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Project-Based Learning (PjBL) Learning Model on Motivation and Biology Learning Outcomes

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Abstract: This study aimed to determine whether the Project-Based Learning (PjBL) learning model influenced the motivation and learning outcomes of class XI IPA students at SMA Negeri 1 Kediri. The Nonrandomized Control Group Design quasi-experimental method was used in this study with a quantitative approach. The population in the survey was class XI IPA at SMA Negeri 1 Kediri, and the purposive sampling was not random, so it obtained class MS1 as the experimental class and class MS2 as the control class. The instruments used were questionnaires and multiple-choice test questions. The data obtained were analysed using ancova at a significant level of 5% using the SPSS 25 program. The hypothesis test results in this study showed an influence of the PjBL model on learning motivation and learning outcomes of class XI IPA students at SMAN 1 Kediri with a significance of 0.000 <0.05. The corrected average learning motivation in the experimental class was 162.077, higher than the control class, 139.423. In contrast, the corrected average learning outcomes in the experimental class were 72.193 higher than in the control class, 48.522. Applying the PjBL learning model, students can develop critical thinking skills, creativity and collaboration through project-based assignments that involve active interaction with learning material.

Keywords: Learning Motivation; Learning Outcomes; Project-Based Learning (PjBL).

Introduction

Biology is a branch of natural science that observes and analyses life in terms of microscopic structure and function and their development and growth [1]. It has a vast scope. Biology does not only focus on living things; it also studies the interactions that occur between organisms and their surrounding environment. This aspect brings a deep understanding of how living things can adapt, compete, and become dependent on their environment [2].

Therefore, students are expected to have learning motivation when studying biology. With learning motivation, students will be more diligent, persistent and enthusiastic about participating in learning activities. According to Setiawan [3], motivation is essential in the learning process, as it encourages students to take action that leads to achieving the desired goals.

Learning motivation plays a vital role in education because it has an extraordinary ability to maintain enthusiasm for learning [4]. This impacts involvement, personal satisfaction, and a happy soul. This enthusiasm creates a chain effect, where students who feel motivated to learn have an abundant energy source [5]. This energy motivates them to face the learning material and tasks enthusiastically and actively. Motivation is not just encouragement but a strong foundation that has a real impact on shaping student achievement and learning outcomes.

This ARCS motivation model was discovered and published by Keller (1987). ARCS stands for Attention, Relevance, Confidence, and Satisfaction and is divided into four categories that represent various motivational characteristics in each individual. According to Jamil [6], the basic model for designing ARCS learning motivation is an analysis of student motivation problems based on subjects, in which four categories are strategies in designing ARCS motivation, namely: (1) Student interest/attention to subjects in building curiosity and ongoing attention, (2) Relevance/relationship to connect subjects with the motives and interests needed by students from the learning, (3) Student expectations from the subject in building self-confidence with motivation for success, (4) Student satisfaction from the learning process in the subject to manage intrinsic and extrinsic reinforcement. The more motivated a person is, the better the learning outcomes.

Student learning outcomes are achievements in an academic context. This achievement is built through various components, including exam results and assignments completed, as well as direct interaction in question-and-answer sessions that build interactive learning. This achievement is not just about numbers or grades; it shows student mastery of the subject matter [7]. Learning outcomes are evaluations given to students as a form of their participation in the learning process. This evaluation includes assessing students' knowledge, attitudes and skills, ultimately resulting in changes in their behaviour and responses to learning [8].

Significant increases in learning outcomes can occur when the quality of learning is improved. Factors such as increased interest in a field can build student enthusiasm, encouraging them to put in the extra time, money and effort to deepen the subject matter they are

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interested in [9]. Internal and external factors influence student learning outcomes. Internal factors include an individual's physical and psychological conditions, such as intelligence, talent, interests, motivation and cognitive abilities. Meanwhile, external factors include environmental and instrumental aspects, such as curriculum, learning programs, facilities and quality of education [10].

Based on interviews conducted regarding biology subjects at SMAN 1 Kediri, it was seen that most students showed less participation in biology learning, while some students were active. The observation also indicates that student involvement in biology learning is related to the motivation to ask, answer, and think critically. More active students tend to be highly motivated to study biology, which can positively affect their learning outcomes. On the other hand, less active students may need additional motivational encouragement to increase their participation and maximise their learning potential in biology subjects.

To improve students' motivation and biology learning outcomes, a learning model must be used to build student motivation to obtain satisfactory learning outcomes. One way is to implement a project-based learning model. The Project Based Learning (PjBL) learning model is a learning approach where students are actively involved in creating a project. This concept prioritises the development of problem-solving skills through project implementation, which can produce natural products or results [11]. Project-based learning (PBL) focuses on the centrality of students in developing understanding. This method encourages students to formulate questions that direct their learning process. Through active inquiry, constructivism is applied by providing opportunities for students to construct knowledge through direct experience. Autonomy is given to students to take responsibility for their learning, while interaction with the natural world is significantly integrated into the learning process [12].

In the PjBL learning strategy, a learning process is needed to observe a series of steps carried out during learning, including the project's preparation, planning, and implementation stages. The initial stage involves preparing relevant materials and resources, while planning includes preparing structured learning steps. Students are actively involved in the project at the implementation stage, developing their skills and knowledge. Afterward, students present the results of their projects to the group or class, allowing for the exchange of ideas and feedback. A comprehensive evaluation is carried out to assess the achievement of learning objectives, ensuring that every aspect planned in the learning process has been achieved [13]. To improve students' motivation and learning outcomes, teachers use more exciting and natural learning methods for them, present materials in a way that is not boring, provide good feedback to students about their performance, provide direction to students to work together and communicate, provide a variety of learning resources so that each student can understand the material better according to their learning style, utilize technology in learning to make it more interactive and flexible, and appreciate student achievements so that they continue to be motivated to learn and achieve better results.

Based on the results of the study entitled "Implementation of the PjBL Learning Model on the Motivation and Biology Learning Outcomes of Students at Unggul State Senior High School in East Aceh," it is known that the PjBL learning model has a significant effect on student motivation and learning outcomes which can form a strong foundation for the development of student's cognitive and affective abilities [14]. The PjBL learning model can train high-level thinking skills by encouraging motivation in students [15]. PjBL learning model prioritises active student participation in searching for and finding information optimally [16]. Through the experience of doing, seeing, and solving problems, students can remember up to 90% of the learning material.

This study aimed to determine the effect of the Project-Based Learning (PjBL) learning model on the motivation and learning outcomes of class XI IPA students at SMAN 1 Kediri.

Research methods

This type of research is a quantitative quasi-experimental study, which is an experiment that places the smallest unit of the experiment into an experimental and control group that is carried out non-randomly [17]. The design used in this study is a non-randomized control group design, which is presented in Table 1.

Table 1. Research Design Nonrandomized Control Group Design

Class	Pretest	Treatment	Posttest
Experiment	O_1	X	O_2
Control	O_3	-	O_4

Information:
O1 = Pretest experimental class
O2 = Posttest of experimental class
O3 = Pretest control class
O4 = Posttest control class
X = Treatment

The population used in this study was all students of class XI IPA at SMA Negeri 1 Kediri, namely class MS1 (science interest 1) and MS2 (science interest 2), with 56 students. Distributed in each class 28 students. The sample of this study is saturated; the classes used as samples are considered equivalent because both classes have been tested for their equivalence. Class MS1 was used as an experimental class with the PjBL learning model, while class MS2 was used as a control class with the conventional learning model.

This study's data collection technique involved observing learning activities using observation sheets and the ARCS questionnaire instrument to assess learning motivation. Learning outcomes were measured using multiple-choice question instruments tested by experts and field tests. The data obtained were analyzed using descriptive and inferential statistics. Descriptive statistics include calculating the average and changes in pretest and posttest scores.

Inferential statistics using covariance analysis (Anacova) to test the hypothesis. This analysis will be assisted by *SPSS 25.0 for Windows* software, with a significance level of 0.05. Before conducting data analysis using covariance analysis (Anacova), the data must first meet the prerequisites for covariance analysis (Anacova), which include standard data, homogeneous data, and linear t *pretest-posttest data*, so that prerequisite tests are carried out, including normality tests using the *Shapiro Wilk test*, because the sample used has less than 50 students. The homogeneity test uses *Levene's Test of Homogeneity Variances*. To analyze the homogeneity of variance involving two or more groups. It is said to be homogeneous when the data used has a significance value > 0.05, and the linearity test uses *Variance Analysis* to determine whether or not there is a linear relationship between the dependent and independent variables [18].

Results and Discussion

Learning Motivation Data Description

Learning motivation in this study used the ARCS questionnaire. Hence, the resulting data included *pretest attention data* for the experimental class, which obtained 3.45, higher than the control class, 3.41. In contrast, *posttest attention data* for the experimental class obtained 4.47, higher than the control class, 3.81. *Pretest relevance data* for the experimental class obtained 3.50 higher than the control class of 3.37, while *posttest relevance data* for the experimental class obtained 4.5 higher than the control class of 3.84. *Pretest confidence data* for the experimental class obtained 3.59 higher than the control class of 3.53, while *posttest confidence data* for the experimental class obtained 4.55 higher than the control class of 3.88. *Pretest satisfaction data* for the control class obtained 3.81 higher than the experimental class of 3.53, while *posttest satisfaction* data for the experimental class obtained 4.50 higher than the control class of 3.97. The average learning motivation score is presented in Table 2.

Table 2. Learning Motivation Data

	Motivational Aspects	Experiment		Control	
		Score	Criteria	Score	Criteria
Pretest	Attention	3.45	Enough	3.41	Enough
	Relevance	3.50	Enough	3.37	Enough
	Confidence	3.59	Good	3.53	Good
	Satisfaction	3.58	Good	3.81	Good
Average		3.53	Good	3.53	Good
Posttest	Attention	4.47	Good	3.81	Good
	Relevance	4.5	Good	3.84	Good
	Confidence	4.55	Very well	3.88	Good
	Satisfaction	4.50	Good	3.97	Good
Average		4.50	Good	3.88	Good

The average value of all pretest data of learning motivation of both control and experimental classes was 3.53. In contrast, the experimental class's average value of all posttest data of learning motivation was 4.50, higher than the control class's 3.88. Figure 1 summarises the learning motivation results data.

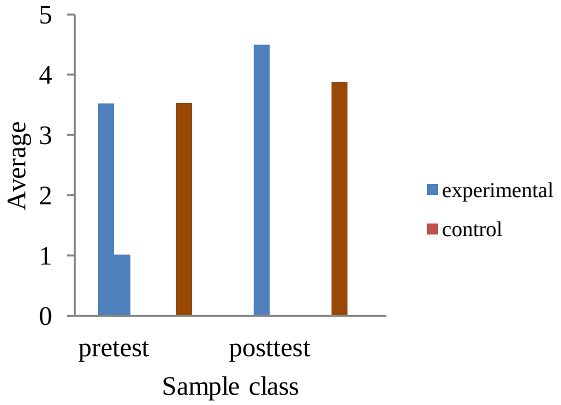

Figure 1. Average Learning Motivation

Learning Outcome Data Description

The pretest learning outcome data obtained was 65, the lowest was 5, the highest posttest learning outcome data obtained was 80, and the lowest was 25. The average value of the pretest learning outcome data for the control class was 29.46, higher than the experimental class of 23.39. In contrast, the experimental class's average post-test learning outcome data was 70.35, higher than the control class's 50.35, while the summary of the learning outcome data is presented in Figure 2.

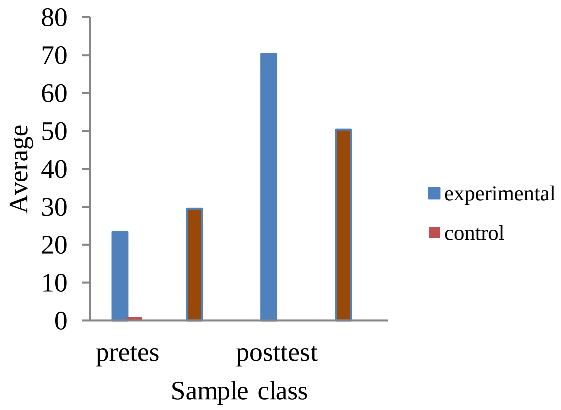

Figure 2. Average Learning Outcome

Testing and Hypothesis Testing of Research Data

Normality Test

Normality test of learning motivation and learning outcomes data using Shapiro Wilk. Table 3 summarises the results of the normality test of learning motivation data.

Table 3. Summary of Results of Normality Test of Learning Motivation Data

	Class	Shapiro Wilk		
		Statistics	Df	Sig.
Motivation to learn	Experiment pretest	.875	28	.060
	Pretest control	.980	28	.846
	Posttest experiment	.956	28	.274
	Posttest kontrol	.978	28	.811

Table 4. Summary of Results of Normality Test of Learning Outcome Data

	Class	Shapiro Wilk		
		Statistics	Df	Sig.
Learning outcomes	Experiment pretest	.956	28	.285
	Pretest control	.918	28	.061
	Posttest experiment	.958	28	.358
	Posttest control	.980	28	.842

Based on Table 3, it is known that the significance value of the normality test of learning motivation for the pretest data of learning motivation for the experimental class is 0.060> 0.05. The control class is 0.846> 0.05, while the posttest data of learning motivation for the experimental class obtained a significance value of 0.274> 0.05 and the control class was 0.811> 0.05, so it can be concluded that the pretest and posttest data of learning motivation for the experimental class and the control class are normally distributed. A summary of the results of the normality test of learning outcomes is presented in Table 5.

Table 4 shows that the significance value of the normality test for the pretest data for the experimental class learning outcomes is 0.285> 0.05, and the control class is 0.061> 0.05. In contrast, the posttest data for the experimental class learning outcomes obtained a significance value of 0.358> 0.05, and the control class was 0.842> 0.05, so it can be concluded that the pretest and posttest data for the experimental class and the control class are normally distributed.

Homogeneity Test

Test the homogeneity of learning motivation and outcomes data using the Test of Homogeneity Variances. Table 5 summarises the results of the homogeneity test of learning motivation data.

Based on the results of Table 5, the significance value of the homogeneity test of the pretest learning motivation data is 0.182 > 0.05, while the posttest learning motivation data obtained is also 0.182 > 0.05.

A value of 0.403 > 0.05 suggests that the pretest and posttest data of learning motivation have homogeneous variants. Table 6 summarizes the results of the homogeneity test of learning outcome data.

Based on Table 6, it is known that the significance value of the homogeneity test of the pretest learning outcome data is 0.507 > 0.05. In contrast, the posttest learning outcome obtained a significance value of 0.672 > 0.05, so it is concluded that the pretest and posttest learning outcome data have homogeneous variance.

Linearity Test

Test the linearity of learning motivation and outcomes data using Analysis of Variances. Summary Table 7 presents the results of the linearity test of learning motivation data.

Table 5. Summary of Results of Homogeneity Test of Learning Motivation Data

		Levene Statistics	df1	df2	Sig.
Learning Motivation Pretest	Based on mean	1,826	1	54	.182
	Based on median	1,784	1	54	.187
	Based on the median with adjusted df	1.784	1	53.995	.187
	Based on trimmed mean	1.887	1	54	.175
Posttest Motivasi Belajar	Based on mean	.711	1	54	.403
	Based on median	.593	1	54	.445
	Based on the median with adjusted df	.593	1	49.592	.445
	Based on trimmed mean	.648	1	54	.424

Table 6. Summary of Results of Homogeneity Test of Learning Motivation Data

		Levene Statistics	df1	df2	Sig.
Pretest Hasil Belajar	Based on mean	.445	1	54	.507
	Based on median	.274	1	54	.603
	Based on the median with adjusted df	.274	1	52.298	.603
	Based on trimmed mean	.393	1	54	.534
Posttest Hasil Belajar	Based on mean	.181	1	54	.672
	Based on median	.525	1	54	.472
	Based on the median with adjusted df	.525	1	47.954	.472
	Based on trimmed mean	.248	1	54	.620

Table 7. Summary of Linearity Test Results of Learning Motivation Data

			Sum of Squares	Df	Mean square	F	Sig.
Pretest Posttest* Learning Motivation	Between groups	(Combined)	11331.833	35	323.767	1.157	.373
		Linearity	1249.513	1	1249.513	4.464	.047
		Deviation from linearity	10082.320	34	296.539	1.059	.457
	Within Groups		5598.667	20	279.933		
	Total		16930.500	55			

Table 8. Summary of Linearity Test Results of Learning Outcome Data

			Sum of Squares	Df	Mean square	F	Sig.
Pretest Posttest* Learning outcomes	Between groups	(Combined)	2699.107	11	245.373	1.044	.427
		Linearity	1008.268	1	1008.268	4.289	.044
		Deviation from linearity	1690.839	10	169.084	.719	.702
	Within Groups		10343.750	44	235.085		
	Total		13042.857	55			

Table 7 shows that the results of the linearity test of the pretest and post-test data on learning motivation obtained a significant linearity value. Of 0.047 < 0.05 and the significance value of Deviation from linearity of 0.457 > 0.05. The significance of Linearity describes how far the relationship between variables follows a linear pattern. If the importance (p < 0.05), then the data is linear, while the significance of Deviation from linearity describes how far the data deviates from the linear pattern; if of the importance (p > 0.05), then the data is linear, so it is concluded that the pretest and posttest data of learning motivation have a linear relationship pattern. A summary of the results of the linearity test of learning outcomes is presented in Table 8. Based on Table 8, it is known that the results of the linearity test of the pretest and post-test data on learning outcomes obtained a Linearity significance value of 0.044 <0.05 and a Deviation from the linearity significance value of 0.702> 0.05. The Linearity significance describes how far the relationship between variables follows a linear pattern. If of the importance (p <0.05), then the data is linear, while the Deviation from linearity significance describes how far the data deviates from the linear pattern; if of the importance (p>0.05), then the data is linear, so it is concluded that the pretest and posttest data on learning outcomes have a linear relationship pattern.

Hypothesis Testing

Hypothesis testing in this study was carried out after the prerequisite tests, namely the normality, homogeneity, and linearity tests, were met, meaning that the data was normally distributed and had homogeneous variance and a linear pattern. Hypothesis testing in this study used analysis of covariance (ANCOVA). Summary The results of the covariance analysis (ANCOVA) test of learning motivation data are presented in Table 9.

Table 9. Results of Covariance Analysis Test of Learning Motivation Data

Source	Type lll Sum of Squares	Df	Mean square	F	Sig.
Corrected Model	8434.392	2	4217.196	26.308	.000
Intercept	19197.154	1	19197.154	119.755	.000
Pretest of learning motivation	1211.249	1	1211.249	7.556	.008
Treatment	7184.878	1	7184.878	44.820	.000
Error	8496.108	53	160.304		
Total	1289562.000	56			
Corrected Total	16930.500	55			

Based on Table 9, it is known that the significance value of the hypothesis test of learning motivation data is 0.000 <0.05, so it can be concluded that $H_{0,}$ which states "there is no influence of the Project Based Learning (PjBL) learning model on the motivation to learn biology of class XI IPA students at SMA Negeri 1 Kediri", Rejected and Ha_{state} that "there is an influence of the Project Based Learning (PjBL) learning model on the motivation to learn biology of class XI IPA students at SMA Negeri 1 Kediri", accepted. The learning motivation hypothesis test results are supported by the corrected average value presented in Table 10.

Table 10. Corrected Average Results of Learning Motivation Data

Class	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Experiment	162.077	2.393	157.278	166.877
Control	139.423	2.393	134.623	144.222

Table 11. Results of Covariance Analysis Test of Learning Outcome Data

Source	Type lll Sum of Squares	Df	Mean square	F	Sig.
Corrected Model	8448.802	2	4174.401	47.133	.000
Intercept	17783.755	1	17783.755	200.794	.000
Pretest learning outcomes	2748.802	1	2748.802	31.036	.000
Treatment	7340.534	1	7340.534	82.881	.000
Error	4694.055	53	88.567		
Total	217050.000	56			
Corrected Total	16930.500	55			

Table 10 shows that the corrected average value of learning motivation in the experimental class is 162.077, which is higher. Compared to the control class of 139.423. A summary of the covariance analysis (ANCOVA) test of learning outcome data is presented in Table 11.

Based on Table 11, it is known that the significance value of the hypothesis test of learning outcome data is 0.000 <0.05, so it can be concluded that H_0, which states "there is no effect of the *Project Based Learning* (PjBL) learning model on the biology learning outcomes of class XI IPA students at SMA Negeri 1 Kediri", is rejected. H_a, which states, "there is an effect of the *Project Based Learning* (PjBL) learning model on the biology learning outcomes of class XI IPA students at SMA Negeri 1 Kediri", is accepted. The corrected average values in Table 12 support the results of the hypothesis test of learning outcomes.

Table 12. Corrected Average Results of Learning Motivation Data

Class	Mean	Std. Error	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Experiment	72.193[a]	1.809	68.565	75.820
Control	48.522[a]	1.809	44.894	52.150

Based on Table 12, the corrected average value of the learning outcomes of the experimental class is 72.193, higher than that of the control class, which is 48.522.

This research aims to determine the influence of the PjBL learning model on the motivation and learning outcomes of biology class XI IPA students at SMA country 1 Kediri so that the resulting data includes learning motivation data and learning outcomes data. Students' motivation and learning outcomes in biology.

The research results at SMAN 1 Kediri used classes MS1 and MS2 as research samples. MS1 is the experimental class, and MS2 is the control class. The application of PjBL in this study uses material on the structure and function of plant cells. For the distribution of the learning motivation questionnaire in this study, two tests were carried out, namely, at the beginning and the end of learning. The results of the learning motivation data analysis were 0.000 <0.05, so it can be concluded that the PjBL learning model influences learning motivation.

This research shows that the classroom atmosphere when implementing PjBL is more interactive. Students feel free to ask questions, discuss and innovate. Teachers act as guides who help students find information and provide direction. This supportive environment makes students feel safe to try and learn from mistakes [19]. This shows that PJBL has a positive influence on students. Students who use the PjBL approach show a significant increase in intrinsic motivation compared to conventional methods [20]. PjBL increases students' learning motivation and improves their overall learning outcomes [21]. PjBL can make students more enthusiastic about participating in learning because they feel more responsible for their learning outcomes [22].

The results of the data analysis are also supported by the corrected average learning motivation of the experimental class being higher than that of the control class. This shows that PjBL syntax is effective in increasing students' learning motivation. In the initial stage, the teacher sets a relevant and challenging question or problem, which students must solve through a project. The challenges must be authentic, meaning relevant to students' lives, so they feel motivated to complete them. Students facing relevant problems tend to be more motivated because they see immediate benefits from the learning [23].

The second stage involves students in designing the project they will work on. Students work in groups to plan their steps to complete the given challenge. When students are engaged in planning, they feel more in control of their learning, contributing to increased intrinsic motivation [24]. A sense of ownership and responsibility for the project encourages them to learn more enthusiastically.

In the third stage, students and teachers prepare a project work schedule, including deadlines and targets to be achieved. This gives the project structure and helps students manage their time well. Scheduling improves time management skills and self-discipline, indirectly increasing students' motivation to meet their targets within the specified time. Furthermore, teachers and students periodically monitor the project's progress [25]. Teachers provide ongoing guidance and feedback to help students improve their deficiencies. Constructive feedback can increase students' motivation because they feel supported in learning [26]. Students who receive feedback feel appreciated and are more motivated to improve and perfect their projects.

Once the project is completed, students present their results to their classmates or the wider community. This stage allows students to show the results of their hard work. Presenting project results gives students a sense of achievement, motivating them to continue trying to achieve better results in the future. Success in completing a project provides a strong motivational boost for students [23].

The final stage is evaluation, both by students and teachers. Students are asked to reflect on their experience, the challenges they have faced, and the solutions they have found. Reflection helps students recognize what they have learned and how they can improve their process in the future, which provides a more meaningful learning experience [24]. This experience not only increases learning motivation but also fosters self-confidence in students' abilities.

Each stage in the PjBL syntax provides opportunities for students to be actively involved, independent, and creative in their learning process. The main effect of implementing PjBL on learning motivation is increasing student engagement *in* learning. PjBL encourages students to be more proactive and take initiative in learning because they are not only recipients of information but also creators of solutions [25]. Interactive, contextual, and collaborative learning like this makes students more interested and motivated to learn.

Data analysis was done using covariance analysis (ANCOVA); the significance obtained from the learning outcomes data was 0.000 <0.05. The learning process uses the PjBL model, namely, students work in groups, collaborate, and are responsible for the projects they work on while applying theory into practice. This strategy includes steps such as planning, research, discussions and presentations that encourage critical and creative thinking skills to improve learning outcomes. Students who learn with the PjBL method show an increase in their conceptual understanding and analytical abilities compared to students who learn through traditional methods [27]. Students involved in project-based learning had higher outcomes because they were more motivated to explore the material in depth [28]. PjBL can improve student learning outcomes because this method involves active learning that requires students to understand and apply knowledge directly in solving real problems [29].

This shows that PjBL syntax is efficacious in improving student learning outcomes. The first stage in PjBL is formulating a problem or question that students must solve through the project. The problems chosen must be challenging and relevant to students' lives. Contextual problems help students relate learning to real life, motivating them to deepen the concepts being learned [30]. This has a direct impact on better learning outcomes because students not only learn theoretically but also apply it.

Once the problem is defined, students begin planning the project they will work on, including determining the steps to solve it and the resources needed. Student involvement in planning a project improves critical thinking and problem-solving skills, which results in a deeper understanding of the material. As students design steps to achieve goals, they develop analytical skills that support better learning outcomes [31].

The next step is to prepare a project work schedule, including setting deadlines for each stage of work. Time management is crucial so students can complete projects on time and stay focused on learning objectives. Scheduling teaches students effective time management skills, which in turn help students work more structured and efficiently [32]. The ability to manage time well contributes to higher learning outcomes because students are more disciplined in completing tasks.

Next, students start implementing the project, and the teacher monitors the process. During this stage, the teacher acts as a facilitator who provides guidance and feedback. Teacher feedback is very important to correct mistakes and help students understand the material better [33]. Effective monitoring ensures that students stay on track to complete projects well and achieve deeper understanding.

After completing the project, students present their results to their teachers and peers. This process allows students to demonstrate what they have learned and how they solved the given problem. Students' ability to present and account for their project results indicates a higher level of understanding because they must clearly explain the concepts they have learned [34]. In addition, project presentation allows students to develop communication skills, which also improves learning outcomes.

The final stage is evaluation and reflection, where students and teachers together review the entire learning process that has been passed. This reflection helps students understand what they have learned, the challenges faced, and the solutions found during the project. Reflection is very important in improving learning outcomes because it helps students identify their weaknesses and strengths to enhance the learning process in the future [35].

Each stage in the PjBL syntax significantly contributes to student learning outcomes. PjBL encourages students to learn more independently because they actively seek solutions and work collaboratively [34]. This helps students develop problem-solving, collaboration, and critical thinking skills, all contributing to improved learning outcomes. Additionally, project-based learning allows students to link theory to practice, resulting in deeper understanding and better overall learning outcomes.

Conclusion

Based on the research results, data analysis and discussion, Motivation data and learning outcomes are 0.00 < 0.05, so it can be concluded that the projects learning (PjBL) learning model has an influence on the motivation and learning outcomes of biology class XI IPA students at SMA Negeri 1 Kediri because students can develop critical thinking skills, creativity, and collaboration through project-based tasks use the PjBL learning model which involves active interaction with learning materials.

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