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The Impact of the Discovery Learning Model on Problem-Solving Ability and Scientific Attitude of Elementary School Teacher Education Students

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ABSTRAK

Kemampuan ataupun keterampilan yang seharusnya dapat dimiliki dalam pembelajaran IPA menjadi kurang maksimal untuk dikembangkan karena adanya pandemi Covid-19. Penelitian ini bertujuan untuk menganalisis pengaruh penerapan model pembelajaran Discovery Learning terhadap kemampuan memecahkan masalah dan sikap ilmiah mahasiswa pendidikan guru sekolah dasar pada pembelajaran IPA. Jenis penelitian ini merupakan penelitian quasi eksperimen dengan desain penelitian non-equivalent control group design. Populasi yang digunakan dalam penelitian ini adalah mahasiswa Program Studi Pendidikan Guru Sekolah Dasar semester genap berjumlah 78 mahasiswa. Pengumpulan data menggunakan metode tes, dengan instrumen berupa soal tes berbentuk essay test untuk menguji kemampuan memecahkan masalah serta lembar observasi untuk mengetahui sikap ilmiah. Teknik analisis data dengan menggunakan uji analisis deskriptif, normalitas, homogentias, uji hipotesis, dan uji Manova. Hasil penelitian menunjukkan bahwa skor rata-rata sikap ilmiah mahasiswa kelas eksperimen lebih tinggi daripada skor rata-rata kemampuan memecahkan masalah dan skor rata-rata sikap ilmiah kelas kontrol. Dengan demikian, dapat disimpulkan bahwa model pembelajaran Discovery Learning mempunyai pengaruh terhadap kemampuan memecahkan masalah dan sikap ilmiah mahasiswa pendidikan guru sekolah dasar dalam Pembelajaran IPA.

ABSTRACT

The abilities or skills that should be possessed in science learning have become less than optimal due to the Covid-19 pandemic. This study aims to analyze the effect of the application of the Discovery Learning model on the problem-solving abilities and scientific attitudes of elementary school teacher education students in science learning. This type of research is quasi-experimental with a non-equivalent control group design. The population used in this study were students of the even semester Elementary School Teacher Education Study Program, totaling 78 students and collecting data using the test method, with instruments in the form of test questions in the form of essay tests to test problem-solving skills and observation sheets to determine scientific attitudes. The data analysis technique used descriptive, normality, homogeneity, hypothesis, and Manova tests. The results showed that the average score of the scientific attitude of the experimental class students was higher than the average score for problem-solving skills and the average score of the control class. Thus, it can be concluded that the Discovery Learning model influences problem-solving abilities and scientific attitudes of elementary school teacher education students in science learning.

1. INTRODUCTION

The rapid development of the 21st century makes all areas of human life will lead to the use of technology, computerization, and communication (Fitriani et al., 2020; Susilo & Sarkowi, 2018). It requires education as one of the most important fields in life to develop according to the pattern of human life, which is always based on technology (Heryana et al., 2020; Rozi & Hanum, 2019). So, in this case, learning activities must be designed according to the needs of the 21st century (Supardi, 2017). One of the subjects that can meet the needs of 21st-century learning is science subjects. Science is part of the organized science of the universe and can be learned through a combination of active thinking processes and scientific attitudes that are studied specifically in formal schools (Juniati & Widiana, 2017; Lestari, 2018; Lusidawaty et al., 2020; Saputri & Djumhana, 2020). It shows that science learning is related to how to find out about nature systematically. Hence, science is not only mastering a collection of knowledge in the form of facts, concepts, or principles but also emphasizes the process of learning (Pratiwi & Aminah, 2019; Rahmi, 2017; Ramlawati et al., 2017).

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Science learning cannot be understood through memorization or just listening to lecturers' explanations related to concepts or theories. Students themselves must also carry out learning through experimentation, observation, and active experimentation, which will eventually form creativity and awareness to maintain and improve natural phenomena that occur for the better. Then form a scientific attitude that can be useful in helping to maintain the balance of nature in a good and sustainable manner (Aditia et al., 2018; Marudut et al., 2020; Novi et al., 2021; Sulthon, 2017). Thus, learning science, in principle, contains three main elements, namely the ability or skill to express scientific knowledge, scientific attitudes, and scientific knowledge as a result of searching in science (Agustiana et al., 2020; Nuraini & Waluyo, 2021; Saputri & Djumhana, 2020).

The abilities or skills that must be possessed in science learning are the ability to solve problems, critical thinking skills, science process skills, scientific attitudes, the ability to ask questions, and others (Agustina et al., 2021; Juita, 2019; Wijanarko, 2017). Given that science is a way to express scientific knowledge, the ability to solve problems is one of the basic aspects that need to be possessed in science learning (Warsiki, 2018). The ability to solve problems is a process to eliminate differences or discrepancies that occur between the results obtained and the desired results (Rahayu et al., 2021). In addition, the ability to solve problems is a process that requires logic to find a solution to a problem (Prastiwi & Nurita, 2016). In addition, the problem-solving ability is also one of the important abilities that students must have because, in everyday life, every individual will always be encountered various problems that must be solved and require creativity to be able to find solutions to the problems faced (Sumiantari et al., 2019). Thus, the ability to solve problems is the most important aspect to be trained in students as a provision for them later in dealing with real problems in everyday life (Mamin et al., 2018).

Another aspect that determines the success of science learning is the scientific attitude possessed by students. A scientific attitude is an attitude aimed at achieving objective knowledge. Scientific attitude is also defined as individual behavior when solving a problem through systematic scientific steps (Ardiansyah & Arda, 2020; Kusherawati et al., 2020). The scientific attitude itself is divided into two types, namely emotional attitude, which consists of curiosity; perseverance; acceptance of failure; open-minded; and cooperation with other people, as well as an intellectual attitude consisting of an attitude of wanting to get reliable sources, doubting, avoiding broad generalizations when the evidence is insufficient; respect other opinions; not easy to believe without evidence; and open to accept the truth (Putra et al., 2019; Rahmah et al., 2019; Saputri & Djumhana, 2020). It means that scientific attitudes can be a record of thinking that creates research tendencies towards integration in higher-order thinking skills such as critical thinking, creativity, metacognition, problem-solving, and decision making, and greatly determines the quality of individual students (Agustina et al., 2021; Ulfa, 2018).

It's just that the reality on the ground shows that the skills that should be possessed in science learning are less than optimal to be developed due to the Covid-19 pandemic. In science learning, designs made by lecturers to help optimize students' abilities and skills are less than optimal because many considerations need to be adjusted between science learning needs and students' learning needs during this online learning activity. It is based on the results of interviews with science lecturers who stated that due to online learning, the science skills or abilities that should be possessed and then developed by students are not optimal due to various limitations that arise in online learning. And if allowed to continue, this will certainly impact the decline in student learning outcomes.

The application of learning models is one way that can be used to streamline a learning process to achieve the planned goals so that the accuracy and suitability of the selection of learning models with the material and objectives to be achieved are the most important factors. The discovery learning model is a learning model that can be applied to assist the formation or development of problem-solving skills and scientific attitudes in science learning (Saleha & Nadar, 2021; Syazali & Umar, 2022; Tyas et al., 2020). The Discovery learning model is a learning model that emphasizes the learning process that is given as a whole but involves students in organizing and developing knowledge and skills to solve problems (Ana, 2019; Rita, 2022; Winoto & Prasetyo, 2020). The advantages of using the discovery learning model in the learning process are that it can help improve and enhance cognitive skills and processes; The knowledge gained through this model is very personal and powerful because it strengthens understanding, memory, and transfer; Can improve the ability to solve problems; Help reinforce concepts; and Encouraging intuitive thinking processes and formulating their hypotheses (Salmi, 2019). Thus, applying the discovery learning model can optimize individual discovery abilities while also helping learning conditions that were initially passive to become more active and creative so that they can change learning that was originally teacher-oriented to student-oriented (Ana, 2019).

Several studies that have been conducted previously revealed that there was an effect of using discovery learning models on student learning outcomes on the Mushroom concept, an increase in learning outcomes due to the learning process emphasizing students to learn actively in understanding the concepts learned through data collection activities accompanied by with group discussions so that a discovery process occurs in the surrounding environment and is supported by literature studies which will indirectly help optimize the creativity of students in the problem-solving process (Ali & Setiani, 2018). Other studies also revealed that the learning outcomes of students who were given treatment through a discovery learning model using video media increased more than before the treatment was given. Learning through the discovery learning model provides opportunities for students to be more confident and active in the learning process and develop students abilities to solve problems and make decisions so that students have an interest in learning (Rahmayani et al., 2019). Based on some of the results of these studies, it can be said that the discovery learning model significantly influences learning outcomes and increases student learning skills. In previous research, there has been no study on the effect of the discovery learning model on problem-solving abilities and scientific attitudes of elementary school teacher education students. So the researchers focused on the study to know the significant differences in problem-solving abilities and scientific attitudes between experimental class students (IPA-A6) who were taught by discovery learning models and control class students (IPA-A7) who were taught by direct learning.

2. METHOD

This research belongs to the type of quantitative research with quasi-experimental methods. The research design used is the Non-Equivalent Control Group Design. The number of classes that became the research sample was two classes. One experimental class (IPA-A6 class) totaled 38 students who were taught using the Discovery Learning learning model, and the control class (IPA-A7 class) consisted of 40 students as a class taught using a direct instruction model. Data collection techniques in this study are test techniques to obtain data on problem-solving abilities and observation techniques to measure students' scientific attitudes. The research instrument used is the instrument of problem-solving ability and scientific attitude of students in science learning. The data obtained in the study were then analyzed by testing the research hypothesis, namely the Multivariate Analysis Of Variance (Manova) test. Several requirements must be met before testing the hypothesis. The analyzed data must be normally distributed, and the analyzed data are homogeneous. Both of these prerequisites must be met and proven beforehand. It is necessary to carry out a prerequisite analysis test, namely the normality and homogeneity tests. Normality test using SPSS 26.0 for windows Shapiro Wilk statistical test at a significance of 0.05. While the homogeneity of variance test in this study was carried out using Levene's Test of Equality of Error Variance test with the help of SPSS through the Box's M test.

All hypotheses were tested using Multivariate Analysis Of Variance (Manova). The first hypothesis and second hypothesis were carried out with the F test of variance through Manova analysis using the Test of Between Subject Effect with the test criteria for a significance level of F = 5%, which was assisted by SPSS 26.0 for windows. While hypothesis 3, carried out by F test through decisions taken by analysis of Pillae Trace, Wilk Lambda, Hotelling's Trace, Roy's Largest Root, with test criteria significance level F = 5%. If the significant number of Fcount is less than 0.05, the null hypothesis (H0) is rejected, and the alternative hypothesis (Ha) is accepted.

3. RESULT AND DISCUSSION

Result

The data obtained in this study are grouped into problem-solving skills taught using the Discovery Learning learning model, scientific attitudes taught using the Discovery Learning learning model, problem-solving skills taught by educator-centered learning, and scientific attitudes of problems taught by educator-centered learning. The recapitulation of the data analysis can be seen in Table 1.

Table 1. Recapitulation of the Results of the Calculation of the Problem-Solving Ability Score and Scientific Attitude

Statistic	A6		A7	
	Y1	Y2	Y1	Y2
Number of Respondents	33	33	33	33
mean	75.45	60.06	84.33	79.58
Standard Deviation	8.807	10.683	5.829	5.948
variance	77.568	114.121	33.979	35.377
Minimum Score	60	44	70	61
Maximum Score	92	80	98	87

Description :
A6Y1 : The results of the problem-solving ability of the experimental class
A7Y1 : The result of control class problem-solving ability
A6Y2 : The results of the scientific attitude of the experimental class
A7Y2 : The results of the scientific attitude of the control class

Based on Table 1. It can be seen that the experimental class's average score of the problem-solving ability is greater, namely 75.45, than the average score of the control class, which is 60.06. Likewise, the experimental class's average score of scientific attitudes is 84.33, which is higher than the average score of scientific attitudes in the control class, 79.58. The normality test and homogeneity test are prerequisite tests that must be carried out before testing the hypothesis. The data normality test was carried out to measure whether the data obtained and analyzed were normally distributed or not, so they could be used in parametric statistics. The normality test is carried out using Shapiro Wilk, then what is seen is the score of Shapiro Wilk and his Asymp.Sig. The normality test can be accepted if it meets the criteria for the calculation results' significance score greater than $\alpha = 0.05$, then the distribution is declared normal. The summary of the normality test can be seen in Table 2.

Table 2. Normality Test Results

Indicator	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
experimental class problem-solving skills	IPA-A6	0.152	33	0.052	0.959	33	0.238
control class problem-solving ability	IPA-A7	0.133	33	0.148	0.944	33	0.090
experimental class scientific attitude	IPA-A6	0.114	33	0.200	0.969	33	0.443
control class scientific attitude	IPA-A7	0.134	33	0.137	0.909	33	0.009

Based on the summary of the data in Table 2 above, the result is that the significance score of the normality test is greater than $\alpha = 0.05$. It means that it can be concluded that overall, the data obtained in the control and experimental groups are normally distributed. Furthermore, this study also carried out the homogeneity of variance test, namely the variance between the experimental and control groups. The homogeneity of variance test in this study was carried out using Levene's Test of Equality of Error Variance test with the help of SPSS through the Box's M test. The complete homogeneity test calculation results are presented in Table 3.

Table 3. Results of The Homogeneity of Variance

Box's Test of Equality of Covariance Matrices[a]	
Box's M	2.268
F	0.730
df1	3
df2	7.373
Sig.	0.534

Based on the summary of the data in Table 3 above, it can be seen that the Box's M score produced is 2.268 ($p = 0.534$), where the score is $0.534 > 0.05$, so it can be concluded that the covariance matrix between groups is assumed to be the same or homogeneous. Based on the summary of the prerequisite tests for data analysis, it was found that the post-test results of the control and experimental groups were normal and homogeneous. After obtaining the results of the prerequisite test of data analysis, it is continued with testing the research hypothesis. From the results of data processing on hypotheses 1 and 2, the variance F test was carried out through Manova analysis using the Test of Between Subject Effects with the test criteria for a significance level of F = 5%, if the significance number Fcount is less than 0.05 then H0 is rejected, and Ha is accepted. The results of processing the test data are presented in Table 4.

Table 4. The results of the variant F test using the Test of Between Subject Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	Problem-solving ability	3910.061	1	3910.061	40.796	0.000	0.389
	Scientific attitude	373.470	1	373.470	10.770	0.002	0.144
Intercept	Problem-solving ability	303011.879	1	303011.879	3.161	0.000	0.980
	Scientific attitude	443292.136	1	443292.136	1.278	0.000	0.995
Class	Problem-solving ability	3910.061	**1**	3910.061	40.796	0.000	0.389
	Scientific attitude	373.470	**1**	373.470	10.770	0.002	0.144
Error	Problem-solving ability	6134.061	64	95.845			
	Scientific attitude	2219.394	64	34.678			
Total	Problem-solving ability	313056.000	66				
	Scientific attitude	445885.000	66				
Corrected Total	Problem-solving ability	10044.121	65				
	Scientific attitude	2592.864	65				

Based on the data processing results in Table 4, it can be described as follows: First Hypothesis, the calculated F score is 40.796, df = 1, and sig = <0.05. It means that the results obtained have a significance of <0.05, so it can be concluded that the null hypothesis (H0) is rejected and the alternative hypothesis (Ha) is accepted. Thus, based on the analysis of the first hypothesis, there is a significant difference in problem-solving abilities between control class students (IPA-A7) who were taught by direct learning and experimental class students (IPA-A6) who the Discovery Learning learning model taught. Furthermore, in the second hypothesis, the results obtained indicate that the calculated F score is 10,770, df = 1, and sig = <0.05. It means that the results obtained have a significance of <0.05, so it can be concluded that the null hypothesis (H0) is rejected and the alternative hypothesis (Ha) is accepted. Thus, based on the results of the second hypothesis analysis, there is a significant difference in scientific attitudes between control class students (IPA-A7) who were taught by direct learning and experimental class students (IPA-A6) who the Discovery Learning learning model taught. In the third hypothesis, the F test was carried out through the decisions taken by the analysis of Pillae Trace, Wilk Lamda, Hotelling's Trace, and Roy's Largest Root, with the test criteria of significance level F = 5%. If the significant number of Fcount is less than 0.05, the null hypothesis (H0) is rejected, and the alternative hypothesis (Ha) is accepted. The results of the test calculations are presented in Table 5.

Table 5. Multivariate Test Results

Multivariate Tests						
	Score	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's trace	0.439	24.648	2.000	63.000	0.000	0.439
Wilks' lambda	0.561	24.648	2.000	63.000	0.000	0.439
Hotelling's trace	0.782	24.648	2.000	63.000	0.000	0.439
Roy's largest root	0.782	24.648	2.000	63.000	0.000	0.439

Based on the summary of the data in Table 5 above, it can be seen that the results of the study indicate that the score of F count = Pillae Trace (F count = 24,648), Wilk Lamda (F count = 24,648), Hotelling's Trace (F count = 24,648), Roy's Largest Root (F count = 24,648) = 24,648), all of which have a significance of <0.05 so that the null hypothesis (H0) is rejected. The alternative hypothesis (Ha) is accepted. Thus, from the analysis of the third hypothesis, there is a significant difference in problem-solving abilities and scientific attitudes between experimental class students (IPA-A6) who were taught by the discovery learning model and control class students (IPA-A8) who were taught by direct learning.

Discussion

Three main findings were obtained based on the research analysis results. The first finding shows a significant difference in problem-solving ability between control class students (IPA-A7) who are taught by direct learning and experimental class students (IPA-A6) who the Discovery Learning learning model teaches. It can then be described that the Discovery Learning learning model has an effective influence so that it can optimize students' problem-solving abilities in the science learning process (Fadillah et al., 2021; Jannah et al., 2022; Siswanti, 2019). It is because the learning process with the Discovery Learning model involves students actively understanding the concepts and principles of science learning, where the learning characteristics of this are in the form of proposing problems to students (Dwi et al., 2020; Septiyowati & Prasetyo, 2021). The problems given can train students in making problem-solving habits that will affect the students' high-level abilities (Bahtiar et al., 2022). The ability in question, for example, familiarizes students to think creatively by exploring and expressing ideas and identifying problem-solving that can be applied to solve the given problem (Supiandi et al., 2016). Discovery learning helps students to improve and enhance skills as well as cognitive processes, as well as improve students' ability to solve problems (Agung & Sutji, 2022; Winangun, 2020). There is an effect of using Discovery Learning on students' problem-solving abilities. It happens because students better understand, plan, solve problems according to plan, and re-check or interpret solutions in the Discovery Learning learning model.

The second finding shows significant differences in scientific attitudes between control class students (IPA-A7) taught by direct learning and experimental class students (IPA-A6) taught by the Discovery Learning learning model. These results then confirm that the Discovery Learning learning model has an effective influence so that it can optimize students' scientific attitudes in the science learning process. It is because the learning process with the Discovery Learning model can facilitate students to develop their scientific attitudes (Khofiyah et al., 2019; Winoto & Prasetyo, 2020). The Discovery Learning model also encourages students to work independently or in groups to authentically construct information that comes from concrete problems in everyday life. The learning process that applies the discovery learning model will focus on finding problems (learning resources) that come from individual concrete experiences (Asmarani et al., 2017). So that the scientific attitude of students can be formed because the discovery learning model conditions students with personal experience (Patrianingsih *et al*., 2017). The influence of the application of the Discovery Learning learning model on students' scientific attitudes is caused because scientific attitudes cannot be taught but must be developed by students actively through exploring and collaborating activities to achieve an understanding of natural phenomena to solve everyday problems.

The third finding revealed a significant difference in problem-solving abilities and scientific attitudes between experimental class students (IPA-A6) taught by the discovery learning model and control class students (IPA-A8) taught by direct learning. Based on the data from the research, descriptively, it can be stated that the Discovery Learning learning model has an effective influence that it can optimize the problem-solving ability and scientific attitude of students in the science learning process (Ana, 2019; Rita, 2022; Winoto & Prasetyo, 2020). This can be realized because the Discovery Learning learning model directs students to build their knowledge by experimenting and then finding out or finding a principle from the results of the experiment (Salmi, 2019). This means that every student is an active actor in the process of teaching and learning activities through their efforts to build knowledge independently based on the experiences they have had or obtained.

The results obtained in this study are in line with the results of previous studies, which also state that there is an effect of using the discovery learning model on student learning outcomes on the Mushroom concept, an increase in learning outcomes because the learning process emphasizes students to learn actively in understanding the concepts used. Studied through data collection activities accompanied by group discussions so that a discovery process occurs in the surrounding environment and is supported by literature studies that will indirectly help optimize students' creativity in problem-solving (Ali & Setiani, 2018). Other studies also revealed that the learning outcomes of students who were given treatment through a discovery learning model using video media increased more than before the treatment was given. Learning through the discovery learning model provides opportunities for students to be more confident and active in the learning process and develop students' abilities to solve problems and make decisions so that students have an interest in learning (Rahmayani et al., 2019). So based on some of the results of these studies, it can be proven that the application of the Discovery Learning learning model influences the ability to solve problems and students' scientific attitudes together. Thus, it can be concluded that the Discovery Learning learning model implemented by the lecturer will greatly affect the problem-solving ability and scientific attitude of students and can optimize the problem-solving ability and scientific attitude.

4. CONCLUSION

Based on the results of the research and discussion, it can be concluded that there are significant differences in problem-solving abilities and scientific attitudes between experimental class students who the Discovery Learning learning model taught and control class students who are direct or educator-centered learning models taught. It can be seen from the average score of problem-solving ability that the average score of the scientific attitude of experimental class students is higher than the average score of problem-solving ability and the average score of the scientific attitude of the control class. Thus, it can be concluded that the Discovery Learning learning model influences the problem-solving ability and scientific attitude of UPY PGSD students in science learning.

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