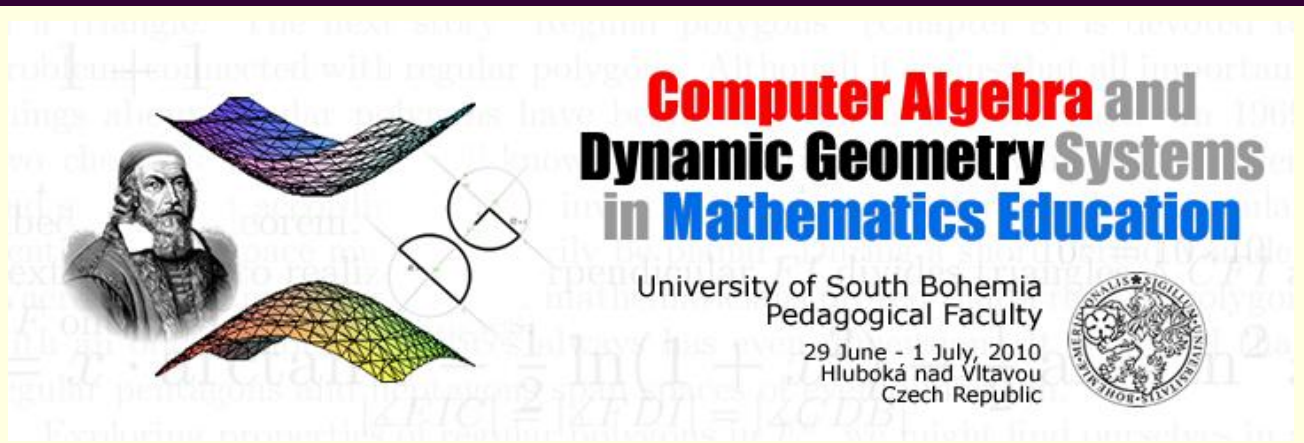
Computer Algebra, Virtual Learning Environment and Meaningful Learning: is it Possible?



AUTHORS

Computer Algebra, Virtual Learning Environment and Meaningful Learning: is it Possible?

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Principles

Research indicates that the limitations in the education of teachers covers:

- ✓ mastery of the specific content subjects,
- ✓ the didactic-pedagogical field,
- ✓ few opportunities for teachers to continue their education throughout their professional life,
- ✓ the use of information and communication technologies.

Principles

Nowadays, many teachers become increasingly distant from the students who belong to a generation steeped in digital media.

Besides acquiring new skills due to new tools, teachers need to rediscover themselves in a new role, interacting in a dynamic new system that includes teacher, student and tools.

Questions

- How to achieve a meaningful learning, if the student and tools are extremely agile, to give space to reflection, thus constituting a true experience?
- How can meaningful learning be achieved, considering that there is no time to reflect on the experience?
- How can we ensure that the experience has been truly lived?

These are the challenges and questions that guide this work and are nowadays presented to teachers.

Principles

The incorporation of technologies in the professional development of the teachers must be present in their initial and permanent education,

It is an indispensible condition that this future teacher develops the ability to research, use, and generate information,

It is only possible with the support of technologies.

“Dynamic Mathematics”

The course "Dynamic Mathematics" was organized in **thematic units** in accordance with the curricular guidelines for Primary and Secondary schools and allowing the participants to evaluate the scope of technology used and the possibility of adapting it to their needs.

“Dynamic Mathematics”

The course is part of the research developed by the Digital Technologies in Mathematics Education (**TecDEM**) research group (CNPq).

It is offered through COGEAE – General Coordinating Committee for Specialization, Improvement and Extension, an academic unit at the Pontifical Catholic University of São Paulo.

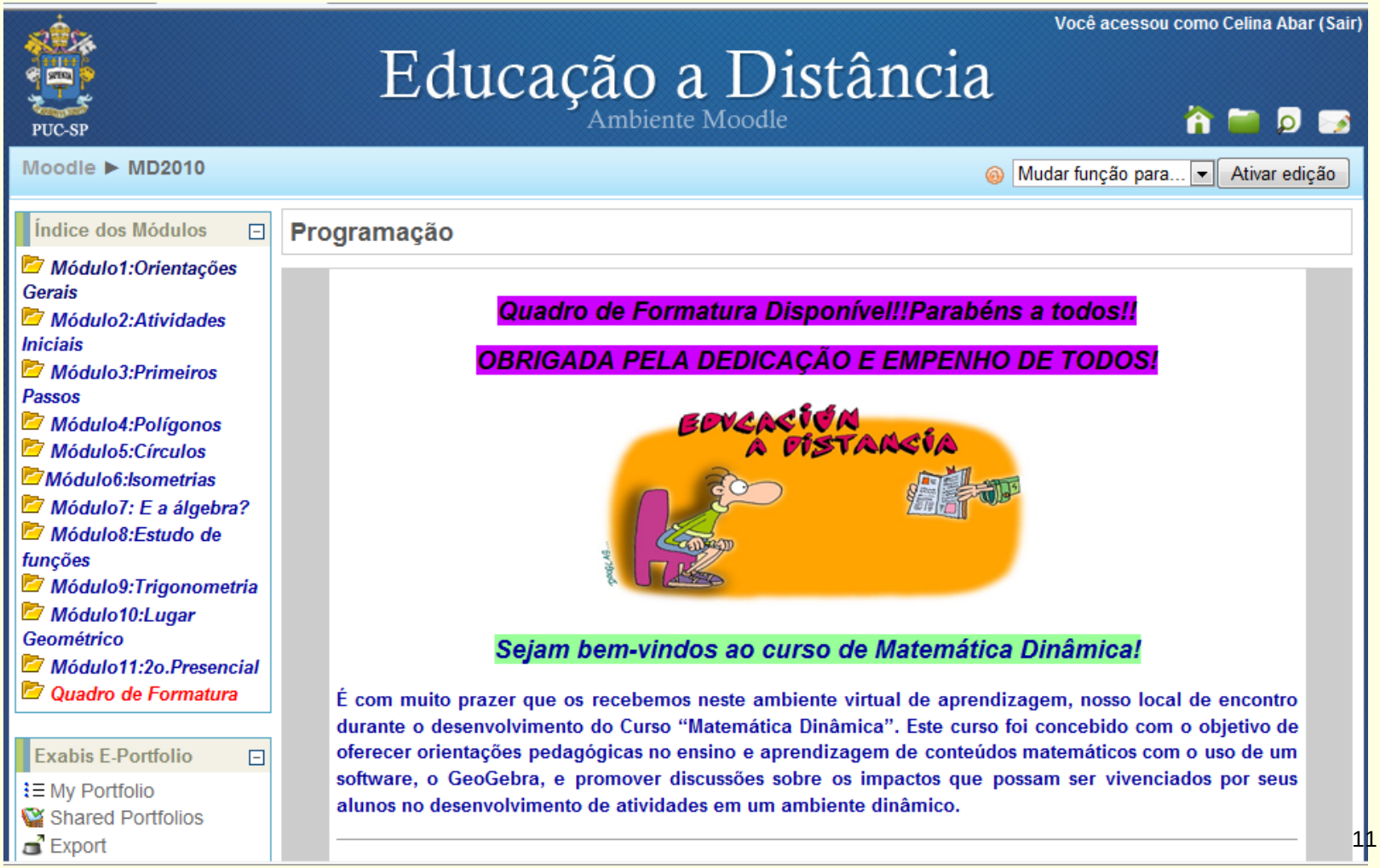
“Dynamic Mathematics”

The proposal of the course that offer plans to provide not only to the technical and didactic questions to the teachers, but primarily the investigation and the concern with the pedagogical model, which can and must attract the students to the experience of reflecting, analyzing, and questioning

Environment Moodle and GeoGebra

The tools chosen - **GeoGebra** and **Moodle** - are freely accessible and easily used, an important factor for the new technology will be incorporated into teaching practice.

Moodle


Você acessou como Celina Abar (Sair)
PUC-SP
Educação a Distância
Ambiente Moodle
Moodle ▶ MD2010
Mudar função para...
Ativar edição
Índice dos Módulos
Módulo1:Orientações Gerais
Módulo2:Atividades Iniciais
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Quadro de Formatura Disponível!!Parabéns a todos!!
OBRIGADA PELA DEDICAÇÃO E EMPENHO DE TODOS!
EDUCACIÓN A DISTANCIA
Sejam bem-vindos ao curso de Matemática Dinâmica!
É com muito prazer que os recebemos neste ambiente virtual de aprendizagem, nosso local de encontro durante o desenvolvimento do Curso "Matemática Dinâmica". Este curso foi concebido com o objetivo de oferecer orientações pedagógicas no ensino e aprendizagem de conteúdos matemáticos com o uso de um software, o GeoGebra, e promover discussões sobre os impactos que possam ser vivenciados por seus alunos no desenvolvimento de atividades em um ambiente dinâmico.

Results

The positive results show that a well-constructed proposal with clarity regarding what it intends to achieve can meet the expectations of the teachers, showing also that the challenge of using new technologies involves not only technical issues but changes in behavior and relationships between the actors involved in the system.

Methodology

Work with Mathematics by thematic units, so that the students can understand the scope of the technology, in particular that of **GeoGebra**, for each theme, and with the depth necessary for their improvement.

The course "**Dynamic Mathematics**" was structured in eight modules to be worked in 44 hours, over 8 weeks: 40-hours distance course and two physical presence meetings of 2 hours.

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Assumptions

The activities have the following assumptions:

(1) the role of the teacher must be valued as poser of problems and not a mere facilitator or activities monitor; to include proposals for experiments beyond those present in the conceptual part and indication texts to diversify the possible approaches that the teachers can use with their students.

(2) clear presentation of the use of the GeoGebra software with simulations, arguments, and records, in order to construct meaningful learning.

(3) proposals consistent with the theoretical-methodological assumptions of Mathematics Education that guide the proposals of the activities and the selection of the content to be presented.

Methodology

To comply with these assumptions, we mean that the methodology of the design-research (Cobb et al., 2003) can support this proposal for the conception and production of the contents.

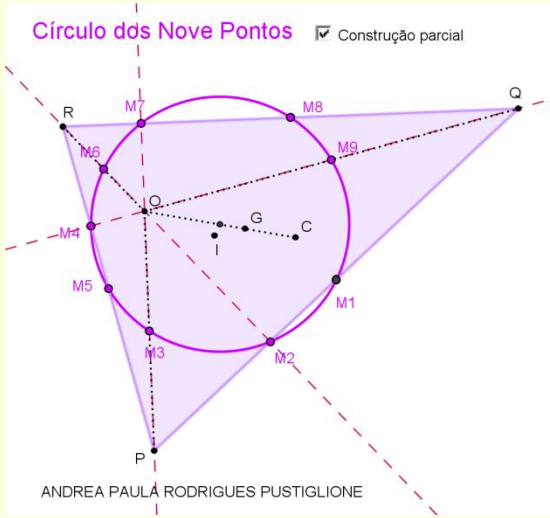
According to Doerr and Wood (2006), this methodology:

[...] *requires several analysis cycles to improve the product and the interpretation at multiple levels*. [...]

That this on-line course is an initial proposal, a detailed analysis of its entire development is inserted in the methodology presented and it will permit an improvement of its design.

Design of the Modules

In each **8 module**, the student should appropriate the ***GeoGebra*** software tools as the activities are developed and become involved in the discovery of strategies for solving tasks, exploring, investigating, resolving problems, and explaining and justifying their reasoning.



Design of the Modules

All the modules presented a **theoretical text**, which was discussed in the ***Forum***, about **research in Mathematics Education** regarding the subjected being studied, highlighting the didactic strategies that could allow the difficulties in understanding the subject to be overcome.

In each module, the student was invited to provide statements in the ***Diary*** tool about each subject studied. (***We consider it important for teachers to cultivate the habit of systematic reflection, both to improve their teaching and to maintain their professional development throughout their lives.)***

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Design of the Modules

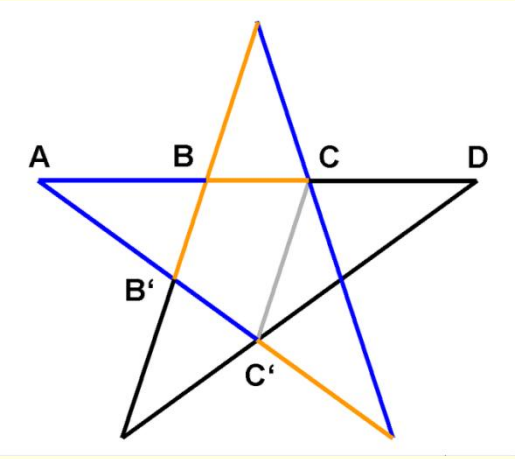
The mechanisms chosen from the Virtual Learning Environment to provide individualized and almost permanent attention to the students: **Forum**, **Diary**, **Task**, **Chat** and **Portfolio**.

Improvements in education do not depend exclusively on the manner in which content is transmitted, but also on the mobilization activities in which the teacher is the primary protagonist, we chose themes that favored the development and advancement of the teaching practices of Mathematics teachers supported by research produced in the area of Mathematics Education.

Subjects Studied and Design of the Modules

1. FIRST STEPS: To acquire familiarity with the screen, with the basic resources of the **GeoGebra** application and in particular to investigate the fundamental constructions of geometric drawings.

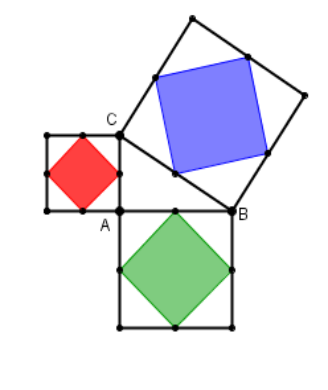
Construct the pentagram symbol of the Pythagoras Society.
HELP: Start by constructing a pentagon inscribed in a circle.
The length of the side of the pentagon is obtained from the golden ratio of the radius of the circle.
In the following figure, AP º AQ and the length of AP is the golden ratio of AC. Next, extend the sides of the pentagon to obtain the five triangles. Hide the construction lines and color the segments, adding the measurement and the ratios in a text box.

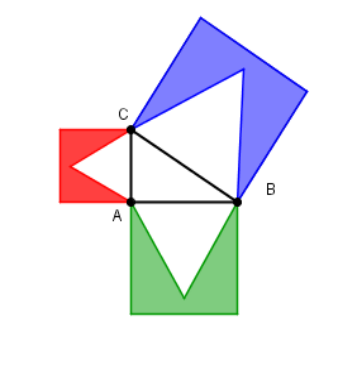


Subjects Studied and Design of the Modules

2. POLYGONS: The investigation and construction of quadrilaterals and triangles, using the **GeoGebra** resources to verify the properties of the geometric figures.

Verify that the colored areas maintain a Pythagorean standard (Barbosa, 1993), using GeoGebra
In constructions such as the ones presented
a)The vertices of the colored squares are the respective mid-points of the sides of the squares whose sides are the hypotenuse and the legs of the right triangle.
b)The triangles inside the colored squares are equilateral with sides equal to the sides of the triangle ABC.
Blue area = Red area + Green area

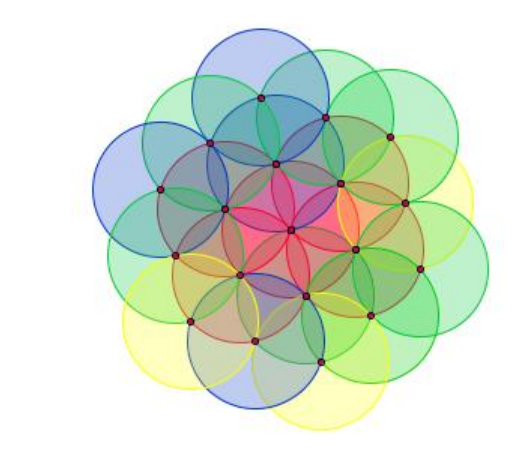




Subjects Studied and Design of the Modules

3. CIRCLES: The properties of circles, often intuitive, but not always so simple, and the construction of mosaics having circles as their base were the main subjects of this module in which we investigated the properties of circles relative to the tangents, cords, arcs, and central angles.

Islamic art was based primarily in designs formed by geometric figures. The circle, in particular, was repeated countless times, forming grids with triangular, square and hexagonal meshes.
Create a work of art using only circles.

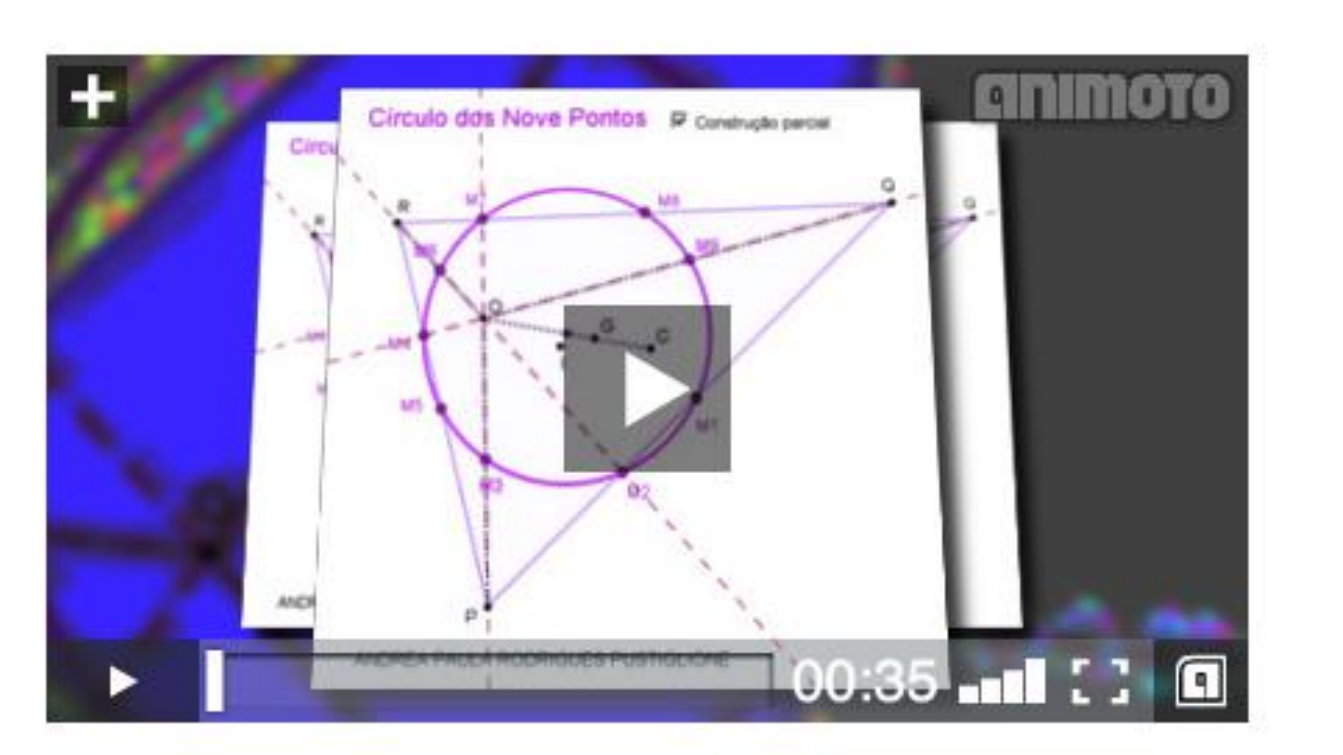


Subjects Studied and Design of the Modules

4. ISOMETRIES: investigated the isometric transformations – translation, reflection, and rotation, as well as some coverings of the plane.

A covering of the plane can be performed with the Tangram pieces. The seven pieces are two large right isosceles triangles, a medium-sized right isosceles triangle, two small right isosceles triangles, one square, and one parallelogram. Construct a covering of the plane with the geometric figures that constitute the Tangram pieces.

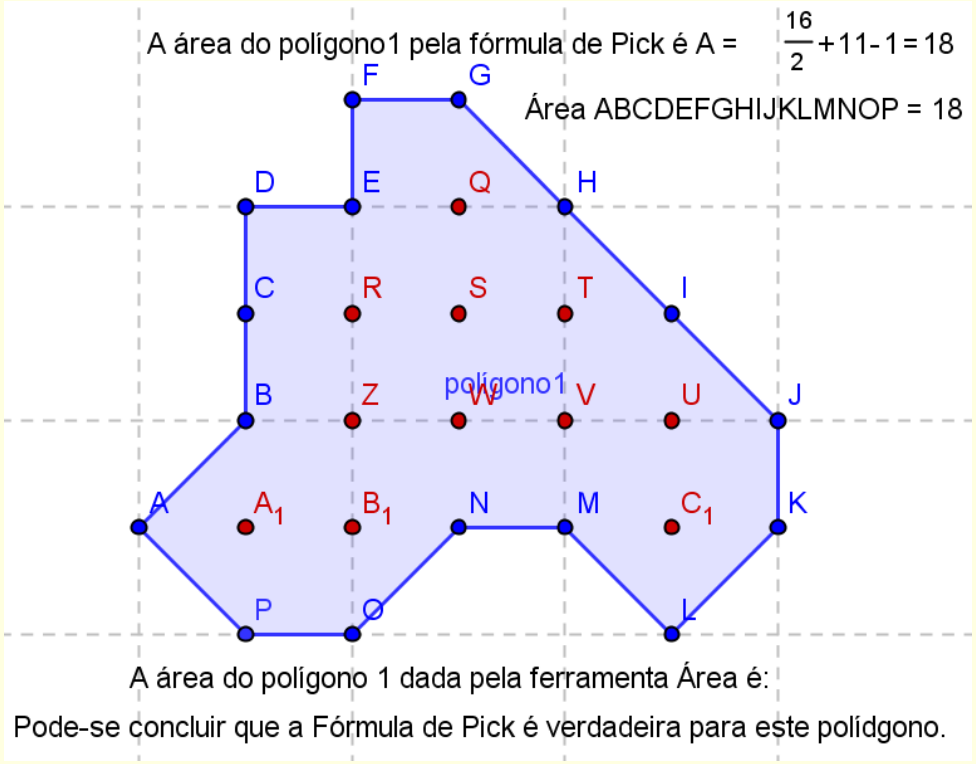
Examples of Activities



http://animoto.com/play/yTFH0FU4dsm45Lb6I9JouQ?utm_source=pucsp.br&utm_medium=player&utm_campaign=player

Subjects Studied and Design of the Modules

5. AND ALGEBRA?: The equations and coordinates can be entered directly in the command area and it is possible to manipulate variables associated with numbers, vectors, and points.

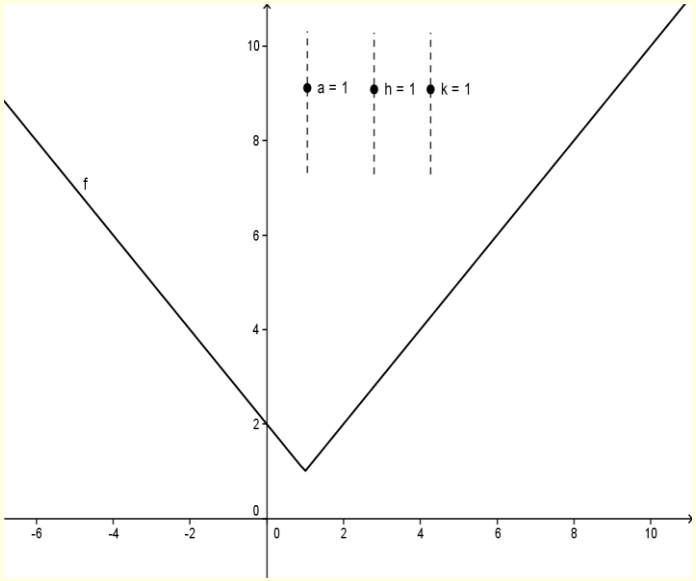


Subjects Studied and Design of the Modules

Subjects Studied and Design of the Modules

6. STUDY OF FUNCTIONS: The algebraic exploration of GeoGebra establishing definitions and properties, and exploring the different records for representation (natural, symbolic, and graphical language).

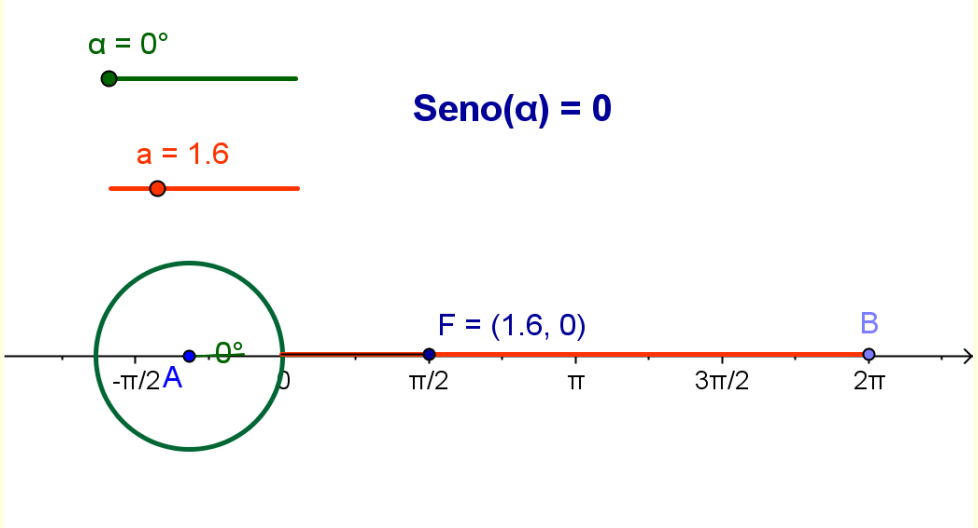
In this activity, we will explore equations and inequalities of a variable. The process for exploring these situations comes from applications of the definition by parts of absolute value. The absolute value of x is equal to x if x is positive; it is equal to –x (negative x) if x is negative, and it is equal to 0 if x is equal to 0.



Subjects Studied and Design of the Modules

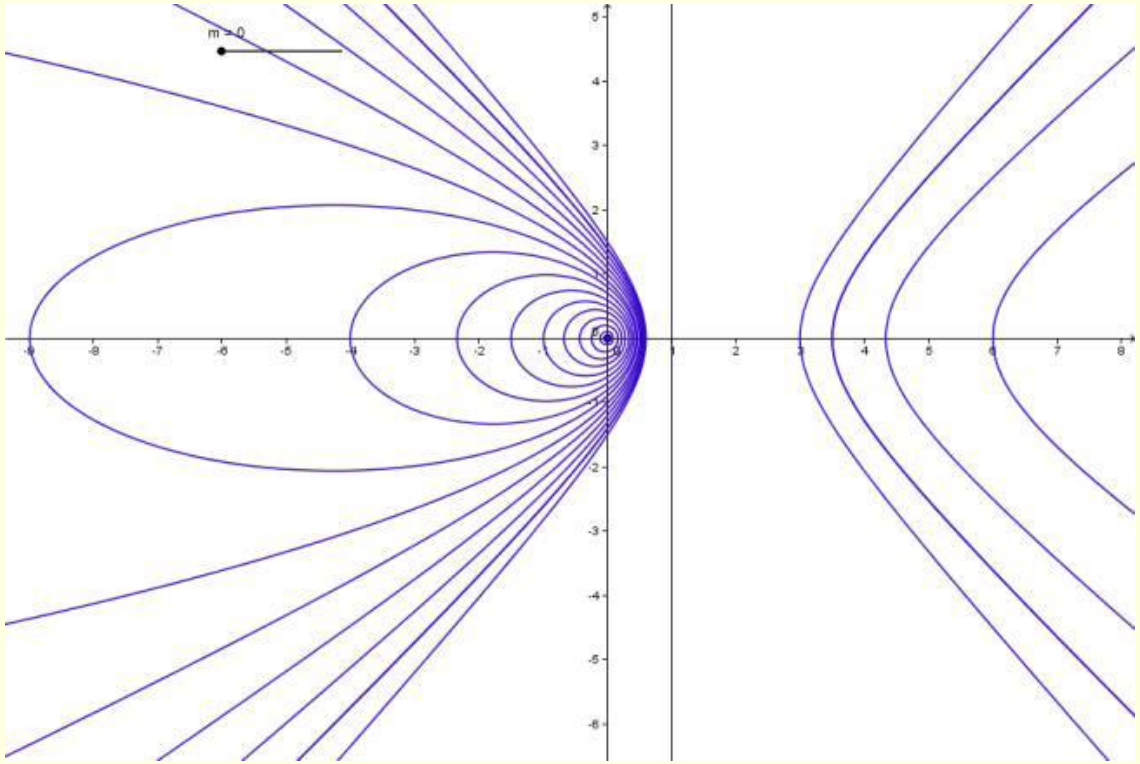
7. TRIGONOMETRY: Studies the relationships between the sides and the angles of a triangle, and that relation between mathematics and astronomy.

In this activity, you will construct an animation that traces a special curve called a "sinusoid." Variations of the "sinusoid" curve are graphs of the functions that are called periodic functions; that is, functions that repeat.

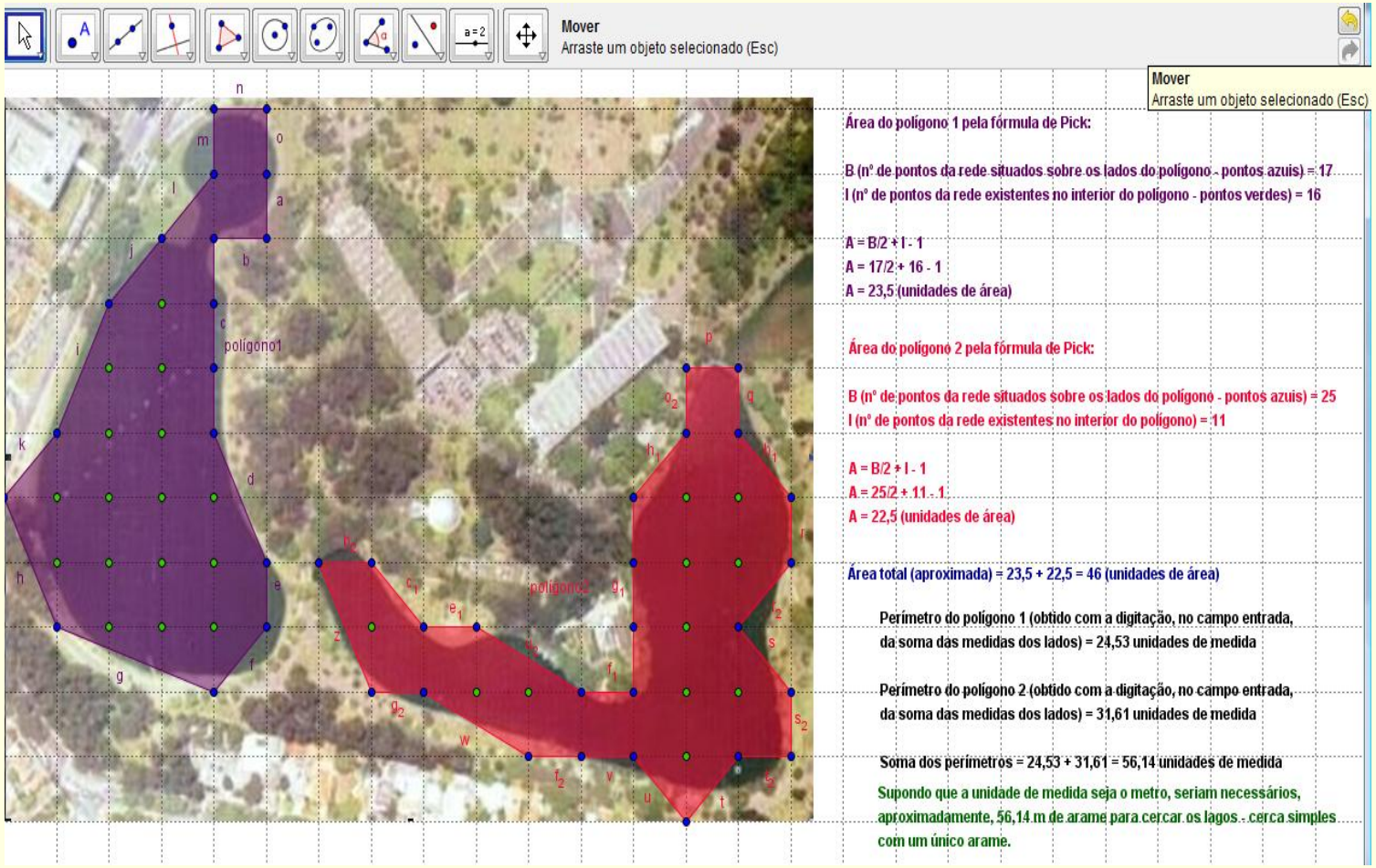


Subjects Studied and Design of the Modules

8. LOCUS: introduction to the concept of geometric place, exploring the facilities of GeoGebra for its construction.



Examples of Activities



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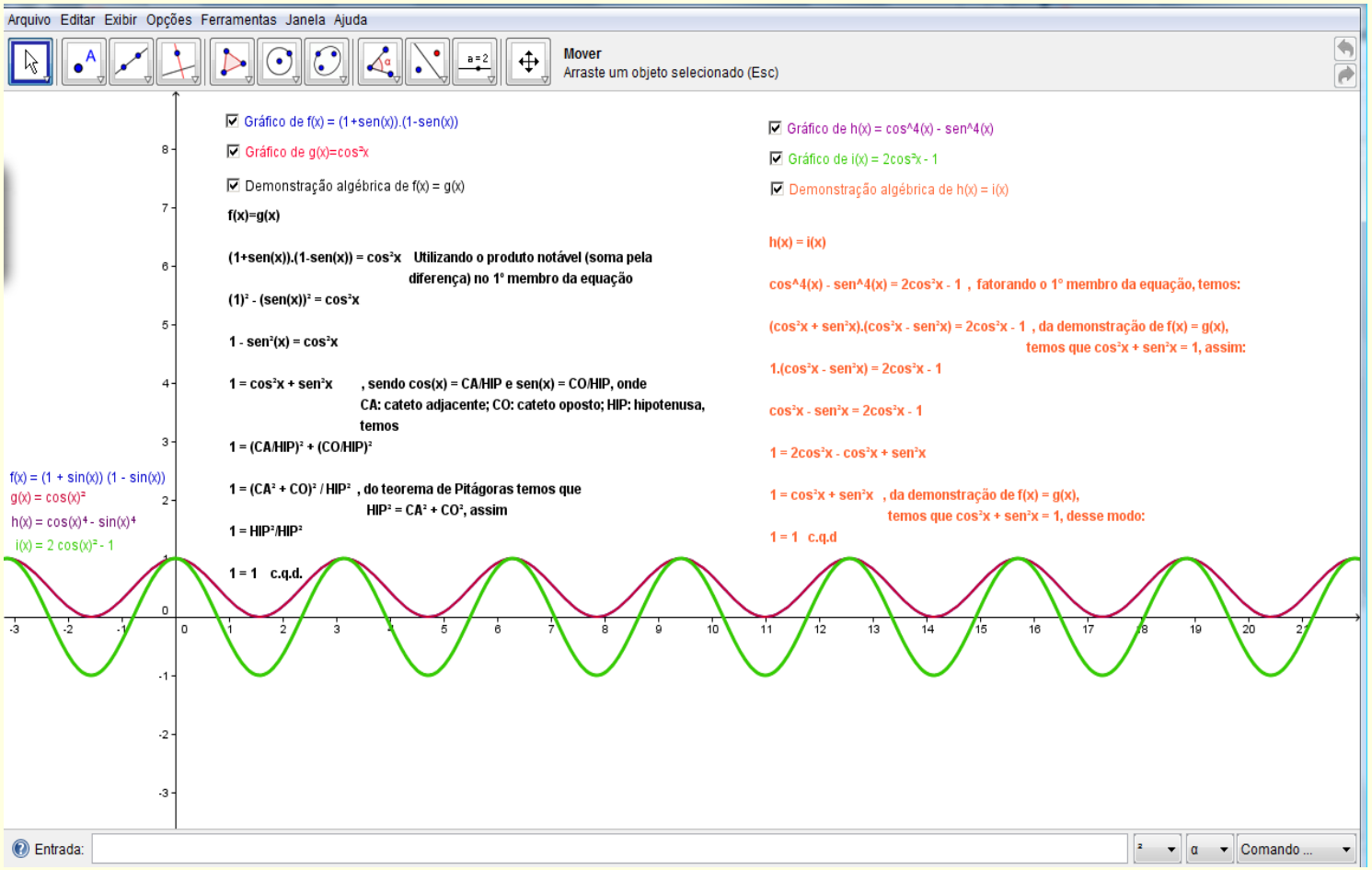

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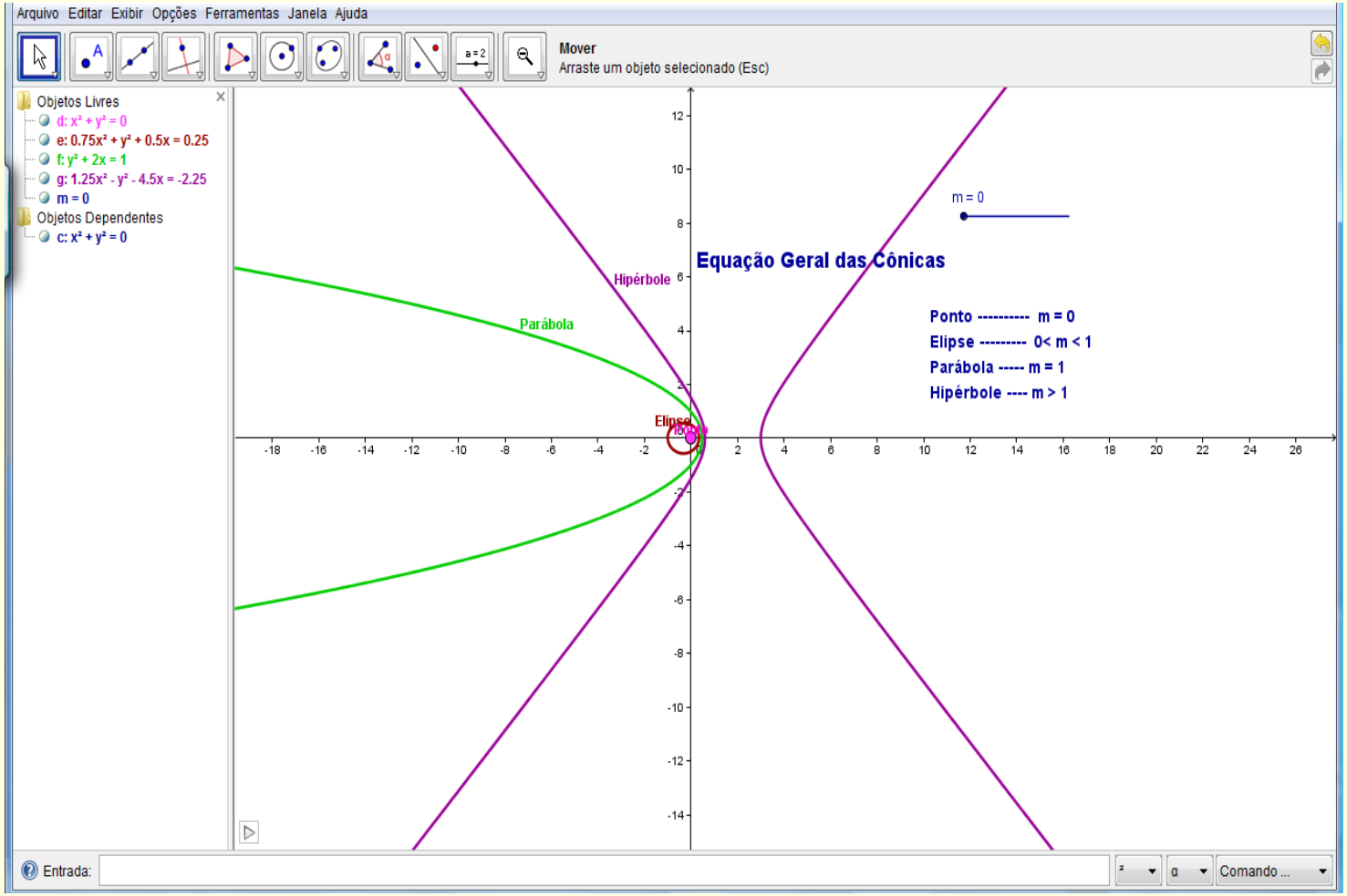


Results

The course **“Dynamic Mathematics”** had the participation of 14 in 2009 (13 in 2010) students, of which 9 in 2009 (12 in 2010) had an effective participation of 75%.

In Module 1, the students presented difficulties that we considered normal.

In Module 2, when the initial difficulties were almost overcome, a view of the teaching practices began to emerge and the day-to-day experiences were recovered as the activities were developed.

Results

In the development of the following two modules, about circles and isometries, the difficulties were directed at performing the activities with the use of resources that required a more creative mathematical reasoning and theoretical knowledge that may have been asleep since graduation. One of the students highlights:

Once again, I was able to complete my task on time. I am pleased, since I worked on developing a covering of the plane with the Tangram pieces. This subject is of great interest to me, since I am developing a project for making games, using virtual tools, and one of the games that we are developing is the Tangram. I plan to use GeoGebra on this project too.

Results

The reflection about the text that was provided in the forum, in the context of algebra, brought to light the difficulties of this subject in primary and secondary school, as one of the students highlights:

The first difficulty in teaching algebra in middle school is the transition that the student must undergo. Upon encountering the first algebra topics, students usually show great insecurity due to the moment of the rupture with concepts and procedures that have already been incorporated, as the authors of the text indicate. One of the needs that these students demonstrate is that of finding meaning in what they are learning. It helps them greatly when they are shown that despite all the abstraction, this material is applicable in their lives.

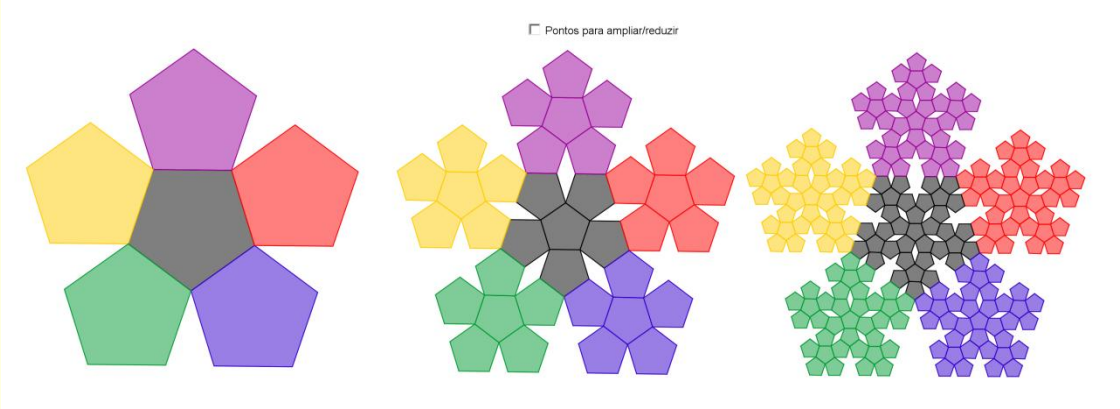
Results

The module that was aimed at studying functions caused a certain impact, since there was an understanding among the students that the Dynamic Geometry software was limited to the exploration of Geometry. Again, the proposed activities brought to light the difficulties experienced in the practice of teaching, as one student observes:

The activity that I considered the most motivating was the activity that dealt with the study of domain, since it is a subject which students have great difficulties in understanding; the relationship between the resolution of the equations and the existence condition in the analysis of a domain is lacking. When analyzed by means of the selector, this becomes very evident. The exploration of functions greatly motivated me. It is much more common to find various resources for geometry and it is rare to find those that explore algebra in an intelligent and interesting manner.

Results (GeoGebra)

The **GeoGebra** software proved to be quite user-friendly as a support for the proposed activities, based on the fact that it is free and that there are suggestions on the Internet for activities from the creators and the community that may be be used directly with the students or, using the creativity of the teachers, with minor modifications.



Example of activity produced by a student in Module 4

Results (Moodle)

The challenges of **Distance Learning** were overcome by the students and indicated a possible path for their continuing education.

The statements consolidate the presented proposal of the course. One student observes:

With each class and with each access to the Internet in the virtual learning environments, I grow and always learn something new. The physical presence meetings were excellent, since we exchanged some of our experiences and we could have a more personal contact, eye to eye, with the participants. However, the Virtual Learning Environments are extremely rich. Through them, we greatly developed our creativity, our writing, our form of communication. It is an environment of mutual collaboration, where one learns with the other. We are all apprentices at some time, and collaborators at others. Each one of us has a new knowledge to be shared.

Conclusion

We found that the effective insertion of technology in teaching involves issues beyond the teacher's good-will, and that the school's organization and support material with recommendations are essential for the teacher's first steps in this paradigm that presents itself.

With the understanding that technology is just a mediator in the process of teaching and learning, the teacher must assume the role of the primary protagonist in the activities of mobilization, creativity, and exchange of experiences with their peers, so that positive changes may occur in their teaching practices.

THANK YOU!!!

http://www.wordle.net/create