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Application of the Drill Method to Improving Science Learning Outcomes

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Abstract: The purpose of this study is to describe the application of the drill method in teaching science at the same time knowing the goodness drill method on learning outcomes of students. Subjects chosen because statistics by developing the notion among students that this course is difficult to understand at once a few of those who obtain superior value (A). Through the pre-experimental study, one group pretest-posttest design in the sixth semester students of class D PGSD FKIP Unram regular afternoon, with 44 samples of 50 students purposive random sampling. Performed drill application of the method to the class VI/D through the afternoon, integrative stage, fixation and autonomous learning statistics. The mean pretest and posttest results to the 44 students of the samples obtained through three implementation pretest and posttest then compared. The results showed a mean posttest learning outcomes (69.41) is better than the average learning outcomes pretest (53.05). Test results found the normalized gain <g> g = 0.348 (moderate classification). Indicated drill method can improve student learning outcomes statistics, indicated by differences in learning outcomes and pretest posttest at 16.36 and significant in the medium category.

Keywords: Application; Drill method; Science Learning

Introduction

Science is a course that aims to assist students in analyzing data (Nugraheni et al., 2019). This kind of ability is needed later after they become teachers. As it is known that, in order to be promoted to rank, every teacher must have scientific work and the like, in accordance with the Regulation of the Minister of Administrative Reform and Bureaucratic Reform (Permen PANRB) No. 16 of 2009 dated 10 November 2009 concerning Teacher Functional Positions and Credit Scores. Elements and sub-elements of teacher activities whose credit scores are assessed include scientific publications on research results or innovative ideas in the field of formal education (Marmoah et al., 2020; Palit et al., 2019; Widana et al., 2019).

If only it was realized that it is necessary to have basic scientific knowledge, then it is likely that every student will try hard for it, but in reality most students, when they hear the word Science, the first thing they imagine is formulas, solving problems and so on. Conditions like this certainly do not support the occurrence of a good and conducive learning process. Therefore, lecturers supporting the course are required to carry out various learning innovations, so that students' curiosity arises, so that they are interested and excited to study science (Handhika et al., 2020; Sutirna, 2018).

One manifestation of the lecturer's efforts to arouse students' interest in learning Science is by applying the drill method (Fadilah, 2019). Through the drill method students will be accustomed not only to understanding the formulas in data analysis, but accompanied by continuous exercises (Handayani, 2021). Thus, it has an impact on improving student abilities in analyzing data. Thus, the quality of the process and results of science learning are increasing (Ariawan, 2019; Sianturi, 2018; Soponyono et al., 2018).

Listening to the urgency, students must be able to analyze data properly and correctly by carrying out a series of varied exercises. The government through the Ministry of National Education underlines the importance of improving student abilities and skills (Astutik, 2018; Octavianingrum, 2020). Students are

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people who are trusted as prospective educators to educate, teach, train, and evaluate the process and learning outcomes of their students (Yuni et al., 2018). In carrying out their duties, students as prospective teachers are not in an empty environment. Students as teacher candidates are part of the preparation of a "big engine" of national education, therefore they are bound by nationally determined guidelines regarding what should be done. Such things are common anywhere (Syamsuri et al., 2021).

Seeing the urgency for students, the application of the drill method in Science courses is needed to increase students' knowledge and understanding abilities, the ability to apply their knowledge and understanding, the ability to analyze, synthesize and evaluate the data processing they are doing. Based on this background, the formulation of the problems raised in this study are: (1) how is the application of the drill method in learning science; (2) what are the learning outcomes of the experimental group students after applying the drill method; and (3) to what extent are the differences in Science learning outcomes for students in the experimental group and the control group after the drill method is applied to the experimental group.

To keep the research focused, the objectives to be achieved were formulated to obtain: (1) an overview of the application of the drill method in learning science, (2) an overview of the learning outcomes of the experimental group of students after the application of the drill method, and (3) differences in the results of the study of science students in the experimental group experimental and control groups after the drill method was applied to the experimental group.

Various experts say that drill means training, skill training, or training. Surakhmad (1982) and Djamarah et al. (2006) interpret that drill as a method can be used to obtain dexterity, accuracy, and skill. As a way of teaching, drill can instill certain habits and maintain good habits. defines drill as a learning method by carrying out certain activities to gain dexterity or higher skills about something that has been learned. By practicing practically, the knowledge of skills possessed by students can be improved and perfected. Drill is not synonymous with just repeating because only with repetition there is no change towards improvement and perfection (Rosidah, 2020). Drill is a reasonable method used to acquire motor or movement skills, mental skills, and associations made by students (Sutarsih, 2020).

This study limits the notion of drill as a skills learning method where students carry out certain activities to gain higher skills, accuracy, speed, and skills regarding something (science) they learn. In its implementation, drill must be preceded by understanding and understanding (explanation), namely students must understand something they are learning, what they have to do and what is the relationship with their competence as prospective teachers.

Method

This study entered the pre-experimental research design. The experiment was carried out on a group of sixth semester students of PGSD FKIP Unram, class VI/D in the afternoon who programmed Science courses on KRS (Study Plan Cards). This group will be tested pre-test and post-test. The first test (pre-test) is given before the application of the drill method, and the second test (post-test) is given after the drill method treatment is carried out. The average of three pre-test results and the average of three post-test results will be compared to determine the impact of applying the drill method in learning science. The research design can be described as follows.

Table 1. Pre-Experimental Research Design One Group Pre-test Post-test Design (Sugiyono, 2018)

Group	Treatment	Pre-test and Post-test
Experiment	X (Drill)	T1 (P5), T2 (P10), T3 (P14)

Information: X = Drill method treatment; T = pre-test and post-test; and P = meeting in learning.

Treatment (X) of the experimental group was carried out to see the goodness of the drill method in learning. Learning with the drill method is a treatment (treatment) X which familiarizes students with practice working on practice questions (Science). Through a series of drill stages (integrative, fixation and autonomous) test (T) student learning outcomes (posttest) after the drill treatment (X) is applied. This was done for three tests each after the drill treatment. The tests were carried out at the 7th, 9th and 11th meetings. The average of the three test results was sought and then the average learning outcomes of the experimental group and the control group were compared.

Population and Sample

The population of this study were all Semester VI students of PGSD FKIP Unram who were programming Science courses. Information obtained from the Head of the Department of Education FKIP Unram, PGSD students have varying levels of ability. There are high ability, medium, and some are low ability. The sample of this research was 44 students of class VI/D who were appointed by purposive random sampling, that is, the sample members were randomly selected from a study that had a specific purpose. What is meant by the specific goal here is an effort to improve student learning outcomes in Science courses.

Research Instruments

The research instruments used for data collection in this experimental research were pre-test and post-test. The test instruments (pretest and posttest) are in the form of questions that are arranged in such a way as to reveal students' abilities in learning science in the domains of knowledge ability, discriminating ability, calculating ability, and interpreting ability. The total number of items there are 24 which are allocated to 10 items for test-1, eight items for test-2 and six items for test-3. The test instrument items are distributed proportionally into each ability domain to be disclosed, as reflected in the test instrument grid (T1, T2, T3). The instrument that has been arranged is first calibrated for each item by conducting a validation test using the product moment correlation technique by Pearson, testing its reliability using the split-half technique using the Spearman-Brown formula, and calculating the level of difficulty and differential power.

Based on the calculation results, it is known that the validity of the instrument with the value of r moves from -0.0434 to 0.722. The results of the consultation on the 5% significance level table obtained 24 valid questions out of 30 items that were tested. As for the reliability of the questions, the reliability value was obtained r = 0.699. Thus, the test instrument was declared reliable. Likewise with the level of difficulty and different power. The test results on 20 PGSD FKIP Unram students obtained the highest score of 92 and the lowest score of 24. Analysis of the difficulty level of the instrument showed that 2 items were classified as difficult, 12 moderate, and 10 easy. After revision and modification, the level of difficulty of the items in the ratio of easy, medium, and difficult at a ratio of 5:14:5. This ratio is considered sufficient to reveal the ability of student learning outcomes. The thing with different power. From the calculation results it is known that the discrimination index is between 0.40 and 0.75. Thus the test results of this test instrument show that the items in the category are sufficient, 2 items, 18 items good and 4 items very good.

Test Assumptions

The distribution normality test was carried out on the instrument scores for applying the drill method and the learning outcomes instrument (Science test) to 44 students in the experimental group, after the research was carried out. The results of data processing found that the drill method scores were normally distributed. The data shows that the price of X^2o is greater than the price of X^2t at degrees of freedom (db) = 1 and a 95% confidence level, namely: $X^2o = 5.80 > X^2t$ (db.1)(tk.95%) = 3.841. The normality test of the distribution of student learning outcomes scores shows a normal distribution. The results of the distribution normality test show that the price of X^2o is greater than the price of X^2t at degrees of freedom (db) = 1 at both the 95% and 99% confidence levels, namely: $X^2o = 13.71 > X^2t$, (db.1) (tk.95 %) = 9.48 where (db.1) (tk.99%) = 13.277.

The case with the homogeneity of Variance. The assumption of homogeneity of variance is set in order to have a strong foundation in making generalizations. Because this research has determined the research setting in the PGSD FKIP Unram study program, the same semester (VI), the same afternoon class, the same course teaching lecturer, and relatively the same learning conditions. So the homogeneity test of variance using scientific analysis is not needed.

Data Analysis Techniques

Data were analyzed using descriptive science and normalized gain <g>. Data descriptions utilize percentage techniques to facilitate understanding in reading research results. Posttest and pretest data will be analyzed for gain (increase/improvement) using the normalized gain <g> then the results are consulted on the normalized gain index (Hake, 1999).

The classification of increasing mastery of subject matter is indicated by the magnitude of <g>, which is high if it is greater than 0.7; medium if between 0.3 to 0.7; and low if less than 0.3 (Hake, 1999). Student learning outcomes are said to increase significantly (significantly) if the normalized gain score of the post-test class average is higher than the pre-test.

Experimental research is vulnerable to various threats to the validity (internal and external) of research results. Internal validity concerns the quality level of the accuracy of controlling the physical-psychological aspects of research implementation and the use of various instruments in conducting research. Controls for various validity threats were carried out to minimize bias in the results of the study. Control is carried out from the preparation of the research to the end of the research implementation, involving: 1) control of selection bias in determining the research sample; 2) control for location bias or the place where the research was conducted; 3) control of instrumentation bias/testing effects related to the preparation of appropriate instruments and the application of test-posttest data collection; 4) maturity effect control related to research time limitation; and 5) Howthorne effect control related to the impressions that arise on research subjects.

Research Procedure

This research consists of 3 stages, as follows. Phase I (research preparation), includes: identifying problems to be researched relating to science learning, preliminary studies namely by studying literature and research class observations, making research proposals or formulating problems, formulating theories and making hypotheses, determining research methods and designs, Determining variables and data sources, compiling instruments to be used in research, conducting experimental studies, testing test and non-test instruments, analyzing test instruments and revising test instruments based on trial results, and analyzing non-test instruments and revising items instruments that do not meet the requirements.

Stage II (implementation of research), includes: explaining to students that this class will be conducted research on the drill method, before the learning process is carried out; conduct treatment in the experimental class by applying the drill method for six meetings (3 sessions), namely meetings 4 and 5 (session-I), meetings 9 and 10 (session-II), and meetings 14 and 15 (session-III). During the treatment process, observations were made and various controls were carried out on the application of the drill method in the implementation of the treatment, giving a pretest before treatment and posttest after the treatment process was carried out, at meeting 5 for pretest-posttest I, meeting 10 for pretest-posttest II, and meeting 14 for pretest-posttest III; giving questionnaires to students to find out student responses to learning activities using the drill method at the 14th meeting after the third posttest; and collect data.

Stage III (data analysis, data processing and drawing conclusions), includes: collecting quantitative data and qualitative data, processing and analyzing quantitative data in the form of pretest and posttest results and finding the average of each test result, and processing and analyzing qualitative data in the form of questionnaire results drilling method.

Result and Discussion

Result

Gain Test Results <g> Normalized

Obtained an overview of the impact of applying the drill method to the increase/improvement (gain) of student learning outcomes, by converting research data into a scale of 0-100. To what extent the gain in student learning outcomes in the post-test will be compared with student learning outcomes in the pretest, Through work tables and the gain formula below will show an increase in student learning outcomes after applying the drill method in learning science.

Table 2. Work

I	Pre-Test Result				Post-Test Result			
	f	x'	fx'	fx'^2	f	y'	fy'	fy'^2
87 – 100	1	+2	2	4	5	+2	10	20
74 – 86	3	+1	3	3	13	+1	13	13
59 – 73	10	0	0	0	16	0	0	0
46 – 58	17	-1	-17	17	7	-1	-7	7
32 – 45	13	-2	-26	52	3	-2	-6	12
∑	44	-	-38	76	44	-	10	52

Based on the data tabulation above, it is known that the mean (average) of student learning outcomes at pretest = 53.05 and posttest = 69.41. Then after calculating the gain formula, the result is 0.348. The gain index shows <g> of 0.348, including the medium category. Thus it can be concluded that there is an impact of applying the drill method to improving student learning outcomes. The increase in the average score of student learning outcomes in the pretest (53.05) increased in the posttest (69.41). The average increase in student learning outcomes was 16.36, which was significant in the medium category.

Discussion

The drill method is a method that familiarizes students with carrying out training tasks (work on questions) immediately after giving material by educators (lecturers). Through a series of exercises that are designed for the purposes of increasing knowledge and skills and monitored by lecturers, students can practice doing assignments as well as training discipline to immediately apply their knowledge in exercises.

Even though skills training dominates learning, the drill method does not ignore the planting of concepts and the transfer of knowledge through the first activity stage, namely the integrative stage. Lecturers present material at this stage as well as ask questions and must be answered by students to find out the Stimulus-Response connection. As prospective teachers, PGSD students are also provided with information about the benefits, functions, and linkages of their learning materials with their future competencies as elementary school teachers. Thus, both the understanding and practice materials presented by the lecturer are as related to learning in elementary schools as possible.

At the fixation stage, learning by the lecturer is focused on exercises to work on questions by demanding to minimize the occurrence of errors, and gradually increasing the tempo of working on questions to become shorter with higher accuracy in answering questions. Autonomous stage, students have been able to reduce the lecturer's assistance in working on the assigned questions. Confidence has increased, the effort to solve the problems it encounters has grown together with the ability to differentiate, analyze, and evaluate. In order to lead to the application of a good drill method, the research lecturer strives for the characteristics of a good drill to be applied from the start, namely:

First, each student does a different exercise from the previous exercise. This happened because the material/topic of discussion at each meeting was indeed different. Second, changes in learning situations and conditions demand different responses, the research lecturer applies a variety of humor related to learning materials. Third, there are skills that can be mastered or perfected in a short time with minimal practice, while others require a long time with maximum practice. Fourth, a skill exercise must be preceded by understanding and understanding, that is, students must understand what they have to do and what the relationship between the exercise and competence is.

The drill method has a number of principles for skills training purposes, namely: a) training is only for responsive action skills (stimulus-response); b) training must have meaning in the broader sense of behavior (meaningful for competence). Before being given the exercise, students need to first understand the meaning of the exercise, the benefits of the exercise, have the attitude that the exercise is useful for the next task; c) the values of the exercise are diagnostic in the sense that in the early stages students do not yet have adequate skills; the next exercise is an attempt to correct mistakes; proceed by showing the correct response; and held a variety of exercises so that skills can be improved and perfected; d) the exercise begins with accuracy and continues with speed and at the end both (accuracy and speed) must be achieved as a whole; e) a short practice period so as not to be boring; f) the training period must be interesting and enjoyable so that the results are satisfactory; g) at the time of training essential processes are prioritized; h) individual differences must underlie training, and individual training is needed before strengthening training in groups (Hidayat et al., 2012).

Conclusion

The stages of implementing the drill method are carried out in a coherent manner, namely the integrative, fixation and autonomous stages. The integrative stage is an effort to provide students with an understanding of the learning material and is followed up with questions to reveal students' understanding of the learning material. The integrative stage is continued at the fixation stage by providing exercises to work on task assignments in an effort to apply student understanding contained in the form of exercises. The autonomous stage is an effort to arouse students' courage in answering training assignments, dare to be creative individually, and dare to express opinions or ideas in drawing conclusions from data analysis carried out by students. The learning takes place in earnest interspersed with fresh humor from the lecturer so that learning is not boring, including when students are doing practice questions.

Science learning outcomes of the experimental group students were better than those of the control group students. The data shows that the number of students with good grades (Guttman scale) is greater in the experimental group students, namely 77.27% (34 people) compared to the control group students, 56.82% (25 people).

The results of the test for differences in the average score of the experimental group students and the control group using the t.Test formula found that the difference in the mean score of the experimental group students was 66.224 compared to 59.660, which was higher than the mean score of the experimental group students. The t-test significance test obtained (to) and t-table (tt) shows: to = 2.319 > tt (tk95%)(44) = 2.010 (interpolation). Thus the average difference in learning outcomes is 6.564, which is significant at the 95% level of confidence. The average score of student learning outcomes in the experimental group is better than the average score of learning outcomes in the control group.

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Place acknowledgments, including information on grants received, before the references, in a separate section, and not as a footnote on the title page.

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