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THE EFFECT OF THE IMPLEMENTATION OF PROJECT BASED LEARNING LEARNING MODEL ON ELECTROLYTE AND NON ELECTROLYTE SOLUTION MATERIALS ON THE LEARNING OUTCOMES OF CLASS X MIPA SMA)

Herfirah Nella
Department of Chemistry, Padang State University, and Padang, Indonesia
Email: herfirahnella99@gmail.com

Abstract

The learning outcomes of class X students at SMA Negeri 1 X Koto Diatas in learning chemistry are still low. One of the methods used to improve student learning outcomes is to apply the Project Based learning model. This study aims to determine the effect of implementing the Project Based Learning model on electrolyte and non-electrolyte solution material on the learning outcomes of students in class X MIPA SMA. This quasi-experimental study used a non-equivalent control group design. The population of this study were all students of class X MIPA even semester of SMAN 1 X Koto Diatas. The sample was taken using a saturated sampling technique, so that class X MIPA 1 was chosen as the experimental class and class X MIPA 2 was the control class. Research data comes from one domain, namely cognitive. The assessment instrument is in the form of a learning outcome test. The data obtained were analyzed using the N-Gain Test, Normality Test, Homogeneity Test and t Test. The results of the study in the cognitive domain obtained that the experimental class average was higher than the control class with the t statistical test, obtained t_{count} = 1.73 and t_{table} = 0.25. Thus, it can be concluded that the learning outcomes of students in class X MIPA SMA Negeri 1 X Koto Diatas are affected by the application of the Project Based Learning model on electrolyte and non-electrolyte solution materials.

Keywords: *electrolyte, learning outcomes, project based learning.*

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INTRODUCTION

Fundamental activities always exist in the human journey cycle called learning. Along with the development of the world in the field of science and technology, the most important thing that must be done is learning because it demands knowledge of progress in thinking, is able to be highly competitive, has knowledge and innovation towards civilization. Learning can also bring up creative ideas when planning something, have good behaviour and be able to think critically. The government is always looking for ways to improve and plan the formation of creativity and an advanced society, can solve real problems and can create renewable technology so that they can compete with other communities and can improve previous technologies (Kristanti & Subiki, 2017).

The learning process cannot take place just like that, but must be supported by learning. Various exercises that are intended to help the learning system completed by students, taking into

account the internal events experienced by students with the role of external extreme events are called learning. In addition, there is an aspect of a teacher's job in imparting knowledge to students known as teaching. The interaction between learning and teaching is sometimes referred to as teaching, which means between student and teacher. The existence of teachers and students in the learning process will optimize student learning outcomes and achieve the desired goals (Nggili RA, 2016).

However, teaching will not be able to run alone without education. Education is a process that combines all aspects of knowledge transfer, value transformation and personality creation. In addition to the transfer of knowledge and competence, the emphasis on education rather than teaching is on building awareness and character of the individual or society. A country or nation can acquire, belief, culture, thought and religious knowledge to the next generation through this procedure, ensuring that the nation and state have a brighter future (Nurkholis, 2013).

According to P.H. Combs (1968), in education today there are still five core problems that occur. First, the abundant number of students who need education. Second, the scarcity of resources and funds. Third, the increase in the cost of education. Fourth, the interests and talents of students are not in accordance with learning outcomes. Fifth, the education system is caused by slow and inefficient teachers in managing the curriculum, less effective in choosing learning models and methods and teaching patterns (Fitri, 2021).

Problems caused by teachers are problems caused by slow and inefficient teachers in managing the curriculum. Low student learning outcomes are the effects of learning methods and models. The purpose of the learning process is to have an impact on student success in learning outcomes. Students are said to be successful in learning if a student is able to improve learning outcomes in accordance with the implementation of the curriculum at school (Yanuarti & Sobandi, 2016).

The meaning of the word "learning outcomes" refers to the level of mastery of students during the learning process so that it is expected to achieve the appropriate learning objectives. According to Sardiman and Rahardjo in (Mansur, 2015), learning outcomes are interactions of dominance that are agreed upon to evaluate student achievement. Individual characteristics such as maturity, intelligence, motivation and personal factors affect learning outcomes, as do elements of society such as instructors, families, and learning media. Learning outcomes must demonstrate improving conditions, therefore it is useful for (1) increasing knowledge, (2) increasing understanding, (3) improving skills, (4) having new views and (5) more appreciating something (Mansur, 2015).

Based on the results of interviews conducted with chemistry teachers at SMAN 1 X Koto Diatas regarding learning chemistry, information was obtained that student learning outcomes were still low. This is evidenced by the average daily test scores of X MIPA 1 and X MIPA 2 semester 1 students in 2021/2022 of 56% and 17.12% and the data is shown in the following table.

Table 1.
Daily Exam of Students Class X MIPA 1 and X MIPA 2 School Year 2021/2022 in Electrolyte and Non Electrolyte Solution Material

Daily Exam of X MIPA 1			Daily Exam of X MIPA 2		
Mark (Xi)	**F**	**F.X**	**Mark (Xi)**	**F**	**F.X**
Total	31	1736	Total	31	531
Average	56		Average	17.12903226	

Based on the description of the teacher in the field of chemistry, Mr. Ahmad Topan, S.Pd, he explained that the problem was that the teacher had not applied the correct learning model when providing learning materials, so that student learning outcomes were still low. The teacher has not linked chemistry learning with everyday chemical products. This causes students to be less enthusiastic in learning, less enthusiastic, less attentive to the teacher when they are talking and many students rarely ask about knowledge that has not been conveyed to them by the teacher.

The results of interviews conducted with chemistry teachers are in line with the results of interviews with 5 students of SMA Negeri 1 X Koto Diatas, there is information where students think that learning chemistry is a difficult learning activity. Chemistry is a subject that many students dislike. Students find it difficult to understand the subject matter because the teacher has not integrated chemistry into everyday life and rarely applied information related to the manufacture of products from chemical applications.

Chemistry is a scientific discipline in the form of scientific facts, hypotheses, principles and techniques (Syukri, 1999). As a result, in the implementation of learning there are main categories that must be covered such as products, methods and scientific attitudes. Because chemistry is abstract and complicated, students often have difficulty understanding it (Brady, 2009). These challenges can result in students having a poor understanding of various chemistry topics. One of the complex and abstract materials is electrolyte and non-electrolyte solutions (Wasonowati, 2014). Therefore, the way to solve the problem is the learning process and practice by applying Project Based Learning.

The learning process is based on a project, namely learning that focuses on students in carrying out a basic exploration of a problem. Students in a productive and collaborative way carry out exploration of learning with designs guided by quality, concrete and meaningful observation of problems and discussions. The syntax of Project Based Learning is: determining essential problems, designing designs, managing project, implementation plans, monitoring projects by teachers, checking projects and assessing knowledge when working on products (Grant, 2002).

Research on Project Based Learning was researched by (Muliaman, 2020) learning outcomes have increased significantly by 0.728. (Harnila, 2016), improved cognitive learning

outcomes and research (Aisyah, 2020) the implementation of chemistry learning increased student participation by 87.50% and student responses by 70.92%.

The purpose of this study was to determine the effect of implementing the Project Based Learning learning model on electrolyte and non-electrolyte solution materials on the learning outcomes of students in class X MIPA SMA.

METHOD

On electrolyte and non-electrolyte solution, this study was done at a SMA Negeri 1 X Koto Diatas. The non-equivalent control group design was employed in this study. Students in class X MIPA Semester 2 made up the study's population. This study's sample was acquired using a saturation sampling approach. Saturated sampling is a method of estimating the sample size when all members of the population are employed as test subjects (Hermawan, 2019). The experimental class, Class X MIPA 1, received project-based learning therapy, whereas the control class, Class X MIPA 2, received learning treatment using a scientific approach.

Two learning techniques, project-based learning and learning with a scientific perspective, are the independent variables in this study, while student learning results are the dependent variable. The test technique is used to collect data, and multiple choice questions are used. The purpose of the test is to assess the cognitive ability of the students. First, the empirical validity of multiple choice questions is determined (Latisma, 2011). This is done to ensure that the inquiries asked are legitimate (Sugiyono, 2015).

In the experimental class, project-based learning is used through assigning learning project assignments, such as the fabrication of electrolyte test equipment (Yulianto, 2016). LKPD and practical guideline were utilized in the control class. The N-Gain test, normalcy test, homogeneity test, and hypothesis testing were all employed in this study.

RESULT AND DISCUSSION

a. Results

Based on research, pre- and post-test data are utilized to measure student learning results. The data for the pre test and post test were gathered from the study findings, which are displayed in Tables 2 and 3.

Table 2.
Results Data of *Pretest* Experiment Class and Control Class

Experiment Class		Control Class	
Mark	**F**	**Mark**	**F**
6 -13	4	13 – 19	3
14 – 21	3	20 – 26	5
22 – 29	5	27 – 33	9
30 – 37	8	34 – 40	2
38 – 45	4	41 – 47	8

46 – 53	7	48 – 54	4
Total	31	Total	31
Average	32.32258065	Average	35.741935
Variance	152.8636837	Variance	149.0946
Standard Deviation	12.36380539	Standard Deviation	12.210433

Table 3.
Results Test *Posttest* Experiment Class and Control Class

Experiment Class		**Control Class**	
Mark	**F**	**Mark**	**F**
46 - 53	7	33 – 41	5
54 - 61	6	42 – 50	3
62 - 69	6	51 – 59	5
70 - 77	3	60 – 68	8
78 - 85	5	69 – 77	4
86 - 93	4	78 – 86	6
Total	31	Total	31
Average	66.74193548	Average	60.129032
Variance	88.72885452	Variance	103.39215
Standard Deviation	9.419599488	Standard Deviation	10.168193

The experimental class's average pre test result is 32.32, while the experimental class's average post test result is 66.74. Meanwhile, the control class's average pre test result was 35.74, while the control class's average post test result was 60.12.

The test was carried out by analyzing the data using the N-Gain test and hypothesis testing (t test) to see if the participants' cognitive learning outcomes in the study had improved following therapy (Sugiyono, 2015). There were a total of 20 questions that were scientifically validated. There are 15 valid questions after completing empirical validity.

Table 4.
Percentage Results of N-Gain Score from Experiment Class

N-Gain Rendah (%)	**N-Gain Sedang (%)**	**N-Gain Tinggi (%)**
13	64	23

Table 4 demonstrates that the percent N-Gain score for the experimental class for the low classification can reach 13 percent, the medium classification can reach 64 percent, and the high classification can reach 23 percent based on the N-Gain score level.

Table 5.
Percentage Results of N-Gain Score from Control Class

N-Gain Rendah (%)	N-Gain Sedang (%)	N-Gain Tinggi (%)
51	39	10

According to Table 5, the N-Gain score level for the experimental class is 51 percent in the low classification, 39 percent in the medium classification, and 10% in the high classification.

Given the typical N-Gain scores, it's reasonable to believe that the experimental class's learning outcomes have improved. The proportion of students in the experimental class who had high N-Gain scores (23 percent) was negatively related to the number of students in the control class who received high N-Gain scores (10 percent).

Hypothesis testing is utilized to generate answers to these hypotheses in this review. Prior to data analysis, the hypothesis was tested (t test). The normality and homogeneity tests are crucial to ensure that the data utilized is suitable. The normalcy test is a data test that ensures that information from each class under consideration has a consistent population (Sahab, 2018). Pre test and post test data for the experimental class, as well as pre test and post test data for the control class.

The data to be utilized can be t-tested if it is distributed regularly and homogeneously. The normality test revealed that |FT-FS| was derived from the experimental class's pre test value of 0.1021374 and the control class's pre test value of 0.150562, and the normality test revealed that the experimental class's and control class's post test scores were 0.0826 and 0.0816, respectively. If |FT-FS| has the smallest value from the Kolmogorov Smirnov table value, Ho is approved and Ha is denied as a consequence of the decision-making criterion. And they came to the conclusion that the data in the sample was regularly distributed.

The homogeneity test was performed using Levenestatistic or the F test utilizing the Test of Homogeneity of Variances; the experimental class's F_{count} was 1.01256, whereas the control class's was 1.129534. Because the resultant number is less than F_{table}, the decision-making criteria indicate that Ho is authorized and Ha is refused. The homogeneity test determined that the data collected from the population was homogenous (Iskandar, 2021).

The data were distributed normally and homogeneously, according to the results of the normality and homogeneity tests(20). As a result, the t-test may be used to evaluate the hypothesis. When compared to a significant level = 0.05 and a df value = (31+31-2) = 60, the value of the data distribution table t is obtained at $t_{(0.05)(60)} = 0.25$, thus the value of t_{count} is smaller than t_{table}, namely $-1.077 < 0.25$, which means Ho is accepted and Ha is rejected. On electrolyte and non-electrolyte

solutions material, the data found no significant difference in student learning outcomes between class X MIPA 1 using the Project Based Learning model and class X MIPA 2 using the Project Based Learning model.

Meanwhile, when the t-test data for the experimental and control classes were processed, it was discovered that t_{count} = 1.73, which when compared to the t-table value of the two samples at a significant level = 0.05 and the value of df = (31+31-2) = 60, the obtained value of the t table distribution is $t_{(0.05)(60)}$ = 0.25, because t_{count} is greater than t_{table}, namely 1.73 > 0.25, means that Ho on electrolyte and non-electrolyte solution materials, between class X MIPA 1 using the Project Based Learning model and class X MIPA 2 not utilizing the Project Based Learning model.

CONCLUSION

Based on the study and data analysis, it can be determined that: t test achieved 1.73 > 0.25 based on the criteria tcount > ttable, therefore Ho is rejected, which shows that the Project Based Learning Model has an impact on the learning outcomes of class X MIPA students at SMA Negeri 1 X Koto Diatas. Electrolyte and non-electrolyte solution materials are being studied. The learning results of students who use the Project Based Learning model are higher than those of students who do not utilize the Project Based Learning model, indicating this.

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