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Astronomy in high school math

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Hélio S. Azevedo

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SUMMARY
The present work aims to present a context around the theme of astronomy and its relationship with mathematics in high school, addressing how these two disciplines can be interconnected, how they complement each other and the main benefits of combining both within the school environment. In order to deepen the argument, bibliographical research will be used with the main texts of some renowned authors in the area.
Keywords: Astronomy; Mathematics; High school.

ABSTRACT
The present work aims to present a context around the theme of astronomy and its relationship with mathematics in high school, addressing how these two disciplines can be interconnected, how they complement each other and the main benefits of joining both within the school environment. In order to deepen the argumentation, bibliographic research will be used with the main texts of some renowned authors in the field.
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1. Introduction

Astronomy can be considered by many as an important science that studies the mysteries of the universe studied for millions of years, since its antiquity, which is why it generates such a great fascination and passion leading man to contemplate the phenomena present in humanity, threats, divine signs. During the Assyrian historical period, progress in relation to astronomy became more concrete. Centuries later, the first texts appeared on the study of movements, began to be observed and related to mathematical theories, in almost a millennium and a half, the wise men elaborated some mathematical theories, which provide a description of the movements of the sun, the moon, the planets and the variations that occurred between them, whether day or night.

The relevance of the topic discussed consists in presenting how mathematics has developed in the area of Astronomy, in scientific studies, addressing how one complements the theories of the other, presenting concrete ways in which the greater presence of this discipline in schools could facilitate the understanding of content by students, raising awareness among educators and professionals in the field.

The main objective of this work is to establish relationships between the mathematics used in astronomy and that taught in high school. Specific objectives include: addressing how astronomy complements reasoning processes in the relationships between content and educational practice, in the production of mathematics knowledge during high school; identify the presence of the main introductory pedagogical practices of this content in schools, their techniques and methods for using the subject, understand how student curricula work in this pedagogical process.

In order to build a concrete argument around the topic, some bibliographical research will be used based on academic texts, books, periodicals and articles that can provide the argument, a concrete construction of content and themes to be addressed. Priority will be taken into account, articles involving the area of astronomy and its contents around the relationship between mathematics.

For the research to develop, we hope to define the concepts and strategies that help in teaching, when talking about astronomy in mathematics subjects, looking for ways to develop it within the student environment

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and propose measures so that this inclusion can be carried out more concretely.

2. Theoretical framework

For Mourão (1997) Astronomy is in essence, the science of observing the stars. He states that "[...] the objective of Astronomy is to locate them, in space and time, to explain their movements and their origins, to discover their nature and characteristics. In the history of science, there has always been an attempt to understand the universe, something almost indecipherable to the human mind, which is why astronomy is one of the most important studies, however, in education the notions of astronomy were diluted and divided into general disciplines. The school began to introduce it in a very superficial way, due to the more traditional teaching model that ends up emphasizing more content and not constructive learning schemes, since, in the most conservative view, astronomy in education does not have much space, being understood as a playful and not very important subject, in high school, only theoretical questions that are present in mathematics still predominate.

> The permanent interaction between Astronomy and Mathematics can somehow be used to try to overcome this traditionalist view. The difficulties that most students experience, both in understanding mathematical concepts and in their application to reality, can be overcome by taking advantage of Astronomy, as it in itself is quite motivated by the curiosity it awakens in people (MORAIS, 2003, p. 8 and 9).

According to the author, the subject can become more interesting when a teacher starts to talk about the planets, the search for extraterrestrial life, awakening in students an interest in space life, a feeling that drove individuals to seek science, so they will become interest in scientific advances, the development of citizenship and may develop greater motivation for studies. Mathematics can go far beyond its formulas and logical structures, but it has its own characteristics of research, language and integration with other natural sciences, explaining its links and aspects between the disciplines that are present in the area, translating its skills general, thus organizing a program of disciplines in the area, themes that structure disciplinary knowledge and are a space, with characteristics specific to skills.

> At the end of High School, students are expected to know how to use Mathematics to solve practical everyday problems; to model phenomena in other areas of knowledge; understand that Mathematics is a science with its own characteristics, which is organized via theorems and demonstrations; perceive Mathematics as socially and historically constructed knowledge; know how to appreciate the importance of Mathematics in scientific and technological development. Complementary Educational Guidelines (BRASIL, 2006, p. 85).

The understanding of these mathematical concepts can be better understood and facilitated by students, where astronomy can be decisive in the deconstruction of more concrete problems, during this research work, it will be addressed how astronomy concepts define learning in mathematics and can complement it in schools.

During the research process, it was possible to analyze that there are already recent studies regarding astronomy and the importance of being combined with mathematics, many authors already understand that this is something relevant and that it could make the content more attractive, since a theme can complement the other.

For the author Silva (2015), there are a diverse number of numbers and functions that can be used to relate mathematical concepts to astronomy, they can be:

The arrangement of stars in a diagram allows us to estimate their evolution.

The slope of a straight line of the functiontoallows estimating the age of the Universe and the speed at which the planets are moving away.

The rate of variation allows us to calculate the areolar speed of the planets. The relationship between the distance of the planets and the Sun in the Solar Systemisnumerical sequence.

The relationship between a star's distance and its brightnessislogarithmic function.

Therefore, according to the concepts proposed by the author, statistical data can allow one to

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analyzing, for example, the possibility of collision of extraterrestrial objects on the surface of the earth, the probability of which also allows us to show an existing possibility of life that could exist beyond the solar system. These themes, which permeate the National Curricular Parameters, can be taught over the three years and cover the main areas that are present in mathematics, namely algebra, in its numbers and functions, geometry with its averages, but mainly the data analysis, methodological options that can be consistently associated with astronomy.

It becomes necessary during the school period for a student to acquire a set of knowledge, so that they understand their reality and the world around them, being able to intervene with competence and autonomy in the situations encountered, so that this can be found in the world of mathematics , according to PCNEM:

> A logical articulation of mathematical ideas and content that can be systematized into three axes or structuring themes, developed concomitantly in the three grades of High School: Algebra, numbers and functions, geometry and measurements, in addition to data analysis. (BRASIL, 2006, p.19).

To think about interpreting Astronomy in a concrete way, answers are sought in the universe, where as-Tronomers estimate distances in miles and kilometers, when studying the solar system the unit of length used is the astronomical unit (AU), the average distance from the earth to the sun, which involves approximately 150 million kilometers, the stars and galaxies are find in a huge quantity far away to be found. The light year is mainly the unit of distance that occupies the most space, since the path taken by light during a year is 300 thousand kilometers per second, equivalent to a path covered by 9 trillion and 460 billion kilometers, meaning that light can travel 8 times around the earth in just 1 second, beyond the distance at which the radius of the earth's orbit is seen at an angle of one arc second.

When the Law of Guidelines and Bases of National Education was sanctioned in 1996, a reform was also implemented by the Ministry of Education, High School then assumes an identity so that the student's general education can be consolidated, so that ethical training could be offered, the National Curricular Guidelines for Secondary Education were developed, guiding the work with subjects in their main areas, and the National Curricular Parameters were then created.

From these parameters, a new meaning was given to Physics, a new vision focused on the formation of citizens, even if after their basic education, they no longer have contact with physical content, they can interact and understand reality in the world. where he lives, this is a teaching proposal, where the skills are gathered into three main axes: Representation and communication, investigation and understanding and sociocultural contextualization, which are also divided into curricular components.

> Competency-based training requires students to be able to recognize the languages used in Physics in various contexts and use them to demonstrate their knowledge. In the Research and Communication axis, the PCN encourages students to develop critical thinking, seeking information from reliable sources that formulate hypotheses about problem situations. In the Sociocultural Contextualization axis, Physics must be seen as a human construction. (TROGELLO, 2015).

These skills, when worked on in isolation, do not have any kind of meaning, but they must be integrated into other areas of knowledge, being contextualized, they represent meaning in the lives of young people, teaching physics has an agenda in their set of skills specific, so that the learner recognizes the natural and technological phenomena that are present in their day, seeing in the human being an agent in the its construction process, knowledge and science, in addition to the possibility of perceiving technology at the moment. The change may also suggest an introduction to a language specific to physics, based on some concepts and a specific form of language based on scientific knowledge, after which the ways in which physics is expressed, with tables, can also be taken into account. laws, graphics and other content.

> Schools, with their political pedagogical projects, should guide the direction of Physics teaching. It is not enough to simply indicate the direction to be taken by teaching Physics at school, there is a long road between discourse and effective practice. Many discussions about how to teach physics, what changes should be made to the curriculum, what topics should be included or removed, it will still take some time for us to have these answers. We did not find in the PCN which contents should be worked on in the component

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> Physics curriculum, but we note the importance given to issues of contextualization and interdisciplinarity, which we consider the Astronomy theme fits very well (BRASIL, 2002).

With the main educational guidelines complementary to the National curricular parameters, the document that came with the objective of articulating the implementation of disciplinary skills, stating that the most important thing for learning physics is not exactly that the teacher should teach the syllabus that encompasses in general, Classical Mechanics, Optics, thermodynamics and Electromagnetism, thus adopting content that can enable the implementation of skills, it is seen that astronomy can fit into this proposal, many issues that are considered important in the daily life of a student, can be answered through Astronomy, such as the way the seasons occur, the phases of the moon, the influence of the sun and moon on the formation of oceanic seas, therefore there is a lot of knowledge added by astronomy.

According to Brasil (2002), themes can be composed as:

> - REPRESENTATION AND COMMUNICATION: Use and understand mathematical language in Physics knowledge, Synthesize subjects that have been worked on through schemes, understand statements that involve physical codes and symbols; express oneself correctly using appropriate physical language; know reliable sources of information, etc.
> - INVESTIGATION AND UNDERSTANDING: Develop the capacity for physical investigation; classify, organize, systematize and identify regularities; observe, estimate orders of magnitude; understand the concept of measuring; understand and use physical laws and theories; articulate physical knowledge with knowledge from other areas of scientific knowledge.
> - SOCIOCULTURAL CONTEXTUALIZATION: Recognize physics as a human construction, an aspect of its history and relationships with the social, cultural, economic and political context; scale the growing capacity of man provided by technology; establish relationships between physical knowledge and other forms of expression of human culture; recognize the role of physics in the production system. The teaching and learning strategies in the pursuit of these objectives are highlighted in the characteristics that cannot be taken into consideration, to plan and execute the didactic pedagogical activities, also taking into account the social environment in which the student is inserted, not one can fail to take into account that he has life experience.

There is then, from this moment on, the possibility of placing astronomy on the thematic axis of earth and universe, having an even more motivating character in the development of a scientific culture, in this sense, when observed from the point of view of the structuring themes proposed in the PCN, as well as in the thematic axes that are proposed for elementary education.

> In Elementary Education, seen since the LDB as an indispensable stage in citizenship training, we have Natural Sciences being presented throughout the final four years, encompassing the teaching of Biology and Chemistry alongside Physics. For this level, the PCN propose knowledge based on its social importance, its meaning for students and its scientific-technological relevance, organizing it into the thematic axes “Life and Environment”, “Human Being and Health”, “Technology and Society” and “Earth and Universe” In this proposal, the contents related to the four axes must be presented from the 6th to the 9th year, with increasing scope and depth, obviously considering the level of development of the students (ROSA et al. , 2015).

Within the areas included in the National curricular parameters, there are specific ones for each area present in knowledge, so that they are effectively implemented in their learning processes, astronomy has been present since the existence of man on planet earth, being the oldest science, however research work in the area is still not developing very well in Brazil, only passing through texts in high school between geography and physics, but there is a lack of the specific discipline of astronomy, in addition to the training of professional educators in this area, therefore if makes it natural for teachers to use textbooks to teach this subject, but it still becomes an immense challenge to teach astronomy, the ideas must initially be geocentric according to the curricular teaching parameters, the observer is located on the surface of the earth, so that observations and systematization is made, computational resources are widely accepted in this matter, such as animations and simulations, the mathematics teacher, mainly, needs continued training to know how to make connections between mathematics and this relationship with the stars and the studies that permeate the universe.

However, several problems surround this issue, as educators are subjected to a workload

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huge amount of work and poor conditions, therefore it becomes difficult for them to seek specialization, as technological measures and advances are kept up with, alternative methodologies are increasingly sought, so that teaching in general becomes increasingly greater , are learning objects, digital resources that can be used in different environments. These tools work as facilitators, in the area of mathematics they could easily help classes become less theoretical and more practical, with star observation, videos, problems involving astronomy.

> Learning objects have some characteristics that are common: reusability, adaptability, accessibility, interoperability, granularity, flexibility, durability, in addition to being updatable. In addition to these characteristics, we must also highlight that a LO must be linked to the real world, thus encouraging experimentation and observation of phenomena; be interdisciplinary, favoring the connection between the various areas of knowledge; present ease of manipulation, so that it can actually be incorporated into the teacher's pedagogical practice; be interactive, to awaken the student's interest, making them become critical, autonomous and reflective citizens. (TAROUCO ET AL, 2003).

The National curricular parameters propose the relationship between mathematics and astronomy as important for the cultural development of students. This contextualization can become a very useful instrument, when interpreted in a broader approach, avoiding artificial and forced ways, so that there is no restricted to the student's daily life.

> The idea is defended that contextualization stimulates the student's creativity, inventive spirit and curiosity). It is important that students realize how Mathematics is an important tool for everyday life and especially for problem solving (GONÇALVES et al., 2007).

This interdisciplinarity is something fundamental for the development of students, but it is not explored for a multitude of reasons, the main one being the lack of support material for this methodology, with the two disciplines complementing each other in elements such as proportion, geometry, trigonometry and theorems.

Conclusion

During the research process, it was possible to understand that since the first mathematical and arithmetic studies According to experts, astronomy was very present, helping in the teaching processes and relationships that permeate these two disciplines, however, as the teaching of mathematics became something more comprehensive, being inserted very prominently in schools, astronomy began to distance itself and was summarized to a complementary role, being considered just one of the spheres in the field of science, but it goes far beyond that.

In almost all sciences, the studies of the stars, movements and directions that permeate the universe were present, since its beginnings, even before the creation of mathematical notions, space was already something that generated questions for man, the investment of our country for this area, however, it is something very vague and still needs reformulations, the National curriculum parameters were a formula that helped to modernize teaching standards.

But the traditional system is still something that is part of Brazilian schools, for a specific subject to be implemented it would be necessary for really concrete changes to happen, but this would be something complementary and very innovative for learning. The presence of astronomy could generate a more critical, creative profile of students and could even provide the inclusion of new technologies and modernizations in the student environment.

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