Influencia de Geogebra en el aprendizaje de la Geometría Analítica.

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Abstract.

Given the inclusion of dynamic geometry software (DGS) in the teaching - learning of geometry, an investigation where an analysis of this process is done by developing and implementing activities that allow teachers serve as a guide in learning, understanding occurs and viewing geometry. Therefore considered relevant analysis of the cognitive processes developed: the difficulties that both the teacher and the student, the factors that are determinants of the processes and the scope that may have use SGD face . All within the South campus of the School of Bachelors of the Autonomous University of Queretaro.

Research into attitudes, actions, activities, plannings and situations that occur in the classroom, to help in identifying the factors that influence learning and understanding of geometry are described. In addition to participating as an observer and researcher within groups, it is possible to obtain the views of both teachers and students to the teaching situations that arise; on the other hand to teach the class Geometry he may be assuming the role of teacher, I allowing a methodological proposal that allows teachers to boost the teaching-learning process placing him as a mentor and guide students in finding their own knowledge, and in turn it is practical to implement in groups.

1 INTRODUCTION

This document presents an investigation in which a didactic analysis that describes and analyzes the process of teaching and learning in the field of analytic geometry using a methodology of qualitative type leading to the development of conceptual models and theories by applying practices that use is made presents the Geogebra program as an introduction to a subject or as reinforcement of the concepts seen in him. These practices allow the student to express procedures, calculus, strokes and analysis performed to solve specific problems in their own words as shown in examples are presented in the results section.

It is worth mentioning that this research is in the early stages of design and implementation of practices, along with recording sessions in which they are applied, further interviews are conducted with teachers expressing their experience and opinions on students, the environment was made in the laboratory with the students and practical activities.

Finally a general conclusion about some examples of observations that have been obtained so far presented.

2 LITERATURE

Often didactic research of mathematics focuses on descriptive studies on cognitive processes of learning, the difficulties that both the teacher and the student and factors that are determinants of the teaching and learning are facing, however (Godino, Bencomo, Font Moll and Wilhelmi, 2006) mention that "the classroom should provide knowledge for the analysis of:

- The adaptation and relevance of mathematical content to a specific educational project.
- • Technological and temporary means suitable for the implementation of a process of mathematical study
- The type of interaction between teacher and students to identify and resolve difficulties and conflicts in the processes of mathematical study.
- The adaptation between the training objectives and capacities and previous skills of students and their interests, emotions and motivations.
- The relevance of the intended meanings (and implemented), the media used and interaction patterns to the educational project of the school and the social context in which the study process develops.

Moreover, the concept of task from an Anthropological Theory of Didactic (TAD), "puts mathematical activity, and consequently the activity of study in mathematics, in all human activities and social institutions" and also supports that all human activity can be described as a unique model seen as a praxeology. Which leads to a type of work and tasks where task is part of a type of tasks that, in this case, will the student by using techniques that can be done using technology (Chevallard 1999) is defined.

Defining as technology "rational discourse-the logos-on-the technical tekhnê-, speech whose first objective is to justify" rationally "ô technique, to ensure that can perform tasks of type T, ie, do the it is intended ". (Chevallard, 1998). Where technology meets three functions:

1. Justify the technique used to solve a task type.
2. Explain the technique and expose why it is correct in the solution or demonstration.
3. Produce technical, where it currently has technologies that help us in producing improvements in the techniques used to perform a type of tasks.

3 THEORETICAL FRAMEWORK

It is worth mentioning that the teacher must possess teaching skills to implement and achieve guide students to acquire skills that enable the students Ortega (2008):

- "Competent to use information technologies.
- Seekers, analyzers and evaluators of information.
- Troubleshooters and decision makers.
- Creative and effective users of productivity tools;
- Communicators, collaborators, publishers and producers.
- Citizens informed, responsible and able to contribute to social development. "

Hence the training of teachers is essential in the development and implementation of teaching strategies that allow the student the above capabilities.

Today, programs Dynamic Geometry have opened new possibilities for teaching geometry, one of the main advantages is that the figures are no longer static, paper jump to the computer screen, allowing observe them from different points of view and may even interact with them modifying the design conditions achieving analyze what happens in any situation of change (Mora, 2007).

Moreover (Mora, 2007) mentions that the SGD is used by students as a drawing tool for support in solving problems, conduct research or follow tasks designed by the teacher; on the other hand he suggests that the teacher makes presentations relying on projector to explain new concepts; and by the institutions they are supported by tutoring students in solving geometry problems. Which allows students to "see" and assimilate the concepts that are presented and propose new and better solutions to problems.

In this sense (Hitt, 2003) mentions that the mathematical visualization problem plays an important role, and it has to do with understanding a statement by bringing into play different representations of the situation in question and this allows us to perform an action that Conducer possibly can towards solving the problem.

Additionally (Barahona, Barrera, Cow, 2015) mentions that learning processes are more efficient when integrated tools to facilitate through visual processes mathematical analysis ensuring linking learning acquired with the contribution of mathematical solutions to problems society. This leads to develop and integrate practices involving the use of SGD.

In this research using Geogebra is dynamic mathematics software for all levels of education that brings together geometry, algebra, spreadsheet, graphics, statistics and calculus in one easy to use program is proposed. GeoGebra also has a rapidly expanding community, with users in almost every country. In addition it has become the leading provider of dynamic mathematics software, supporting education in Science, Technology, Engineering and Mathematics (STEM: Science Technology Engineering & Mathematics) and innovation in teaching and learning worldwide. (Geogebra, 2015)

Some of the educational uses that allows us to use the SGD are:

- Handling activities and drag to proving theorems (Figure 1).
- Construction and exploration that they allow us students to make conjectures about geometric situations that can build and test.
- Reconstruction activities. These being the most elaborate since by these students reconstructs geometric designs using various tools that are normally associated with isometric transformations, thus replicating a design discovery of relationships that underlie these and geometric ideas that inspired is encouraged the authors.
- Demonstration activities. At this point it is provided to students demonstrating geometric to relate ideas that allow the student to reach checking geometric properties demonstrations.
- Troubleshooting. It is based on the application of eurísticas strategies that can be applied to problems of implementation or explanation of geometric properties by using construction tools and measurement.
- Conical constructions and its main elements. Aids in the explanation and demonstration of their properties.
- Building related to isometric transformations and homotecia.
- Graphing for analytic geometry using tools included in the software.
- Tools associated with algebra and calculus functions.
- The design of teaching materials simple and practical way to allow the teacher to expose concepts.

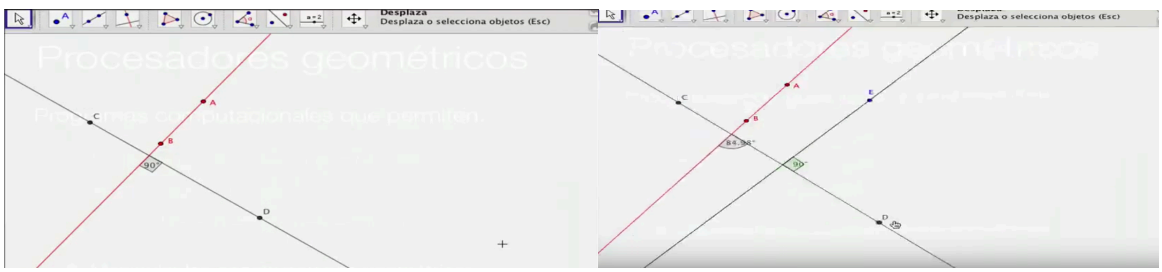


Figure 1: Construction and drag function in Geogebra.

4 RESEARCH DESIGN

This research is qualitative type under a naturalistic paradigm which is interested in the study of the individual (student and teacher) as the active agent in the construction of reality studied (teaching-learning) where the development of conceptual models and theories is performed connecting with the data. Additionally this paradigm is linked to the analytical method - inductive (Hernández, Fernández, Baptista, 2010). All this by interacting with students and teachers to acquire any evidence throughout the semester.

Introduction to the subject and application of the concepts seen: As part of the investigation the development and implementation of laboratory practices will be developed with two objectives are realized.

Observations are collected as follows:

- Recording laboratory sessions.
- Analysis of the actions and attitudes of students in the laboratory.
- Analysis of results, strokes and drawing conclusions made by students.
- Analysis of the results obtained in midterms
- In-depth interviews with teachers about their experience in each practice.
- Conducting focus groups with students.

Which are obtained, categories and variables focused on achieving the overall objectives and specific research.

The general structure of the practices presented is as follows:

1. Name (s) student (s).
2. Introduction on the subject.
3. Development of the theoretical framework, where the student is asked to perform a previous research on the concepts to work, Geogebra tools to be used and / or review questions on the subject.
4. Objective of practice.
5. Resources to use.
6. Development of practice, this section adds a space for teachers add exercises it deems appropriate.
7. Conclusions In this section questions about the concepts, procedures, additional questions to consider teaching and / or observations that the student believes are performed.

Additionally, in some cases, the student is asked to add files to the screenshot on the work done, strokes and / or calculations performed to obtain the results presented. And are these documents that give strength to the observations obtained from the practices.

5 EQUIPMENT AND PROCESS

For the realization of recordings that are made in the computer lab, a video camera using for this a tripod that allows to have a greater stability of the camera and to make approaches to the monitors used alumnus. These recordings are made in the back of the laboratory in order not to cause disruptions and / or distractions to students, plus

Moreover it prompted the teacher and the loan of qualified students practice with two objectives:

- Identify the results obtained by students and
- Know the issues and how they are evaluated by the teacher.

Moreover with the aim of future reference, practices are photocopied and stored for later delivered to the teacher as soon as possible and not affect the continuity of their classes.

Once cases are identified with similar caraterísticas alumnus requested to attend special sessions to conducting focus groups, in addition to requesting an interview with the teacher in order to obtain their experience in the development of practice.

6 AN EXAMPLE

Among the observations that have so far include the following:

- Lack of understanding or lack of attention in reading the questions the theoretical framework.
- Writing brief definitions in most cases.
- Identification of the tools to be used in the development of practice.
- The few students present difficulties in locating the tools to be used.
- Students do collaborative work when the teacher only solve particular doubts.
- Misspellings are presented frequently.

Among the observations previously mentioned, it is common to find that one student describes the tools differently. Ie in Figure 2 the student draws the icon of the "straight" tool to illustrate the use of the "segment of given length" followed by the description of its operation tool. Commenting with the teacher on the review of this question, it mentions that by the end of practice development at its discretion and the response is valid and has no problem on the student. However, the representation of a tool that does not correspond to that requested, might indicate a distraction student when answering the question since the wording of the procedure is correct.

As shown in Figure 3, in practice in the description of the polygonal tool, the same student only describes how a regular polygon is created without illustrate the icon to use.

On the other hand some students have trouble understanding some instructions, however it is perceived that the student is based on the use of illustrations to provide for his explanation. In these examples, Figures 4 to 6; the teacher qualifies answers as correct because of the flexibility in drafting the answers.

What shown here is a brief sample of the comments that have been obtained in an initial stage of implementation of practices. Nevertheless

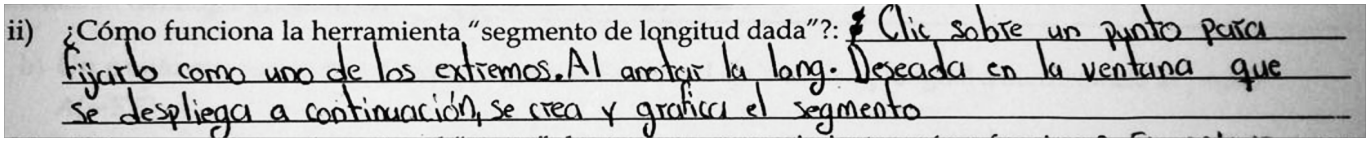


Figure 2 Tool description given length segment.

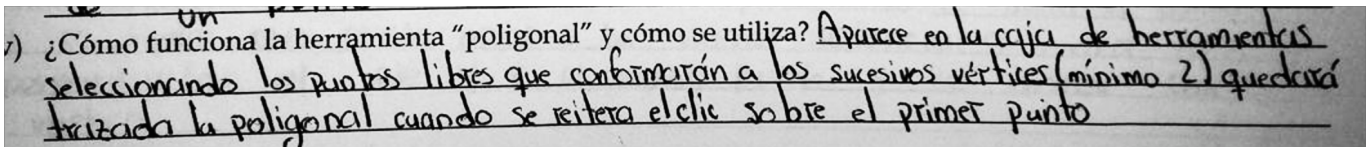


Figure 3 Description of the polygon tool.

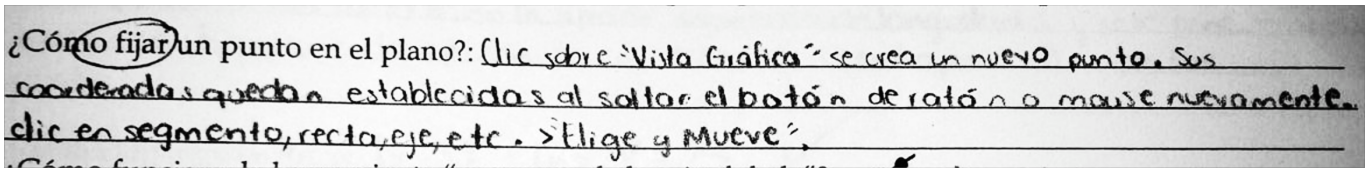


Figure 4 Procedure for setting a point in the plane.

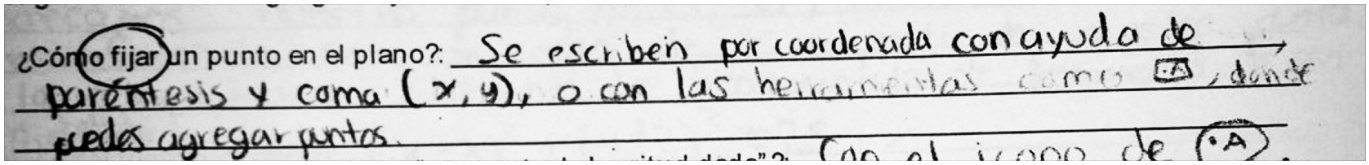
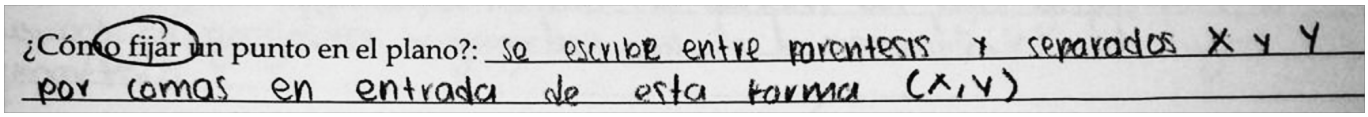


Figure 5 Indications to set a point in the plane.



6 Procedure for setting a point in the plane.

7 LIMITATIONS

Within the limitations that may occur include the following:

- Availability by teachers and students to participate in this research.
- Access to group classes for observation.
- Access classes at the School of Bachelors of the Autonomous University of Queretaro as part of research.

As for the material resources that may be limiting in this research are:

- Access to the math lab that has the Geogebra program.
- Access to an area to conduct interviews with students and teachers.
- Software that allows the recording of interviews with teachers and students.
- Software for transcribing interviews.

8 CONCLUSION

As previously mentioned in this document this research is in the early stage of experimentation, data collection, interviews with teachers and students, making it difficult to issue a conclusion in general. However it is expected that with the help of the methodology before planteadaa possible to obtain data to obtain resulting data into categories, and consequently generate theories of teaching - learning of geometry using Geogebra

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REFERENCES

Barahona, F., Barrera, O., Vaca B. (2015) Geogebra para la enseñanza de la matemática y su incidencia en el rendimiento academic estudiantil. Geogebra teaching of mathematics and its impact on student academic achievement. XVIII Congreso Internacional EDUTEC "Educación y Tecnología desde una vision Transformadora" ISBN: 978-84-608-3627-8.

Chevallard, Y. (1999). El análisis de las prácticas docentes en la teoría antropológica de lo didáctico. *Recherches en Didactique des Mathématiques,* 19, (8), pp. 221-266. Francia. Traducción de Ricardo Barroso Campos. Departamento de Didáctica de las Matemáticas. Universidad de Sevilla. Con la colaboración de Teresa Fernández García, Catedrática de Francés, IES Martinéz Montañes, Sevilla.

Geogebra [En línea] *¿Qué es Geogebra?*. (2015). [Fecha de consulta: 28 de septiembre de 2015]. Disponible en: http://www.geogebra.org/about.

Godino, J. D., Bencomo, D., Font Moll, V. y Wilhelmi, M. R. *Análisis y valoración de la idoneidad didáctica de procesos de estudio de las matemáticas.* En X Simposio de la SEIEM 2006, Huesca (España). 2006. pp. 221-252.

Hernández R., Fernández C., Baptista Ma d P., (2010). Metodología de la Investigación. ISBN: 978-607-10-5753-7. México.

Hitt F. (2003). *Una reflexión sobre la construcción de conceptos Matemáticos en ambientes con tecnología*. Boletín de la Asociación Matemática Venezolana, Vol. X. No. 2. pp 213 – 223.

Mora, J.A. (2007). Geometría Dinámica en Secundaria. Recuperado de: http://jmora7.com/miWeb8/Archiv/2007%20Granada%20JAMora.pdf

Ortega. J.A. *Las competencias tecnológicas de los docentes y sus implicaciones en los desarrollos curriculares: Teachers Technological Competencies and their implications in curricular developments.* Tecnología y Desarrollo Curricular. Investigación Educativa (2008.). 12 (21): 77 – 93. ISSN 17285852.