PROJECT BASE LEARNING (PjBL) MODEL IN BIOLOGY LEARNING CONCEPT: A META-ANALYSIS

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ABSTRACT

The need for active and innovative learning models in the 21st century encourages teachers to use appropriate learning models to achieve learning objectives. PjBL is a learning model that organizes classes in a project. The purpose of this study was to re-analyze research on project-based learning models (PjBL) in biology learning. This study uses the method of meta-analysis by reviewing a number of research results related to the research theme. The samples taken from this study were 10 articles with national and international standards. Based on the results of the analysis, the overall average effect size is 0.936. This shows that overall the project-based learning model has a high effect, so that it can be used as an alternative learning model that is effectively applied in biology learning.

Introduction

Teaching and learning activities are a condition that is deliberately created. Teachers who teach and students who learn. As a teacher, of course, you are aware of what should be done to create teaching and learning conditions that can lead students to achieve their learning goals. In teaching and learning activities, students act as subjects as well as objects. The need for active and innovative learning models in the 21st century encourages teachers to use appropriate learning models to achieve learning objectives. The nature of learning is a change in behavior and the essence of teaching is a regulatory process. In the learning process, the teacher facilitates the learning process and encourages students to actively learn, to gain learning experience.

In fact, the learning outcomes of students are still not optimal due to the low understanding of students' concepts of subject matter, especially biology. Some of the factors that cause the students' learning outcomes to be less than optimal are that in biology learning activities the teacher does not use learning models that demand student activity. Teachers tend to require students to memorize in order to master the material, while students' memory of biology material tends not to last long. In addition, students rarely get the opportunity to implement the concept findings that have been obtained so that the knowledge students get becomes less meaningful. The knowledge that students get is not well organized because it is not implemented into something real (Refualu, 2021).

Responding to these problems we can use the project based learning (PjBL) model which can improve students' understanding and concepts. Project-based learning is a learning model that uses problems as a first step in collecting and integrating new knowledge based on experience in real activities. Through PjBL, the inquiry process begins by raising a guiding question and guiding students in a collaborative project that integrates various subjects (matter) in the curriculum. Project Based Learning is student-centered innovative learning and places educators as motivators and facilitators, where students are given the opportunity to work autonomously to construct their learning Zulfikri (2004).

Project based learning (PjBL) is a learning model that organizes classes in a project (Thomas, 2000) According to Fathurrohman (2016) project based learning or project based learning is a learning model that uses projects or activities as a learning tool to achieve attitude, knowledge and competence competencies. Skills. The project itself can be interpreted as an activity that consists of a lot of work and requires coordination and specialization of support personnel to complete it. According to Mulyasa (2014) explains the notion of Project Based Learning or abbreviated as PJBL is a learning model that has the goal of guiding students through a collaborative project that integrates various subjects or curriculum materials and provides opportunities for students to explore material using various meaningful ways for themselves, and conduct experiments collaboratively.

Through a project-based learning model (PjBL), learning is centered on students to carry out an in-depth investigation of a topic. According to Rian Vebrianto et al (2021) project based learning (PjBL) facilitates students to investigate and determine a solution to the problems they face. Project based learning (PjBL) is designed to be used on complex problems that students need to investigate and understand. Students can be active in solving the real problems, also not only increasing student independence in learning but also increasing collaboration skills between students, especially in group task-based learning. After the implementation of this project-based learning model, it is expected that the ability to learn independently, collaboration skills and experimental abilities will emerge in students.

Each model, method, or learning design has its own advantages and disadvantages. Likewise with the project based learning method. As a general description, project based learning is a universal (all-in-one/all-in-one) model that involves contextual learning, investigation/inquiry, and problem solving which will have a very good impact on the overall competency of students (attitudes, knowledge, and skills). According to Daryanto and Rahardjo (2012) the project-based learning model has the following advantages, including increasing students' motivation to learn, increasing problem-solving skills, making students more active and successful in solving complex problems and increasing collaboration power.

Based on a search of existing educational articles, this study aims to analyze the project base learning (PjBL) model in biology learning. The results of the meta-analysis of the PjBL journal used from 2015-2022 are expected to provide a uniform view of the overall findings which will be reviewed based on media classification, material used and educational level.

Methods

This research is a type of quantitative research using data analysis techniques, namely meta-analysis. Meta-analysis is a technique for combining the results of several similar studies in order to obtain a combination of quantitative data. In this meta-analysis the writer will calculate the effect size of each article used. Effect size is the difference in the incidence of the effect between the experimental group and the control group. The purpose of this meta-analysis is to obtain an estimate of the effect size, there are the strength of the relationship or the

difference between variables. In this study the authors reviewed 10 articles which were educational journal articles published in the last 10 years. From the review of the article, the data obtained is secondary data, because the data is obtained from the results of research that has been done before. The data collection technique in this study was the documentation of the reference articles used. Based on Becker & Park (2011) data analysis techniques in determining effect size values canuse the following equation:

Mean and standard deviation of two groups posttest only

$$ES = \frac{\overline{X}_E - \overline{X}_C}{SD_C}$$

Information :
ES = Effect size
X E = Average of the
experimental groupX C =
Average control group
SDC = Standard deviation of class control

Effect Size can be categorized at levels as shown in Table 2.
Table 1. Criteria for Effect Size (ES) according to Cohen's (1998)

Number	Effect Size (ES)	Category
1.	$0 \leq ES \leq 0,2$	Low
2.	$0,2 \leq ES \leq 0,8$	Middle
3.	$0,8 \leq ES$	High

Research Result

After identifying 10 articles in the range of 2015 to 2022 with different variables, it can be grouped into the Project Based Learning (PjBL) model for understanding students' concepts in biology learning based on variables and calculating the effect size value of each article. The grouping is based on the variable understanding of students' conceptual aspects of knowledge based on their level of education. The descriptions of the articles analyzed can be seen from Table 2

Table 2. Description of the Articles Analyzed

No	Article Code	Title	Writer	Publication Year	Grade	*Effect size*	Category
1.	A1	Pengaruh Model Pembelajaran Berbasis Proyek Terhadap Hasil Belajar IPA	1.Gusti Ayu Made Dwiyani Putri 2.Ni Wayan Rati 3.Luh Putu Putrini Mahadewi	2019	Element ary School	1,235	High

No	Code	Title	Authors	Year	Level	Value	Category
2.	A2	Pengaruh *Project Based Learning* Terhadap Motivasi Belajar, Kreativitas, Kemampuan Berpikir Kritis, Dan Kemampuan Kognitif Siswa Pada Pembelajaran Biologi	1.Dewi Insyasiska 2.Siti Zubaidah 3.Herawati Susilo	2015	Junior High School	0,467	Middle
3.	A3	Pengaruh Model *Project Based Learning* Terhadap Keterampilan Berpikir Kritis, Aktivitas Dan Hasil Belajar IPA Pada Materi Bioteknologi Peserta Didik Kelas IX 2 SMP Negeri 12 Parepare	Sitti Marwani Syamsuddin	2022	Junior High School	1,481	High
4.	A4	Pengaruh Penerapan Model Pembelajaran Project Based Learning (PjBL) Yang Dipadu Metode *Gallery Walk* Terhadap Hasil Belajar Siswa Pada Konsep Pencemaran Lingkungan Kelas X IPA SMA Negeri 1 Bireuen	1.M. Rezeki Muamar 2.Rahmawati 3.Irnawati	2017	Senior High School	0,772	Middle
5.	A5	Implementasi Pembelajaran Berbasis Proyek Pada Materi Pencemaran Lingkungan Untuk Meningkatkan Literasi Stem Siswa SMA	1.Ariani Aninda 2.Anna Permanasari 3.Didit Ardianto	2019	Senior High School	1,101	High

No.	Code	Title	Authors	Year	Level	Value	Category
6.	A6	Pengaruh Model Pembelajaran Project Based Learning (PjBL) terhadap Hasil Belajar Siswa pada Materi Keanekaragaman Hayati di Kelas X MIPA SMA Negeri 6 Pulau Taliabu	1. Sulina Tamimu 2. Nurlia 3. Abdul Muin Kenta	2022	Senior High School	0,042	Low
7.	A7	Pengaruh Model Pembelajaran Project Based Learning terhadap Hasil Belajar Biologi Siswa SMAN 1 Aeksongsongan	1. Erlina Utami Panjaitan	2019	Senior High School	0,613	Middle
8.	A8	Biology Blog : Project-Based Learning in Pandemic Periode to Encourage Students' Creativity	1. Nawita 2. Eka Trisianawati 3. Abdul Karim	2021	University	1	High
9.	A9	Thinking Skills for Environmental Sustainability Prespective of Students of Biology Education Department Through Blended Project Based Learning Model	Husamah	2015	University	1,283	High
10	A10	Presepsi Mahasiswa Pendidikan Biologi Terhadap Model Pembelajaran	1. Maria Fransiska Kurniawati 2. Dewa Ayu Puspa wati	2022	University	0,993	High
		Project Based Learning (PjBL) Dalam Pembuatan Alat Peraga Berbasis Lingkungan	3. Ida Bagus Ari Arjaya				

∑ES = 9,365
N = 15
Average ES = 0,936 (High Category)

Based on Table 2, it can be seen from the description of the article that the effect size is obtained from the influence of the Project Based Learning (PjBL) model on understanding concepts in biology learning with an average effect size of 0.936 in the high category. There are 10 articles identified.

The influence of the Project Based Learning (PjBL) Model on understanding concepts in Biology learning based on educational level

From the analyzed articles, it was obtained that the average effect size was based on the level of education at the elementary, middle, high school and tertiary levels of the 10 education articles, and obtained data for calculating data for each article. The average value of the effect size and the criteria can be seen in Table 3.

Table 3. Effect Size Effect of the Project Based Learning (PjBL) Model on Learning Biology Based on Education Level

No	Grade	Artickel Code	*Effect size*	Category
1.	Elementary School	A1	1,235	High
2.	Junior Highschool	A2		High
3.	Junior Highschool	A3	1,948	
4.	Senior Highschool	A4		
5.	Senior Highschool	A5		
6.	Senior Highschool	A6	0,632	Middle
7.	Senior Highschool	A7		
8.	University	A8		
9.	University	A9		High
10.	University	A10	1,091	

∑ES = 4,906 N

= 4

Average ES = 1,2265 (High Category)

Based on the analysis of the articles contained in Table 3 regarding the influence of the Project Based Learning (PjBL) model in learning from the education level, it can be seen that there are 4 levels, elementary school, junior high school, high school and university. At the elementary level there are 3 articles, junior high school level 2 articles, high school 4 articles and university level 3 articles.

Discussion

Effect size is an important component in meta-analysis. Effect size shows the of the influence of a relationship between two variables. Effect size can present information from the results of the analyzed journal summary. The effect size is determined from the average

calculated effect size as a whole. In this study, the calculation of the effect size uses the Cohen formula. The relationship between variables seen in this study is the relationship between the influence of the project-based learning model and the understanding of biological concepts.

This research is a descriptive research that aims to see some research results about the effect that the Project Based Learning model can understand concepts in biology subjects. Based on the results of the research, it can be seen that the overall Project Based Learning (PjBL) model almost has a positive effect on students' conceptual understanding of biology subjects. From the 10 articles analyzed which consisted of 4 stages of Education (Elementary school, Junior High School, Senior High School and University) it can be seen the influence of the application of the Project Based Learning (PjBL) model, there are medium and high. The results of data analysis of the application of the project-based learning (PjBL) model with the subject of differences in educational level, show that the application of the project-based learning (PjBL) model is effective at all levels of education.

Based on the results of the effect size analysis with the level of education, students at the junior high school level have the highest effect size value of 1.948. This is because the input data from the post test results of students at the junior high school level is higher than at other levels. While the value of the effect size at the high school level shows the lowest value compared to other levels of education, which is equal to 0.632. This is due to the input data from the post test results of students at the low high school level.

The use of project-based learning (PjBL) models can be used as an alternative in designing learning activities to improve students' understanding of concepts. In learning activities that apply the project-based learning model/(PjBL) maximum emphasis is placed on students seeking and finding. In other words, students as learning subjects. So, in the Project Based Learning (PjBL) model, students do not only act as listeners but students are also directly involved in learning activities.

In learning using the project-based learning model/Project Based Learning (PjBL) students are required to be more active in the learning process such as making decisions, observing and collecting data for presentations. Whereas in the conventional learning model, students act as learning objects, which means that the activities of students are only limited to listening and receiving information provided by the teacher, without developing concepts and being examined in detail by students.

The application of the project-based learning (PjBL) model at all levels of elementary, middle, high school and tertiary education shows a high effect size value. The effect size calculation results show that the effect size is at the education level High School $\leq$ University $\leq$ Elementary School $\leq$ Junior High School. Based on the effect size calculation category according to Cohen's (1998) these four levels are in the high category. This is because the effect size value obtained is more than 0.8.

Conclusion

Based on the results and discussion, it can be concluded that the project base learning (PjBL) model has a high effect on understanding biology concepts, so it can be used as an alternative learning model that is effectively applied in biology learning with an overall average effect size of 0.936 with the highest effect size value shown at the junior high school level with a value of 1.948 and the lowest effect size value shown at the high school level with a value of 0.632.

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