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Teaching and Learning of Mathematics and its Technologies through Video Lessons and Interactions on Social Networks

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ABSTRACT

In this work we present teaching and learning alternatives, through a set of video lessons on Mathematics and its Technologies present in the tests of the National High School Exam (ENEM). The objective was to mobilize, from video lessons, skills and competences in mathematical concepts present in the High School curriculum, pointed out by the students from a diagnosis as difficult to understand. The videos were produced by students of the Degree in Mathematics, scholarship holders of the Tutorial Education Program (PET): Knowledge Connections and posted on the YouTube channel, with a suggestion of individual interaction of the participants through WhatsApp and other social networks. After a period of one year of posting the videos, it was possible to observe a considerable number of shares with requests for clarification on mathematical concepts, especially related to solving problems involving algebra and geometry, enabling a favorable interaction to the learning process.

KEYWORDS: Mathematics; Teaching; Learning; Videos Classes.

INTRODUCTION

There are several questions that arise when we plan the teaching of Mathematics in Basic Education, among them, the most appropriate way to approach constructions of concepts, basic operations and how to make these tools usable in daily life. In this context, the present project aimed to present a proposal of activities that could make the learning process of Mathematics and Its Technologies more meaningful, aiming to arouse in the student the interest in this subject from the use of several available technologies and use of curricular materials as a didactic possibility in the mediation of teaching, assuming that every didactic resource must be related to teaching activities.

The project was developed by the scholarship holders of the Tutorial Education Program (PET): Connections of Knowledge in Mathematics of the Federal University of Acre (UFAC) through videos, available on YouTube channel, with personalized monitoring through WhatsApp, for which you can difficulties in solving problems will be shared. The expectation when offering a set of videos on the internet was that the difficulties expressed by the project participants could offer a starting point for the adequate planning of new videos, aiming at a learning that was in fact significant about the topics listed by the students, related to in a previously performed diagnosis.

THEORETICAL REFERENCE

The actions developed in the project had as theoretical orientation the works produced by several authors such as Manfredo (2006) who recommend as teaching alternatives capable of mobilizing student learning, project methodologies in the teacher training process as a significant experience in teaching practice de Mathematics and Melo (2016, 2018, 2020, 2021 and 2022) that view school planning from teaching alternatives with curricular subjects, outlines courses for training Mathematics teachers and encourages learning conducted by research and extension projects such as contributions to the training of mathematics teachers through the supervised internship.

In addition, Melo (2020) argues that the practice of teaching Mathematics should be conducted from a reflective and collaborative perspective, considering the various registers of semiotic representation as pointed out by Duval (2011) when reflecting on how to conceive the teaching of Mathematics in another way, seeking to enter the mathematical way of thinking through the records of

semiotic representations and leading the learner to appropriate a significant learning that according to Moreira (2010) occurs when a new idea is related to previous knowledge, in a relevant situation for the student, proposed by the student. teacher. In this process, the student expands and updates the previous information, attributing new meanings to their knowledge:

> "Meaningful learning is characterized by the interaction between prior knowledge and new knowledge, and that this interaction is non-literal and non-arbitrary. In this process, new knowledge acquires meaning for the subject and previous knowledge acquires new meanings or greater cognitive stability. " (MOREIRA, 2010, p. 2)

To solve related problems, especially about geometries, visualization was prioritized in the videos, aiming to build a metal entity that in the view of Fischbein (1993) contributes to the elaboration of a mathematical reasoning, in which a figure is different both from its formal definition and from its mental image and is in turn supported by a sensory perception of a particular representation provided.

For the aforementioned author, what portrays a concept is the fact that it expresses an idea, a form of ideal representation of a class of objects that have common characteristics. On the other hand, a (mental) image refers to a sensorial representation of an object or phenomenon (Fischbein, 1993). For Costa (2020), mobilizing mathematical thinking through visualization favors a mental skill in the construction of mathematical knowledge, in order to coherently apply mathematics in problem solving.

On the other hand, Duval (2011) points out that the acquisition and organization of learning situations of mathematical concepts is related to cognitive aspects and "semiotic representations constituted by the use of signs belonging to a representation system which have their own difficulties of meaning and functioning" (DUVAL, 1993, p. 39). Understanding a concept therefore has two dimensions: one mathematical, when one is able to justify a result through a property, and the other cognitive, when one recognizes the same object in different semiotic representations (DUVAL, 2011).

Silva (2018), when investigating the potential that the production and use of mathematical videos can provide to undergraduates of a distance mathematics course, inferred "that videos of mathematical content are part of the lives of these graduates, who watch them in order to to contribute to their studies in the most varied disciplines". Thus, based on the theories presented and through videos made available on the internet with individual monitoring by social networks, we sought to develop activities privileging the construction of algebraic and geometric reasoning of the participants, encouraging the process of understanding the concepts and ideas.

METHODOLOGICAL PROCEDURE

The videos were produced by scholarship students of the Tutorial Education Program (PET): Connections of Knowledge in Mathematics of the Mathematics Degree Course at the Federal University of Acre, released on the YouTube channel: https://www.youtube.com/channel /UCNaMYvIc9lwU1XyqQCABdFw/videos. By watching and sharing the videos, high school students interested in learning mathematical content could report on their difficulties in the process of understanding the concepts, question the way of presentation and contact tutors (PET Scholars) through WhatsApp made available for contacts. On the other hand, the tutors, producers of the videos, in interaction with the participants via WhatsApp, could mobilize clarifications on the exposed content in the student in order to interactively raise the level of skills and competences of these students and help in overcoming the difficulties overcoming the procedures. standardized, typical of didactics detached from real situations, consolidating a new relationship between the student and mathematical knowledge, enabling students to understand more dynamically and better understand important concepts and applications.

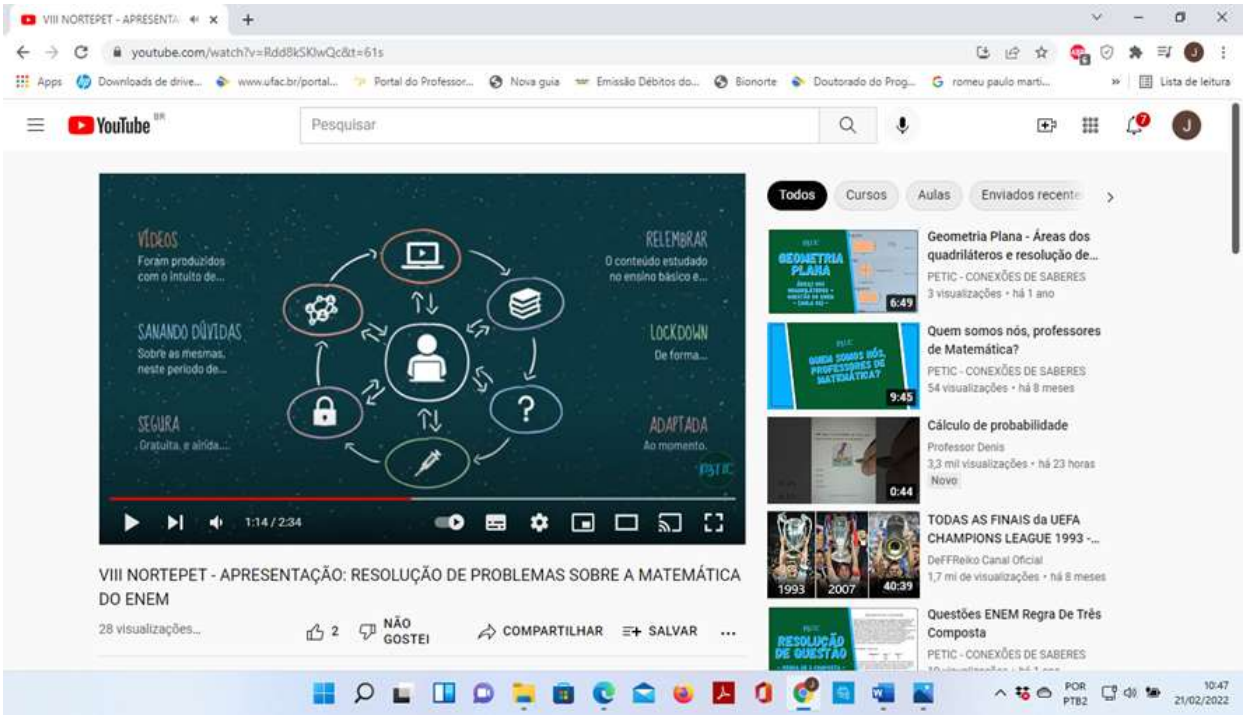
From the first access to the videos, a protocol was made available in which those interested in participating in virtual classes, with individual monitoring, could register with personal information, request individual assistance, as well as point out learning difficulties.

The exposure of mathematical content through videos was carried out using the Problem Solving methodology suggested by Polya (1995) and guided according to the author in three steps: Understanding the problem, designating a plan, executing the plan and looking back at the problem. These steps were followed with the help of digital curriculum materials. Access to the videos was made through the following link which, whenaccessed https://www.youtube.com/channel/UCNaMYvIc9lwU1Xyq QCABdFw/videos,
directed participants to videos posted in the presentation, according to the Videos Menu in Figure 1. has links to several videos:

Fonte: https://www.youtube.com/channel/UCNaMYvIc9lwU1XyqQCABdFw/videos

The process of making and presenting the videos provided students of the Licentiate in Mathematics course, scholarship holders of the Tutorial Education Program, with several connections, especially in relation to the process of teacher training. These participants built for the development of the videos, objectives and procedures presented according to the following diagram:

Photo 2: Video development diagram



Fonte: https://www.youtube.com/channel/UCNaMYvIc9lwU1XyqQCABdFw/videos

The way in which the videos were produced was the object of a mini-course presented at the VIII meeting of tutors and scholarship holders of the Tutoring Education Program (PET) in the northern region. Photo 2 represents a synthesis of the process by which it was methodologically possible to carry out the experience developed by Petianos.

DATA DESCRIPTION AND ANALYSIS

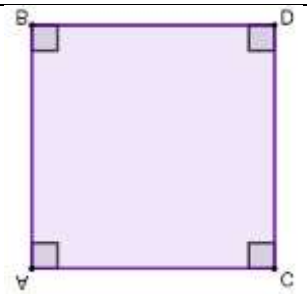
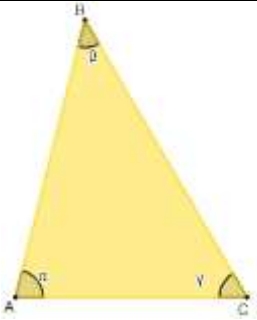
As a means of developing the proposed project, given the context of the pandemic, available technological resources were used, based on these tools, the methodology applied was developed for a better understanding of the content, always aiming at possible difficulties for students. Hence one of the established artifices was the posting of videos on the YouTube channel.

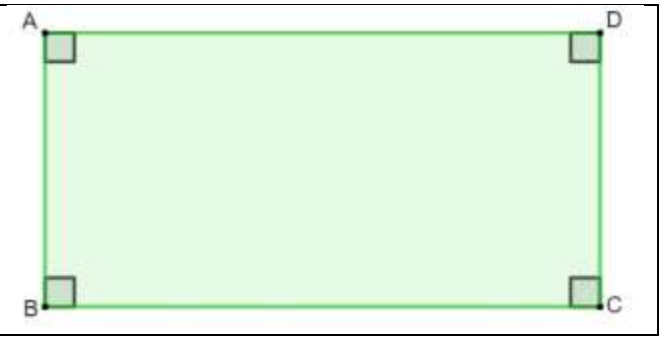
Some students had difficulties in organizing a study agenda, for not knowing the contents that would be covered, and with that, the interaction with the tutors was somehow impaired. In order to alleviate this problem and contribute more intensively to the learning of these participants, it was decided to create a group focused on individual tutoring, posting practical problems on the subject covered in the videos, encouraging that the resolution of these problems was discussed and resolved with the help of tutors.

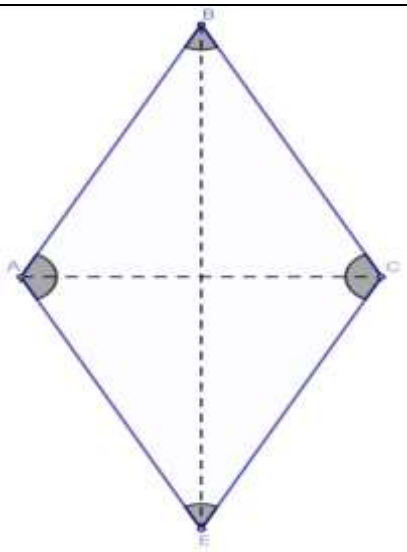
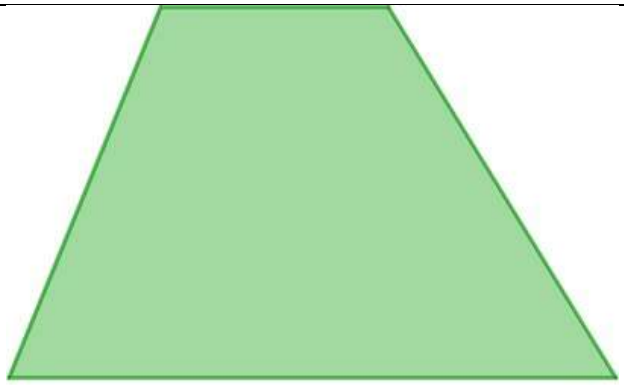
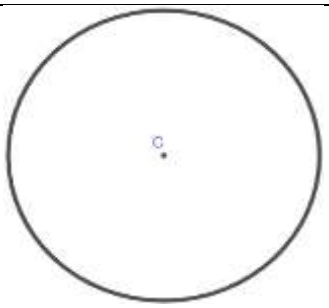
As doubts were expressed, during the tutor's dialogues with the student, the debate could be increased through videos, audio/message and video call, among other means. Occasion in which doubts were noted and new videos were produced for posting on the YouTube channel, understanding that these doubts could be common to other participants.

In the context of tutor-student interactions, through social networks (particularly through WhatsApp), participants reported difficulties in understanding the composition of the formulas of flat and solid figures of revolution and in solving problems involving these formulas. Difficulties in understanding relationships between areas and volumes of Plato's solids were also observed, as well as difficulties in handling GeoGebra when the use of this resource was requested.

In view of this, new videos were produced, whose content was focused on clarifying these difficulties. Especially in relation to the construction of formulas for the areas of flat and spatial figures, didactic sequences were built with at least two forms of representation as guided by Durval (2011). A representation using the concepts to build the formulas, followed by examples and another form of representation with the help of GeoGebra, as described below:

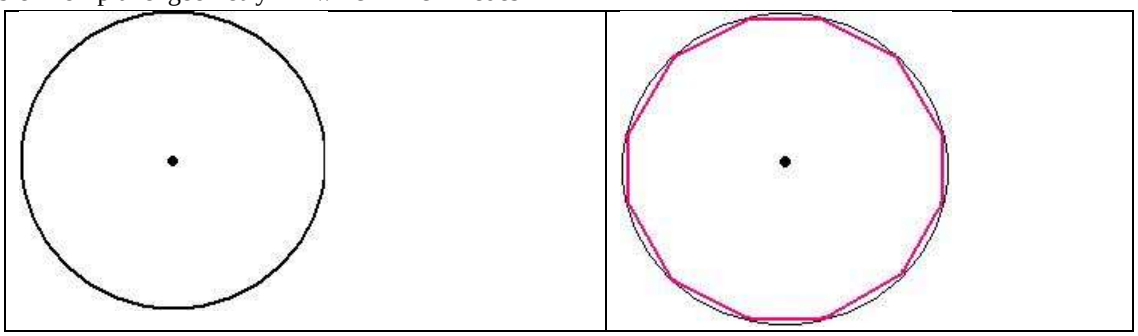
SQUARE: is a quadrilateral, that is, a polygon with four sides, which has all right angles and all sides congruent, with an area determined by the product of the sides. $A = l^2$ ($l \rightarrow$ side of the square)	
TRIANGLE: is the polygon formed by three sides and three angles, with area A where b is the base and h is the height. $A = \frac{b \cdot h}{2}$	

RECTANGLE: quadrilateral that has all right angles (the four angles measure 90º) and has area $A = b \cdot h$, where b is the base and h is the height	

LOSANGO: is a quadrilateral that has all sides congruent, that is, all sides have the same measure. Its area is obtained by $A = \frac{D \cdot d}{2}$ Where D is the major diagonal and d is the minor diagonal. The area of the rhombus can also be obtained from the area of the rectangle, by composing figures.	
TRAPEZIUM: quadrilateral that has two parallel sides and area $A = \frac{(B + b) \cdot h}{2}$ Where B is the Major Base, b is the Minor Base, and h is the Height. To determine this formula is to visualize it composing rectangles and triangles inscribed in the rectangle.	
CIRCLE: is the plane figure formed by all points that are equidistant from the center. Its area is obtained by the formula $A = \pi r^2$, where r is the radius.	

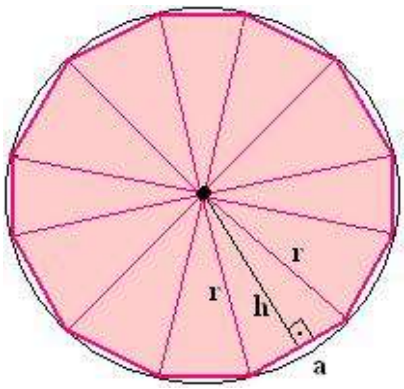
The circle was constituted in the geometric figure whose explanation of the formula presented a high degree of difficulty of understanding by the participants, being opportune a discussion and the production of a video showing how you can calculate π using the calculation of the square of the circle with ruler and compass present in the famous problem of plane geometry in which Archimedes finds a reasonable approximation of π by constructing a 96-sided polygon inscribed in the circle.

To understand the formula used to calculate the area of a circle, we have to imagine a circumference and within it a regular polygon, for example with 12 sides, is circumscribed:



The line segments starting from the center of the circle and going to the vertex of the regular polygon are the radii of the circle. Thus, forming n triangles in the regular polygon, based on the calculation of the area of a regular tridecagon, for example, we can say that the area of a regular polygon with n sides would be: $n.\frac{a.h}{2}$

The line segments starting from the center of the circle and going to the vertex of the regular polygon are the radii of the circle. So, forming n triangles in the regular polygon, based on the calculation of the area of a regular tridecagon, for example, we can say that the area of a regular polygon with n sides would be:



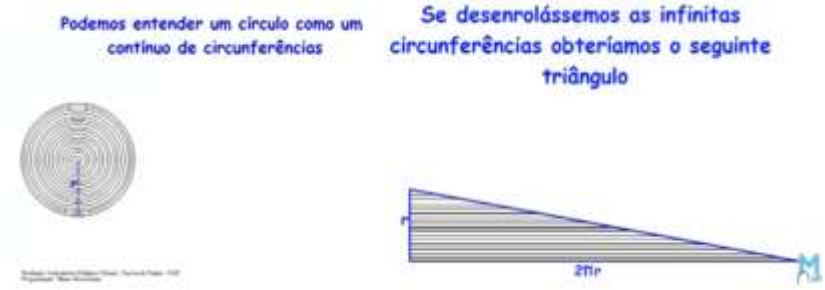
Sendo $n.a$ o valor do perímetro do polígono regular e A= $n.\frac{a.h}{2}$.

As the figure above suggests, if we increase the number of sides of the regular polygon, the tendency is for its perimeter to become more and more similar to the length of the circumference, and the height of each triangle formed in the regular polygon to be equal to the radius of the circle. Thus, we can conclude that the formula for calculating the area of a circle can be indicated in the same way as the area of a regular n-sided polygon, which leads us to conclude that the area of the circle is given by: A= (length of circle). Radius which is equivalent to $A = \frac{2\pi r.r}{2}$ which simplifying we have: $A = \pi r^2$

It was also shown, using practical experience, that measuring the length of round figures with a string and dividing this length by the length of the string that connects one point to another of the circle, passing through the center, one obtains π ≅ 3.1416…

Finally, we present a material posted on the internet through the link https://educacaopublica.cecierj.edu.br/artigos/19/11/ideia-intuitiva-de-limite-usando-o-circulo-e-a-circunferencia, showing that in an experience carried out by teachers: Daniela Mendes Vieira da Silva: coordinator of the Sustainable Mathematics Laboratory Project (Seeduc/RJ), professor at UCB and at the Cecierj Foundation, National Sesi Consultant. Fabiana Andrade - PhD in Mathematics Teaching (UFRJ), professor at IFRJ and Isabela Alcantara do Nascimento - Master in Education and Sciences (UFRRJ), mediator (Consórcio Cederj/Cecierj).

The students were surprised by the video, which presents the calculation of the area of the circle as the unfolding of infinite circles that decrease until the zero radius and that make up the figure of a right triangle with base 2πr and height πr, which leads to the well-known formula for the area of the circle A = πr2.



With the elaboration and dissemination of virtual classes, the greatest difficulty was to discover the reach of the target audience and if the expectations of those interested were being met, considering that the exposure of the contents was being proposed through remote technologies, through communications networks that became accessible to all.

Considering that the use of technologies associated with the study is increasingly common, becoming an indispensable tool of study, the reach through social media made available became of good efficiency, since most of the participants already used digital platforms for studies and improvement.

For students graduating from the Exact Sciences courses and for future providers of the National High School Exam (ENEM), monitoring/tutoring, developed by the group, has become a great potential aid for study routines in different ways, from understanding of simple doubts to the explanation of more comprehensive contents, in addition to certain concepts presented as an addition to subjects that, for internal reasons, were not taught in depth (in some cases not even superficially) in the school environment.

With the discussions about doubts and explanations carried out between students and tutors, in a virtual way, the performance of many participants gradually increased, according to what each one proposed to do. Among the various ways in which the concepts were approached by the educational monitors/tutors, the most frequently performed were the explanations regarding the doubts that arose from the students themselves.

With the diversification in the presentation of concepts as recommended by Durval (2011), the participants were getting involved in the project, the learning was improving. It was also noticed a better level in the development of interactions and significant evolution in the acquisition of knowledge, leading the participants to the desired meaningful learning in the sense suggested by Moreira (2006).

The narratives expressed in the weekly meetings of scholarship holders/tutors, locus of evaluation of the project, indicated a better understanding of the ideas, methods and knowledge of the educational field, leading to reflections and learning about knowledge inherent to the teaching profession, considering in their reflections, teachings present in several authors who provide guidance on teaching that can lead to meaningful learning. Among them Anastasiou (2004) who deals with assumptions for classroom work strategies; Bordenave, Juan E. Diaz; Pereira, Adair Martins (1985) who proposes teaching-learning strategies; MELO (2010, 2013, 2016, 2018) which discusses the teaching and historical development of mathematics, training of mathematics teacher trainers for Basic Education, narratives and courses for training mathematics teachers; Moreira (2006), who presents the theory of meaningful learning and its implementation in the classroom and; Durval (2011) that takes into account the different forms of representation of the same mathematical object, especially in relation to ideas, concepts, properties, structures and relationships that can express different situations, whose access is only possible through symbolic representations.

CONCLUSIONS

The development and implementation of the narrated project suggests that the videos available in virtual learning environments, accompanied by tutoring, can favor a learning relationship even without the physical space of the classroom, in person. However, this movement needs improvement, especially in relation to bureaucratic control that will demarcate more precisely and efficiently the teaching offered, in order to prove, in fact, the occurrence of significant learning in the perspective guided by MOREIRA (2006).

Also noteworthy is the feedback that social media, especially YouTube, allowed for the interaction between tutor/teacher and student during this possibility of remote teaching. The computerized environment through the means used proved to be, due to necessity, favorable to the transmission of knowledge without significant losses for assimilation and learning.

The actions implemented through the project were beneficial for students who want to attend an undergraduate degree, promoted assistance for those who are already enrolled in the university and have difficulties with the basic contents of mathematics for which, for some reason, they did not have the opportunity to experience it. them throughout Basic Education. Finally, the realization of the project revealed significant learning for the teacher training process, due to the level of commitment and ability to invent and reinvent ways of accessing knowledge, through teaching guided by the strategies, plans and forms found by tutors/scholarship holders. PET, students of the Mathematics Course, in the process of teacher training and participants in this enterprise.

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