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The Effect of the Implementation of the ICARE Learning Model on the Physics Learning Outcomes of Students of Class XII IPA

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Abstract: The constructivist approach with educators as facilitators to students is ICARE's learning model because ICARE learning requires students to make introductions, connect new material with previous material, students apply knowledge directly to real problems happening around them, reflect and expand their understanding of the material from educator to student. The purpose of this study is to find out whether there is an influence on students' physics learning outcomes using the ICARE learning model. This study used a quasi-experimental design for 4 meetings. The results of the research obtained in the cognitive realm were in the experimental class (61.63) and the control class (60.35). After the Mann-Whitney test was carried out, *an Asym score was obtained. Sig (2-tailed)* is 0.573 > 0.05 so, the hypothesis is rejected. Therefore, it can be concluded that there is no significant effect of the application of the ICARE learning model on the learning outcomes of science physics class XII.

Keywords: ICARE; Learning Model; Learning Outcomes; Physics

Abstrak: Pendekatan konstruktivis dengan pendidik sebagai fasilitator kepada siswa merupakan model pembelajaran ICARE karena pembelajaran ICARE mengharuskan siswa untuk melakukan perkenalan, menghubungkan materi baru dengan materi sebelumnya, siswa menerapkan pengetahuan langsung pada masalah nyata yang terjadi di sekitar mereka, merefleksikan dan memperluas pemahaman mereka tentang materi dari pendidik ke siswa. Tujuan dari penelitian ini adalah untuk mengetahui apakah ada pengaruh terhadap hasil belajar fisika siswa dengan menggunakan model pembelajaran ICARE. Penelitian ini menggunakan desain kuasi-eksperimental 4 kali pertemuan. Hasil penelitian yang diperoleh ranah kognitif pada kelas eksperimen (61,63) dan kelas kontrol (60,35). Setelah dilakukan uji Mann-Whitney diperoleh nilai *Asym. Sig (2-tailed)* yaitu 0,573 > 0,05 maka hipotesisnya ditolak. Sehingga dapat disimpulkan bahwa tidak ada pengaruh penerapan model pembelajaran ICARE yang signifikan terhadap hasil belajar fisika IPA kelas XII.

Kata Kunci: ICARE; Model Pembelajaran; Hasil Pembelajaran; Fisika

INTRODUCTION

Education is a learning and teaching process that aims to improve the knowledge, skills, and understanding of individuals or groups. Education plays a crucial role in personal and social development, as well as in preparing individuals to face future challenges in Adapa, S. (2015). Education helps individuals to develop independence, critical thinking, and problem-solving skills. Educated individuals tend to be better able to overcome challenges in daily life and make better decisions for themselves and the society around them.

According to Djamaludin, (2020:17); Rifa, (2020) the learning process is the most important part of an educational activity. The quality of students' learning experience determines the achievement of educational goals. The final result of students depends on an effective and quality learning process. One of the subjects in

Senior High School is physics. Darwis, (2022:324) stated that physics is one of the branches of science and technology and the concept of living in harmony with nature.

Physics is one of the subjects that has been introduced to students from elementary school to college. As a fundamental science, physics also aids in understanding the principles that govern the universe, from subatomic particles to the structure and evolution of the universe as a whole. The main goal of physics learning is to improve students' understanding of the principles of physics as well as their ability to apply those concepts in real-world situations, so that they can develop the analytical, problem-solving, and critical thinking skills necessary in a variety of contexts. The results of the researcher's interview with one of the educators at SMA Negeri 13 Kerinci on March 4, 2025 stated that some students in class XI of SMA Negeri 13 Kerinci in physics learning still did not reach the minimum completeness criterion (KKM) of 75. From the results of the interview, it was obtained that during the learning process, educators only applied a scientific learning model.

This ICARE learning model is carried out on Magnetism material, where during the learning process an introduction to magnetism material. Students are introduced to basic concepts that include the formation of magnetism and its complex interactions with surrounding objects. In addition, its linkages with other principles of physics such as the laws of electromagnetism and the working principles of generators are highlighted to broaden students' understanding. The next step is to explore the various practical applications of magnetism in everyday life and modern industry, which includes power generation, electronic equipment and transportation. In the *reflection* phase, students are invited to imagine the social and environmental impact of the use of magnetism so that students understand the concept more deeply. Then at the *extension* stage, educators provide activities that students can do after the lesson ends to strengthen and expand learning. This activity can be provider material that will be discussed at the next meeting or through homework. This activity aims to assess the extent to which learners can automatically use what they have learned. In this material, students are required to understand the concept of magnetic fields and achieve their application in daily life. Therefore, the ICARE model is expected to improve student learning outcomes.

The research that is relevant to this study is a study conducted by Musri (2020) entitled "The use of the ICARE learning model in thermodynamic materials in an effort to support green technology: a case study at SMA Negeri 2 Pulau Punjung, Dhamasraya Regency". The results of the study showed that the classical completeness of students obtained in the first cycle was 4.54% while the second cycle was 90.90%. Student learning outcomes have increased by 86.36%. This shows that the application of the ICARE learning model has a positive effect on the learning outcomes of thermodynamic materials of students at SMAN 2 Pulau Punjung. The next relevant research was conducted by Risda (2021) entitled "the effectiveness of the ICARE model to improve the creative thinking skills of optical tools". The results of the research are the ICARE learning model in improving creative thinking skills with an N-Gain value of 0.44 which means there is an increase in the medium category, and an effect size value of 3.47 was obtained which is included in the large effect category so that in this study using the ICARE learning model is effective in improving creative skills. Is there any influence on the implementation of the learning model ICARE on the learning outcomes of class XII IPA students.

RESEARCH METHOD

The research method used is quantitative research with a type of quasi-experimental research (*Quasi Experiment*). According to Sugiyono (2012:82), this design has two groups that are randomly selected. control class and experimental class but cannot fully function to control external variables that affect the implementation of experiments. The research design used was *a posttest only control group design* consisting of two learning groups, namely the experimental class and the control class. Sukmadinata (2022:73), said that *the Control Only Group design* was carried out by pairing/matching groups that were given treatment called experimental groups.

Research instruments are a tool to obtain data on students' physics learning outcomes. According to Sugiyono (2012:102) a research instrument is a tool used to measure the observed phenomena, as well as the social. In the cognitive realm, this study uses an instrument in the form of an essay test to see the learning outcomes of students, in the affective realm seen from the activities of students during the learning process using observation sheets, while in the psychomotor realm it is carried out by assessing the performance of students during practicum/experiments with *a Rating Scale.*

ICARE model research procedure (*Introduction, Connection, Application, Reflection, Extension*).

The preparation stage involves several steps. First, a research permit must be prepared. After obtaining information about time allocation, the research schedule is determined. Next, the sample of the research class is selected, and students are divided into heterogeneous groups based on their academic abilities. The necessary material data sources are then prepared to support the ICARE model. Additionally, a final grid is created based on the teaching materials, and final test questions are prepared according to the test grid.

In the implementation stage, the experimental class applies the ICARE learning model, which consists of Introduction, Connection, Application, Reflection, and Extension. Meanwhile, the control class follows a scientific learning model. Finally, in the final stage, a final test is conducted on both samples to assess the students' physics learning outcomes. The results are then analyzed, and conclusions are drawn based on the applied data analysis techniques

Data analysis is a very important method in the scientific method, because by conducting data analysis it can be given a useful meaning and meaning in solving research problems.

1. Data analysis of students' physics learning outcomes

a. *Normality test*

According to Nuryadi (2023:80), the normality test is used to find out whether the data obtained is normally distributed or not.

The statistical hypothesis used is as follows.

H_0: Normal distributed data sample

H_1: Normally undistributed data samples

The test used is the liliefors test, which determines the highest of $f_z - s_z$ reffered to as l_0. it is then compared with H_0 is accepted if $l_0 < l_{tabel}$; otherwise, H_0 is rejected.

b. *Homogeneity Test*

The similarity test of two variances (homogeneity) is used to test whether the distribution of data between the experimental class and the control class is homogeneous or not, namely by comparing the two variations. The data of both classes are calculated by *the Fisher F* test with the following formula:

$$F = \frac{S_1^2}{S_2^2}$$

Information:

- Group 1 variance
- Group 2 variance

The hypothesis of this homogeneity test is:

$H_0: S_1^2 = S_2^2$ (There is no difference between the two variances)

$H_1: S_1^2 \neq S_2^2$ (There is difference between the two variances)

The decision-making guidelines for this test are:

If $F_{hitung} \geq F_{tabel}\ (0{,}05, df_1, df_2)$ then H_0 rejected

If $F_{hitung} < F_{tabel}\ (0{,}05, df_1, df_2)$ so H_0 Accepted

c. *Hypothesis Test*

The test was conducted using the Mann-Whitney test, as proposed by Santoso (2024:20), through the SPSS version 22 program. The procedure involved several steps. First, the SPSS worksheet was opened, and the Variable View was accessed. In the Name column, "Result" was written in the first line, and "Class" was written in the second line. In the label section, "Physics Learning Outcomes" was assigned to the results, while "Class" was assigned to the group. Next, the Data View was selected, displaying the previously created variables. The data was then imported from Microsoft Excel. Following this, the Analyze menu was accessed, followed by selecting Nonparametric Test and then 2-Independent Samples. A dialog box appeared, where the variable "Physics Learning Outcomes" was entered into the Test Variable List, and the class/group variable was entered into the Grouping Variable box. Subsequently, another dialog box appeared for Two-Independent Samples, where the number "1" was assigned to Group 1 and "2" to Group 2, followed by clicking Continue. Finally, a checkmark (√) was placed in the Mann-Whitney column, and the OK button was clicked to complete the test process The hypothesis used, namely:

H_0: *The value of asymp.Sig.* < 0.05, the hypothesis is accepted, which means that there is a significant influence on the use of the ICARE learning model on the learning outcomes of physics students in class XII SCIENCE SMA Negeri 13 Kerinci.

H_I: *The value of asymp.Sig.* > 0.05, the hypothesis was rejected which means that there was no significant influence on the use of the ICARE learning model on the physics learning outcomes of students in class XII Science of SMA Negeri 13 Kerinci.

2. Affective Assessment

In the realm of affective assessment in accordance with the activities of students in the classroom during

The learning process takes place. If students carry out activities as in the indicators that have been made by the educator, then they are given a check mark. For each aspect observed, a score of 1 is given if "Yes" is observed and a score of 0 is given if "No" is observed. The scoring criteria are as follows:

Yes = If the student shows the activity according to the observation activity

No = if the student does not show activities according to the observation aspect

To make it easier to score students' activities with a final score, using simple statistics according to Kunandar (2021:130).

RESULT AND DISCUSSION

RESULT

a. Normality tes in the stage

The normality test was carried out to see if the learning outcome data of the sample class was distributed normally. The normality test was carried out using *the liliefors test* on both samples, namely the experimental class and the control class. Based on the normality test of the experimental class and the control class, it was obtained L_0 and at the real level () 0.05.$L_1\alpha$ as seen in Table 1.

Table 1. Results of the Normality Test of the Final Test of the Cognitive Domain Sample Class

Sample Class	L_0	L_t	Distribution
Experiment	0,465	0,195	Data is not normally distributed
control	0,272	0,190	Data is not normally distributed

From Table 1, it can be seen that the results of the normality test that has been carried out are obtained that in the > experimental class L_0 , it can be concluded that the scores of the physics learning outcomes of students in the > experimental class, namely 0.465 > 0.195 so that the samples are abnormally distributed as well as in the control class >, which is 0.272 > 0.190 so that it is abnormally distributed.$L_tL_0L_tL_0L_t$ as seen in Table 2.

b. Homogenity test in the final stage

The homogeneity test was carried out to see whether the learning outcome data of the sample class had a homogeneous variance or not. In the homogeneity test, F. After calculations were carried out on both samples, the results were obtained as seen in Table 2.

Table 2. The results of the homogeneity test of the two sample classes.

	Variable 1	Variable 2
Average	61,63	60,35
Variance	151,35	266,55
Observation	19	20
Df	18	19
F	0,567825	
P(F<=f) one-tail	0,11793	
F critical one-tail	0,453865	

Table 2 shows that the results of the homogeneity test conducted on the final test data of the two samples turned out to be obtained F_{hitung} = 0.567825. Thus, the results of the homogeneity test can be concluded that the value is > so that in this distribution it is stated that both classes have non-homogeneous data variance $F_{hitung}F_{tabel}$.

c. Hypothesis test in the final stage

After the normality test and homogeneity test were carried out in the final test of the students in the experimental class and the control class, it was obtained that the two classes of samples were abnormally distributed and had non-homogeneous variances, so the hypothesis test was carried out using the Mann-Whitney Test. The test results are as follows, as seen in Table 3.

Table 3. Mann-Whitney Test Results

Test Statistic[a]

Mann-Whitney U	170.000
Wilcoxon W	380.000
Z	-,563
Asymp. Sig. (2-tailed)	.573

a. Grouping variable: class

Mann-Whitney test decision-making basis

1. If the value asymp.sig. < 0.05, then the hypothesis is accepted.
2. If the value asymp.sig. > 0.05, then the hypothesis is rejected.

Meaning of the value of *asym.sig.(2-tailed)* in the Mann Whitney test **.573** is equal to **0.573** because the value is used to compare with the value of α = 0.05. Based on Table 24 of the above statistical results, it can be seen that *the value of Asymp. Sig. (2-tailed)* is .573 so it can be concluded that 0.573 > 0.05 and the hypothesis is rejected.

The learning outcomes of the affective physics realm observed during learning activities are in the form of student learning activities. Assessment of the affective domain using an observation sheet on the implementation of the ICARE learning model which took place three meetings consisting of subtopics of magnetic field material, magnetic induction, and Lorentz force. Each of the observed learning stages provides an overview of the extent to which students participate in the learning stages using the ICARE learning model. The results of observation of student activities on the implementation of the ICARE model can be seen in Table 4.

Table 4. Results of observation of the activities of the two sample classes

Phase Observation Activity	**Observation Results of Experimental Classes Meeting to**			**Class Observation Results Control Meeting to**		
	I	**II**	**III**	**I**	**II**	**III**
1	89,5	58	58	45	60	50
2	73,7	68	63	45	75	75
3	73,7	63	58	55	55	50
4	63	53	68	70	70	50
Score Average	**75**	**60**	**62**	**53,75**	**65**	**56,25**
	66			**58**		

The following indicators are used by observers to assess student activities:

1. Students do not cheat in doing assignments
2. Students work on collecting assignments according to the predetermined time
3. Students are active in group work
4. Students dare to express their opinions, ask questions and answer questions

Based on Table 4, it can be seen that the average observation results of students in the experimental class from the beginning of the meeting to the third meeting are 66

and the control class is 58. During three material meetings and one final test meeting, student activities have been observed by observers with results that show several variations. At the first meeting, the students' activities were at a fairly good level with a score of 75. This score shows that at first students seem to be quite involved and active in learning activities. They were more motivated by the new material or the use of ICARE's interesting learning model at the first meeting. In the second meeting, the score dropped to 60. This decrease can indicate several things such as reduced motivation, increased material difficulty levels, or perhaps external factors such as fatigue or boredom. Meanwhile, in the control class, there was an increase where in the second meeting obtained a score of 65, this was because students began to be active in following the learning process and enthusiastic about the new material, namely in the second meeting of magnetic induction material. At the third meeting, the activities of the experimental class students again showed a slight increase from the second meeting with a score of 62. Meanwhile, the control class decreased drastically, while the score obtained was 56.25, this was because the treatment given was still in the learning model that is usually given by educators at the school, namely scientific, so that there was a decrease in the affivity of students.

Based on the assessment from the observer, the students at the first meeting were more active and very motivated by the material they learned, namely the magnetic field material, especially at the *introduction* and *connection* stage, the students were very enthusiastic in following the learning process accompanied by the stimulus of the learning video presented by the educator, then continued with the connection between materials related to the magnetic field. So that the value of student activities is at a fairly good level.

Furthermore, the observer also said that students at the first meeting of the control class, students were less active in following the learning process, this was seen when the educator asked one of the group representatives to answer the exercise in front of the class. The following is Figure 1 of the average affective score of the experimental class and the control class.

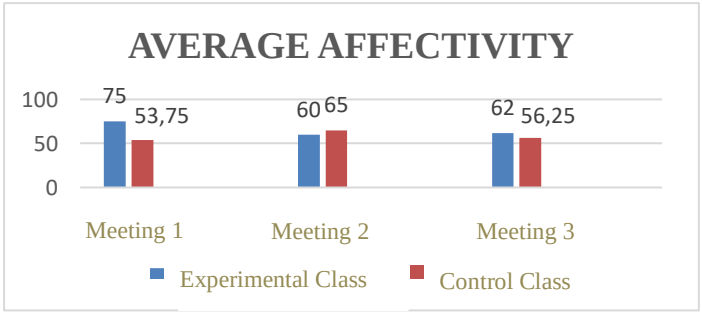

Figure 1. Average affective assessment for the experimental class and control class.

Based on the calculations in Figure 1, it can be concluded that there are differences in student activities during learning. The average results of each meeting in the affective assessment in the first meeting of the experimental class 75 and the control class were 53.75, the second meeting in the experimental class with an average result of 60 while in the control class 65. This is because in the second meeting, the material that will be studied is interesting to discuss, namely magnetic induction so that the curiosity of students increases, not only that when viewed from the indicators

of the meeting 2 aspects of responsibility in the control class are quite good, because it can be seen that when the educator gives the assignment, the student always does it on time. On the other hand, in the experimental class, there was a decrease because students were still adapting to the new learning model. Therefore, at the second meeting, the score value in the control class became higher compared to the experimental class. In the third meeting, the experimental class had an average result of 61.25 while the control class had an average result of 57.25. It can be seen that as many as three meetings, only one meeting from the control class can exceed/exceed the average score of the experimental class. Thus, in the affective realm using the ICARE model, it can increase the affectivity of students.

1. Data Analysis of Learning Outcomes in the Psychomotor Domain

The acquisition of learning outcomes in the psychomotor realm was seen after carrying out a simple practicum contained in the teaching materials three meetings. In this study, the data on learning outcomes in the psychomotor domain were only taken in the experimental class. The following are the results of the performance scores of students in the experimental class as seen in Table 5.

Table 5. Results of the performance scores of students in the experimental class.

It	Indicators	Meeting		
		1	**2**	**3**
1	Assembling tools	45	45	46
2	Observation	36	43	55
3	Data obtained	28	43	50
4	Conclusion	36	42	55
	Average	**36**	**43**	**57**

The results of psychomotor assessments in the experimental class are listed below:

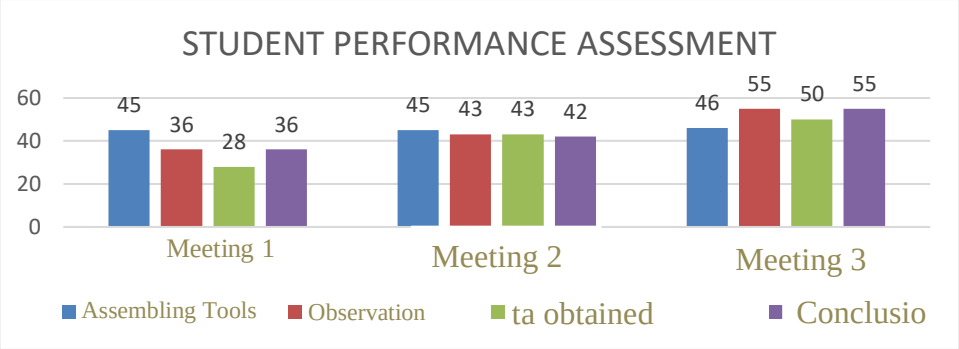

Figure 2. Results of Performance Scores of Experimental Class Students

Figure 2 shows that the performance of the students in the experimental class has improved but the aspect in meeting 1 is so low, because the students in meeting 1 are still confused about the procedure to be followed. However, at the next meeting, students were able to do all aspects well through the help of educators and teaching material procedures.

DISCUSSION

The learning outcomes assessed in this study are the learning outcomes of the cognitive realm and affective. The research was carried out 4 meetings consisting of three meetings of material delivery and one meeting in the form of a final test. Based

on the analysis of data carried out on the learning outcomes after the final test of the sample class research, it showed that the average experimental class of 61.63 obtained higher than the control class which obtained an average score of 60.35. The highest score of the final test in the experimental class was 90 while the highest score in the control class was 97. As for the lowest score in the experimental class, which is 43 and in the control class, 25. (Mulyasa, 2004).

It can be seen that the average physics learning outcome of students in the control class is higher than the average of the experimental class with the highest score obtained by the students of the control class of 97, greater than the value of the experimental class which is 90 and the lowest score in the control class is 25 with an average of 60.75 with a standard deviation of 24.26. Meanwhile, the lowest score in the experimental class was 43 with an average score of 60.35 and a standard deviation of 27.

Based on the final data test results in the form of cognitive learning results showing application of the learning start with a model questions with ICARE approach give positive influence on students cognitive learning outcomes. This can be seen in the postest score of the experimental class is higher than the postest score of the control class. (Susanto and Munoto, 2014). In addition to the analysis of post-test scores, the affective learning outcomes of the experimental and control classes were analyzed descriptively. Affective learning outcomes reflect attitudes during the learning process, which will later shape a person's character and demonstrate their skills (Qomari, 2008).

The affective aspect was assessed based on four aspects, and the affective criteria were divided into three categories: very good, sufficient, and lacking. Affective assessment was conducted three times. The first affective assessment in the experimental class showed that 5 out of 21 students received a "good" criterion, 11 out of 21 students received a "sufficient" criterion, and 5 out of 21 students received a "lacking" criterion. In the second affective assessment, 4 out of 21 students received a "good" criterion, 5 out of 21 students received a "sufficient" criterion, and 12 out of 21 students received a "lacking" criterion. In the third affective assessment, 4 out of 21 students received a "good" criterion, 9 out of 21 students received a "sufficient" criterion, and 10 out of 21 students received a "lacking" criterion.

This result is due to the learning process in the experimental class, which encourages students to take a more active role, especially in questioning, reading, group discussions, and solving various problems (Susatyo, et al., 2009).

Affective Learning Outcomes

The results of the analysis of the affective assessment of students at each meeting at the first meeting, the aspect of honesty in the experimental class became a significant difference when compared to other aspects. The experimental class obtained an average score of 89.5 and the control class with an average score of 45. In the category of assessing the effectiveness of the honesty aspect of the experimental class, there was a very significant difference compared to the control class. However, in terms of confidence, the control class outperformed the experimental class. In the second meeting, the aspects of honesty, discipline, and confidence in the control class became a significant difference when compared to other aspects. By obtaining an average score in the aspects of honesty 60, discipline 75, confidence 70. This is because the learning model used scientifically where students are used to the learning/familiar, students

tend to adapt easily and get better results, especially in the aspects that have been explained. The reason for the decrease in experimental classes is that students need time to adapt. At the first meeting, students were still motivated or enthusiastic about the new learning model. However, at the second meeting, the motivation of the students decreased. Another cause of the decline in the average affectivity of students is also due to the adaptation period that is not completely stable, causing students to begin to face challenges in adapting to the new learning model.

The control class score obtained a score of 75 in the discipline aspect. Meanwhile, the experimental class is only 68. Not only that, at the second meeting of the average scores of these four aspects, the control class was also higher than the experimental class. As for the analysis of the average score data, it was found that the control class had an average score of 65 while the average score in the experimental class was 60. From the data above, it can be seen that the confidence aspect of the experimental class is quite low, thus affecting the average score of the experimental class. Based on the explanation from the observer who stated that during the learning process, students are still hesitant to ask questions and prefer not to ask/be silent in the sense that students are less courageous in expressing their opinions.

In the third meeting, it can be seen that the discipline aspect of the control class is higher than the experimental class in the discipline aspect of the control class 2 meetings always outperform because it can be seen in the second and third meetings, this kind of thing has been shown starting from the second meeting because the students of the control class are very disciplined when working and collecting assignments are always on time. However, in terms of honesty, responsibility and confidence, they have not been able to achieve a better category than the experimental class. Likewise, the average score obtained at this third meeting, the control class only got an average score of 56.25 while the experimental class 62. Judging from the average score of all meetings in the observation of student activities in the experimental class 66, in the control class 58. So it can be concluded that the experimental class is better able to follow the aspects of student activities by using the ICARE learning model (Susatyo, et al., 2009).

CONCLUSION

Based on the results of data analysis and discussion that has been presented, it is concluded that the learning outcomes of students' physics on magnetic field materials by applying the ICARE Introduction, *Connection, Application, Refflecation, Extension* learning model in class XII IPA do not have a significant effect on the physics learning outcomes of students using a scientific approach. The physics learning outcomes of students in the experimental class were 61.63 and the control class was 60.35. The average score of students in the affective domain for the experimental class 66 and in the control class 58. For testing based on the hypothesis using the Mann-Whitney test using the SPSS program, the *Asymp.sig(2-taild) value was* obtained $0.573 > 0.05$, then the hypothesis H_1 was rejected and accepted. The conclusion of the hypothesis is that there is no significant influence of the application of the ICARE learning model on the physics learning outcomes of students in class XII IPA.

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