

PIBID OF MATHEMATICS: EXPERIENCE REPORT AT THE STATE CENTER FOR PROFESSIONAL EDUCATION PROFESSOR FRANCISCO DE ASSIS PEDROSA <https://doi.org/10.63330/aurumpub.013-006>**Sidney Barbosa de Sena¹ and Francisco de Assis Alves da Silva²****ABSTRACT**

This article describes an experience experienced by students at CEEP Professor Francisco de Assis Pedrosa, a vocational high school institution with PIBID students, in 2023. Based on prior planning, practical classes were developed in the institution's mathematics laboratory under the supervision of the program's teacher. An active methodology (flipped classroom, project-based learning, and problem-solving) was applied, using concrete materials and games. The objective was to replenish mathematical knowledge lost during the pandemic, such as arithmetic, plane geometry, spatial geometry, algebra, and trigonometry, in a practical, creative, and transdisciplinary way. This teaching methodology demonstrated results, increasing grades from 3.3 to 4.4 in procedural assessments administered to third-year students in the Rio Grande do Norte school system in 2025.

Keywords: Planning; Practical class; Project; Recomposition; Evaluation.

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INTRODUCTION

During the development of the Institutional Program for Teaching Initiation Scholarships (PIBID) in Mathematics, efforts were made to develop activities in the laboratory during experimental mathematics classes, using didactic resources such as concrete materials, games, and activities involving active methodologies (flipped classroom, problem-solving, and project-based learning). The theoretical foundation of this report is based on Vasconcellos (2006), Freire (1997), and Campos (2017). This text reports the experiences of activities created and implemented at CEEP Professor Francisco de Assis Pedrosa, a vocational high school institution, in 2023. These activities were applied to students of the 1st year A of Nutrition and 2nd year A of Environmental Studies. For the other classes, a Mathematics Workshop was held, involving all students of the institution, made possible through the partnership with other PIBID participants from the neighboring school, Escola Estadual Professora Aida Ramalho Cortez Pereira, and the Mathematics advisor from the 12th Regional Directorate of Mossoró, who worked with third-year classes on activities carried out on October 9 of the same year. Written observations and graph analyses were practiced to describe the performance of students from the first-year A Nutrition class.

THEORETICAL FRAMEWORK

During the 2023 academic year, activities were designed and implemented in the mathematics laboratory as presented in Table 1 below. Vasconcellos reminds us that:

“Planning is mentally anticipating an action to be carried out; it is acting according to what was foreseen; it is seeking something incredible, essentially human: the real commanded by the ideal. Thus, we understand that planning only makes sense if the subject places themselves in a perspective of change.” (Vasconcellos, 2006).



Table 1: Activities carried out at CEEP Professor Francisco de Assis Pedrosa in 2023 by PIBID Mathematics

Content	Objective	Activity	Methodology	Year	Evaluation
Exploring the value of π : measuring circumference and understanding the relationship between numbers and measurements	((EF02MA16) Understand the relationship between the circumference length and its diameter	Measuring circular objects and applying the relationship between measurement and proportion	Measuring circular objects and dividing by the diameter; Circle game	1st A Nutrition and 2nd A Environmental Studies	Diagnostic
Percentage and average speed	(EF06MA14) Relate average speed to the concept of percentage	Calculate classmates' average speed	Flipped classroom (sports court)	1st A Nutrition and 2nd A Environmental Studies	
Geometric solids	(EM13MAT302) Build geometric solids; Calculate area and volume; Recognize plane figures of these solids	Construction of solids, calculation of area and volume, and recognition of plane figures	Construction of geometric solids using modeling clay and jelly beans	1st A Nutrition and 2nd A Environmental Studies	
Workshops in the institution to approach mathematics through practical activities and games to work on elementary and fundamental mathematical concepts in high school students' education	(EM13MAT302) Build mathematical games emphasizing equations, history of mathematics, arithmetic, and geometric figures	Production of games, recreational activities, and problem-solving	Game production	1st A and B, 2nd A and B Nutrition; 1st A and B, 2nd A and B Environmental Studies	Formative
Area of a rhombus	((EM13MAT302) Build kites in the shape of a rhombus and calculate their area and perimeter	Kite construction	Kite production	1st A Nutrition	Summative

Source: Author's elaboration

Next, the text explains how each activity was carried out.

Knowledge, Society and Education



DISCOVERING THE VALUE OF PI

Practice conducted by mathematicians: Gregório, Xavier, Sidney, and PIBID/IFRN/2023 students.



Source: Author's elaboration

Introduction

The history of the number π (pi) is long. Literature shows that many ancient civilizations attempted to determine its value, but it was the great Greek mathematician Archimedes who achieved the best approximation when he divided the circumference length by its diameter, obtaining a value close to 3.14.

General Objective

To discover the ratio between the circumference length and its diameter.

Specific Objectives

Measure circular objects to find their circumference and diameter, and determine the value of π .

Use measuring instruments such as rulers, string, and measuring tape.

Study proportions and decimal numbers.

Knowledge Involved

Mathematics, Engineering, and Technology.

Procedures

Students are asked to measure objects with circular shapes (perimeter) and their diameters.

Divide the perimeter of the circular object by its diameter.

Here is the template.



Object	Circumference perimeter	Diameter	Circular object perimeter / diameter

Result and Discussion

Students should notice that dividing the circumference by its diameter always yields a constant close to 3.14, which the famous Greek mathematician, engineer, physicist, inventor, and astronomer of Classical Antiquity called an irrational number represented by the Greek letter π .

Evaluation

Students will be continuously assessed through activities and games emphasizing the value of π .

UNDERSTANDING AVERAGE SPEED

Practice conducted by mathematicians: Gregório, Xavier, Sidney, and PIBID/IFRN/2023 students.



Source: Author's elaboration

Introduction

Average speed can be defined as a physical quantity that measures how fast a body or object moves over a displacement in a given time. It is considered an average because its calculation is an arithmetic mean of the speed at all points along the path. The formula used to calculate average speed is:

$$V_m = \Delta S / \Delta t$$

Knowledge, Society and Education



Speed is measured in m/s.

General Objective

To calculate average speed through an experiment.

Specific Objectives

Measure the length of the sports court.

Demonstrate to students that Mathematics is present in everyday life.

Knowledge Involved

Mathematics, Physics, and Physical Education.

Procedures

Students measure the length of the court and record the time taken to run across it.

Divide the length of the court by the time taken.

Result and Discussion

Students should realize that dividing the length of the court by the time taken gives the value of average speed.

Student run:



Source: Author's elaboration



Evaluation

Students will be continuously assessed through activities and games emphasizing the calculation of average speed.

MATHEMATICAL EXPRESSION RELATING SHOE SIZE AND FOOT LENGTH

Practice conducted by mathematicians: Gregório, Xavier, Sidney, and PIBID/IFRN/2023 students.



Source: Author's elaboration

Introduction

Shoe size varies according to each person's foot length and differs from country to country. In Brazil, for example, the mathematical equation $S = (5p + 28) : 4$ is used to calculate shoe size, where feet are measured in centimeters. Here, S represents shoe size, and p represents foot length in centimeters.

General Objective

To calculate shoe size given foot length in centimeters, as well as the foot size having the shoe number as reference.

Specific Objectives

- Show students that Mathematics is present in daily life.
- Solve the mathematical equation to calculate foot length.
- Explore the history of footwear in various countries.
- Locate countries and their shoe size systems.



Knowledge Involved

Mathematics, History, and Geography.

Procedures

Students measure their foot length and calculate shoe size.

Produce a text about the history of shoes and locate countries with different shoe size systems.

Result and Discussion

Students understood the history of shoes and learned to calculate foot length and shoe size using the mathematical equation.

Evaluation

Students will be continuously assessed through activities and games emphasizing shoe size and foot length.

BUILDING GEOMETRIC SOLIDS

Practice conducted by mathematicians: Gregório, Xavier, Sidney, and PIBID/IFRN/2023 students.



Source: Author's elaboration

Introduction

In this practical class, we present the Platonic solids. In *Timaeus*, a philosophical treatise by Plato explaining nature, each classical element (earth, air, water, and fire) is associated with a regular polyhedron: earth with the cube, air with the octahedron, water with the icosahedron, and fire with the tetrahedron. Regarding the fifth Platonic solid, the dodecahedron, Plato wrote: “There was still a fifth construction, which God used to arrange the constellations of the heavens.” Euclid, in Book XIII of *The Elements*, calculated the ratio between the diameter of the circumscribed sphere and the edge length of each solid. In Proposition 18, he demonstrated that no other regular polyhedra exist. During the class, we also showed, through nets, why there are only five regular polyhedra, constructed them, presented Euler’s



theorem $V - A + F = 2$ - $A + F = 2V - A + F = 2$, and suggested pedagogical activities for building polyhedra to aid visualization and understanding.

General Objective

To present and construct Platonic solids.

Specific Objectives

Show students that Mathematics is present in daily life.

Build geometric solids using toothpicks, modeling clay, or jelly beans.

Identify vertices, edges, and faces.

Solve Euler's relation.

Differentiate between plane and spatial figures.

Name the solids brought to class.

Knowledge Involved

Mathematics, History, Philosophy, and Technology.

Procedures

Students identify plane and spatial figures and construct the requested solids.

Result and Discussion

Students understood the history of Platonic solids and solved Euler's relation.

Evaluation

Students will be continuously assessed through activities and games emphasizing geometric solids.



MATHEMATICS WORKSHOP

Classroom Workshop



Source: Author's elaboration

Introduction

The Mathematics Workshop: Recomposition of Mathematical Knowledge was carried out after the diagnostic assessment applied to first-year high school students at CEEP Professor Francisco de Assis Pedrosa, as these students showed difficulties in numbers, algebra, plane and spatial geometry, trigonometry, and statistics. The objective was to explore mathematics in a practical, creative, and transdisciplinary way, individually or in groups, reinforcing concepts, solving problems, and developing mathematical skills.

A qualitative and descriptive methodology was used for this work. In this workshop, the educator assumes multiple roles: player, researcher, guide, learner, and practitioner. Criticism of the formal method allows overcoming the fear of producing knowledge beyond formal language, embracing transdisciplinarity that leads to the new and unknown, which will be pursued and integrated into the essence of the desire to know. From the concrete to the abstract, language translates the moment of overcoming ignorance. Concepts exist independently of language, but through it, knowledge is historically socialized. The articulation between objectives and methodology involves understanding that these terms can be transcended by transdisciplinarity. This approach should generate something new. The aim is to build an argument showing the multiple possibilities for implementing the process of mathematical literacy, which goes beyond numbers, using the Mathematics Workshop as a space for articulating mathematical knowledge in a transdisciplinary understanding.

Thus, mathematical knowledge is constructed by articulating content observed in objects, artifacts, or other forms where underlying mathematics exists and can be researched. This work synthesizes years of experience born from the intense relationship between theory and practice.

The Mathematics Workshop: Recomposition of Mathematical Knowledge aimed to understand mathematics in a practical, creative, and interdisciplinary way, as well as to reinforce concepts, solve problems, and develop mathematical skills.



General Objective

Explore mathematics in a practical, creative, and transdisciplinary way, individually or in groups.

Specific Objectives

Reinforce concepts, solve problems, and develop mathematical skills.

Procedure

Each classroom was assigned a game to reinforce a mathematical concept identified in the diagnostic assessment.

Result and Discussion

It was a morning full of knowledge and learning, as confirmed by the survey conducted.

Evaluation

Students were continuously assessed based on their engagement in the assigned game.

KITE ACTIVITY AND LEARNING ABOUT THE RHOMBUS

Practice applied by Sidney, Gregório, and Xavier.



Source: Author's elaboration

Introduction

Literature shows that kites originated in ancient China around 1200 B.C. Since then, they have been used for various purposes, such as military signaling, measuring atmospheric conditions, contributing to the invention of the lightning rod, and, to this day, as a popular toy among children, adolescents, and young people worldwide. The basic structure of a kite consists of a frame supporting a sheet of tissue paper that functions as a wing. Making and flying kites with students from CEEP Professor Francisco de Assis Pedrosa was very enjoyable; however, this activity aimed to enhance knowledge in Physics, as kites (also called stars, papagaios, pandorgas, or raías) are flying toys whose flight occurs due



to the opposing force of the wind acting on the kite, which is held by its operator. In Mathematics and Geometry classes, students worked on length measurements, unit conversions, polygons (specifically the rhombus), angles, symmetry, and face identification. In Geography, it was possible to teach about seasons, differences between weather and climate, and climate elements. Consolidating and expanding mathematical concepts was essential for students to see them in new extensions, representations, or connections with other concepts. The purpose of this activity was to provide students with opportunities to enjoy mathematical knowledge as one of the most important cultural assets constructed by humanity. It was based on Freire (1987) and Sousa (2007), as it was understood that this approach could facilitate learning for first-year Nutrition students at this institution.

General Objective

Build and fly kites.

Specific Objectives

Calculate the area of a rhombus.

Solve word problems involving the perimeter of a rhombus.

Convert length measurements.

Identify angles in polygons.

Identify faces.

Knowledge Involved

Physics, Mathematics, Geometry, and Geography.

Procedures

Students will build kites.

Fly kites.

Solve problems involving the rhombus.

Results and Discussion

The process was enjoyable, and learning occurred satisfactorily.

Evaluation

Students were continuously assessed through activities and games emphasizing the rhombus.

During the implementation of the activities, a structured sequence was always followed. In the reinforcement activities, the process began by reviewing previously taught content, followed by an explanation of how the activity would take place and the rules (in cases where the resource used was a game). From there, students proceeded to carry out the activity. Freire (1997, p.79) was considered: “No one walks without learning to walk, without learning to make the path by walking, remaking and retouching the dream for which one set out to walk.” In activities introducing new content, the sequence was slightly different, as active methodologies were used to guide them. It is worth noting that training, in this sense, is conceived as integral and continuous, so that it is not limited to a single formation, but rather multiple formations that require the permanent condition of learning, unlearning, and relearning to interpret reality, broaden one’s worldview, and achieve praxis (CAMPOS, 2017).

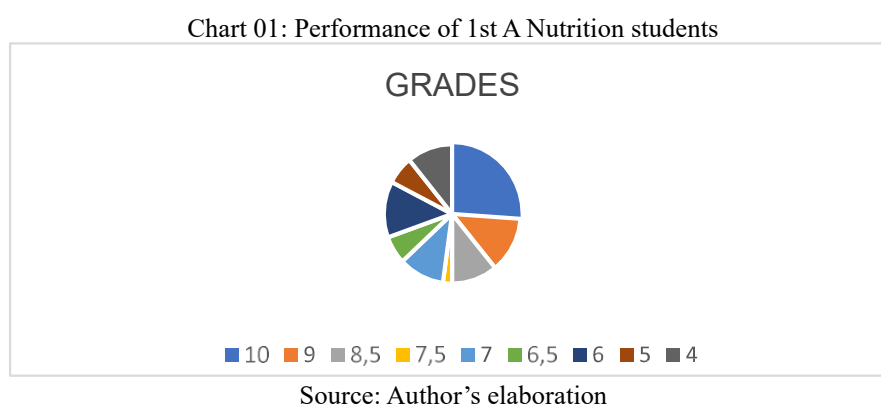
METHODOLOGY

From a methodological perspective, this study is a qualitative research with a descriptive approach, using bibliographic research and a field study of the case study type. The field research was conducted between May and December 2023 by PIBID students at CEEP Professor Francisco de Assis Pedrosa, a state vocational education institution in Mossoró-RN, in first- and second-year classes. Direct observations were made, and records were kept of the students in 1st A Nutrition. A pie chart was used to discuss the results obtained by these students.

RESULTS AND DISCUSSION

All actions developed at the school were carried out with the assistance of the school supervisor, emphasizing that this partnership was essential for the success of the activities.

It was confirmed that students’ academic performance improves when active methodologies such as flipped classroom, problem-solving, and gamification are applied, as shown in the chart below:





The PIBID participants facilitated the connection between theory and practice, contributing to a differentiated learning experience based on a critical perspective, with the development of practical and playful activities aimed at providing meaningful and enjoyable learning.

CONCLUSION

The PIBID participants created opportunities for collaborative learning, with the entire team working together to achieve the objectives. Collaborative work showed great potential for improving ways of thinking, acting, and solving problems in the face of challenges present in education.

By adopting differentiated methodologies for teaching various contents, it was observed that students' acceptance was satisfactory, with strong engagement in the proposed activities.



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