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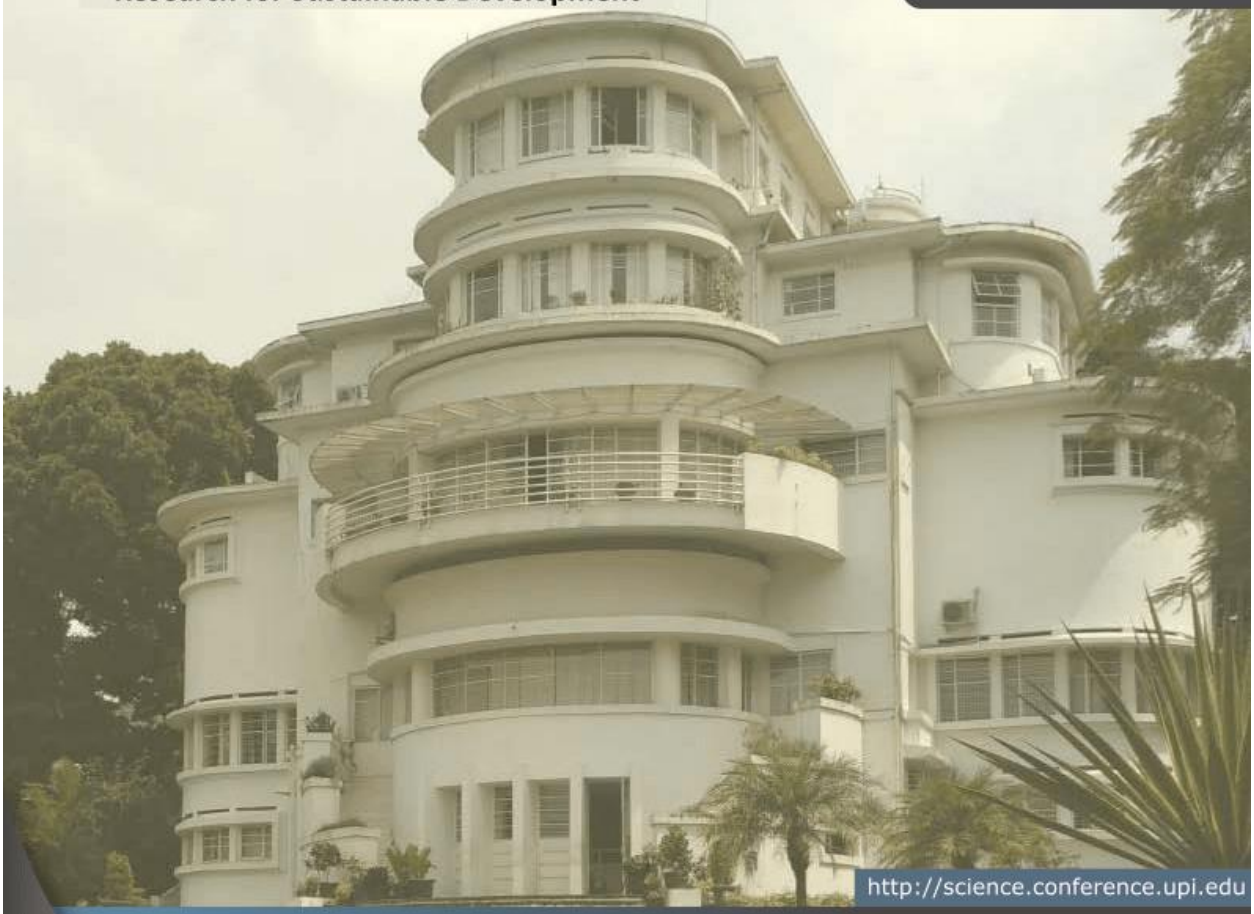

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Effectiveness of Mathematical Modules with Guided Discovery Approach Viewed from PGSD UAD Student Motivation and Achievement

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Abstract. The aim of the study was to determine the effectiveness of product development in the form of mathematical modules with a guided discovery approach in terms of motivation and learning achievement of UAD PGSD students. Guided discovery approach is a method that involves students in an optimum way to find formulas and theorems, while educators provide guidance to students who have difficulty. This type of research is a quasi-experimental study with *pretest-posttest nonequivalent comparison-group design*. *The group* used in this study consisted of two groups, namely the experimental group and the control group. Based on the calculation in the attachment, the value of t count is 5.37. The calculated t value obtained is greater than $t_{table} = t_{0.05;\ 28} = 1.701$ so Ho is rejected. Thus it can be concluded that at the 5% significance level, approach is *the guided discovery* effective in terms of student learning achievement. Based on the calculation in the attachment, the value of t count is -1.805. The calculated t value obtained is smaller than $t_{table} = 1.701$ so Ho is not rejected. Thus it can be concluded that at the 5% significance level, approach is *the guided discovery* not effective in terms of student learning motivation. It can be concluded that mathematics learning with a guided discovery approach is effective in terms of student learning achievement, but is not effective in terms of student learning motivation.

1. Introduction

Mathematics is one of the subjects studied for UAD's PGSD students. There are several subjects that discuss Mathematics which are divided into 6 courses. This is done as a basis for prospective elementary school educators to get basic knowledge to be taught when they become an elementary teacher. Mathematics needs to be given to all students starting from elementary school to equip students with the ability to think logically, analytically, systematically, critically, creatively, the ability to cooperate, and develop the ability to use mathematics in problem solving and communicating ideas or ideas using symbols, tables, diagrams, and other media. Having these abilities is expected to improve student mathematics learning achievements. Basically Mathematics is a science that is learned for all groups and ages. One of them is for elementary school educators who are PGSD students.

PGSD students come from various regions and various departments when in high school. Based on the results of interviews with several new students of the class of 2017 on October 23, 2017, it is known that in one class the students come from various departments when in high school such as Science, Social Sciences, Language, Informatics, Electrical Engineering and nursing. This causes not all students to like Mathematics lectures and difficulties in learning the concepts of Mathematics.

Volume 4, 2019 | P-ISSN 2655-2361, E-ISSN 2655-3252

Therefore, educators should create learning and teaching materials that are appropriate to the needs of students. One teaching material that can help students in understanding the concept of Mathematics is by developing modules with a guided discovery approach.

Material that builds up curved side space is one of the concepts that is difficult to understand for students. Students usually only memorize formulas and difficulties when applied to story questions, especially story questions that have been modified differently from the examples given during the learning process [1]. One alternative solution in overcoming these problems is a guided discovery learning approach that directs students to find out for themselves the concepts given in the learning process. This approach is packaged in teaching materials that have been developed in previous studies, in the form of mathematical modules. Modules are teaching materials that can be used as a substitute for teachers or educators when at home. Therefore, the module must be able to help students understand a concept without having to be accompanied by the educator. Guided discovery approach is a method that involves students optimally in finding formulas and theorems, while educators provide guidance to students who have difficulty learning [3]. In inquiry, the intellectual quality of lessons can improve significantly over time with specific gains in higher other thinking and the problem of form of knowledge [4]. Guided inquiry presents contextual investigations that include ambiguous to open pathways for solving the problems and open ways to answer questions with students making decisions about how they navigate the problems process [5].

Discovery learning is a pedagogic strategy which constructs knowledge on theirs own [2]. Discovery learning can make the human learner better and deeper when they are required to discover and construct the essential information for themselves and underlying principles [6]. Students who study with a guided discovery approach can gain a lot of experience directly in finding concepts, principles in learning. Besides that they can build on the knowledge they already have with the new experiences gained in the learning process to solve a problem that exists in everyday life.

However, pure discovery environment lacks structure, guidance, and minimal feedback would get into trial and error, lost and frustrated situations [7]. It should be noted that the learning environment with pure discovery has a lack of structure, guidance and minimal feedback and is in a trial and error situation, and frustrates students. For guided discovery students are superior to pure discovery in helping students learn. Students are more focused on learning if it starts from the easy one to the more difficult ones. This is in line with Moreno [8] which states that students learn more deeply from strongly guided learning than from discovery. Mathematics can be applied in various fields of life so that everyone can feel the benefits of learning mathematics, both at school, in the work environment, and in everyday life.

2. Method

This research is a quasi-experimental with a pretest posttest design control group design. This research was conducted on UAD PGSD students. The experiment is carried out in May-June 2018. Research Procedures The stages in this study include: preparation, implementation and final stages. The preparation stage, namely: teacher training, making learning materials, compiling RPS, compiling instruments, determining the time of execution, making a permit. The implementation phase includes: doing the pretest, treatment, and posttest. The final stage includes: processing and analyzing experimental data, discussion, concluding and reporting the results of the study.

Data needed in this study are student motivation and learning achievement. Data collection techniques that will be used are learning motivation questionnaire, learning achievement test, and observation. Data analysis begins with descriptive analysis, and to describe the effectiveness of learning with guided discovery methods, the data were analyzed by t test statistics at a significance level of 5%. The data described is data obtained from measurements on research variables (dependent variables), namely learning motivation and learning achievement. The data is calculated the average value then interpreted into the criteria that have been set. According to Sudijono [9] the reference for changing the score to a standard scale is five as presented in Table 1.

Volume 4, 2019 | P-ISSN 2655-2361, E-ISSN 2655-3252

Table 1. Conversion of values in 5 categories of

Intervals	Criteria
X> 80	Very high
60 <X≤80	High
40 <X≤60	Is being
20 <X≤40	Low
X≤20	Very Low

Learning mathematics with a guided discovery approach to student motivation and learning achievement is said to be effective if the average score is high and very high. The high criteria for motivation to learn mathematics are the range of scores of $105 \leq X \leq 140$, while for learning achievement the criteria are very high, namely $75 \leq X \leq 100$. The hypotheses tested are as follows.

$H0: \mu 1 \leq 75$

$Ha: \mu 1 > 75$

The above hypothesis means that learning with brain-based learning methods is not effective in increasing student learning motivation that is if the average student gets a score of ≤ 140. Learning with a guided discovery approach is effective for increasing student learning motivation if the score is> 140.

$H0: \mu 2 \leq 105$

$Ha: \mu 2 > 105$

The above hypothesis means that learning with brain-based learning method is not effective to improve student learning achievement, is if the average student gets a score of ≤ 75. Learning with a guided discovery approach is effective to improve student learning achievement if the score is> 75.

In this study multivariate analysis was carried out before hypothesis testing. Multivariate analysis aims to determine whether there are differences in motivation scores between the initial motivation score (pre) and the final motivation score (post), and the difference in achievement scores between the initial achievement score (pretest) and the final achievement score (posttest). If there are differences, it can be continued with the t test.

3. Result and Discussion

Learning is said to be effective if the effort in learning reaches its goal. This can be known by comparing the expected conditions with the conditions achieved. Achieving effective learning, the teacher must also be effective in teaching. According to Rob Norris [10] effective teaching depends on: (1) the personality of the teacher, (2) the method chosen, (3) behavior patterns, and (4) relevant competencies. The chosen learning method must be effectively used in achieving optimal results. One approach that can be used is the guided discovery approach.

Motivation for learning and mathematics learning achievement at PGSD before being given a treatment of guided discovery approach is not as expected. Student learning achievement is still relatively low. This can be seen from the value of the average learning outcomes of students who have not reached the minimum completeness criteria, the learning achievement is still low. The motivation of students is still low. This can be seen when the researcher made observations when the learning took place before the research was conducted, where there were still many students who did not pay attention during learning. The results of the initial motivation questionnaire also showed that the average score of student motivation questionnaires was in the low category. The fore going results in mathematics learning not being effective. The guided discovery approach has been tested for its effectiveness on motivation and learning achievement in advanced mathematics courses at PGSD UAD. The research data were obtained by pretest and posttest, learning motivation data through learning motivation questionnaires amounted to 35 statement items and learning achievement data through learning achievement tests totaling 30 items in question.

The data of the study showed that the average measurement results of learning motivation before treatment were 94.42 with low learning motivation criteria, while after treatment it was 96.90 with high learning motivation criteria in conventional classes. While the average motivation of students

before treatment was 93.52 and after treatment 100.97 with high motivation criteria in the class with a guided discovery approach.

Table 2. Standard Deviation Score theoretical maximum and minimum scores theoretical learning motivation

Values	class Conventional		Class *Guided discovery*	
	before *treatment*	after *treatment*	before *treatment*	after *treatment*
Average	94,42	96,90	93,52	100,79
Standard deviation	12,80	14,07	10,13	12,57
Highest total score achieved	117	120	117	125
lowest total score achieved	70	75	72	80
Maximum possible total score	150	150	150	150
total possible minimum score	30	30	30	30
Category	High	High	High	High

The results of student motivation questionnaire results were then converted into very high, medium, low, and very low categories. Frequency distribution and percentage of learning motivation scores before and after treatment are presented in Table 3 below.

Table 3. Frequency Distribution and Percentage of Student Motivation in Conventional and Guided Discovery Classes.

Category	Class Conventional				Class *Guided discovery*			
	Pretest		*Postest*		*Pretest*		*Postest*	
	f	%	F	%	F	%	F	%
Very High	0	0,00	1	3,23	0	0,00	4	17,24
High	21	67,74	21	67,74	17	24,14	17	58,62
Is being	10	32,26	9	29,03	12	68,97	8	24,14
Low	0	0,00	0	0,00	0	0,00	0	0,00
Very low	0	0,00	0	0,00	0	0,00	0	0,00

Date in Table 3 shows that before being given *treatment*, students in both classes were in the medium and high learning motivation category. Most students in both classes are in the category of high learning motivation. After being given *treatment, the* category of student learning motivation has increased to moderate, high, and very high. The percentage of students who are in the very high category in the guided discovery class is 14.01% higher than conventional classes.

The results of the achievement test data in groups with a learning approach *guided discovery* and conventional learning are described based on the values of the *pretest* and *posttest* presented in the following table.

Table 4. Average Score, Standard Deviation, Theoretic Maximum Score, and Minimum Theoretic Score in Mathematics Learning Achievement

Value	Conventional Class		Class *Guided Discovery*	
	Pretest	*Postest*	*Pretest*	*Postest*
Average	40.16	79.03	37.24	84.14
Standard deviation	12.08	13.63	9.50	9.17
Maximum value that may be	100	100	100	100
Minimum value maybe	0	0	0	0
The highest score achieved	70	100	50	100
The lowest value achieved	20	45	20	60
Completeness	0%	77.42%	0%	86.21%

Volume 4, 2019 | P-ISSN 2655-2361, E-ISSN 2655-3252

Based on Table 4 above it can be seen that the average *pretest of* student learning achievement in the guided discovery class is lower than the conventional class of 2.92 while the average *posttest* student achievement in the guided discovery class is 5.11 higher than the conventional class. The average learning achievement test in the discovery class is guided increased by 46.9 after being given *treatment* while in the conventional class experienced an increase of an average of 38.87. Data on learning achievement test results in guided discovery classes and conventional classes can be seen in attachment. The results of the achievement test data were then converted into very high, high, medium, low, and very low categories. Frequency distribution and percentage of achievements before and after *treatment are* presented in the following table.

Table 5. Frequency Distribution and Percentage of Mathematics Learning Achievements in Conventional Classes and Classes *Guided Discovery*.

Category	Class Conventional				Class *Guided discovery*			
	Pretest		*Postest*		*Pretest*		*Postest*	
	F	%	F	%	F	%	F	%
Very High	0	0,00	12	38,71	0	0,00	19	65,52
High	1	3,23	15	48,39	0	0,00	9	31,03
Is being	12	38,71	4	12,90	9	31,03	1	3,45
Low	17	54,84	0	0,00	18	62,07	0	0,00
Very low	1	3,22	0	0,00	2	6,90	0	0,00

Data in Table 5 shows that before being given *treatment* there were no students who were in the very high category in both classes even in the guided discovery class no student is in the high category. The percentage of students who are under the high category before *treatment* is 100% in the guided discovery class and 96.77% in conventional classes. After *treatment* there are no students in the low or very low categories in the two classes. Students who are in the high or very high category in the guided discovery class there are 96.55% while in the conventional class there are 87.1%.

Data on achievement results based on student learning completeness are presented in Table 6. Student learning completeness is based on the minimum achievement of learning that is 75.

Table 6. Frequency Distribution and Percentage of Mathematics Learning Achievement in Conventional Classes andClasses *Guided Discovery*.

Percentage of	Class Conventional		Class *Guided discovery*	
	Pretest	*Posttest*	*Pretest*	*Posttest*
Students Completed	0%	77,42%	0%	86,21%
Students Not Completed	100%	22,58%	100%	13,79%

Based on Table 6, it can be seen that before *treatment* there were no students completing in both classes. After being given *treatment*, *the* percentage of students who complete the guided discovery class 8.79% higher than conventional class.

3.1 Effectiveness of the Approach in Guided Discovery terms of Learning Achievement and Student Learning Motivation

There are two hypotheses to be tested, namely guided discovery is effective in terms of (a) achievement learning, and (b) student learning motivation. Analysis of the data used is one sample t test. The following are the results of the analysis. The effectiveness of *guided discovery in* terms of Learning Achievement. The hypothesis is as follows:

$$H0: P \leq 75$$
$$Ha: P > 75$$

Based on the calculation in the attachment, the value of t arithmetic is 5.37. The calculated t value obtained is greater than $t_{table} = t_{0.05;\ 28} = 1.701$ so Ho is rejected. Thus it can be concluded that at the 5% significance level, approach is *the guided discovery* effective in terms of student learning achievement.

Volume 4, 2019 | P-ISSN 2655-2361, E-ISSN 2655-3252

The effectiveness of *guided discovery in* terms of Student learning Motivation The hypothesis is as follows: H0 :D 5105

Ha :D> 105

Based on the calculations in the attachment obtained the value of t count of -1,805. The calculated t value obtained is smaller than t_{table} = 1.701 so Ho is not rejected. Thus it can be concluded that at the 5% significance level, approach is *the guided discovery* not effective in terms of student learning motivation.

3.2 Effectiveness of the Conventional Approach in terms of Learning Achievement, and Student Learning Motivation.

In this section there are two hypotheses tested, namely the conventional approach is effective in terms of (a) learning achievement, and (b) student learning motivation. Analysis of the data used is one sample t test. Following are the results of the analysis.

The Effectiveness of the Conventional Approach in terms of Learning Achievement. The hypothesis is as follows: H0:P≤ 75

Ha:P> 75

Based on calculations in appendix 7 page 292 obtained t count of 1.65. The calculated t value obtained is smaller than $t_{table} = t_{0.05;\ 30}$ = 1.697 so Ho is not rejected. Thus it can be concluded that at the 5% significance level, the conventional approach is not effective in terms of student learning achievement.

The Effectiveness of Conventional Approaches in terms of Student Learning Motivation. The hypothesis is as follows: H0:D≤ 96

Ha:D> 96

Based on the calculations in appendix 7 page 294, the value of t count is -3.21. The value of t count is smaller than t_{table} = 1.697 so Ho is not rejected. Thus it can be concluded that at the 5% significance level, the conventional approach is not effective in terms of student learning motivation.

4. Conclusion

Based on the results of testing the hypothesis and discussing the results of the study, it can be concluded several things related to the research hypothesis, namely: 1) Mathematical learning with a guided discovery approach is effective in terms of student learning achievement, but not effective in terms of student learning motivation. When in conventional learning it is not effective in terms of student learning achievement, and student motivation. 2) The learning process with a guided discovery approach is carried out well in conventional learning and in the classroom using a guided discovery approach.

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Volume 4, 2019 | P-ISSN 2655-2361, E-ISSN 2655-3252

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