A GEOMETRY CLASS IN HIGH SCHOOL WITH GEOGEBRA

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Main Topic: GeoGebra as strategies of teaching and learning in basic education.
Modality: Oral presentation
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ABSTRACT: The current study is an analysis of an activity performed with a group of the 1st grade of high school in Pernambuco state. The objective of the activity was to promote graphic equations' learning having GeoGebra software as resource. The activity consisted of graphical display of four equations that represent four straight lines. How GeoGebra enables a dynamic work with equations and their graphical representations, students could view points in the graphic, the relative position between straight lines and relative position between the lines and axes. The results indicate that about 83% of the students developed the activity without error in the representation, which gives evidence that the software used in Geometry class is a great relevance for the understanding contents.

INTRODUCTION

This research was held in a public school in Pernambuco state; the school attends students of the 6th grade of elementary school to high school and works in the morning, afternoon and evening.

The activity was applied with 1st grade high school students in two days and two hours classes. The classroom content was Geometry, wich was a shortly subject addressed by the teacher, moreover, the school teachers are advised to work based on the Curricular Parameters of Pernambuco (PCPE). As the mathematics teacher uses the PCPE in class, this document also served as reference for research.

The mathematics teacher of the class provided all students to develop the activity better, the class was divided according to the number of computers that was working in the lab, so it was necessary to perform the activity in two days. One part of the class on the first day in two hours classes, and another class in another day, also for two hours classes. Although the class is large, according to the teacher, about 40 students in the booklet, there
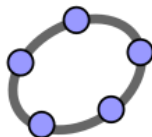
were only present a 17 total students. It appears that in the beginning of the year registrations and attendances are great and during the year process the classes go through a dropout students and low classes frequency.

The GeoGebra's objective activity was to help students in the graphical learning representation of the straight lines. With GeoGebra's tools uses available, was possible to dynamically visualize the straight lines on the graphical representations, as the students typed their equations. The technological resources integration in the schools have been a practice encouraged by the mathematics education since before the students and computerized society daily lives we live in, it becomes increasingly difficult to talk about education without including technology. In this context, the softwares have occupied an important position, especially free software like GeoGebra. They are excellent resources, as well as some provide a menu of mathematical content tools, software present a dynamic and interactive environment for learning, which attracts a lot the students attention and interest.

The content was chosen for Geometry class, specifically the graphc equations study, in other words, the straight lines on the Cartesian plane . The activity was designed based on the Mathematic Curricular Parameter of Pernambuco (PCPE). Moreover, the study of the straight lines on the Cartesian plane had already been worked by the mathematics class teacher, so the activity with GeoGebra was an opportunity to retake that content under a different look than just the textbook and the blackboard teaching. We know that the representations in the books and in the blackboard may not offer the immediate visualization of changes performed on the straight lines or in the equation, but with GeoGebra is possible. Therefore, the straight lines and the equations visualizations with GeoGebra provide a more dynamic and interactive work in the geometry teaching.

GeoGebra was chosen to carry out the activity to be an open source, easy to use and available on school computers. As the students were already familiar with the software environment, due to previous activities performed by the math teacher, was not necessary to specify the students how to use GeoGebra, it was only indicated how changing the straight lines colors and how to save the file. This text is an example of how to conduct a geometry class in high school dynamically, with students' participation and technology use.
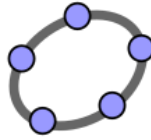
OBJECTIVES

The activity was designed to promote the graphical representation equations learning and straight lines visualizations on the Cartesian plane. Moreover, students were encouraged to identify in the computer's screen the parallel lines, the intersecting lines, the straight lines position to the axes and which points belonged the straight lines, so that the main content, geometry, has been approached, specifically the straights study line in the Cartesian plane.

METHODOLOGY

The activity was conducted in a group of the 1st grade of a public high school in Pernambuco State.

The school was chosen because of the computer lab with GeoGebra installed and to select the class was taken considering the suggestion of the math teacher at the same, because he said the students had worked with GeoGebra which facilitated the execution of the work, because it was not necessary to introduce the rudiments of how to use the software. During the activity, students were familiar with and interested in the activity GeGeobra.

On the first day of the activity, the teacher provided some of the students to the computer lab, students received a sheet with the activity guidelines. On the sheet, students were asked to highlight a straight line in red color, this advice was given because then they were asked about the red line position as well as the other straight line and the axes. The students had no difficulties to use GeoGebra's tools, including some formatted straight lines using the thickness option. The guidelines that the students received are below:

Let's insert in the input line GeoGebra's equations:

y = x + 1, y = x - 1

$$y = -x + 1$$
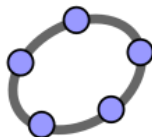
Then click the right button in the equation y = x + 1, choose properties, and then the color item, select the red color to y = x + 1. For the other lines put the color you prefer.

In the straight line y = x + 1 mark the following points:

(2, 3), (3, 4), (5, 6), (1, 2), (4, 5), (-2, -1)

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Now find the point where the red line y = x + 1:

Touches the X axis

Touches the Y axis

Which lines are competitors? What are the intersection points?

Which lines are parallel?

When finished, click the file menu, choose record as target and type your name and save it.

GeoGebra is a free software that favors the simultaneous display of algebraic and geometric representation of the same mathematical object. We can identify in its interface an algebra window on the left and a preview window on the right with the Cartesian plane. In picture 1 below, locates the input line in which students typed the equations that are on the left of the screen, it is possible to view the equation in red color y = x + 1 and the equation y = - x + 1 in black color. We also identify A (0, 1), B (1, 0) and C (-1, 0). On the right side of the screen we have the graphical representation of the straight lines and points on the Cartesian plane.
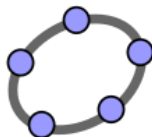
Picture 1 – GeoGebra interface
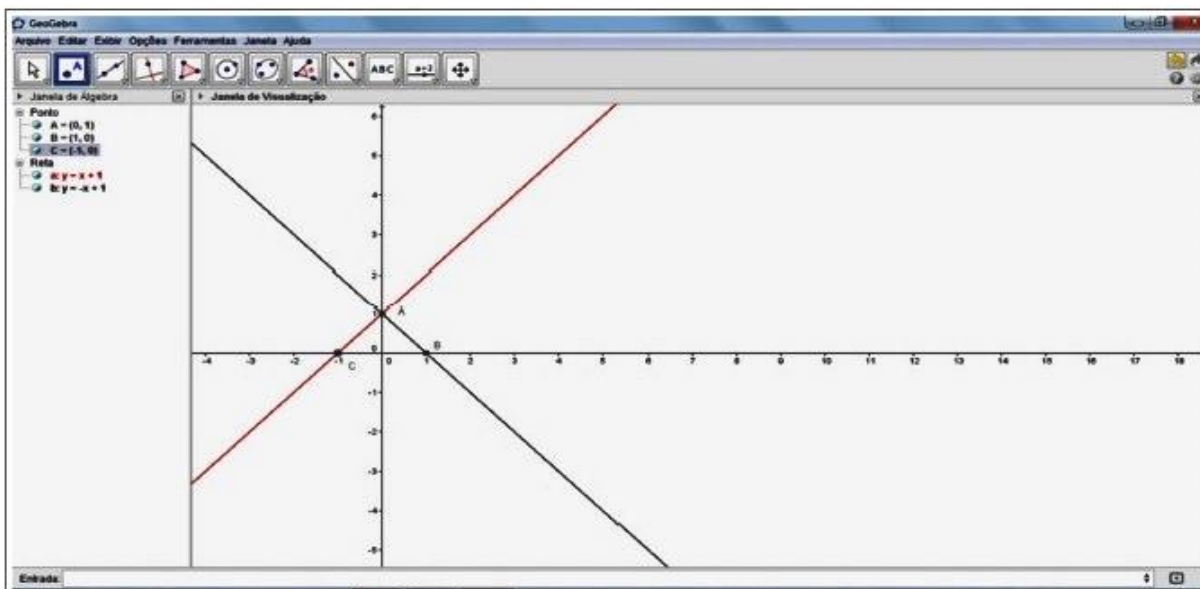

Source: Prepared by the authors

RESULTS

We analyzed seventeen activities and found that fifteen students performed the activity without using other GeoGebra's tools beyond color, which was requested. Three students made errors in the activity's representation and another two had some kind of formatting in addition to the straight line colors.

Table 1 – Major differences in students' productions

| Number of students	Activities without errors	Activities with errors	Changes in formatting	Without changes in formatting
17	14	3	1 with error	15
			1 without error	

Source: Prepared by the authors
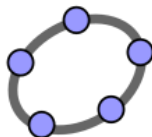
AD student entered the function in his/her activity tool to represent the straight line y = - x + 1 we can visualize in his activity function f (x) = = - x + 1. What may be an indication of skills with GeoGebra and probably also an attempt to relate the function notion with the contents of straight line. But during the laboratory activity content function was not mentioned.

See picture 2:

Picture 2 – AD Student Activity
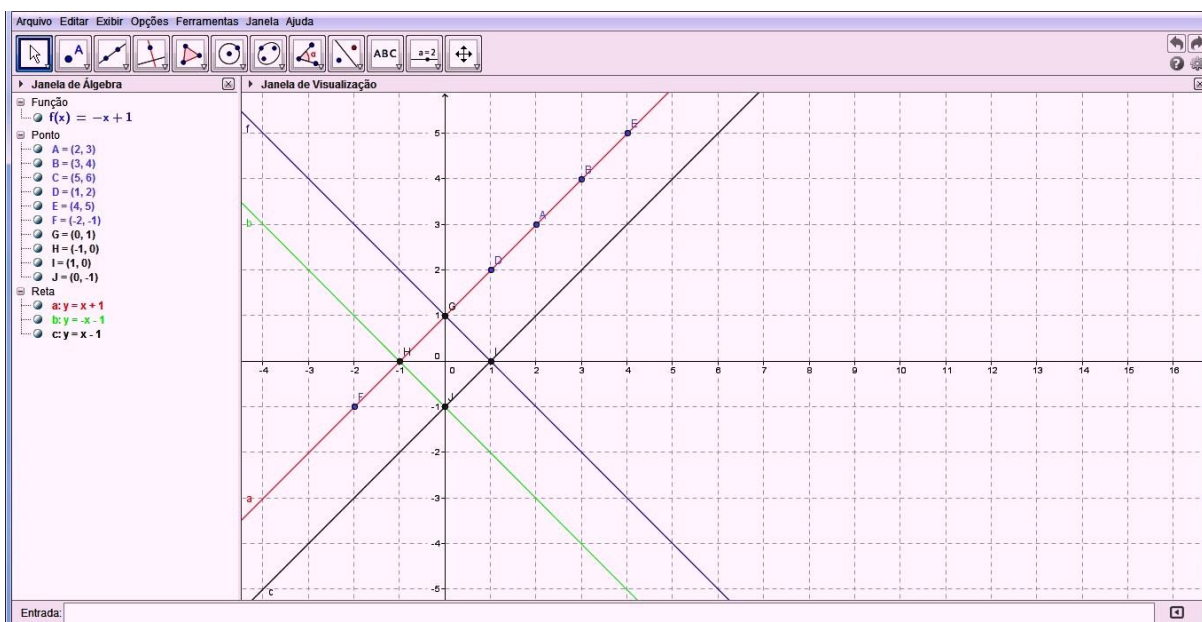
Source: Prepared by the authors

In another protocol, we can see that the student has not clicked in properly ordered pair in the plane, leading to the appearance of decimal numbers representing the ordered pair differently from the desired activity. What gives evidences that such student does not have a lot of skills with the software, because the student failed to locate correctly the points on the straight line. Moreover, this type of error also concerns us as the understanding of the content covered.

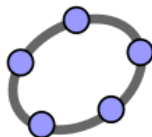Notice picture 3:
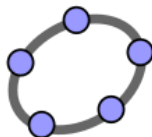
Picture 3 – ED student activity
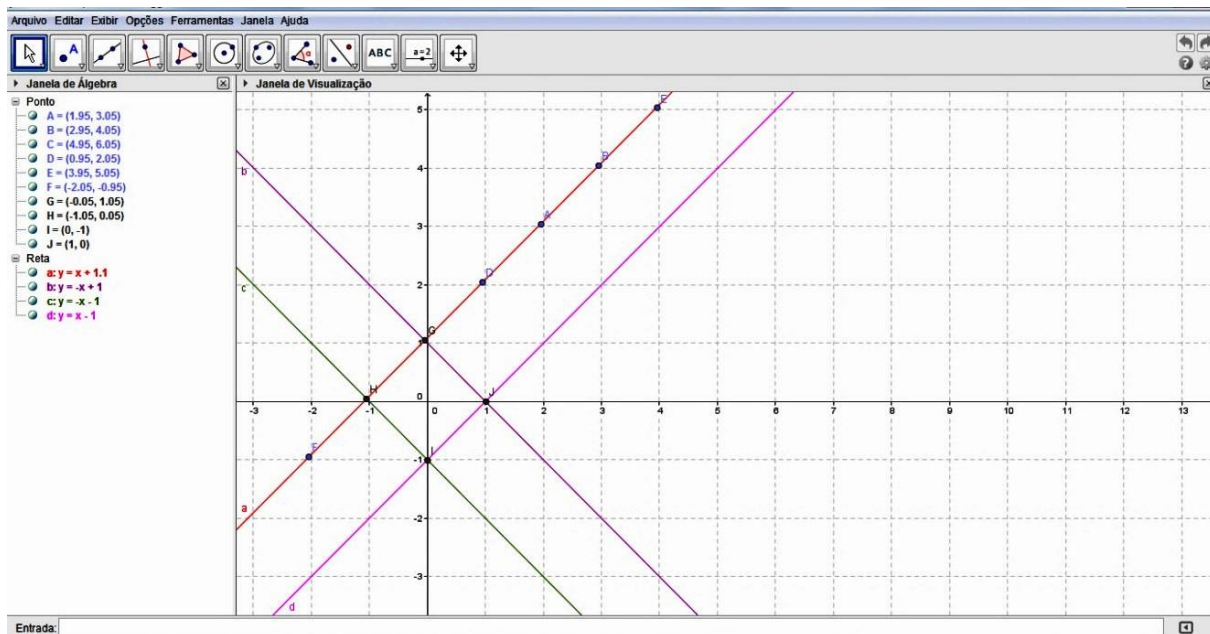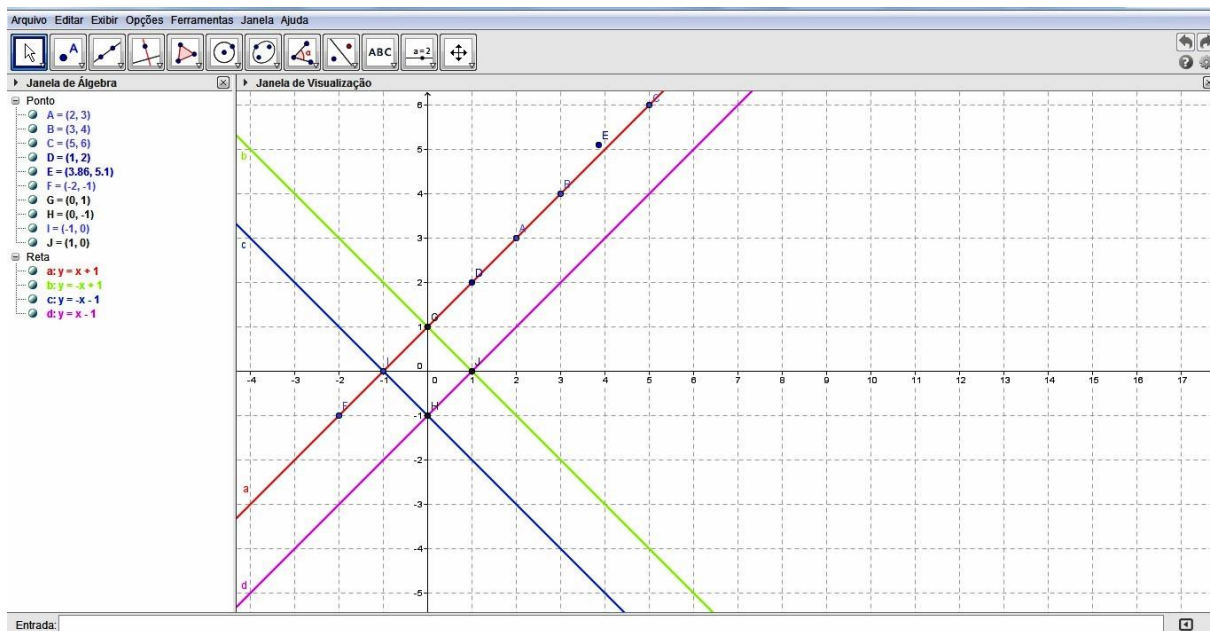

Source: Prepared by the authors

The same error was noted by OJ student, in marking the points in decimal representations. However, this student changed the thickness of the lines, which shows some skills with the software, since this procedure was not mentioned in the activity with GeoGebra.

See picture 4.

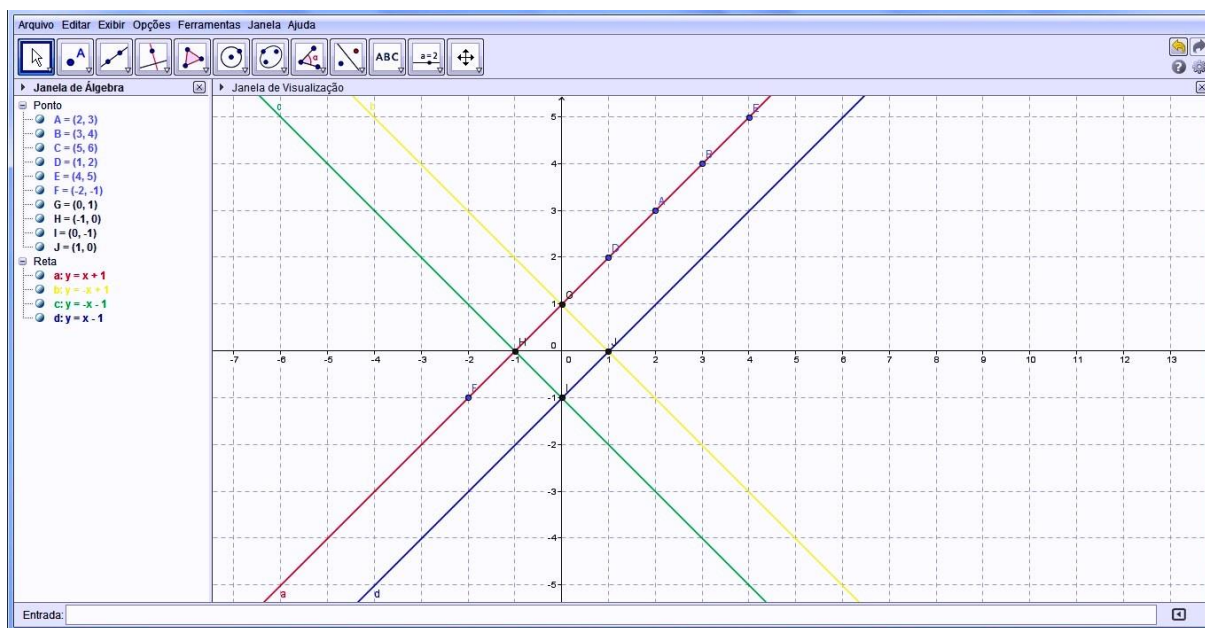Picture 4 – OJ Student Activity
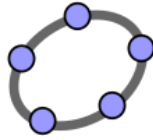

Source: Prepared by the authors

In picture 5 below, the MY student has not submitted error in her activity, but it was found that she changed the thickness of the lines.

Picture 5 – MY Activity

Source: Prepared by the authors

Picture 6 – Students while performing the activity in laboratory

Source: Prepared by the author

CONCLUSIONS

This research indicates that GeoGebra's uses software favored the teaching and learning contents proposed by the activity. With the GeoGebra's tools students besides visualizing geometric objects dynamically in the preview window, could also associate each representing its equation, in order to relate the algebraic representation and the geometric representation of mathematical objects being studied, including that one student inserted the idea of depending on his activity. During the activity, students were able to answer all questions, there was class participation and student motivation to perform the activity.
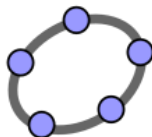
By questioning students about the points location on the straight line, the relative
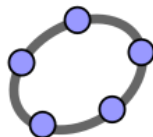
position between two straight lines (parallel and competitors), the position of a line to the axes and identify the points on the Cartesian plane, we approached the activity, especially the contents of geometry and we can see that the activity has developed satisfactorily, because before the questions most students participated and answered correctly, as can be seen in the results that 83% of students were able to develop the activity in accordance with what has been proposed. As difficulties, it is important to point out the small number of students were present on the activity day, totaling only 17, a greater number would offer more varieties of answers and results. It is also important to note that the lab despite having more than 20 computers, not all were working and there is not an employee at school in charge of the lab. We know that this is the reality in many schools, schools receive computers but the maintenance is not adequate. On the other hand, fill classrooms and computer labs with more than 40 students would not facilitate the development of the activity and on the reduced number of working machines, we divide the activity into two days. It is noteworthy that during the activity the students showed that they already knew the GeoGebra software, but

both activities were found in which students left the points in decimal form, as another student input as a function of the straight line equation. Since no subsequent conversation with students was given as an interview or a questionnaire in order to investigate how these students were conducted to interpret the guidelines, the three activities that had an error may have resulted from the inability to cope with the software or misunderstanding of the guidelines given.

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