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The Effectiveness of Mathematics Teaching Outcome Taught with Geometer's Sketchpad Program (GSP) toward Mathematical Concept and Attitude of Tenth Grade Students

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ABSTRACT

The purposes of this action research were to examine the effects of using the Geometer's Sketchpad (GSP) in teaching the analytic geometry and to investigate student attitudes toward learning mathematics with the GSP. Participants of this research were 36 grade-10 students in Samsenwittayalai School, Bangkok, Thailand. The researcher provided 8 periods for teaching and conducting the research. Research findings show that the GSP helped students to improve their understanding in mathematical concepts. The designed learning activities with the GSP have efficiencies at 87.5/80.56 which are higher than the standard level at 80/80. Students have positive attitudes in learning mathematics with the GSP.

Keywords: The Geometer's Sketchpad (GSP), Analytic Geometry, Learning Efficiencies, Student Attitudes

1. Introduction

Mathematics has an important role in the development of thinking skills. It helps improving systematic thinking, assists in the analysis of problems, and provides abilities to make decisions. Mathematics is an essential tool for studying many applied science, technology, and other related subjects. NTCM (2002) focused on developing conceptual learning for students to be able to apply their knowledge to a variety of situations.

Information technology is the one of useful tools for mathematics teaching. It has changed the context of the instruction from teacher-centered approach to student-centered approach (NTCM, 2002). There are many software and tools which assist in teaching mathematics like Cabri, GeoGebra, and Geometer's Sketchpad (GSP). This research focused on using the Geometer's Sketchpad Program (GSP) as a part of teaching mathematics. Almeqdadi F. (2000) stated that the GSP has positive effects on students' understanding of geometrical concepts. It helps improving knowledge and understanding in analytic geometry (Chuchai T., 2008), and it is an instrument which enables students to obtain a deeper insight into the concept (Khairiree K., 2005). Previously presented results also show that student attitudes towards learning mathematics with the GSP are positive (Khiriree K., 2005, Boyraz S., 2008).

In teaching analytic geometry, the researchers experienced that most of students could remember several known math formulas and were able to apply them for solving given math problems. However, many students did not understand how those formulas were retrieved from which in fact these concepts are very important for understanding many features and important for learning at higher levels. Learning without understanding critical concepts also results on low level of attitudes. According to previously stated problems, the research was interested in using the GSP to assist in teaching the analytic geometry.

2. Research Objectives

This research aimed to enhance student understandings of mathematical concepts through the use of the Geometer's Sketchpad Program (GSP). Efficiencies of the designed learning activities with the GSP and student attitudes towards learning with the GSP were to be measured and analyzed.

3. Methodology

3.1 Participants

Participants in this action research were 36 students in grade tenth at Samsenwittayalai School, Bangkok, Thailand. This research was done as a part of the instruction in the “Analytic Geometry” course.

3.2 Instruments

Research instruments are consisted of 3 types as follows:

- 1) Lesson plans in the analytic geometry course (grade-10 mathematics) using the Geometer's Sketchpad Program (GSP) as a part of learning activities. The following topics are included in the lesson plans:
 - Distance between two points
 - Midpoint of a line segment joining two points
 - Slope of a line
 - The equation of a line
 - Parallel lines
 - Perpendicular lines
 - Distance from a point to a lines
 - Distance between two parallel lines
- 2) An achievement test which includes formative test consisting 10 questions (for 10 points).
- 3) An attitude test (a questionnaire) which is based on a five-point Likert scale format covering the following areas: contents, learning management, learning materials.

2.3 Data Collection

Data collection was done as follows:

- 1) Studied the related theories, principles, concepts, and technical methods for the preparation of lesson plans based on the basic education curriculum, 2008.
- 2) Prepared lesson plans which include the Geometer's Sketchpad Program (GSP) as a part of the instruction. There were 8 lesson plans in total.
- 3) Managed learning activities in the classroom following the designed lesson plans in the analytic geometry course.
- 4) Students completed the exercise (formative test) at the end of each session.
- 5) Tested students to measure their learning achievements. There are total of 10 points.
- 6) Students filled in the questionnaire to test their attitudes towards learning mathematics with the GSP.
- 7) Analyzed the data and concluded the results.

2.4 Data Analysis

- 1) Efficiencies of the designed learning activities with the GSP are calculated using the E_1 / E_2 criterion (Promwong, 1977) described as follows:

$$E_1 = \frac{\sum x_1}{N_1} \times 100 ,$$

where

E_1

means the efficiency of the learning process,

$\sum x_1$

means sum of the scores in all exercises collected from students,

A

means the total scores of all exercises,

N_1

means the number of students.

$$E_2 = \frac{\sum x_2}{\frac{N_2}{B}} \times 100,$$

where

E_2

means the efficiency of the learning outcome,

$\sum x_2$

means sum of the scores of the achievement test (post-test),

B

means the total scores of the achievement test,

N_2

means the number of students.

- 2) Student attitudes are considered from questionnaire results. A questionnaire is based on a typical five-point Likert scale weighted on students' level of agreement on each specified statement. The overall student attitude is determined from the average score:

4.21 – 5.00 means “very positive”

3.41 – 4.20 means “positive”

2.61 – 3.40 means “neutral”

1.81 – 2.60 means “negative”

1.00 – 1.80 means “very negative”

3. Results

Efficiencies of the designed learning activities using the GSP are shown in Table 1. The learning process efficiency (E_1) is at 87.5 and the learning outcome efficiency (E_2) is at 80.56. The learning efficiencies $E_1 / E_2 = 87.5/80.56$ is higher than the standard level at 80/80. Questionnaire results are displayed in Table 2 showing that the overall attitude towards the designed learning activities with the GSP is positive.

Table 1
Learning efficiencies

$E = E_1 / E_2$	$\bar{x}_1 = 43.75$	$N_1 = 36$	$E_1 = 87.5$
	$\bar{x}_2 = 8.06$	$N_2 = 36$	$E_2 = 80.56$

Remark: $\bar{x}_1 = \frac{\sum x_1}{N_1}$ and $\bar{x}_2 = \frac{\sum x_2}{N_2}$

Table 2
Student attitudes

Aspects	Mean	Level
Content	3.98	Positive
Learning Management	4.27	Very Positive
Learning Material	4.02	Positive
Overall Mean	4.09	Positive

4. Conclusion and Discussion

This study investigates the effects of using the Geometer's Sketchpad Program (GSP) in teaching analytic geometry. The designed learning activities with the GSP have efficiencies at 87.5/80.56 attaining above the standard level at 80/80. It can be concluded from questionnaire results that students have positive attitudes in learning mathematics with the GSP.

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