

The Influence of Experimental Methods on Natural Science Learning Outcomes

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Abstract

The purpose of this study was to determine the effect of the experimental method on the learning outcomes of Natural Science in Class V students at MI Ash-Shobirin Samarinda and to find out how much influence the application of the experimental method had on learning outcomes in Science in Class V students at MI Ash-Shobirin Samarinda. This study uses a quantitative approach with a quasi-experimental research design. Data collection techniques using tests, observation and documentation. The test is used to determine student learning outcomes on the application of the experimental method. Observation is used to observe the teacher's ability to use the experimental method. And documentation is used for data collection related to research. The variables in this study consisted of variable X experimental method and variable Y learning outcomes from science learning. The sample in this study were all fifth grade students at MI Ash-Shobirin Samarinda, totaling 45 people. The experimental class consisted of 23 students and the control class consisted of 22 students. The data validity technique uses validity and reliability tests. The data analysis technique uses an independent T-test. The results obtained from the independent t-test in the experimental group against the control group showed a significance value of 0.013 less than 0.05. Then it is stated that H_a is accepted and H_0 is rejected. It can be concluded that there is an effect of the use of the Experimental Method on the learning outcomes of natural science on single and mixed substances in class V students at MI Ash- Shobirin Samarinda.

Keywords: experimental method, learning outcomes, natural science

Abstract

The aim of this research is to determine the effect of the experimental method on the learning outcomes of Natural Sciences in class V students at MI Ash-Shobirin Samarinda and to find out how much influence the application of the experimental method has on the learning outcomes of Science in Class V Students at MI Ash-Shobirin Samarinda. This research uses a quantitative approach with research design *quasi-experimental*. Data collection techniques use tests, observation and documentation. The test is used to determine student learning outcomes regarding the application of the experimental method. Observation is used to observe the teacher's ability to use experimental methods. And documentation is used to collect data related to research. The variables in this research consist of variable X experimental method and variable Y learning outcomes from science learning. The sample in this study was all class V students at MI Ash-Shobirin Samarinda, totaling 45 people. The experimental class has 23 students and the control class has 22 students. Data validity techniques use validity and reliability tests. Data analysis techniques use tests *independent T-test*. Results obtained from the test *independent* The t-test in the experimental group against the control group showed a significance value of 0.013, less than 0.05. So it is stated H_a accepted and H_0 rejected. It can be concluded that there is an influence of the use of the Experimental Method on the learning outcomes of natural science in single and mixed substance materials in class V students at MI Ash-Shobirin Samarinda.

Keywords: experimental methods, learning outcomes, natural sciences

1. BACKGROUND

Education is the process by which an individual develops knowledge, skills, and types of behavior in the general society in which he lives. With education, people will gain different knowledge for life management because education is a direct need that must be met throughout life.¹

The aims and functions of education in the Republic of Indonesia Law Number 20 of 2013 concerning the national education system, in Chapter II, Article 3, namely: national education is useful for developing skills, forming character and civilization, which is related to education for social life, piety, faith, and have noble character, healthy, knowledgeable, capable,

¹ Ghullam Hamdu and Lisa Agustina, "The Influence of Student Learning Motivation on Grade IV Siawa Science Learning Achievement at SDN Tarumanegara", in *Journal of Educational Research* edition No. 1 Vol. 12, 2011

Creative aims to develop the potential of students to be independent, to become democratic and responsible citizens.²

Based on the aims and functions of education, it is hoped that a teacher can produce a process that is related to learning in the life of the nation, planned in developing students' skills so that they become someone who is devoted to God Almighty, has a good, healthy, educated, capable, innovative, independent, and so dignified and insightful people. Based on this goal, teachers are expected to be able to create an exciting learning process and produce confident students with innovative and creative attitudes.

In the educational process there are learning and teaching activities, according to Slameto, understanding the psychology of learning is the progress of change, meaning changes in attitudes as a result of interactions with one's life needs.³ According to Tutik and Daryanto, learning is an interaction to change behavior with the aim that the knowledge and abilities obtained are better than expected. Meanwhile, according to Oemar Hamalik, "teaching is an effort to organize the environment so as to create learning conditions for students".⁴

As for what can be concluded from the four definitions above regarding learning and teaching, learning is a process of changing behavior in children for a certain goal. Meanwhile, teaching is the process of providing guidance and learning to children in order to achieve that goal.

In the learning and teaching process, the achievement of educational goals can be measured through student learning outcomes. According to Bloom's Taxonomy, learning outcomes can be seen from cognitive (knowledge), affective (attitude) and psychomotor (skill) achievements. It can be seen that in fact the world has experienced a pandemic for 2 years which has resulted in children not being able to meet face to face with teachers, this has resulted in a decline in students' knowledge, attitudes and skills. This year the government gave permission for schools to resume face-to-face learning. Here teachers are required to create an interesting learning atmosphere so that students can develop a sense of curiosity in the learning process. In creating an interesting learning process, teachers can use appropriate learning methods in each learning process.

Based on the results of the researcher's observations in class V MI Ash-Shobirin Samarinda, the researcher found that the activities in learning science subjects in the teacher's class only used the lecture method, as a result, making students feel uncomfortable.

² Ushwa Dwi Masrurah Arifin Bando and, Elihami, "The Influence of Demonstration Methods

on Fiqh Learning in Islamic Boarding Schools Through the Concept of Non-formal Education",
in *Journal of Nonformal Education*, No. 1 Vol 2, 2021.

³ Slameto, *Learning & Influencing Factors*, (Jakarta: Rineka Cipta, 2013), p.2

⁴ Oemar Hamalik, *Teaching and learning process*, (Jakarta: Bumi Aksara, 2011), p. 53.

motivated and less enthusiastic about the learning and teaching process. This can be seen based on the students' daily assignments, especially on single and mixed substances (homogeneous and heterogeneous). In this material, it can be seen that students find it difficult to understand the differences between single substances and mixtures (homogeneous and heterogeneous), this is because there is scientific language that has only been heard by the students, resulting in this material still being at a low average, namely 70 out of 45 students, only 10 people. who got a score above the KKM (Minimum Completeness Criteria) 75, while the rest were below the KKM 70 - 75. The lecture method is not suitable for all the material to be presented. In practice, there is no active role for students in the learning process. This causes students to only be able to memorize without understanding the material, and will have an impact on student learning outcomes. This happens especially in the learning process of science subjects.

Based on the problems found by researchers, this was the result of teachers not choosing appropriate learning methods in Natural Science subjects with single substance and mixed substance material. The learning method that is suitable for building student activity is the group method which is adapted to science material in that it requires a process of trying, observing and discussing.

The experimental method is one of the methods that can build student activity in class because this method will require students to solve problems by seeing, observing and drawing conclusions directly. According to Roestyah, the exploration technique has several benefits, in particular: (1) By trialling, students are prepared to involve logical strategies in managing all problems, it becomes not difficult to believe in something that is uncertain, and not difficult. It is not difficult to accept what an individual says before showing reality; (2) They are more dynamic in thinking and acting; which is highly desired by today's educational and learning practices, where students are more dynamic in learning alone with direction from educators. (3) Students in carrying out exploration cycles and obtaining information, also track appropriate experience and abilities in using experimental equipment. (4) With experiments, students demonstrate hypotheses for themselves so that they will change their attitude of believing in things that do not make sense, to certain opportunities that do not seem real.⁵

2. RESEARCH METHODS

This research uses a quantitative approach using experimental research methods with *designlike an experiment*. The population in this study were all 45 class V students at MI Ash-Shobirin. The samples obtained were class VA consisting of 22 students and class VB consisting of 23 students, so the total sample size was 45 students, in this study

⁵ Roestiyah N.K, *Teaching Learning Strategies*, (Jakarta: Rineka Cipta, 2012), p. 82.

using test data collection techniques, observation and documentation. To determine science learning outcomes, researchers used 20 questions, observation to determine the teacher's ability to apply experimental methods in class and documentation to find out data related to the research carried out.

3. RESULTS AND DISCUSSION

3.1. Validity Test Results

The results of r_{xy} (rcalculation) will be compared to r product moment which has a significance level of 5%. So that the final determination of the item can be said to be significant or valid, can $r_{count} \geq r_{table}$ be known when

r_{table} , and vice versa r_{table} then the item can be said to be no
if $r_{count} < r_{table}$ significant or invalid.

The researcher tested the test instrument in the form of multiple choice questions totaling 25 questions on respondents totaling 29 students. After the trial, the test results were tested for validity using the IBM SPSS Statistics Version 22 application. The results were as follows:

TABLE: VALIDITY TEST RESULTS OF TEST QUESTIONS

No.	Item	r-count	r-table	Information
1	Soal 1	0,590	0,367	Valid
2	Soal 2	0,025	0,367	Invalid
3	Soal 3	0,421	0,367	Valid
4	Soal 4	0,385	0,367	Valid
5	Soal 5	0,328	0,367	Invalid
6	Soal 6	0,334	0,367	Invalid
7	Soal 7	0,691	0,367	Valid
8	Soal 8	0,334	0,367	Invalid
9	Soal 9	0,487	0,367	Valid
10	Soal 10	0,742	0,367	Valid
11	Soal 11	0,627	0,367	Valid
12	Soal 12	0,385	0,367	Valid
13	Soal 13	0,633	0,367	Valid
14	Soal 14	0,390	0,367	Valid
15	Soal 15	0,635	0,367	Valid
16	Soal 16	0,385	0,367	Valid
17	Soal 17	0,631	0,367	Valid

18	Soal 18	0,638	0,367	Valid
19	Soal 19	0,633	0,367	Valid
20	Soal 20	0,418	0,367	Valid
21	Soal 21	0,143	0,367	Invalid
22	Soal 22	0,590	0,367	Valid
23	Soal 23	0,657	0,367	Valid
24	Soal 24	0,691	0,367	Valid
25	Soal 25	0,450	0,367	Valid

The instrument is said to be valid if $r\text{-count} > r\text{-table}$ with a total of 29 respondents and a total of 25 questions, the following results are obtained: based on the data above, it is known that there are 20 valid questions.

The 5 invalid questions were not used because the 20 valid questions already represented all the indicators in the research instrument.

TABLE: DATA ANALYSIS OF DIFFICULTY LEVEL

No.	JB	N	JB/n	Criteria
1	22	29	0,758620	Easy
2	22	29	0,758620	Easy
3	25	29	0,862068	Easy
4	18	29	0,620689	Currently
5	16	29	0,551724	Currently
6	20	29	0,689655	Currently
7	21	29	0,724137	Easy
8	18	29	0,620689	Currently
9	18	29	0,620689	Currently
10	18	29	0,620689	Currently
11	18	29	0,620689	Currently
12	18	29	0,620689	Currently
13	22	29	0,758620	Easy
14	8	29	0,275862	Difficult
15	21	29	0,724137	Easy
16	25	29	0,862068	Easy
17	13	29	0,448275	Currently
18	12	29	0,413793	Currently
19	22	29	0,758620	Easy
20	24	29	0,827586	Easy
21	14	29	0,482758	Currently
22	22	29	0,758620	Easy
23	17	29	0,586206	Currently
24	21	29	0,724137	Easy
25	12	29	0,413793	Currently

Calculate the level of difficulty using the formula:

$$TK = \frac{JB}{n}$$

Information:

TK : Difficulty Level

JB : Number of correct answers

N : the number of students

Whereas for interpret used classification The difficulty index is:

TK = 0.00 : the question is too

difficult $0.00 < TK \leq 0.30$: difficult

question $0.30 < TK \leq 0.70$: medium

question $0.70 < TK < 1.00$: easy

question.

Next, the researcher tested the difficulty level of the questions. It can be seen in the table above that there is 1 difficult question, namely no. 14, there are 13 medium questions, and there are 11 easy questions.

TABLE: DIFFERENTIAL POWER CRITERIA

Differentiating Power Criteria	Interpretation
$0,00 < DB \leq 0,20$	Low
$0,00 < DB \leq 0,40$	Enough
$0,40 < DB \leq 0,70$	Good
$0,70 < DB \leq 1,00$	Very good

The formula for determining is as follows:

$$DB = \frac{B_a}{J_a} - \frac{B_b}{J_b}$$

informati

on:

DB: the

different

power

sought

Not : number of participants in the upper group who answered correctly
 Bb : number of participants in the lower group who answered correctly
 Ja : number of upper groups
 Jb : number of lower groups

TABLE: DATA ON VALID DIFFERENT POWER OF QUESTIONS

No.	Question Items	DB	Information
1	Soal 1	0,42	Good
2	Soal 2	0,28	Enough
3	Soal 3	0,50	Good
4	Soal 4	0,28	Enough
5	Soal 5	0,50	Good
6	Soal 6	0,64	Good
7	Soal 7	0,42	Good
8	Soal 8	0,35	Enough
9	Soal 9	0,50	Good
10	Soal 10	0,21	Enough
11	Soal 11	0,42	Good
12	Soal 12	0,28	Enough
13	Soal 13	0,50	Good
14	Soal 14	0,57	Good
15	Soal 15	0,28	Enough
16	Soal 16	0,21	Enough
17	Soal 17	0,35	Enough

18	Soal 18	0,57	Good
19	Soal 19	0,57	Good
20	Soal 20	0,28	Enough

After knowing the data on the difficulty of the questions, we then used a valid data test on the different power of the questions so that it was known that the questions had good different power to be tested in accordance with the criteria stated that 20 valid questions met good and sufficient different power.

a. Reliability Test Results

The 20 valid questions were then tested for reliability with an r_{table} of 0.367 to determine the reliability test calculation data in this research using the help of the IBM SPSS Statistics Version 22 application.

TABLE: RELIABILITY TEST RESULTS

Reliability Statistics	
Cronbach's Alpha	N of Items
0,891	20

It can be seen from the table above that the reliability of the test questions is stated as the Cronbach's Alpha or 'count > 'table value, namely $0.891 > 0.367$ so that all 20 test questions are reliable.

b. Experimental and Control Class Pre-Test Results

TABLE: EXPERIMENTAL AND CONTROL CLASS PRE-TEST RESULTS

No.	AND Experiment	Mark	VB Control	Mark
1	AFDS	55	NOTE	30
2	AM	10	WITH	40
3	WITH	30	BAR	55
4	ANAS	50	CNCK	20
5	BYP	45	CAA	30
6	DP	85	DKW	65
7	AND	20	HS	55
8	HYM	70	MDRP	55
9	IA	40	MAR	35
10	KM	80	MDN	70
11	MZAT	30	MHN	30
12	MG	30	MN	30
13	MAC	15	that	70
14	MDR	25	NF	40
15	ME	65	DA	35
16	MID	45	RDS	50
17	NS	60	RS	25
18	DA	70	RJAP	45
19	SR	40	SRA	95
20	SJS	25	SM	40
21	SBD	40	TH	90
22	SAN	20	YR	68
23	RY	40		
Amount		990	Amount	1.073
Rate-rate		43,0435	Rate-rate	48,7727

From the experimental class students' learning results, they were

obtained from the pre-test with the lowest score of 10, the highest score was 85, and the average was 43.0435, while the control class learning results were obtained from the pre-test with the lowest score of 20, the highest score was 95, the average 48, 7727.

c. Post-Test Results for Experimental and Control classes

TABLE: RESULTSPOST-TEST EXPERIMENTAL AND CONTROL CLASS

No.	AND Experiment	Mark	VB Control	Mark
1	AFDS	80	NOTE	60
2	AM	60	WITH	60
3	WITH	55	BAR	85
4	ANAS	80	CNCK	55
5	BYP	75	CAA	60
6	DP	95	DKW	45
7	AND	50	HS	65
8	HYM	80	MDRP	65
9	IA	80	MAR	35
10	KM	95	MDN	55
11	MZAT	60	MHN	30
12	MG	60	MN	50
13	MAC	70	that	40
14	MDR	40	NF	55
15	ME	85	DA	45
16	MID	70	RDS	60
17	NS	70	RS	55
18	DA	80	RJAP	45
19	SR	70	SRA	85
20	SJS	55	SM	85
21	SBD	75	TH	65
22	SAN	65	YR	65
23	RY	75		
Amount		1.625	Amount	1.265
Rate-rate		70,65	Rate-rate	59,32

From the learning results of experimental class students, post-test data was obtained with the lowest score of 40, the highest score was 95, and the average was 70.65, while from the learning results of students in the control class, post-test data was obtained with the lowest score of 30, the highest score was 85, average. -average 59.

d. Observation Results

Observations were carried out to find out whether there were differences in the application of experimental methods in learning. Here the researcher acts as a teacher and collaborates with peers as observers. In the control class the teacher applies the lecture method. In the learning process, there are students who don't pay much attention and are busy chatting with friends, and there are students who

pay attention but don't understand what the teacher is saying. Meanwhile, in the experimental class, the teacher applied the experimental method and obtained responses from students who actively engaged in discussions with friends and asked questions and answers and students were able to understand the material presented by the teacher.

e. Normality Test Results

TABLE: LEARNING OUTCOMES NORMALITY TEST DATA

	Tests of Normality					
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
IMPACT A	.123	22	.200*	.970	22	.706
IPA B	.177	22	.072	.930	22	.126

The data is assumed to be normally distributed with a significance level of >0.05 , conversely, if the data is said to be abnormally distributed with a significance level of <0.05 , it is said to be not normally distributed. Based on the data above, it can be seen that the significance value is 0.706 and 0.126, which means it is greater than 0.05, so it can be stated that the data is normally distributed.

f. Homogeneity Test Results

TABLE: HOMOGENEITY TEST DATA OF STUDENT LEARNING RESULTS

Test of Homogeneity of Variances			
Science Learning Outcomes			
Levene Statistic	df1	df2	Sig.
.125	1	43	.726

To accept or reject the hypothesis by comparing the sig value in levene statistics, namely 0.05 ($\text{sig} > 0.05$). Based on the results above, the results of the research variable homogeneity test using the Levene test in the table above, the significant value is 0.726 because the significant value is greater than 0.05, it can be concluded that the experimental class and control class students have the same variance, or both classes. declared homogeneous.

g. Hypothesis Test Results

TABLE: INDEPENDENT SAMPLE TEST DATA T-TEST

Independent Samples Test								
	Levene's Test for Equality of Variances		t-test for Equality of Means					
	F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference

									Lower	Up is
Hasil Belaj ar IPA	Equal variances assumed	.125	.726	2.587	43	.013	11.334	4.381	2.499	20.16 9
	Equal variances not assumed			2.579	41.635	.013	11.334	4.395	2.463	20.2 05

Based on the results of the statistical test above, it can be seen that Sig (2-tailed) is 0.013, because 0.013 is smaller than 0.05. So it can be concluded that H_a accepted. This means that learning using the Experimental Method influences learning outcomes in Natural Sciences subjects in class V MI Ash-Shobirin Samarinda.

This research shows that science learning must be interesting, like what other researchers have produced⁶, teachers need to apply the best models and efforts⁷, and also includes quality school policies⁸ in improving student performance.

4. CONCLUSION

Based on research results obtained from research analysis, experimental classes that use experimental methods are more effective than control classes that use conventional methods (lectures). This is shown by using the sample t-test hypothesis test, namely, the value of 0.013 is smaller than 0.05, so it can be concluded that H_a is accepted, H_o is rejected. Or the calculated t value obtained is 2.587 which is greater than the t-table which is $2.587 > 1.679$. So it can be concluded that the experimental method influences the learning outcomes of Natural Sciences with single and mixed substance material in class V students at MI Ash-Shobirin Samarinda.

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