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# Improving trigonometry learning motivation using Geogebra-Assisted Guided Discovery Student Worksheet (GDSW)

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**Abstract.** This study aims to determine student motivation using Geogebra assisted GDSW. The instrument of this research are worksheet compiled with guided discovery approach and student motivation questionnaire. The motivation questionnaire consists of three aspects of interest, pleasure, and satisfaction, which are outlined in 15 questions submitted to 118 of 10<sup>th</sup> grade students. Data analysis of the questionnaire using Likert scale 1-4, with ideal score is 4, and the lowest score is 1. There are five interval classes. The result of this research, that student motivation using Geogebra assisted GDSW has an average of 3.11 with the category of "good". It means that students have good motivation on learning using Geogebra-assisted GDSW.

## 1. Introduction

Motivation is a change of energy in a person, which is characterized by the emergence of feelings and reactions to achieve a goal. The task of a teacher is not only to carry out teaching activities, research, develop, and manage an educational institution, but also responsible for arousing student motivation during the teaching and learning process takes place. Motivation influences the way an individual allocates time, uses energy to do a given task, thinks and feels about the task, and how long it takes to do the task [1]. A teacher is responsible so that learning works well. Success in the teaching and learning process depends on the efforts of the teacher in arousing student motivation. Motivation is very important in teaching and learning activities, because motivation can encourage enthusiasm for learning and conversely lack of motivation will weaken the spirit of learning. A student who learns without motivation or lack of motivation will not achieve maximum results. Motivation is the self-driving of students to be able to learn, which can guarantee the continuity of the learning process and provide direction for learning activities, so that the goals to be achieved in the learning process can be realized. The use of media in the learning process is one way that can be used to generate student learning motivation.

Media is necessary in the learning process, because without the media, learning will not work. Selection of the appropriate learning format, as well as the availability of a variety of learning media for educators is an important decision to stimulate student motivation [2]. Information or ideas in the mind of the teacher will not be transmitted into the minds of learners. Media is a means of transportation that deliver information from teachers to students. Therefore, the media has a very important role and position in addition to other learning components. Media is needed to transmit and deliver content to students so that learning takes place effectively. The use of learning media can actively involve students in the teaching-learning process, thus greatly increasing the effectiveness of communication [3].

Learning media should be designed to fit the classroom situation and conditions. Selection of learning media greatly affect student's learning motivation. Learning materials that are packed with interesting and appropriate media will lead learners into a fun learning environment and generate strong desire in learners to follow the learning process.



Learning motivation for students in education is important, because without motivation, learning is not possible. In education the role of motivation is effective in learning. Students can work on tasks and achieve their goals, because of motivation. Motivation increases the speed of one's work to take action to achieve goals. Motivation increases learning performance, and provides energy for learners in doing assignments. In education, motivation influences student success. Motivation affects high or low goals [4].

Mathematics is a science that leads to logical thinking, rational, and confident. One of the subjects of mathematics is trigonometry. Trigonometry is the study of the relations between the sides and angles of triangles. The word "trigonometry" is derived from the Greek words *trigono*, meaning "triangle", and *metro*, meaning "measure". Trigonometry is distinguished from elementary geometry in part by its extensive use of certain functions of angles, known as the trigonometric functions [5]. Mathematics, especially trigonometry is one of the school subjects that students don't like. Trigonometry is a field of mathematics that is believed to be very abstract and difficult to compare with other topics in mathematics [6].

At high school level, trigonometric subjects include trigonometric ratios, trigonometric identities, sine rules and cosine rules, trigonometric equations, trigonometric function graphs, trigonometric formulas of numbers and two angle differences, double angle trigonometric formulas, multiplication formula of sinus and cosine, and the difference in sinus and cosine. The number of trigonometric concepts can make students difficult to learn and memorize the formulas, so that learning should be focused on understanding the concept of trigonometry in order to be more meaningful. Use of appropriate teaching materials is needed to support the reinforcement of trigonometric concepts. There are different types of teaching materials that teachers can use. The collection may contain the whole range of materials used in teaching. Printed matter such as books, pamphlets, periodicals audio-visual material such as slides, filmstrips, recordings and the equipment needed to use them are equally available to teachers and students. Free and inexpensive materials, charts, clippings, globes and maps are also included, as are the less common but useful items such as models, specimens, dioramas. According to Abdul Majid (2006), the types of teaching materials can be classified into four types of printed materials, audio-visual materials, visual audiences, and interactive teaching materials. One type of instructional material is a student worksheet that includes printed materials [7].

The information conveyed by teachers to students only through presentations is not enough to motivate students to learn independently to build and achieve their own knowledge. Today, a new generation that can use high-level cognitive skills to find out how to continue learning and build new knowledge is needed to handle all types of professions [8]. In the application of student worksheet on learning mathematics required a method of learning. One type of learning method is guided discovery method. With this method, students are easier in constructing new knowledge. Guided discovery method, the teacher is positioned as a facilitator so that the teacher guides the students only if necessary. This method encourages students to think for themselves, analyze themselves so that they can find general principles based on the resources provided by the teacher. The Guided Discovery approach is a process in which students are encouraged to reinvent [8]. Guided discovery is a teaching method where the teacher guides students through open ended activities in order to encourage them to discover concepts for themselves [10].

GDSW used in this research is assisted by mathematical software that is Geogebra software. GeoGebra combines interactive geometry, algebra, tables, graphs, calculus and statistics. GeoGebra is an open source software that anyone can access [11]. GeoGebra accepts geometric, algebraic, and calculus commands and links multiple representations [12].

Motivation is the tendency of subjects to feel interested in certain subjects and feel happy to learn the material. The existence of motivation can be shown by the following aspects.

## 1) Pleasure

Feelings can arise from observing, remembering or thinking about something. Feelings of pleasure will generate interest in students so that students are not forced to learn.

## 2) Interest

The existence of student interest in the assigned tasks can encourage students to continue their work. Students will go back to something interesting to their attention. Generating interest is an effort to cultivate the student's curiosity required in learning.

## 3) Satisfaction

Satisfaction is related to feeling proud, satisfied, for the results achieved. Students who have successfully done or achieved something feel proud or satisfied with the success. Success and pride it becomes a booster for these students to achieve further success [13].

In this article we investigate the effect of using GeoGebra-assisted GDSW to teach the topic of Trigonometry to student learning interests. With trigonometry learning with Geogebra assisted GDSW, it is expected to increase student interest which includes pleasure, interest, and satisfaction.

## 2. Method

The research method used in this research is qualitative to know student learning motivation using Geogebra-assisted GDSW. Sources of data in the study are high school students of high school in Yogyakarta, as many as 118 students of 10<sup>th</sup> grade students. Research instrument used:

### 2.1 Student Worksheet

Student worksheet used in the form of student worksheet with guided discovery method consisting of 4 materials, namely Angle in Trigonometry, Trigonometry Comparison, Trigonometric Identity and Trigonometric Function. Students worksheet is equipped with media made with Geogebra (Figure 1).

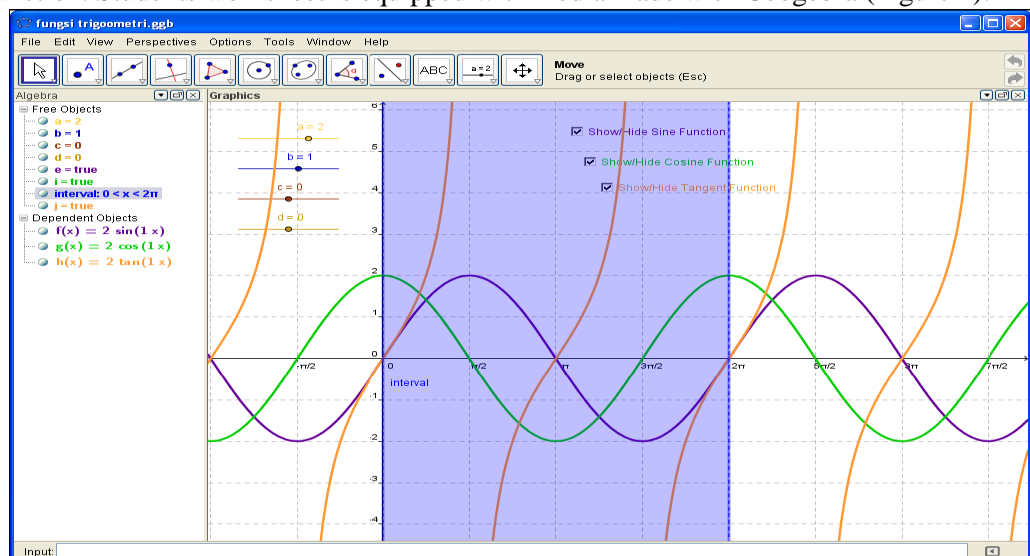
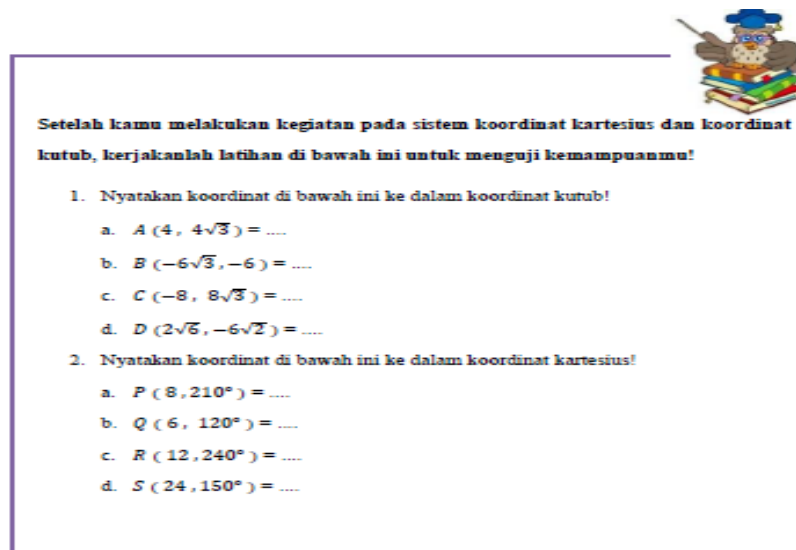


Figure 1a. GDSW



**Figure 1b.** Student worksheet

## 2.2 Student Motivation Questionnaire

Questionnaire Motivation described in 15 questions asked to students, consists of 3 aspects: interest (item 1, 2, 6, 8, 13), pleasure (item 5, 9, 11, 14, 15) and satisfaction (item 3, 4, 7, 10, 12) as follows.

- 1) Learning trigonometry using Student worksheet makes me excited
- 2) Learning by using computers makes me excited to learn mathematics
- 3) Learning trigonometry topics becomes more difficult by using a Geogebra assisted GDSW
- 4) I feel satisfied when studying with this GeoGebra assisted GDWS
- 5) The steps on Geogebra assisted GDSW are difficult for me to understand
- 6) Discussing with friends or teachers is a pleasant thing for me
- 7) Learning using Geogebra assisted GDSW is useless
- 8) Learning with Geogebra assisted GDSW is challenging
- 9) Questions and problems with Geogebra assisted GDSW made me curious
- 10) Complete the steps in the Geogebra assisted GDSW satisfies the results that have been achieved
- 11) Geogebra assisted GDSW appealed to me for further material
- 12) Learning by using Geogebra assisted GDSW is fun
- 13) Learning by using Geogebra assisted GDSW makes me panic
- 14) Learning with Geogebra assisted GDSW makes me not concentrate
- 15) The steps in the Geogebra assisted GDSW are not interesting to do

Data of student's motivation toward student worksheet, analyzed quantitatively to know qualitative criteria of student motivation to GDSW. The step taken is to convert qualitative data into quantitative data with the following guidelines

**Table 1.** Guidance of Student Motivation Questionnaire Review

Category	Scores	
	Positive Statement	Negative Statement
Strongly Agree	4	1
Agree	3	2
Disagree	2	3
Strongly Disagree	1	4

Then do the calculation with ideally score is 4, using Likert scale 1-4, with lowest score is 1. Number of class intervals are 5 [14].

**Table 2.** Number of class interval

Category	Qualitative criterion
$\bar{x} > Mi + 1,8 SBi$	Very Good
$Mi + 0,6 SBi < \bar{x} \leq Mi + 1,8 SBi$	Good
$Mi - 0,6 SBi < \bar{x} \leq Mi + 0,6 SBi$	Sufficient
$Mi - 1,8 SBi < \bar{x} \leq Mi - 0,6 SBi$	Not good
$\bar{x} \leq Mi - 1,8 SBi$	Very less good

where

$Mi$  (Ideal Mean) =  $\frac{1}{2}$  (Ideal max scores+ Ideal min scores)

$SBi$  (Idealstandard deviation) =  $\frac{1}{6}$  (Ideal max scores -Ideal min scores)

Ideal max scores = Highest Score

Ideal min scores = lowest Score

### 3. Finding

Instrument geogebra-assisted GDSW tested to 118 students 10<sup>th</sup> grade of State Senior High School in second semester. This implementation aims to know student's motivation to trigonometric learning using GeoGebra assisted GDSW. In the learning process, students create small groups. It is intended that students can discuss with their friends. GDSW is shared with students. Students work on GDSW with the help of interactive GeoGebra-assisted media files. Students organize, process, organize and analyze based on questions in LKS. Students discuss with a group of friends about the material in the student worksheet or about GeoGebra software. Students make conjectures and write conclusions about what they have learned.

#### 3.1 Analysis of data research

Student motivation data on geogebra assisted GDSW was analyzed quantitatively to know the qualitative criteria of students' learning motivation using GDSW. The step taken is to convert qualitative data into quantitative data with the following guidelines (calculated based on table 2 formula). Based on the results of the questionnaire of student motivation, obtained the following classification of the report:

**Table 3.** Scoring Classification

Score Interval	Qualitative Criteria
$\bar{x} > 3.4$	Very Good
$2.8 < \bar{x} \leq 3.4$	Good
$2.0 < \bar{x} \leq 2.8$	Sufficient
$1.6 < \bar{x} \leq 2.0$	Not good
$\bar{x} < 1.6$	Very less good

$\bar{x}$  = x average

#### 3.2 Evaluation of student motivation questionnaire to Geogebra assisted GDSW

Questionnaire student motivation used to know student's motivation to learning using Geogebra assisted GDSW. Aspects to be known in the questionnaire of student motivation, among other aspects of interest, fun aspects, and aspects of satisfaction. Based on the results of the questionnaire, and referenced in Table 3, so the result of questionnaire analysis of student motivation for each aspect (Table 4).

**Table 4.** Results of student motivation questionnaire evaluation

Aspect	Score average	Criteria
Interest	<b>3.13</b>	Good
Pleasure	<b>3.04</b>	Good

Satisfaction	<b>3.11</b>	Good
Average overall aspect	<b>3.11</b>	Good

Overall the result (Table 4) of student motivation questionnaire analysis on Geogebra assisted GDSW has an average of 3.1. The average indicates students' motivation for Geogebra assisted GDSW is included in the "good" category.

#### 4. Conclusion

Based on the results of research and discussion it can be concluded that that students have good motivation on learning using Geogebra assisted GDSW on the topic of trigonometry. The results of this study provide support for research where student-driven, challenging, and fun learning environments can have a positive impact on student learning motivation [15] [16] [17].

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