

# Using dynamic geometry sketchpad to enhance student thinking in geometry

BY

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## ABSTRACT

This paper examines the relationship among van Hiele perspective and its stages of student thinking in geometry with the dynamic geometry sketchpad software program. The paper examines the harmony among the dynamic geometry sketchpad software and the van Hiele perspective. Furthermore, it proposes a technique of using sketchpad software program to educate geometry in K to12 classes and using it as an instrument to create geometric thoughts. This study examines the effects of dynamic geometry into the seventh grade syllabus. Experimental method is used to examine the performance of students by using dynamic geometry software. The learners in an experimental group were busy in lessons that used the dynamic Geometer's Sketchpad application, whereas learners in a control group get guidelines that followed an old technique. During the two weeks of this research, learners in both experimental and control groups were circumspectly observed to examine differences in motivation and attitude.

Following the lessons completions and the geometry analysis, a test was performed on the grades of both experimental groups. The results of both test show that integration of the dynamic geometry application did not improve learner presentation on the post-test; though, differences in motivation and attitude were observed. In addition, learner reactions to interview questions exposed advantages of incorporation such dynamic geometry software. The application of dynamic geometer's sketchpad software appeared to improve excitement, motivation, and self-discovery in the classes. It also improves student thinking in geometry.

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## **INTRODUCTION**

This paper examines the relationship among van Hiele perspective and its stages of student thinking in geometry with the dynamic geometry sketchpad software program. The paper examines the harmony among the dynamic geometry sketchpad software and the van Hiele perspective. Furthermore, it proposes a technique of using sketchpad software program to educate geometry in K to12 classes and

using it as an instrument to create geometric thoughts. The ultra-fast development of new technologies in the years 70-80 has transformed our lives in all areas. The means of calculation and simulation more than modest available to the scientists there are still forty years have given instead to computers capable of performing complex calculations at a speed incredible. This enormous progress in the field of information technology has caused a real revolution in science such as physics, chemistry, biology, mathematics etc. The teaching of these subjects could not remain indifferent to all these changes. Now the Information and Communication Technologies Education (ICTE) occupy an important place in the teaching of all science subjects at school and high school and, in particular, education mathematics. Software resources in mathematics made provision of mathematics teachers consist of spreadsheets, software geometry, and algebra software, for plotters and graphs and "Exercisers". This dissertation is devoted mainly to activities designed for software dynamic geometry, especially for GeoGebra. This software allows a dynamic approach to the construction figures and facilitates problem solving.

Dynamic geometry sketchpad software program has become generally used in several schools nowadays. This software can help learners in understanding main ideas by allowing them to imagine and examine different figures. Dynamic geometry software has become broadly used in several schools nowadays. Dynamic geometry application can assist students in understand key ideas by allowing them to imagine and examine a variety of figures. Dynamic geometry software application for example Cabri, Geometer's Sketchpad, and Geometry creator can surely stimulate learners' minds and encourage them to investigate geometric theorems. Learners will be able to evaluate an issue by studying a massive amount of instances, and then make inferences by observing frequent prototypes.

Mathematics instructors should make implement of these dynamic software sources as frequently as possible in order that learners are expectant to go further than just learning theorems and in its place truthfully grab the ideas. Nevertheless, the difficulty of educational attainment still takes place. This software can give students by interactive exercise of geometry software and can convince learners to think significantly, however can it actually improve learner presentation on contented tests? This research objective is to answer that query.

Dynamic geometry often called software environment that can do geometric constructions on the computer so that when the original objects all drawing is saved. This program explains the idea underlying this type of program. Roughly speaking, any geometric figure obtained by applying to certain data - points, lines, numerical parameters (such as the length of the segment or the angle ) of a sequence of constructions

- in the simplest case, the classical constructions by compass and straightedge. In other words, it is the result of applying the data of some algorithm for constructing, using a specific set of operations. It is this drawing, and the result is a product of "conventional" systems of computer graphics in their purely geometrical incarnation. In contrast, a drawing created in an environment of dynamic geometry - a model that preserves not only the result of the construction, but also the raw data and the algorithm. In this case, all the data are readily available to change (you can move the mouse point to vary the data segments, manually entered new values of the numeric data, and so on. N.). And the result of these changes immediately and dynamically, seen on the computer screen. Add to that an expanded set of tools for constructing (including, for example, geometric transformations), the possibility of design drawings (line style, color), the possibility of animation - Automatic movement points, and we will get an idea about the basic features provided by a typical environment of dynamic geometry (also used another term - "an interactive geometry system").

For teachers, the issue of displacement of instrumentation and, more generally, the instrumentation of dynamic geometry, there is even more complex ways. They must not only know the technology and how to use it to build figures and solve problems, but they also know how to organize the conditions of learning with technology. For example, didactic knowledge about dynamic geometry, i.e. on the organization of learning, is the fact that the movement may have several functions in a teaching situation: (i) moving and reveals illustrate a mathematical property preserved when moving points of the figure, (ii) allows the movement to speculate when a property is used to adjust various ways the figure for the simultaneous achievement of the assumptions and the conclusion of the property or (iii) moving to validate or invalidate a construction.

## **LITERATURE REVIEW**

This section of research helps to review the literature and past studies about the using of dynamic geometry sketchpad to enhance student thinking in geometry from the student of K to 12. The Geometer's Sketchpad is one of the active geometry application for exploring, creating, analyzing a broad variety of geometry and mathematics ideas in the field of trigonometry, geometry, calculus, and other fields. According to Furner and Marinas, Geometer's Sketchpad is excellent software which persuades a discovery process in which learners first imagine and analyze an issue and then create conjectures.

Geometer's Sketchpad also permits students to work by many examples and allows them to find out patterns by making their own drafts.

There has been relatively a figure of local researches performed to assess the impact and influence of the implement of Geometer's Sketchpad on mathematics teaching and learning. According to the Nurul Hidayah, a secondary school learners groups who had undergone employ of Geometer's Sketchpad guided program increased high accomplishment scores as contrasted to their complements in the control group. Whereas, Kamariah, Rohani, Ahmad Fauzi and Aida Suraya found that there was no major dissimilarity in mean mathematical presentation among the Geometer's Sketchpad group and the customary teaching approach group. The "Sketchpad" is an exploration mathematical and geometry tool. It is used as a "cognitive tools."

Yelland (1999) investigated the possible of technology and computer in class environments. Technology role is considered significant in elementary schools and Yelland's research proposes that technology will not be apply efficiently in learning aspects except 5 dynamic geometer Sketchpad circumstances are met. Yelland (1999) depicts that the influence of computers and technology enhance student thinking in geometry when Yelland says, "All of an abrupt learning with doing became the law somewhat than the exemption. As computer imitation of just regarding something is now feasible, one must not learn regarding a frog with cutting it. As a replacement for, children may be asked to plan frogs, to construct an animal by frog-like actions, to adapt the behaviour, to reproduce the muscles, to have fun by the frog."

Many studies have shown that moving the points of a figure, and fundamental activity in the use of dynamic geometry and allows student of K to 12 to enjoy the best of its potential for students and for teachers. For example students of sixth grader, after several months of regular work with the dynamic geometry, can spend more than twenty minutes to try fruitlessly to place a point on a segment at exactly 1.11 cm another point. They proceed as follows. With the dot tool, they place a point on the perceptually segment, then measure the distance between the two points. If the measure is 1.11 cm, they suppress the point and start again, without trying to move the point built. This difficulty moving is generally observed when students are willing to move the points but restricting their movements in the vicinity of the initial positions (Tahri 1993) or only move one point of the figure, while passing by feedback significant.

For those, who truly shake the figure appears a new problem, that of geometric analysis feedback. They remain largely a spatio-graphical analysis of deformations: it shrinks; it flattens etc without

progress to the geometry. And finally, students who recognize that the desired geometric property is lost seek to establish "mechanically" points rather than use the proper geometric relationship (Satterfield, 2001). Thus, if the move is a central feature of dynamic geometry, it is not immediately available to all users to solve geometry problems. It only becomes an "instrument" useful for doing mathematics that during a learning process that must accompany teachers.

According to Grandgenett (2005), "is comparatively instinctive" and "has a client forthcoming drag and drop perspective to making graphs, tables, and inferential studies, which become easy to make a statistical examination and show the data on a printable sheet". Grandgenett (2005) examines a main strength of researcher Fathom with talking regarding the "effortlessness by which information can be signified in a variety of means: "a click" and a drop will make cases tables versus features for a set, and an additional click and drop will make an unfilled graph". According to Grandgenett (2005), "Fathom is brilliant as it comes to hypothesis study and evaluations of sample parameters."

Edwards experiment used a 3 days sequence of geometry conversation and activities appetizers for secondary school learners. By use of Dynamic Geometry application, this sequence of actions encouraged learners to build their own theories and conjectures regarding locus placement and function plans in geometry. He found from his research that Edward has offered a sight of means in which dynamic geometry application can be implement as a instrument to encourage mathematical discussion with learners both in entire group and surroundings.

The equipment perhaps used to persuade a vision of geometry like an imaginative, appealing obedience one in which examination, discussion, and investigation are vital to all class actions. Before encouraging the all-too-popular idea of school geometry like a laborious topic remembered mainly for the "formulas memorization" and "inscription of 2 column evidences," dynamic geometry application allows class teachers to promote a vision of geometry like an educational regulation in which queries are as significant as replies and in which describing one's ideas thoroughly is a significant as writing 2 column evidences. It is in this way that dynamic geometry application may assist to break the sequence of misconception that appears to repeatedly plague well-liked analysis of school geometry.

Santos-Trigo (2004) found that the role of dynamic software becomes an important tool for students to guide the exploration of mathematical relationships. In some cases, the use of the software provides evidence about the existence of particular relationships. Later on, Santos-Trigo says that "In general, the process of analyzing parts of certain geometric configurations represents a challenge for

students allowing them to observe and document the behavior of families of objects (segments, lines or points) within a dynamic representation. Students themselves get the opportunity to reconstruct or discover new theorems or relationships. A crucial aspect that emerged in students' problem solving instruction is that with the use of dynamic software they had the opportunity to engage in a way of thinking that goes beyond reaching a particular solution or response to a particular problem."

"Sketchpad" has unique dynamic features and it helps the traditional teaching of geometry into a new field. In physics, a lot of the law has its mathematical model, so students can use the "Sketchpad" to simulate physics experiments. It can be said that physics' simulation ". Physics teacher can use it for preparation; they can use it to lectures. Students can also use it, so it is also helpful in teaching efficiency and improve the quality of a good tool.

According to Manouchehri et al. (1998), sketchpad is big promoters of setting up dynamic software, i.e. Geometer's Sketchpad, within the syllabus at the Pre-Algebra grade. Manouchehri et al, talk regarding a progression throughout Geometry by the Pre-Algebra grade. They propose starting by free examination. The free examination phase typically lasts regarding 3-4 days and is the instance as the learners get recognizable by the fundamentals of Geometer's Sketchpad. The authors are given work and handouts on their own, effort to observe what will task and what won't task.

According to one of studies explains the interaction of teacher-student in an action by the use of two different kinds of geometry application (Hannafin et al., 2001). As, this software has been made that teachers can give lessons scaffolding in the kind of prompting and questioning, the investigators wanted to examine how instructors would give scaffolding in an learning environment. The investigators produced an instructivist education environment by the use of two computer and technology based equipments: dynamic geometry software (Geometer's Sketchpad) and a technology assisted class plan. The overall objectives of the research were to examine the impacts of the two dissimilar kinds of geometry software. Learners worked in groups on actions and also kept articles and journals. Learners had permission to software on their laptops and computers. The instructor's role was to move through the class room and support the learners to use the class when essential or to request suitable questions. As there were so several variables in this research, it is hard to state whether the dynamic Geometer's Sketchpad enhanced a better classroom environment for the learners or not (Jackiw, 1995).



According to NCTM, (2004), The NCTM Principles and Standards for Mathematics for Grades 6-8 say that students should “develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids and circles and develop strategies to find the area of more-complex shapes (p. 240).”

In a research by Woodward and Byrd (1983), 129 eighth-graders were given a process to discover the lawn with the biggest place out of six differently-shaped quadratque, all with a border of 60 metres. Only 23% responded to the query properly (the rectangle lawn is the largest), while 59% of the learners said all the landscapes were the same dimension. Students from a arithmetic course for potential primary university instructors were requested the same query. Almost two-thirds of the instructors mentioned that the landscapes were all the same dimension. Although the learners and instructors had discovered the system for determining place and the size of each lawn were given, somehow the relationship was not created that landscapes with the same border were not actually the same dimension. Clearly, something was missing in the way in which place was trained to these individuals. A formula-based strategy using only computational methods does not perform. Treatments should instead be designed inductively.

In my own life time experience in a seventh-grade class room, I have seen many kids (working on a identical problem) condition that the number of different tubes of various levels will be the same if the place is the same (it is not, the highest possible quantity is the one whose distance is equal to its height). However, it is not until the kids actually complete these bins with legumes and evaluate the quantity for themselves that they see that the quantity differs.

Geometer's Sketchpad allows learners to “see for themselves” in an exclusive atmosphere. Since they management what the pc is doing, they will know it is not relaxing when it reveals two quadratique of the same border having different places. They can also create treatments inductively and analyze them with the application. Vygotsky's concepts say that kids use resources (or artifacts) to mediate between the customer and the surroundings. The laptops and computer is a material artifact like a pen, a finance calculator, or a publication, that functions as an arbitrator in the training and learning procedure. It is not the instructor (Jonassen, 2000). The students dealing with an application should be able to go at his or her own amount, select the way he or she techniques the venture, and see his or her own perform in the computer's outcome. It is essential that the kind of application being used act as a Mindtool.

## **HYPOTHESIS**

The hypothesis is that student's learners use Geometer's Sketchpad application will show improved educational performance, improved visual skills, in addition to increased motivation as evaluated to learners who do not use the software.

Null hypothesis: there is no significant relationship between Geometer's Sketchpad application and improved learning skills.

Alternative hypothesis: there is significant relationship between Geometer's Sketchpad application and improved learning skills.

## **METHODOLOGY**

This section explains the methodology of research. Dynamic Geometry software differs significantly from the other fields of mathematics. Dynamic Geometry software needs visual helps consistent with all classes; in addition, a great importance is frequently positioned on the theorems memorization. If learners are to fully grab the concepts and facts entrenched in the geometry study, they should go beyond just memorizing truth. The purpose of this application is to complete this job. Students can really understand the legitimacy of theorems as they are offered by the chance to influence objects and research numerous instances. After observing recurring prototypes and consistencies throughout this application, the theorems will start to create sense rationally. Not just will the learners then truthfully understand the perspective, they will also turn out to be lively students by self-discovery allowed by the application. The reason of this research was to study the efficiency of Geometer's Sketchpad application for academic development. Student understanding of geometric theorems was experienced by the management of a post-test to authenticate the advantages of combining Geometer's Sketchpad application into the higher school geometry prospectus. The study hypothesis is that learners who use dynamic Geometer's Sketchpad application will show enhanced academic presentation, improved visual skills, in addition to increased inspiration as compared to learners who do not use the software.

To measure the efficiency of Geometer's Sketchpad application, an experiment study was performed by an experimental group and a control group. This researched is performed on a post-test just perceptible by two 7th grade maths classes. The subjects were selected depend on the integral classes by an all females personal middle school. The experimental group and control group both included 14 girls' learners. To get rid of some extraneous variables and to enhance experiment validity, the investigators were used to educate both study groups in experiment. The learners were represented by similar material

in each class; though, the sources accessible to all groups were dissimilar. The rulers, compasses and protractors are used by the control group to create suppositions and informed speculations regarding geometric diagrams. Conversely, the experimental group attained conclusion with performing guided works in dynamic Geometer's Sketchpad application. The study era lasted 4 weeks by the learners meeting 5 times a week for 40 mins a day.

The lectures were formatted like so. All the groups came into classroom and taken the lesson by the instructor whereas taking notes. The lesson ranged from 15 to 20 mins. The learners were then divided into groups of 3 or 4 for educational tasks. The control groups had their compasses and protractors at hand, whereas the experimental groups had their computers by Geometer's Sketchpad software running. For a number of the actions, the learners would sketch different diagram from scratch; though, sometimes, the learners were given by previous made figures in on paper or Geometer's Sketchpad applications. In either example, learners were anticipating to create conjectures depend on consistencies noticed through figures and sketches. The instructor described the results before the end of category and then each team was allocated preparation on that day's session. The management team obtained conventional preparation to be finished with pen and document, while the trial team obtained preparation to be finished on their laptop computers. To review, the training were damaged up into three segments for each group – lecture, action, and preparation. The following is an example of a session used for 'Lines and Perspectives.' The instructor started by talking about unique connections between collections and angles. For example, angles attracted on a directly line are said to be additional, significance their amounts equivalent  $180^\circ$  (Fig. 1). Straight angles were also

Introduced; however, the instructor did not give the theorem on these angles. The learners were simply proven attract of vertical angles (Fig. 2) and then were damaged up into categories to find the connection between these collections and angles. The management team used protractors and kings, while the trial team used Geometer's Sketchpad to attract and evaluate vertical angles. The objective was for them to understand that reverse angles are congruent and nearby angles is additional.

After the finishing the Geometry section, both categories were given the same analyze based on past training. The results were examined with a t-test to see if there persisted a factor in ratings between the two categories. Furthermore, an appropriate response rate was measured for each query analysed. In particular, concerns that needed slides were examined to figure out if the GSP application assisted to

improve students' visible abilities. The instructor also properly noticed student actions throughout the research to see if a distinction in mind-set and inspiration persisted amongst the two categories. Moreover, an arbitrarily chosen number of learners were questioned so that the specialist could obtain understanding into their understanding of the application. The following presumptions were made in order to perform this research. First, since the learners engaged in the research own laptop computers for university, they know how to do all primary PC functions. Secondly, it was believed that learners obtained qualifications information in geometry during their before years in mathematical information. However, learners in the 7th quality should not have had any experience using the Geometer's Sketchpad application.

The formula used for T-test is as follows:

$$t = \frac{|M_x - A|}{\sigma / \sqrt{N}}$$

Van Hiele (Suwangsih and Tiurlina 2010, p. 92) states that there are five stages in a child's learning to learn geometry, namely: the introduction stage, the stage of the analysis, the sorting stage, the deduction phases, and phase accuracy, the following is a breakdown:

1. Stage Introduction (Visualization)

At this stage children begin to learn to recognize a geometric shape overall, but have not been able to determine the presence of the properties of geometric shapes he sees it. For example, if the child is shown a cube, then he did not know or regularity properties owned by the cube. He did not know that the cube has sides that are the child was not aware that the square (square) and the four sides equal to four right-angled corners (Nur'aeni, 2008).

2. Phase Analysis

At this stage the child has begun to recognize the properties owned geometry observed. He has been able to mention that there are regularities in the wake geometry. For example, when he observed a rectangle, he has learned that there are two pairs of opposite sides, and two pairs of sides are parallel to each other. but this stage the child has not been able to determine the relationship between an object related geometry with other geometry objects. For example, children may not know that a square is a rectangle or a square, it is a rhombus and so on.

3. Phase Ordering (Informal Deduction)

At this stage the child has begun to implement the conclusion that we know called deductive thinking. However, this capability has not been fully developed. One thing to note is, the child at this stage

has begun to sort. For example, it has been recognized that a square is a parallelogram, rhombus that is kite. Similarly, the introduction of space objects, the children understand that the cube is a beam as well, with its privileges is that all sides are square shaped. The mindset of a child at this stage is still not able to explain why the diagonal of a rectangle is the same length. Children may not understand that a rhombus can be formed from two triangles are congruent.

#### 4. Phase Deduction

In this stage the child is able to draw conclusions deductively, namely the conclusion of the things that are common to the things that are special. For example, children are beginning to understand the proposition. moreover, at this stage the child has begun to use traditional axioms or postulates that used in the proof. but the children do not understand why something is made postulate or proposition.

#### 5. Phase Accuracy

In this stage the child has begun to realize the importance of the accuracy of the basic principles underlying a proof. For example, he knows the importance of axioms or postulates of Euclidean geometry. Phase accuracy is high thinking stage, complicated, and complex. It is therefore not surprising that not all children, even though it was sitting in high school, still has not reached the stage of this thinking.

Mayberry (in Ruseffendi, 1998, p. 164) says that if at one stage of the fifth stage of the students do not master, then at a higher stage will happen memorization.

#### Stages of Learning Geometry By Van Hiele

Thinking level geometry student progress forward from one level to the next involves five stages or as a result of teaching organized into five stages of learning. Progress from one level to the next level depends more on the educational experience / learning rather than on age or maturity. Some experiences can facilitate (or inhibit) the progress in one level or to a higher level.

As for the stage - the stage of the Van Hiele described as follows:

Phase 1: Information (Information): Through discussion, the teacher identifies what students already know about a topic and students become oriented to the new topic. Teachers and students engage in conversation and activity of objects, observations were made, questions raised and special vocabulary introduced.

Orientation Phase 2 Discussion / Integrated (Guided Orientation): Students explore the objects of instruction in tasks such as folding carefully structured, measurement, or constructing. Teachers ensure that students explore specific concepts.

Stage 3 Explication: Students describe what they have learned about the topic with their own words, teachers help students to use vocabulary that is true and accurate, the teacher introduces terms that are relevant mathematics.

Stage 4 Orientation Free : Students apply the relationships they are learning to solve problems and check task more open (open-ended)

Stage 5 Integration: Students summarize / summarize and integrate what they have learned, to develop a new network of objects and relations.

## ANALYSIS

Before this research, it can be determined that the management and trial categories were not considerably different in statistical accomplishment. A t-test research was measured on the first one fourth qualities for both categories to figure out if a factor persisted in the educational capabilities of these

### CATEGORIES. THE MEASURED T-OBSERVED VALUE FOR THE ONE FOURTH QUALITIES OF -1.22

WAS LESS THAN THE T-CRITICAL value of 2.056 (Tab. 1). Therefore, both categories were equally healthy in statistical capabilities

Table No.1 showing Quarter One Grades

The geometry application analyze was applied to both the trial and management categories after the finishing the geometry training. To be able to decline the zero

speculation, it is necessary to get a measured t-observed value that surpasses the t-critical value to demonstrate that the Geometer's Sketchpad application was accountable for a factor on the post-test qualities. The measured t-observed value of -0.73 was less than the t-critical value of 2.056 (Tab. 2). These outcomes allow for the approval of the zero speculation which declares that the learners who use Geometer's Sketchpad application do not illustrate enhanced educational efficiency.

	ave rage	S t.dev	t- observed	t- critical	p-value
Control group	87. 5	5 .9	-1.22	2. 056	0.24 0.24
<b>EXPERIMENTAL GROUP</b>	<b>84. 2</b>	<b>8 .8</b>		2. 056	

Table No.2 showing Quarter One Grades

In order to figure out if the GSP software improved the visible abilities of learners, appropriate reaction prices for both categories were examined (Tab. 3). There were 28 concerns on the geometry content analyze. Of these 28 concerns, 21 were associated with some visible reflection to help reaction the query. Question 15 is an example of a visible query. The staying 7 concerns were non-visual significance there was not an associated with plan to help learners with the reaction. However, it would have been valuable for

	av erage	t.dev	t- observed	t -critical	p-value
Control group	87			2	0.24
	.5	.9	-	.056	0.24
Experimental Group	84		1.22	2	
	.2	.8		.056	
	av erage	t.dev	t- observed	t -critical	p-value
Control group	83		-	2	0.48
	.6	.13	0.73	.056	
Experimental Group	85				
	.7	.99			

learners to draw their own blueprints to help with the reaction. Question 7 is an example of a non-visual query. The mean appropriate reaction amount for visible concerns was 84% for both the management and trial categories. The mean appropriate reaction amount for non-visual concerns was 69% for the management team and 65% for the trial team. According to these results, the strategy taken for geometry training really had no impact on their visible abilities.

Table 3

Right answers for the Geometry Test

Questions	Visual	Correct answers	Experimental group
	Y	12	12
	Y	14	9
	N	13	11
	Y	10	12
	Y	2	14
	Y	6	12
	Y	3	12
	N	6	6
	Y	14	14
	Y	13	11
	Y	12	11
	N	9	14
	Y	11	13
	Y	12	9
	Y	14	12
	Y	12	14
	Y	12	13
	N	6	10
	Y	14	2
	N	11	6
	Y	11	3



	Y	14	6
	Y	13	14
	N	9	13
	Y	13	12
	Y	12	9
	Y	10	11
	N	9	12

Through observation study, the instructor viewed for variations in mind-set and inspiration amongst the two categories. A unique selection of learners was also requested to answer a few concerns to give the specialist more understanding when evaluating the application. The concerns targeted to recognize the level of assurance and enjoyment the learners experienced when working with the application. Furthermore, the concerns evaluated the ease of making questions with the use of application since student conjecturing is an highlighted standard in geometry. The learners all agreed that they experienced assured using the application since it was "easy to learn." Furthermore, the learners using Geometer's Sketchpad on their laptop computers were more thrilled when performing category actions because they were learning individually through self-discovery. One student mentioned that the application allows "you [to be] your own instructor." For this reason, learners develop possession of the content and enjoy creating conjectures. Since the GSP application always gives precise dimensions, the instructor was able to act merely as a company while learners used these dimensions to attract results. Students were more inspired to learn that they were creating precise conjectures based on their findings of repeating styles. Another student mentioned that "it was helpful to see the activity of things instead of just looking at them on document." Students in the management team were also able to make advised conjectures; however, it was necessary for the instructor to consistently examine their performance. If any of their side or position dimensions were a little bit wrong, they could not reach the appropriate results. Therefore, category actions in the management category room were much a longer period intensive and the instructor had less a chance to review results.

Another observed enhancement was the quality of preparation for the trial team. When using the GSP application, learners had the independence to modify the shape of numbers, stretch out lines, and modify the levels in any given position. This permitted them to immediately see if their reactions were appropriate. A student in the trial team mentioned that she realized she would get full credit for her preparation because she could immediately examine her solutions. Hence, the instructor was not needed to examine homework; learners could evaluate their performance on their own.

## **CONCLUSION**

To conclude, Dynamic geometry software is a learning and teaching in all branches of mathematical software. The main advantage of this software is that it combines geometric designs, algebra and calculus. By using it, three performances will be visible on the window graphic for example, points, curves representing functions or circles, then the algebraic representation, such as coordinates or equations, and finally the spreadsheet representation. The user will find that these representations are completely linked to each other in a dynamic way: any change in representation will affect all others. The objective of this research was to examine the consequences of integrating powerful geometry application into a junior high university arithmetic program. The proof that has been gathered indicates that developing such application does not enhance the educational efficiency of junior high university learners. Thus, despite the researcher's speculation, a factor on post-test ratings between management and trial categories was not accomplished. However, findings do recommend that there are still benefits to using the Geometer's Sketchpad application.

The outcomes of this research may not be appropriate to bigger inhabitants for the following reasons. To begin with, the example size used for this research was small containing only 14 learners in both the management and trial categories. Furthermore, since the research was performed in an all ladies personal university, the outcomes may not be general to consist of all boys' educational institutions or coeducational surroundings. Finally, due to the challenging 7th quality arithmetic program, only four several weeks could be devoted to the analysis of geometry. Perhaps if a longer period were available for this subject and the learners obtained extra encounter with the GSP application, mathematical variations would have been seen amongst team efficiency as seen in Funkhouser's analysis described previously. His analysis was performed over the course of two 18-week semesters and the team getting computer-

augmented training obtained considerably better of the geometry analyze. This was perhaps because they obtained useful encounter when working with the application over an extended time period.

Despite the outcomes of the t-test analysis, there is still proof that GSP application can be a beneficial inclusion to the category room. It showed up those learners in the trial team designed more beneficial behaviour towards arithmetic. There was a typical sensation of assurance amongst the learners using the application. While learners were able to work at their own rate, the instructor observed ongoing exclamations of "this is so awesome." They were thrilled because they could quickly respond to concerns and achieve outcomes once they had calculated and controlled pre-made images. They also obtained an knowing of theorems more quickly than the learners in the management team because they were able to perspective many more illustrations in the allocated category time. Therefore, even though the mathematical analysis does not indicate there are advantages to the application, it does provide advantages to the studying atmosphere. Furthermore, since today's world is technology-centered, it is always beneficial to existing learners to new applications whenever possible.

Future analysis of this subject is still necessary. To start with, the use of unchanged sessions should be prevented. This was not possible for the existing analysis because sessions had already been recognized. An identical analysis should be performed using a management and trial team. However, the management team should get only conventional training while the trial team gets conventional training together with hands-on studying with GSP application. Despite the mathematical outcomes of this research, it can still be determined that Geometer's Sketchpad application motivates learners to understand through self-discovery at their own speed. Instructors need to position their power into offering learners with this new studying system as motivated by the Nationwide Authorities of Instructors of Arithmetic [NCTM]. The appropriate execution of this application can cause to passionate learners who perspective geometry as a subject that has significance in the class room as well as the real-world (Sobel and Maletsky, 2004).

This dynamic geometer 'allows Student well separate the various stages of movement that allows assembly (sliding without turning and rotations). Such As the mouse action on a form can per- put both simultaneously transformations, the student is forced to drag her in order to form two overlapping point and then rotate to see if the assembly is possible. Of course, most of the time, especially in the first phases, the student performs a series of translations and rotations to achieve this displacement cement. It has been observed in many times that students are able to decide perceptive that the assembly will not possible even

before the complete realization the expected move, simply position appropriately shape mo- the at distance from each other, by a movement of rotation. This work on the movement and the different entering successive transformations in moving is a specificity of the used environment would not be possible with a handling material. In this class, the teacher had manufactured forms thick cardboard for better communication of the set point. Us have found that students are easily transfer between the two and do feel any more the need to return the material then. The computing environment allows So in our work by simulating a hardware device without losing what may appointer handling, with identical needed of gestures related to the movement that per- would the hardware task. Geometry is a branch of mathematics that works for everyday life, but it can also foster geometry logical way of thinking for people who study it. But in reality there are many students, especially in elementary school who do not understand the basic concepts of geometry, one good theory to be applied in the geometry of the student learning process, especially at the elementary school is the Van Hiele theory, ie a theory that studies the geometry by using multiple stages of thinking namely: the introduction phase (visualization), phase analysis, sorting stage (informal deduction), the deduction phases, and phase accuracy (Nur'aeni, 2008). Van Hiele theory is applicable and relevant to teaching in elementary school when the teacher is to understand the stages on the way to think of students as well as if the teacher can adapt his teaching to the stage.

## **RECOMMENDATION**

In teaching materials, especially the material geometry of the elementary students, teachers should adjust the level of development or the way children think that the teaching-teachers will not encounter any obstacles that are very heavy, as well as children or students can also attend lessons with easy to understand. Teachers are also required to be clever in choosing model, strategies or techniques in the delivery of such materials.

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