



Analysis of Student Concept Mastery Using the Project Based Learning Model Seen from Parents' Work

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Abstract: The research that has been carried out aims to determine the influence of parents' work on students' mastery of concepts after being given the Project Based Learning (PjBL) learning model. The research method used was quantitative descriptive with the research population being all students of class XII MIPA at SMA 13 Bungo with a sample of 33 people selected using purposive sampling techniques. Data collection was carried out using an essay test, where the average student test score was 72.61 with the lowest score being 44 and the highest being 92 indicating a normal distribution. The t test was carried out on students' daily test scores, with t_{count} of -1.357 and t_{table} of 1.693 at a significance level of 0.05. $t_{\text{count}} < t_{\text{table}}$ (-1.357 < 1.693), so the test hypothesis H_0 is accepted, and H_a is rejected. The research results show that there is no significant influence of the PjBL model on student learning outcomes in parental work, especially in Dynamic Electricity material.

INTRODUCTION

Physics is knowledge in the form of scientific studies that originate from the phenomena of the universe. Physics is defined as a collection of knowledge about natural objects and phenomena obtained as a result of scientists' reflection and research carried out with experimental skills using scientific methods (Kim et al., 2018; Stathopoulou & Vosniadou, 2007). Physics knowledge can be derived from knowledge based on observation and classification of data and is often organized and verified according to quantitative laws, which include the application of data analysis and mathematical reasoning about natural phenomena. Thus, physics is essentially the science of natural phenomena expressed in the form of events, concepts, principles and laws whose authenticity has been proven and through a series of testing activities using scientific methods (Lin et al., 2019; Tippett, 2018). In studying physics, there is some material that is quite interesting to study but has a high level of difficulty such as dynamic electricity.

The physics learning process, especially dynamic electrical materials, aims to direct students to be able to grow and develop into complete and perfect individuals by providing support with good education such as a learning model and a good place to study. To

develop students' abilities to easily absorb various types of knowledge, it is necessary to have a learning process that is carried out as well and maximally as possible in the educational process (Sarsengeldin et al., 2013; Wei et al., 2021) and of course, there is the role of parents who are used to choose the best place for their child's education. Appropriate education makes a big contribution to the progress of a nation, therefore it must be correct and in accordance with the wishes and interests of students and the school and home, in this case, have a significant role (Basham et al., 2010; Mozaffari et al., 2020). Child development can take place in various places, both at school and at home (Dawson & Venville, 2010; Junaedi, 2014).

The learning paradigm views the family as the most minor social institution capable of influencing learning outcomes. However, there is also much information about children from disadvantaged groups with extraordinary achievements and vice versa. The family is determined to improve their child's quality from childhood (Eagles & Demare, 1999; Syehan et al., 2023). Education in the family environment is standard (without any special conditioning); this is called non-formal education, which takes place in the family environment. Education in the family environment is the basis for forming children's attitudes and personalities. Education in the family can be called non-formal education because it is obtained from daily experience, whether we realize it or not, and activities are carried out without strict organization, and there is no schedule (Amanul Ardhiyah, 2019; Arief et al., 2021). Parents are responsible for their children's education. Wherever a child goes to school, whether in formal, informal or non-formal institutions, the role of parents in determining their child's educational future is significant. Parents' active role in learning at home will influence children's academic achievement. Achieving output standards that align with values greatly determines a child's success in school. Therefore, a child's good attitudes and behaviour can be a source of pride for himself and his parents and become a plan for the future to achieve the child's desired goals.

Understanding a physics concept is an individual student process that leads to mastery of knowledge, skills, and attitudes through a skills process. It is organized in order to form progressive and adaptive behaviour. The purpose of the test is to obtain indicators of student success. From the definition above, it can be concluded that Learning Outcomes are learning outcomes achieved by students while carrying out teaching and learning activities through changes and formation of actions according to student demands. To guarantee that a learning process can be successful, each teacher has his own method for his philosophy (Amanul Ardhiyah, 2019; Arief et al., 2021; Carli & Pantano, 2023). However, to equalize awareness, we should be guided on improving the existing curriculum moment, including that process of related teaching with material learning that is stated to succeed if objective learning can be achieved. For achieved or not objective learning of certain things, teachers should do a formative inspection every time they deliver a discussion with the student.

Learning process to 2013 curriculum is underway in accordance with the scientific method. Subjects high school physics set in 2013 curriculum with objective learning according to scientific method, esp. practice student solve the problem in a systematic way And reach results Study high practice (Oviana, 2013). The objective implementation of the

program in 2013 is to form Skills And personality students form a synthesis of knowledge, skills And can attitude showed student in form understanding to the concepts studied in context alone. Because that's the achieved goal when student faced on the learning process which includes cognitive processes in problems solution and in the process of discovering new knowledge (Sullivan & Freishtat, 2013).

The initial research process or observations by researchers on students at SMAN 13 Bungo for the 2023/2024 academic year revealed that the learning process carried out by teachers used group learning methods, discussions and presentations. Then, students learn activities to master physics concepts, and they are less active in the learning process because teachers still use the project learning model. Judging from the project-making activities, students are very active because students like practical learning or creating work, and if we look at the work of the students's parents, most of them are rubber farmers with an average monthly income of IDR 1,500,000.00. The reason is that the location of SMAN 13 Bungo is a village surrounded by rubber plantations. Physics is compulsory and a specialization subject according to the adopted curriculum. This subject is designed so that students can improve their understanding of physics through material that has been adapted to the curriculum and so that students can apply it in everyday life. The results of learning this physics subject are that students can master the concepts of physics material, analyze problems in physics material, identify and analyze the concept of project-based learning models, and apply the way PjBL works.

Project Based Learning (PjBL) is a teaching and learning strategy that emphasizes an educational approach that is student-centered, direct practice, and inquiry-based (Erlinawati, 2020; Santhosh et al., 2023; Sinaga et al., 2023). In project-based Learning, students are involved in additional projects or assignments that aim to address real-world problems or challenges (Lin et al., 2019; Misbah et al., 2024; Putri & Dwikoranto, 2022) . These projects are designed to foster a deeper understanding of concepts, develop critical thinking skills, and encourage collaboration between students (Santhosh et al., 2023) . Therefore, the level of success of PjBL will vary depending on its implementation in each learning context. These indicators can help in evaluating the extent to which PjBL has been successfully implemented and provided significant benefits for students. *Project Based Learning* (PjBL) is a learning approach that emphasizes practical experience and collaborastive projects.

In the learning process using the project-based learning model, students will have many advantages where they will have conceptual relevance where projects can be designed to reflect real-world situations, increasing the relevance and understanding of physics concepts. In implementing the learning process, active involvement will be created which can encourage students' active participation in exploring ideas, conducting experiments, and solving physics problems (Fernandez, 2017). Learning using PjBL will help students develop collaboration and communication skills through teamwork in completing physics projects. The ability to work together will increase students' interest and Intrinsic Motivation tends to grow better because the project provides an interesting and relevant context for learning physics (Dargaud et al., 2010). The researcher in this study believes that no one has specifically reviewed the subject where the researcher

conducted the research so that it helps students develop skills such as problem-solving, creativity and critical thinking that are needed in understanding physics material, especially dynamic electricity, so that students can find it easier to understand and at the same time increase students' interest and motivation in learning (Hariyanto et al., 2016; Rozal et al., 2021).

METHOD

The research that the researchers have conducted aims to determine the effect of student's mastery of concepts based on their parents' jobs with the limitations of their parents' jobs as farmers and State Civil Apparatus in physics learning, especially in Dynamic Electricity material, by using or being given a learning model that the researchers believe it can be implemented and is appropriate to overcome the lack of student activity, namely the project-based learning model (PjBL). This research uses a quantitative descriptive approach. Quantitative descriptive research is research that measures a variable that is considered to contribute to making a change in the results of students' actions or treatment (Creswell, 2012). Observed variables that are believed to play a role in influencing student learning outcomes will be measured and observed. In this research, teacher variables, namely in determining the learning model used, and student variables, namely student employment and income, are used. The objective of quantitative research that researchers hope for is to find the actual results; a description process will then be carried out, followed by comparing or analyzing patterns to see whether there is a significant relationship.

The population of this research was all students of class XII MIPA SMA 13 Bungo. This research population is considered to be very appropriate in representing students' understanding, especially in areas outside the capital of Jambi province, and researchers believe it can become a system that can be generalized to other areas, especially in physics learning. The population that researchers took as research subjects is diverse, where children have the same abilities and average understanding of physics subjects, especially dynamic electricity. The sample in this study was taken using a purposive sampling technique. The purposive sampling technique is a sampling technique based on certain criteria or considerations, where the researcher considers students who have the same abilities and are taught by the same teacher, and then the researcher also considers the initial learning implementation time. The sample in this research was class XII MIPA, totaling 33 people.

The instrument used to collect data was a test instrument in the form of essay questions on mastery of the concept of dynamic electrical material. Questions are given to obtain student answers. These answers will be calculated and analyzed according to indicators, which can then be used to carefully determine students' mastery of concepts. Then, a conclusion will be made on whether the PjBL model and parental employment variables have a significant relationship or not. The assessment will be carried out professionally using predetermined rules and measuring tools. All students will get the same proportions and assessments and all external variables. The assessments carried out

will be adjusted to the indicators and learning activities carried out, especially on project implementation that receives the most attention.

RESULT AND DISCUSSION

This research provides some information about the role of PjBL and also the work of parents in influencing student learning outcomes. In this research, the researcher at the initial stage created an appropriate learning process plan and produced a form of learning implementation that was in accordance with the PjBL learning model. The preparation of learning carefully and in accordance with the learning model was carried out as an effort to focus the research results of researchers (Bertrand & Namukasa, 2020; Sari et al., 2022) in implementing it using the actual PjBL model or with project-based learning syntax in physics learning, especially in Electrical Dynamics material which in this research follows the 2013 Curriculum syllabus with the eyes of the Subject teacher Physics at SMAN 13 Bungo is still applied at this school. Making a learning process plan. The learning implementation process will be carried out and adapted to the teacher's ability to shape learning from the results of the agreements and plans that have been made. The agreed learning components will be immediately implemented according to the plans that have been prepared, then each implementation will be monitored and evaluated before entering another learning stage.

The research process begins with the process of conditioning the project-based learning model by testing the material before the dynamic electricity material and also providing students with an understanding of the syntax they are learning so that during the research process, the students understand the PjBL syntax provided. This research will be preceded by providing an overview to students where students are introduced to the syntax and principles of learning models, which are then continued with Electrical Dynamics material. Conditioning wants to see how students' initial understanding really is and, at the same time, introduce students to the model that is being taught. At the beginning of implementation, students felt confused about the syntax applied, but in the middle of learning, students began to understand the Pjbl learning model, as seen in Figure 1.



Figure 1. Application syntax PjBL

Introduction to activities including orientation classes to increase learning motivation and provide apperception to students, all of which are carried out to carry out the understanding process later in actual research on dynamic fluid material. Providing initial skills or trials will have a large and significant impact on student's abilities in the learning process that they will carry out. In research after the conditioning process, students are expected to be able to recall the relationship between the previous material and the Electrical Dynamics material and convey the objectives of the Electrical Dynamics material in order to achieve the designed learning process plan. The sub-material is about Electric Current and the measurement part. Students pay attention to it carefully and are well-studied by the teacher. The understanding process has two directions in general, namely, students get material from the results of the presentation given by the teacher and there is also a part that is absorbed by themselves from the results of connections or observations of the environment or natural surroundings (Liaw & Huang, 2013; Torres, 2011).

The more students interact and connect some of the knowledge they have, the more abilities students will gain to complete the knowledge they are studying so that it can be used to improve the quality of their understanding (Goodhew et al., 2019; Wells et al., 2019). This research process will be initiated by the teacher to identify significant projects which will be studied by students, where students are asked to identify projects and then students plan and design projects to design projects in parallel, series and mixed series. Students in PjBL learning will be divided into 5 groups which have been arranged in a heterogeneous manner. The group will carry out its role in accordance with the teacher's instructions, and at the next meeting will prepare the tools to carry out project-based learning (PjBL).

The PjBL learning process is carried out using dynamic electrical material by having students bring tools and materials agreed upon at the beginning of the meeting. The tools and materials for carrying out PjBL learning are carried out by a student design process based on groups that have been divided into sections where all the equipment is designed together with each group by the 4th stage of investigation and problem-solving ((Investigation and Problem-Solving) in the PjBL model. This design process is used To help students understand the context and find creative solutions to the problems they face (Docktor et al., 2015; Weaver et al., 2018). When students bring learning equipment, the aim is to provide students with a direct understanding of the dynamic electricity material being taught, then proceed with the fifth step, namely Project Implementation, where students, from The knowledge, possessed and the equipment used, can apply knowledge and skills in the context of project creation.

In making projects, students are required to use learning steps from the beginning or basic concepts so that the material used can strengthen the students' practice. Sometimes in implementation students tend to be able to, but in theory many do not understand well, this incident can sometimes affect students' maximum understanding so that students when carrying out projects because of other things experience problems in mastering concepts that are not yet good. Mastery of concepts and application (practice) must have a close relationship so that the material can be understood by students well and maximally. One

of the student learning outcomes in this research can be seen from how students carry out the assigned projects well and correctly. The student activities carried out in the project application can be seen in Figure 2.



Figure 2. Project creation

The research in Figure 2 clearly shows how student enjoyment is carried out through the PjBL learning model. This process is in accordance with the sixth syntax of the project-based learning model, namely Presentation and Evaluation. This process can provide encouragement to students in learning activities and contribute more in understanding or implementing the learning process so that it can indirectly increase students' interest and motivation to learn to be more measurable and increase (Sergis et al., 2018; Y. Zheng et al., 2024). Students are then allowed to carry out the presentation process by giving students the opportunity to share the results of their work as shown in Figure 3.



Figure 3. Presentation by student

Figure 3 clearly shows how students are able and successful in carrying out the dynamic electrical material project given. The students seemed enthusiastic in presenting and the teacher provided an evaluation of the students' work. students' abilities provide an illustration that students' psychomotor skills have increased and this is accompanied by an increase in the quality of students' learning (Kusumaningrum, 2018; Prihatiningtyas et al., 2013). Then the researcher tried to analyze other variables which the researcher believed were able to influence student learning outcomes, namely parental occupation, where the data that had been collected showed that as many as 30 students whose parents'

occupation were farmers and as many as 3 students whose parents' occupation were civil servants. The researcher believes that the amount of student work that is not the same can affect the validity of the research results, but the researcher tried as hard as possible to explain the findings that have been obtained and adjust them to the results of the student learning tests. The results of the concept mastery test for students whose parents work as entrepreneurs can be seen in Table 1.

Table 1. Parents ' job

Type of work	Number of Students
Farmer	30
Civil Servants	3

Table 1 of the research results process shows how there are 2 parts or differences in the jobs of the student's parents, where there are 28 students whose parents are farmers and 2 students whose parents are civil servants. The amount of parental work that is not spread evenly is a deficiency in the research conducted and of course, the data is still very lacking, especially in carrying out the comparison process, but researchers are trying to provide a more comprehensive picture of the impact that will have on student learning outcomes. All the data observed only tries to explain in real terms the images obtained by students and how the variables are related. The student learning test results can be seen in Table 2.

Table 2. Student Daily Test Score Data

N	Min Value	Max Value	Average	Standard Deviation
33	44	92	72,61	10, 13

Based on table 2 with student totaling 33, it can be seen that the average student test score is 72.61 with the lowest test score being 44, and the highest score being 92. In this way, the average daily test score for students can be said to be sufficient. It can be said that students are quite good at understanding the *project-based learning model*. However, efforts are needed to improve the quality of the learning process, because student test scores are still very low. Researchers believe that the students' medium scores may be because the learning model is still very new, and learning is still carried out in a style that tends not to run optimally and according to plan. However, efforts are needed to improve the quality of the learning process, because student test scores are still in the quite good category, and still need to be optimized further. Researchers believe that the students' low scores may be because the learning model is still very new, and learning is still carried out in a style that tends not to run optimally and according to plan.

In the learning process, teachers often use learning models that make students less active in learning. Teachers should use learning models that can encourage students to be more active in learning so that learning takes place more effectively. *Project-based learning* is a learning model that guides students to discover their knowledge through discussion activities in groups, and testing so that students understand better understanding concepts in learning. By using this learning model, you can measure student learning outcomes in dynamic electricity material.

Testing Prerequisites for Analysis

In this study, a normality test was carried out to ensure whether the data obtained had a normal distribution or not. The normality test in this study used the Shapiro-Wilk descriptive statistics method with the help of IBM SPSS Statistics 22, with a significance level of 5% or $\alpha = 0.05$. The results of the normality test in this study are recorded in the following Table 3:

Table 3. Normality Test Results

	Kolmogorov-Smirnov ³			Shapiro-Wilk		
	Statistics	df	Sig.	Statistics	df	Sig.
Student Test Scores	.122	33	.200	.974	33	.106

From Table 3, it can be seen that the significance value in the student test score data is 0.106, which indicates that this value is greater than the significance value $\alpha = 0.05$. Therefore, it can be concluded that the student test score data has a normal distribution. Meanwhile, for the homogeneity test, researchers have also tested it with the Bartlett test, where the data are also homogeneous so that the data can be continued with the t test to see the comparison of students based on learning outcome variables and parental employment.

Hypothesis testing

Hypothesis This is tested to mark test daily students. Based on precondition data analysis, known that the result data test daily student own normal distribution. Because of that, test it hypothesis can done with use independent t-test or sample t-test free. Results calculation mark test daily student with use t-test has been served in table 4:

Table 4. T Test Results Student Test Scores

T count	T table $\alpha = 0.05$
-1,357	1,693

From Table 4, a t-test was carried out on students' daily test scores, with a calculated t value of -1.357 and a t table of 1.693 at a significance level of 0.05. Thus $t_{\text{count}} < t_{\text{table}}$ ($-1.357 < 1.693$), so the null hypothesis (H_0) is accepted, and the alternative hypothesis (H_a) is rejected. Based on the research results, there is no significant influence of the PjBL model on student learning outcomes in physics and dynamic electricity learning from the perspective of parents' work. Basically, the Project-based learning model helps students work in groups where students actively develop their abilities in gathering information, managing and concluding the material being taught.

In group collaboration, students interact from different backgrounds and have different ways of thinking to solve problems together, so that it can increase students' learning motivation at school and ultimately influence their academic achievement. The insignificance of the data between student learning outcomes and their parents' occupation

may also be due to the amount or distribution of parental data not being the same, where students whose parents' backgrounds are farmers dominate too much so that the data cannot show the true value. The difference in the number of parental employment variables can influence the influence of the analysis of the hypothesis obtained, but the researcher tries to present real data, that seen from student learning outcomes, the teacher's role will be the most dominant and if it is done well and with the right learning model such as the PjBL model. So, differences in parents' jobs will have a small impact on student learning outcomes in class, where students' grades will be greatly pushed or experience changes according to the model taught by the teacher as if.

In this research, several interesting facts were also found where students used the knowledge they had to solve problems, and they accepted the answers given by the group or class as a whole after the teacher introduced the PjBL learning model, so that students' enthusiasm which was previously not good could be maximized. Each student has different knowledge, so the knowledge they gain will also vary on certain topics (Cremers et al., 2014; McCombs, 1988). However, if the teacher uses the right learning model, the differences that exist in students caused by external factors, namely outside the classroom environment, can be minimized by being serious about the teacher in the learning process, one of which is applying the right learning model (Shaw, 2014; Yazan & De Vasconcelos, 2016). The right learning model will be the best solution and solve student problems. The teacher's ability in the learning process is one of the crucial aspects in improving student learning outcomes. The right learning model can help improve student academic achievement so that all student variables outside the classroom environment can be minimized.

CONCLUSION

From the research that has been carried out, looking at the data obtained and from the discussion that the researcher has stated above where after carrying out a t-test on students' daily test scores in terms of the parent's employment variable, values and information were obtained with a calculated t-value of -1.357 and t table amounting to 1.693 at a significance level of 0.05. Thus $t_{count} < t_{table}$ (-1.357 < 1.693), so the null hypothesis (H_0) is accepted, and the alternative hypothesis (H_a) is rejected. Based on the findings of this research, it can be concluded that there is no significant influence of the PjBL model on student learning outcomes in dynamic physics and electricity learning in terms of parents' work. Of course, this difference must be explored further by other researchers by considering the number of parents' jobs compared to the number of students, where the researcher suggests that other researchers review it more widely with more data and suggest a more proportional distribution of data for the parent variable. Researchers also hope that the implementation of the PjBL model can continue to be observed and implemented from the perspective of other variables.

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