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Impact of Geometer's Sketch Pad on High School Students' Performance in Mathematics

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ABSTRACT

Mathematics has long been one of the most feared subjects among students. As such, educators have been constantly looking into different approaches to continue improving the transaction of this subject. This study seeks to investigate the impact of Geometers' Sketchpad (GSP) – a dynamic geometrical software, in the teaching and learning of Mathematics among high school students. This study was conducted on 40 students who were divided into the control group and an experimental group. The control group received conventional teaching method while the experimental group was taught based on a GSP module designed to solve Triangles. A questionnaire was used to see the attitude and perception of students towards the usage of Geometers Sketch pad and an achievement test was administered to see its impact on students' achievement. A descriptive analysis showed that most of the students agreed that the Geometer's Sketchpad is a useful tool for learning Geometry. The findings from this study have indicated that the students perception towards the use of Geometer's Sketchpad is positive, there is a need to improve the attitude of the students towards the use of Geometer's Sketchpad since there is a considerable improvement in the scores of students in the achievement test after the use of Geometers Sketchpad in the teaching learning process.

Key words: Geometers sketch pad, geometry, attitude, achievement

INTRODUCTION

Teaching mathematics has progressed throughout time as new devices and methods have been introduced. The challenge has been to identify which devices and methods are helpful and which devices and methods are just different. Teachers need to find the most effective way to teach, whether it is "old way" or "new way".

In recent years, a lot of talks have been expressed on the use of Information, Communication and Technology (ICT) in education. Along with the implementation of IT in education, it provides us a good chance to make use of ICT in teaching and learning mathematics. Some of these are in the form of hand held tools (e.g. calculators and graphic calculators) and softwares such as Mathcad, Derive, Mathematica, Matlab, Geometer's Sketchpad, Autograph dan Matlab. For the software application, it could perform like a mindtool to facilitate learning. Unlike a calculator that gives an answer when instructions are posed, a mindtool would form a learning partner with a student, allowing the student to learn through exploratory method.

The learning of geometry emphasizes the mastery of deductive skills in writing proof. In the current trend of the teaching and learning of mathematics, it is no longer adequate to teach students with the traditional expository approach at the current age of knowledge explosion. In response to the foreseeable change of global knowledge economy, the teaching and learning of geometry utilizing dynamic geometry softwares have been explicitly indicated in the secondary schools,. Teachers have been recommended to utilize dynamic softwares and one such dynamic geometry software licensed is the Geometer's Sketchpad (GSP) software, developed partly under the Geometry Visual Project conducted in Pennsylvania and

sponsored by the National Science Foundation

Geometer's Sketchpad:

The Geometer's Sketchpad is a popular commercial interactive geometry software programme for exploring Euclidean geometry, algebra, calculus, and other areas of mathematics. It was created by Nicholas Jackiw (1995). Geometer's Sketchpad includes the traditional Euclidean tools of classical geometric constructions, that is, if a figure as it can be constructed with compass and straight-edge, it can also be constructed using GSP. Objects can also be animated. The programme also allows the determination of the midpoint and mid segments of objects.

Geometer's Sketchpad allows students to design figures using circles, lines, segments, arcs, and other geometric shapes. Once students design an object, they can measure angles, arcs, segment lengths, find midpoints and other measurements. The student can then grab a point on the figure, move it, and watch the measurements change with the change in the object. For example, if a geometry teacher is teaching students about parallel lines and angles, then the students can design two or more parallel lines and a transversal using Sketchpad. Similarly the student can measure alternate interior, alternate exterior, corresponding, same side interior, and same side exterior angles also using Sketchpad. Once the student measures all of these angles, he or she should see the pairs of matching angles. The student can move the lines and watch the measurements change, but stay equal to the measurement of the matching angle. This fast-paced manipulation of a figure cannot be done using paper and pencil. This computer programme allows students to change or move figures very quickly and get clear results. Once students become comfortable using Geometers Sketchpad, lessons typically proceed at a much faster pace.

Sketchpad's integration of visual and numerical representations supports students' constructions of meaning and connects shape and number. In preparing students for the world, teachers increasingly understand the importance of modeling, which provides a rich arena for students' mathematical development, transcending example-based processes and linking real-world situations to mathematical processes.

Geometer's Sketchpad allows students to "see for themselves" in a virtual environment. Since they can control what the computer is doing, they can also develop formulas inductively and test them with the software and Geometers' Sketchpad used in this study also suggest that there is a need to provide more interactive and hands-on learning activities for geometry learning at the secondary school level.

Significance of the problem: Learning geometry may not be easy, and a large number of the students fail to develop an adequate understanding of geometry concepts, geometry reasoning, and geometry problem solving skills. The lack of understanding in learning geometry often causes discouragement among the students, which invariably will lead to poor performance in geometry. This study would contribute significantly to the existing knowledge when looking at the effect of utilizing technology for the teaching of mathematics, especially in a subject that is not a favorite amongst students. The research also had utilized a Geometer's Sketchpad software used for teaching mathematics. The results of this research would be very useful for all secondary students.

Research questions:

This study attempts to answer the following research questions:

1. What are the student's perceptions about the usage of Geometers' Sketchpad in learning geometry?
2. What is the student's attitude about using the Geometer's Sketchpad in learning Geometry?
3. Is there an improvement in the student's achievement after using the Geometer's Sketchpad?

Objectives of the study:

1. To understand the perception of students on the use of Geometer's Sketchpad in the teaching and learning process.
2. To understand the Geometer's Sketchpad usage in mathematics classroom specifically on students' attitude.
3. To explore the effectiveness of using Geometer's Sketchpad on students' achievement.
4. Hypotheses of the study:

Hypothesis 1: There is a significant difference in the perception of students' towards the use of Geometer's Sketchpad before and after the intervention programme.

Hypothesis 2: There is a significant difference in the attitude of students' towards the use of Geometer's Sketchpad before and after the intervention programme.

Hypothesis 3: There is a significant difference in the achievement of students' towards the use of the Geometer's Sketchpad before and after the intervention programme.

Variables:

Independent Variables: Intervention programme

Dependent Variable: student achievement, student attitude, student perception

MATERIALS AND METHODS

The study was quasi-experimental that uses pre-test, post-test, non-equivalent group design. In this study quantitative approach was used to compare the pre-test as well as the post- test scored of the two groups namely the students who learnt through Geometry sketchpads and the students who learnt through traditional classroom instruction. In addition to this, questionnaires were used to investigate the perception of the participants towards using Geometry Sketchpad instruction quantitatively.

Population: 8th grade students of Hyderabad district.

Sample: Forty 8th grade students from Gopi Memorial High School, Kushaiguda were taken as the sample for the study. Out of which 20 students comprised the control group and 20 students comprised the experimental group. Stratified random sampling technique was used.

Research tool:

a. In order to measure students' attitude and students' perception towards the use of geometers sketchpad in the teaching learning process, a self developed questionnaire which consists of 34 questions was used.
b. In order to test the performance of students an achievement test i.e. pre-test and post- test was developed for 25 marks on the topic "Triangles". Classification of Triangles Median and Altitudes of a Triangle, Interior and Exterior of a triangle, Area and Perimeter of a Triangle were tested upon.

STATISTICAL METHODS

In order to analyze the data Mean, Standard Deviation and t-test were used.

Analysis and interpretation

Hypothesis – I

There is a significant difference in the students' perception on using the Geometer's Sketchpad in learning geometry before and after the intervention programme.

Null hypothesis

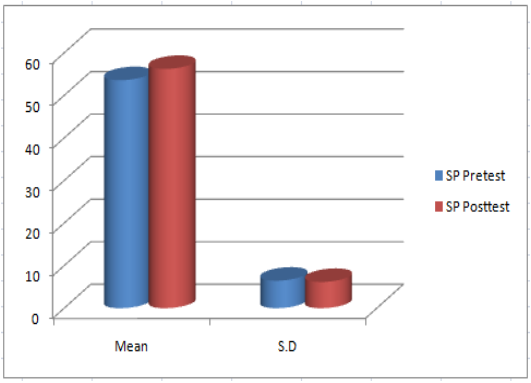
There is no significant difference in the students' perception on using the Geometer's Sketchpad in learning geometry before and after the intervention programme.

Table-1 Table showing the differences in Mean, Standard Deviation and *t*-Value between students Perceptions on using the Geometer's Sketchpad in learning geometry before and after the intervention programme.

Description	Sample Size(n)	Sample Mean(m)	Standard Deviation	*t*-value	Significance level
SP Pretest	20	53.58	6.464	2.115	Significant at 0.05 level
SP Post test	20	56.23	6.154		

df = 19 , t table value = 2.09

Graph -1 Graph showing Students' Perceptions on using the Geometer's Sketchpad in learning geometry before and after the intervention programme.



Interpretation: The calculated mean value of SP pretest scores of Students' Perception is 53.58 and S.D value is 6.464 at 19 df. The mean value of SP posttest scores of Students' Perception is 56.23 and the S.D value is 6.154 at 19 df. The obtained t-value at 39 df is 2.115, the table t value at 19 df is 2.09 at 0.05 significance level; $p > 0.05$ .Since the obtained t-value is more than the table value at 0.05 significance level; $p > 0.05$.

Hence, research hypothesis is accepted and null hypothesis is rejected, which implies that there is a significant difference in the students' perception on the usage of Geometer's Sketchpad in learning geometry before and after the intervention programme.

Hypothesis – II

There is a significant difference in the students' attitude on using the Geometer's Sketchpad in learning geometry before and after the intervention programme.

Null hypothesis

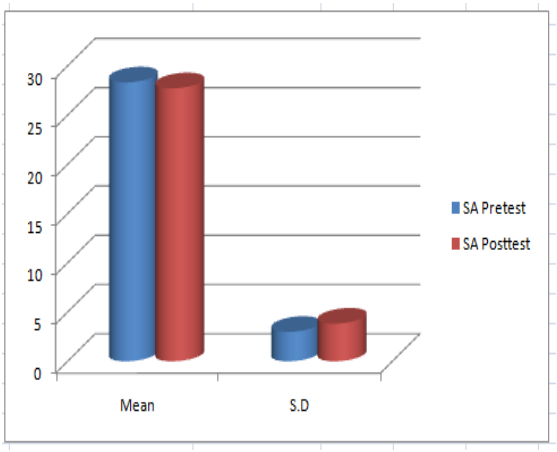
There is no significant difference in the students' attitude on using the Geometer's Sketchpad in learning geometry before and after the intervention programme.

Table -2. Table showing the differences in Mean, Standard Deviation and *t*-Value Between students' attitude on the usage of Geometer's Sketchpad in learning geometry before and after the intervention programme.

Description	Sample Size(n)	Mean(m)	Standard Deviation	*t*-value	Significance level
SA Pretest	20	28.33	2.990	.822	Not Significant at 0.05 level
SA Posttest	20	27.73	3.830		

df = 19, t table value = 2.09

Graph -2 Graph showing Students' attitude on the usage of Geometer's Sketchpad in learning geometry before and after the intervention program.



Interpretation:

The calculated mean value of SA Pretest scores of Students' attitude is 28.33 and S.D value is 2.990 at 19 df. The mean value of SA posttest scores of Students' attitude is 27.73and the S.D value is 3.830 at 19 df. The obtained t-value at 19 df is 0.822, the table t value at 19 df is 2.09 at 0.05 significance level; $p< 0.05$ .Since the obtained t-value is less than the table value at 0.05 significance level; $p < 0.05$.

Hence research Hypothesis is rejected and null hypothesis is accepted which implies that there is no significant difference in the students' attitude on using the Geometer's Sketchpad in learning geometry before and after the intervention programme.

Hypothesis – III

There is a significant difference in the students' achievement on the usage of Geometer's Sketchpad in learning geometry before and after the intervention programme.

Null hypothesis

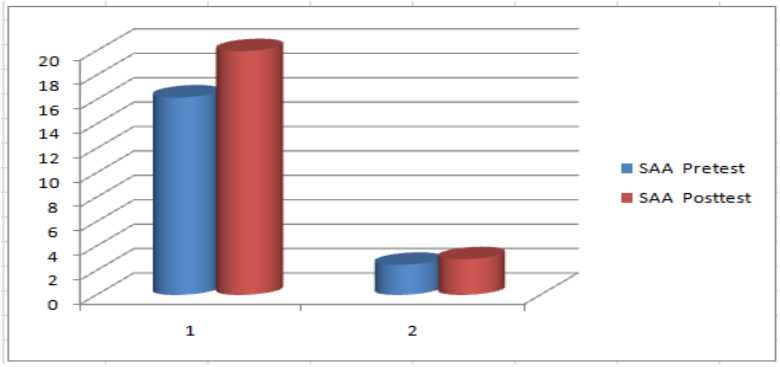
There is no significant difference in the students' achievement on the usage of Geometer's Sketchpad in learning geometry before and after the intervention programme.

Table -3 Table showing the differences in Mean, Standard Deviation and *t*-Value Between students' achievement on the usage of Geometer's Sketchpad in learning geometry before and after the intervention programme.

Description	Sample Size(n)	Mean(m)	Standard Deviation	*t*-value	Significance level
SAA Pretest	20	16.18	2.469	6.819	Significant at 0.05 level
SAA Posttest	20	19.98	2.931		

df = 19, t table value = 2.09

Graph -3 Graph showing students' achievement on the usage of Geometer's Sketchpad in learning geometry before and after the intervention programme.



Interpretation:

The calculated mean value of SAA Pretest scores of students' achievement is 16.18 and S.D value is 2.469 at 39 df. The mean value of SAA posttest scores of students' achievement is 19.98 and the S.D value is 2.931 at 19 df. The obtained t-value at 19 df is 6.819, the table t value at 19 df is 2.09 at 0.05 significance level; $p > 0.05$ .Since the obtained t-value is less than the table value at 0.05 significance level; $p > 0.05$.

Hence, research Hypothesis is accepted and null hypothesis is rejected, which implies that there is a significant difference in the students' achievement on using the Geometer's Sketchpad in learning geometry before and after the intervention programme.

RESULTS

- There is a significant difference in the perception of students' towards the use of Geometer's Sketchpad before and after the intervention programme.
- There is a significant difference in the attitude of students' towards the use of Geometer's Sketchpad before and after the intervention programme.
- There is significant difference in the achievement of students' towards the use of the Geometer's Sketchpad before and after the intervention programme.

DISCUSSION

- **There is a significant difference in the perception of students' towards the use of Geometer's Sketchpad before and after the intervention programme.**

The Geometer's Sketch pad shows a lot of discovery and exploration, problem solving and reasoning where the student can learn easily and enjoy the learning through Geometer's Sketchpad .Mathematics thus becomes more enjoyable for students.

- **There is a significant difference in the attitude of students' towards the use of Geometer's Sketchpad before and after the intervention programme.**

Students who learned using organization of activities by the use of the Geometer's Sketchpad Programme as media had lower attitude towards mathematics learning than those organization of activities using conventional method. The organization of activities using the Geometer's Sketchpad Programme engaged the students actively in mathematics.

- **There is significant difference in the achievement of students' towards the use of the Geometer's Sketchpad before and after the intervention programme.**

The significant differences in the achievement of the experimental group as

compared to control group indicate that the Geometer's Sketch pad shows promising implications for the potential use of Geometer's sketchpad in learning geometry at high school level.

CONCLUSION

The results of this study revealed that using Geometer's Sketchpad as a teaching tool improved student's perception, student's achievement in mathematics. This approach is easy to adopt, practically acceptable for learners to use, keep them actively engaged. The result of this study is that the addition of this software had increased students' perception and achievement in mathematics as well as enhanced their understanding of mathematical concepts. This observation can therefore encourage classroom teachers and even curriculum developers of the potential use of the geometer's sketchpad as an effective tool in learning geometry.

REFERENCES

Books:

1. Best, John; (2017). Research in Education, tenth edition, pp 14, 15, 152, Pearson India Education services private limited.
2. Koul, Lokesh; (2015). Methodology of Educational Research, Fourth Edition, vikas publishing house pvt. Ltd, pp 166 – 180.

e-Journals:

1. Binti, Suraini; (2014). Effects Of Geometer's Sketchpad On Students' Achievement of Combined Transformations and Attitude towards Mathematics. https://ir.unimas.my/id/eprint/15386/
2. Dekker David J. (2004). Effect of Geometer's Sketchpad on Student Knowledge and Attitude. https://digitalcollections.dordt.edu/med_theses/37/
3. Donnell Ashley O.(2011) Using Geometer‟s Sketchpad to Improve Student Attitude in the Mathematics Classroom. http://yourspace.minotstateu.edu/laurie.geller/capstone%20examples/final%20capstone%20projects/ashley%20o'donnoll%20capstone%20project.pdf
4. Idris Noraini (2009) The Impact of Using Geometers' Sketchpad on Malaysian Students' Achievement and Van Hiele Geometric Thinking. https://s3.amazonaws.com/keycurriculum.com/PDF/Sketchpad/GSP_Impact-of-Sketchpad_JME_2009_Dec.pdf
5. Ngonyofi, Leena.N et.al. (2017). The Effects of 'Geometry Sketchpad' on Grade 12 Learners' Performance in Geometry. International Electronic Journal Of Mathematics Education. https://www.iejme.com/article/the-effects-of-geometry-sketchpad-on-grade-12-learners-performance-in-geometry

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