according to their interests and aptitudes, thus ensuring the flexibility of the curriculum.

The training itineraries have the following objectives:

- Deepen learning related to general competencies;
- Consolidate the integral education of students, developing the necessary autonomy for them to carry out their life projects;
- Promote the incorporation of universal values, such as ethics, freedom, democracy, social justice, plurality, solidarity and sustainability; and
- Develop skills that allow students to have a broad and heterogeneous view of the world, make decisions, and act in the most diverse situations, whether at school, at work, or in life (BRASIL, 2023).

The National Curriculum Guidelines for High School (CDNEM) establish that training itineraries must be organized based on four structuring axes.

They are:

1. Scientific research;
2. Creative Processes;
3. Mediation and Sociocultural Intervention; and
4. Entrepreneurship.

In addition, the curricular organization of the training itineraries must be given by disciplines, workshops, thematic units/fields, and projects, among other experiences that enable the flexibility of the curriculum.

Elective courses, in turn, are part of this flexible part of the curriculum, aiming to provide more personalized and flexible training, allowing students to deepen their knowledge in areas of their interest or develop specific skills.

Elective courses cover different areas of knowledge and may vary according to the offer of each school.

In addition, an analysis of the National Common Curricular Base (BNCC) for high school was carried out to analyze the objectives of the teaching of mathematics.

In the BNCC, High School is organized into four areas of knowledge, following the parameters determined by the LDB (Law of Guidelines and Bases of National Education). In each area of knowledge, specific competencies are defined that must be fostered

throughout this stage, both in the context of the National Common Curricular Base (BNCC) and in the training itineraries of the various areas.

The BNCC for high school in the area of Mathematics and its Technologies proposes the expansion and deepening of fundamental learning developed up to the 9th grade of Elementary School, focusing on the construction of an integrated view of mathematics, applied to reality. To this end, students must develop skills related to the processes of investigation, creation of models, and problem-solving, being encouraged to: (i) mobilize their way of reasoning, interacting with classmates and teachers, investigating, explaining, and justify problems solved through mathematical argumentation; (ii) represent, through the elaboration of records to remember mathematical concepts and objects; (iii) argue, through the formulation and testing of conjectures with the presentation of justifications; (iv) communicate, being able to present their results, not only through mathematical symbols but also through oral expression, transmitting their findings verbally, (v) in addition to learning concepts, developing more advanced representations and procedures.

In addition, according to the BNCC, the different fields of mathematics - Arithmetic, Algebra, Geometry, Probability and Statistics, Quantities and Measures - must be integrated, always maintaining the proper correlation between them.

The BNCC also emphasizes the importance of providing students with mathematical literacy, ensuring that they recognize that mathematical knowledge is fundamental to understanding and interacting effectively in the world. In addition, the BNCC also recognizes that one of the challenges for learning mathematics is to convey to students the perception that it is not limited to a set of rules and techniques, but is intrinsically linked to our culture and history.

Additionally, to support the choice of the theme for the proposed Elective Course, research was carried out in search of articles that would justify the use of the history of mathematics in the classroom. For this, Google Scholar, the PROFMAT dissertation collection available on the program's website, and the CAPES (Coordination for the Improvement of Higher Education Personnel) Theses and Dissertations Catalog were used as research sources. During this search, several articles and academic works were found that defend the use of the history of mathematics as a methodological tool that facilitates the teaching-learning process of the discipline.

For D'AMBROSIO, the approach to the History of Mathematics in teaching should be mainly valued for its ability to motivate interest in Mathematics

By this conception, we find the work of (DA COSTA, 2016), who says:

[...]as using historical facts about the lives of mathematicians and the purpose of some discoveries, when approached in the classroom, can stimulate students to learn the discipline and demystify the idea that Mathematics is directed only to the best intellectually qualified. (DA COSTA, 2016)

For Pereira (2022), history can contribute to facilitating the learning of mathematics by being a source that encourages research into the content already studied in the classroom.

Lustosa (2021) defends the use of the History of Mathematics in the classroom to make sense of pre-packaged concepts and formulas, once the concepts are worked on from a context, which makes learning more meaningful and encourages reflection and analysis.

Silva, 2019, addressed the contribution of the History of Mathematics to the formation of students' citizenship. To this end, he investigated how the history of mathematics, as a teaching resource, affects the process of cognitive, intellectual, social, and cultural transformation of the person. Silva explored in his work Mathematics Education, Citizenship, History of Mathematics and the Formation of citizenship, establishing the relationship between mathematics and citizenship and came to the conclusion that the teaching of mathematics through the History of Mathematics not only encourages students to think and reflect on the historical context in which the production of mathematical knowledge originated, but it also highlights the large number of people involved in the process of its construction.

RESULTS AND DISCUSSION

As a result of this research, we have the syllabus of an elective course. This discipline should have the workload destined to the training itineraries, to enable students to expand and deepen their knowledge regarding the contents belonging to basic general education.

In addition, the elective "History of Mathematics" should be part of the structuring axis "Scientific Investigation" and emphasizes expanding the student's ability to investigate reality, understand, value, and apply systematized knowledge, through the realization of scientific practices and productions (BRASIL²).

Next, there is the syllabus of the elective course.

- Title: History of Mathematics
- Curricular Component: Mathematics
- Structuring: Scientific Research
- Duration: 40H/A
- Abstract: The elective History of Mathematics aims to awaken interest in mathematics through the historical knowledge that permeates the objects of knowledge of this discipline. Throughout the elective, students will be introduced to the needs that led people to develop mathematics as we know it today and to the processes that were necessary to systematize mathematical practice. In addition, students will have the opportunity to understand that mathematical knowledge is indispensable for life in society and that this knowledge is related to several other areas. In this elective course, the student will be able to access answers to questions such as "Where did the numbers come from?" or "Where will I use fractions?". As a culmination, students will have the opportunity to participate in storytelling, providing opportunities for research, programming, organization, teamwork, respect, protagonism, orality, creativity, and critical thinking (DE SOUSA). As for the evaluation, the teacher must observe the interaction, and participation in the classes, in addition to the involvement, engagement, and achievement of the culmination.
- General Objective: To arouse interest in mathematics through the recognition of its relevance to the construction of life in society.
- Specific Objectives:
 - Expand students' knowledge about mathematics;
 - Understand that mathematics did not arise by chance;
 - To know the historical processes that led civilizations to develop the mathematics we know today;
 - Promote interest in mathematics.

Throughout the 40H of the course, it is proposed to address topics such as The importance of history, numbering systems, the Babylonian numeral system, the Egyptian numeral system, the Roman numeral system, the origin of mathematical symbols, the history of fractions, sets of natural, integer, rational, irrational and real numbers, functions, in addition to addressing contemporary mathematics.

It is worth mentioning that all the objects of knowledge mentioned above must be addressed to achieve the objectives present in the BNCC.

FINAL CONSIDERATIONS

Given the extensive literature that defends the use of the History of Mathematics in teaching, it is essential to highlight the lack of practical guidelines for its effective application in the classroom. This work, by focusing on this need, seeks to contribute significantly to the enrichment of the pedagogical repertoire of mathematics teachers.

In this context, we also aim for future studies to complement this material, developing didactic sequences that use the history of mathematics as a facilitator of the understanding of mathematical concepts. By integrating this historical approach into teaching in a more systematic way, it would be possible to further enrich pedagogical strategies and promote more meaningful learning.

Additionally, we propose that an extension of this study include an in-depth analysis of the results, both in increasing the students' knowledge and in their receptivity and appreciation for the contents covered. Systematized collection of this data can provide valuable insights into the effectiveness of this approach, allowing us to identify areas for adjustments and improvements. Thus, the continuity of this research can contribute significantly to the constant evolution of teaching, offering a solid basis for future improvements in the teaching-learning process.

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