

The Geometry I see

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Sustainable Development Goals / ONU Quality Education

Abstract. Geometry has been present in everyday life since the first civilizations, but its teaching is still often marked by abstraction and distancing from the reality of students. In this context, the extension project "The geometry I see" was developed in the discipline of Euclidean Geometry I at the Federal University of Rondonópolis, with the objective of highlighting the presence of geometry in everyday life and bringing universities and schools closer together. The proposal involved the production of photographs that illustrated geometric concepts, classroom discussions, group research, poster elaboration and presentations at the Professora Elizabeth de Freitas Magalhães State School, ending with an interactive quiz on Kahoot. The results showed that the licentiate students expanded their knowledge and experienced the teaching practice at the beginning of the course, whereas the school's students showed interest and engagement. The experience favored meaningful learning and strengthened the relationship between theory and practice in the teaching of mathematics. The project also aligns with the Sustainable Development Goals by promoting Quality Education.

Keywords: Geometry, Mathematics Teaching, University Extension

Introduction

Geometry means "measure of the earth". The calculation of areas and volumes is a very old subject for humanity. Since the advent of trade and the institution of taxes, these measures have needed to be known. Thus, already in ancient Egypt and Mesopotamia, we find records of (very accurate) attempts at these calculations. The first mathematical proofs are due to Thales, and from then on, the Greeks developed geometry via a deductive system formed by axioms, definitions and theorems (Eves, 2008). It is with this structure that geometry today and other areas of mathematics are structured. (Barbosa, 1985).

Geometric figures and concepts are present all around us. As an example, the triangle shape is widely used in constructions because it has the property of not "deforming". In other words, given a triangle, it is not possible to construct a different triangle via the same measurements. This property is called a triangle congruence criterion. The same does not occur with quadrilaterals: it is possible to have two distinct quadrilaterals whose sides have the same measurements (Barbsa, 1985).

The importance of geometry in its applied and theoretical aspects is clear.

Unsurprisingly, geometry is part of the mathematics curricular component of basic Brazilian education (Silva, Rodrigues, 2025).

However, mathematics presented in the classroom, even in higher education, is often presented in an abstract way and without connection with reality (Baraldi, 1999). In addition, many geometric concepts are left aside by the elementary school teacher, either because of the high demand for content, prioritization of algebra and arithmetic, or insecurity with the topic (Silva, Rodrigues, 2025).

In view of this scenario, the curricular extension project "The geometry I see" was thought and developed in the discipline of Euclidean Geometry I of the Mathematics Degree course at the Federal University of Rondonópolis. The objectives of this project were to show how geometry is all around us and how geometric concepts are applied in everyday life, to present geometric concepts different from what is often seen in the classroom (both in higher and basic education) and to prepare the future graduate for teaching practice by involving him, already in the first semester of the course, in an activity within the school.

In addition, the action dialogs directly with the Sustainable Development Goals, especially

SDG 4 (Quality Education), by promoting innovative teaching practices and bringing universities and schools closer together (ORGANIZAÇÃO DAS NAÇÕES UNIDAS, 2015).

Material and Methods

The project began with an extension activity of the Euclidean Geometry I discipline. The students should, in the first stage, take a photo of what represents some geometric concept observed in everyday life.

On the agreed-upon date, the images of each participant were discussed in the classroom. Inspired by these photos, the teacher also discussed in-depth geometry topics, such as the packaging problem and the theory of knots.

On the basis of these discussions, the students were encouraged to conduct research related to the themes present in their photographs. Those who addressed similar content formed working groups, resulting in seven different themes. Each group prepared a poster with their research.

The works were then presented to the students of Professora Elizabeth de Freitas Magalhães State School at night on July 30, 2025. The school was chosen primarily for its proximity and easy access to the university and for having classes at night, since the mathematics degree course is at night and the vast majority of students work during the day.

The posters were arranged in the school's cultural environment for students' appreciation. There were two sessions of activities for two groups of students from the school. All the students present on the day participated in one of these sessions.

First, the students were instructed to observe the posters and presentations of the students in the mathematics course and were able to ask questions and interact in the presentations. The students should also evaluate the students in relation to the poster and its presentation. The evaluation took place through a form on Google.

In the end, they participated in an interactive activity: a game with multiple-choice questions and true or false questions prepared by the students with the content present in the posters, using the Kahoot platform (KAHOOT!, 2025). The activity ended with the award of the top three places in the game, encouraging engagement and learning in a playful way.

Results and discussion

For the first part of the project's preparation, the students had to photograph something from everyday life that contained geometry, training their eyes to find concepts and ideas that are always around but that are often not perceived. During the

exhibition of the photos to their classmates, the students observed different geometric shapes and concepts of the author of the photo, which further strengthened the proposal to show how much geometry is part of our daily lives from different perspectives, that is, to show the geometry that each one sees. Several students observed triangular shapes in the structures of houses and gates on farms. Others identified patterns on floors and walls. Light poles and the geometric shapes formed by the wires were also observed. Some students noticed packed shapes and the intertwining of wires in certain fences, while others recognized plane geometric shapes in everyday objects such as mirrors, tables, and chairs.

Subsequently, related subjects for in-depth exploration were proposed, such as *knot theory*, *circle packing theory*, *tessellation*, and the *catenary curve*. Beyond what was expected, this activity made it possible to relate geometry to art and architecture, also by observing plane tessellations and the catenary in modern constructions.

The research on the suggested topics and the writing of the poster provided a moment of deepening and writing practices. The preparation of the poster made it possible to acquire new knowledge, and the preparation of the presentation took place collaboratively, with the students exchanging experiences and guidance with each other. In addition, as the extension activity was carried out in the first semester of the course, many students represented the first experience in a school environment as nonstudents did.

The experience was especially relevant because it was a teaching degree course, as it promoted not only research in mathematics but also the development of the presentation and explanation skills of mathematical concepts.

During the poster session, interest and curiosity were observed on the part of the students. Some students reported that they understood the content faster and easier than they did in the classroom. The students also engaged in the evaluation of the poster. At the time of the *quiz*, the participants related the questions to the corresponding posters, showing attention and involvement. In general, many students participated in the activity.

To carry out the quiz, it was necessary to use a cell phone with internet access. The coordination authorized the use of the devices for this purpose, but not all the students had a connection, which represented a challenge. Even so, those most interested organized themselves into groups, using the device of colleagues who had internet access, thus ensuring participation in the game.



Figure 1. Photo of the activity being carried out at the school.

Conclusion

The project "The geometry I see" provided significant experience for both the undergraduates and the students of the school. By relating geometric concepts to everyday life, the activity favored a more concrete and motivating understanding of mathematics.

For undergraduate students, the action contributed to the development of teaching skills, such as research, the presentation of content and interaction with different audiences. For basic education students, contact with posters and playful activities enabled greater interest and participation.

Despite challenges, such as limitations in internet access during the quiz, the cooperation and engagement of students reinforced the relevance of active methodologies and the approximation between universities and schools in the teaching of mathematics.

In this way, the experience contributed not only to teacher training and student engagement but also to the fulfillment of SDG 4 of the 2030 Agenda, reinforcing the university's commitment to inclusive and high-quality education.

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