



THE EFFECT OF CONSTRUCTIVISM LEARNING ON STUDENT LEARNING OUTCOMES: A META ANALYSIS STUDY

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Accepted: March 9th, 2023. Published: July 31th, 2023

Abstract

Constructivism in learning is a philosophy that holds where the process of forming knowledge in individuals is the result of mental activity supported by the process of learning experience. Many studies have been conducted on the effect of constructivism theory on learning outcomes, but few have quantifies the effect so that it can be analyzed qualitatively. Therefore, the purpose of this research was to quantify the effect size of the relationship between constructivism theory and student learning outcomes using meta-analytic research and data analysis techniques with openMEE software. Data was collected from Scopus and Google Scholar for 17 articles published in 2019 till 2022. Based on the analysis, In terms of the effectiveness of constructivism learning theory, an estimated data of 1.548 is obtained which indicates that constructivist theory has great effectiveness in improving student learning outcomes. In addition, the effect size measurement at the primary and secondary levels of education indicates that the student is in high category. This explains why constructivism learning is very well implemented because children at this level are already able to be encouraged to construct their own knowledge which influences their learning outcomes.

Keywords: Constructivism Learning, Learning Outcomes, Effect Size, Meta Analysis

Introduction

View on learning and the learning process began to emerge alongside the development of philosophy and psychology, starting with the theories of behaviorism, cognitivism, constructivism, humanism, and cybernetics. Learning is defined differently in each theory. Specifically for constructivism theory, the learning process depends by learner's prior knowledge, learning experiences, and construction of meaning in the learner's mind. According to Sani (2019), constructivism is one of the pillar of thinking about contextual teaching and learning approaches, namely knowledge that is gradually built by students and then expanded through a limited (narrow) context. Knowledge is not collection of facts, concepts or rules that can be easily be retrieved and memorized. Humans must create that knowledge and give it meaning through real-world experience.

The constructivism philosophy is based on two basic principles: first that all knowledge is the result of construction, not the result of direct perception by the senses (smell, touch, hearing, touch, and so on) and second, that social interaction is an important aspect of the construction of knowledge. Constructivism is rooted in the assumption that knowledge, no matter how it is defined, is formed in the human brain, and that the thinking subject has no alternative but to construct what he knows based on his own experience. All thoughts are based on experience, so they are subjective.

Constructivism is known to have many implications for the learning process in the classroom. Students develop their own knowledge during the learning process by actively participating in teaching and learning process. The student becomes the center of activity, not the teacher. So it can be said that constructivism emphasizes the principle of student-centered learning. The student must make the information his own. In this case, the teacher does not only offer knowledge to students, but it is up to students to construct knowledge in their minds. This will activate students and affect learning outcomes. There is relationship between student activity during learning process with learning outcomes (Tanjung,

2018). In a constructivist class, every student must be able to participate effectively and to construct knowledge, the environment must be flexible and student-based (Gomleksiz & Elaldi, 2011).

Constructivists believe that each individual learns best when they actively construct their own understanding from newly acquired knowledge (Clark, 2018). Knowledge can be built by students when they get certain experiences. This experience is useful for understanding all kinds of new information so as to form new knowledge (Thompson, 2018). Students are required to be able to experience the knowledge they acquire themselves, so the learning process is more important than learning products (Amineh & Asl, 2015; Kara, 2018). Furthermore, students are responsible for what and how they will learn so they can build new knowledge for themselves (Jaleel & Verghis, 2015).

Constructivism is a school of learning philosophy that continues to grow and serves as the foundation for the emergence of new learning methodologies and models. This learning model is expected to create learning that directs students in developing their own knowledge. The application of appropriate learning models based on constructivism is believed to affect learning outcomes. Using selected models with constructivism can direct students how to learn and how to think (Tanjung, 2015).

Several studies have been conducted in the 2019-2022 period regarding the correlation between constructivism theory-based learning models and cognitive learning outcomes where constructivism learning can improve learning outcomes (Hamise, Anom & Tuerah, 2019; Hendy, 2020; Gathage John et al., 2022; Ismail, 2022). Other research examines the effect of constructivism learning on scientific literacy, conceptual understanding, and social skills (Hendy, 2020; Lestari et al., 2021; Harefa et al., 2022). These studies have shown positive results for learning in the classroom, so it is also necessary to examine how strong the resulting effect is so that it becomes a reference for other researchers in applying constructivism theory-based learning.

Research Method

This research uses a type of meta-analysis with a quantitative approach. Meta-analysis is a literature review technique that uses statistical analysis by combining the results of two or more similar studies to obtain a quantitative relationship. Meta analysis is a revolutionary technique that helps many disciplines build evidence-based practices. Gurevitch et al (2018) stated that the purpose of meta-analysis is to assess evidence of the effectiveness of a particular topic or a hypothesized causal relationship for a particular situation in a relatively small number of studies or less than 25. Through this method, a further description of the research as a result of the meta-analysis can be obtained so that there are opportunities for the development of new theories or research models (Toraman & Demir, 2016).

The articles used as data sources were 17 articles selected according to the criteria, they are: 1) Research articles published in reputable International Journals and National Journals accredited for at least Sinta 6 years 2019-2022; 2) Assessing the effect or influence of certain learning models based on constructivism theory on study's result; 3) Having complete sample data, Mean, Standard Deviation so that it can be processed to obtain the effect size.

The research instrument used was a tabulation sheet containing correlated article data and processed with openMEE software. This software helps calculate the effect size more accurately and quickly. These results are then converted into a qualitative assessment, which becomes the conclusion of the research. The final assessment of effect size is based on Cohen's (1981) category.

Table 1. Effect Size Category (Cohen, 1981)

No	Effect Size (ES)	Category
1	$0,00 \leq ES \leq 0,20$	Ignore
2	$0,20 < ES \leq 0,50$	Low
3	$0,50 < ES \leq 0,80$	Currently
4	$0,80 < ES \leq 1,30$	High
5	$1,30 \leq ES$	Very high

Result and Discussion

This research was conducted to see the effect of constructivism learning theory on student learning outcomes by reviewing and analyzing several moderator variables. Data were obtained from articles that were relevant to this research and supported the calculation of the effect size of each journal. Researchers collect data from various sources such as Google Scholar, Eric, and Scient Direct. A total of 17 articles were selected based on criteria, namely 1) the research must contain a constructivism-based learning model, 2) the research examines the effect of the model used on student learning outcomes, and 3) The articles are in the range of 2019 to 2022.

The results of the effect size computation for the 17 journals mentioned above are divided into three parts. First, consider education level. Second, by country. The effect sizes of these two aspects can be seen in Table 2.

Table 2. Effect Size of All Journals

Journal	Level	Country	Effect Size
S1	Junior High School	Indonesia	1,885
S2	Senior High School	Indonesia	0,314
S3	Primary School	US	1,083
S4	Primary School	US	1,502
S5	Primary School	US	2,819
S6	Primary School	Mesir	3,805
S7	Primary School	Mesir	7,118
S8	Primary School	Ethiopia	1,433
S9	Junior High School	Indonesia	0,655
S10	Junior High School	Indonesia	2,008
S11	Senior High School	Kenya	1,104
S12	Senior High School	Kenya	1,098
S13	Junior High	Oman	0,679

	School		
S14	Senior High School	Indonesia	1,415
S15	Senior High School	Nigeria	0,612
S16	Senior High School	Nigeria	0,795
S17	Senior High School	Nigeria	0,081

The first result in this research is the effect size of the influence of constructivism learning on learning outcomes in terms of educational level. The calculations obtained are presented in Table 3.

Table 3. Effect Size Based on Education Level

Level	Journal	Effect Size	Average Effect Size	Category
Primary School	S3	1,083	2,96	High
	S4	1,502		
	S5	2,819		
	S6	3,805		
	S7	7,118		
Junior High School	S8	1,433	1,30675	High
	S1	1,885		
	S9	0,655		
	S10	2,008		
Senior High School	S13	0,679	0,774143	currently
	S2	0,314		
	S11	1,104		
	S12	1,098		
	S14	1,415		
	S15	0,612		
	S16	0,795		
S17	0,081			

The effect size of constructivism learning theory on learning outcomes based on educational level is calculated as ES=2.96 with the high effect size category for the elementary school level; ES=1.30 with a high effect size category for the junior high school level and ES = 0.7 with a

moderate effect category for the senior high school level.

The high category at the elementary and junior high school levels explains why the constructivism-based model has a high effect on student's learning outcomes in elementary and junior high school. Elementary school students aged 7 to 11 years (called the concrete operational phase) are able to think logically with concrete objects and grasp relationships, and classify things, allowing the notion of learning to construct children's abilities at this point. In the concrete operational stage, children require learning environment that can build their knowledge based on the basic abilities they have at this point (Mu'min, 2017; Marinda, 2020).

While junior high school students aged 11 and up, have begun to enter the formal operating phase. Especially junior high school students aged 11 to 15 years have begun to think about concrete experiences in a more logical and idealistic way, so that youngsters in this phase are already capable of self-reflection. The application of constructivism theory-based learning models at this level helps students in developing knowledge and appreciating ideas as a result of their ability to think logically and ideally. Students in this phase have been able to speculate about the ideal quality, so that learning with construction concepts helps to achieve their knowledge of anything (Marinda, 2020).

The second result in this research is the effect size of the influence of constructivism learning on learning outcomes in terms of country. Table 4 summarizes the results of the calculations.

Table 4. Effect Size by Country

Country	Journal	Effect Size	Average	Category
Indonesia	S1	1,885	1,255	High
	S2	0,314		

	S9	0,655		
	S10	2,008		
	S14	1,415		
United States of America	S3	1,083		
	S4	1,502	1,801	Very High
	S5	2,819		
Mesir	S6	3,805	5,461	Very High
	S7	7,118		
Kenya	S11	1,104		
	S12	1,098	1,101	High
	S15	0,612		
Nigeria	S16	0,795	0,496	Low
	S17	0,081		
Ethiopia	S8	1,433	1,433	High
Oman	S13	0,679	0,679	Currently

The calculation of Effect Size reveals that the influence of learning theory constructivism on learning outcomes by country is very high in the United States with an effect size of 1.801 and in Egypt with an effect size of 5.461.

The implementation of constructivism learning in the United States uses a problem-based learning model (PBL). PBL is focused on concrete problems in order to stimulate and develop students' higher-order thinking skills (Saputro & Pakpahan, 2021; Rehmat & Hartley, 2020; Cerling, Syam & Junus, 2020). In the PBL model, activities are carried out through a process of teamwork and discussion. Social interaction spurs the formation of new ideas and can enrich children's cognitive development.

PBL can encourage students to be more able to explore, construct, and understand contents of the learning material (Napitupulu, Simanjuntak & Sinurat, 2019). Based on this, the PBL model is considered to be very compatible with constructivism learning theory so that it has a very good effect on student learning outcomes. Constructivism influences learning instruction and learning outcomes through

problem-based models (Afolabi & Akinbobola, 2009; Lombardi, 2011; Ayoade, 2012).

Apart from the United States, a very high category of Effect Size was found in studies in Egypt, namely Hendy's research (2020). The application of constructivism learning theory is carried out through the 4Cs learning model which consists of 4 phases: contextualism, connectivism, constructivism and cognitivism. One of the phases is constructivism which directs students to construct new knowledge from the topic given by the teacher. Constructivism learning theory defines that all knowledge is built on the basis of previous knowledge (Onanuga, Ifamuyiwa & Alebiosu, 2021). Students are not something empty and knowledge cannot be given without being made by students according to the concept (Lombardi, 2011).

The acquisition of an average effect size with a low category was found in studies in Nigeria. One study uses the learning concept by doing which is not specific in directing students to build their knowledge so that it has a low effect on student learning outcomes (Onanuga, Ifamuyiwa & Alebiosu, 2021).

An overview of the effect size of the relationship between the constructivism model and the learning outcomes of the entire study (17 articles) is shown in the Forest plot summary (Picture 1)

Forest Plot

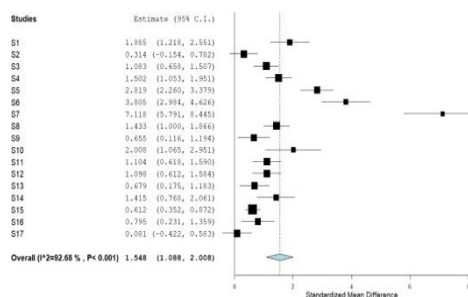


Figure 1. Forest Plot Summary of the Relationship between Constructivism Learning and Learning Outcomes

In general it can be concluded that from the data analysis each study has an effect size of 1.58. This is included in the criteria for large effect or having a large influence. So that it can be seen that the average effect size of constructivism learning theory on learning is very high. This is also reflected in the data distribution where the largest data is found in the Very Large effect size distribution.

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Summary
Continuous Random-Effects Model
Metric: Standardized Mean Difference

Model Results
Estimate  Lower bound  Upper bound  Std. error  p-Value
1.548     1.088        2.008        0.235       < 0.001

Heterogeneity
tau^2    Q(df=16)    Het. p-Value  I^2
0.839    218.695    < 0.001      92.684
    
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From the summary data on the effectiveness of constructivism learning theory, an estimated value of 1.548 is obtained which is an overall picture of the size effect data that has been analyzed. This value indicates that constructivism theory has great effectiveness in improving student learning outcomes. Furthermore, the lowest value limit approaches the number 1.088, where this figure remains in the high category or the assessment remains high. Meanwhile, the upper limit value is 2.008, where this value is included in the large effect category or has high effectiveness. Then look at the heterogeneity value with the I^2 function, which has a value of 92.68. This shows that the distribution of the analyzed data is above 75%, so the distribution of the data is heterogeneous.

Conclusion

The application of constructivism learning theory has a great influence and effectiveness on the learning process. Where almost half of the research data shows that constructivism learning theory is included in the very high category of influence on learning outcomes. In addition, the effect size measurement at the primary and secondary level of education shows the high category. This explains that constructivism learning is very well applied because the thinking stage of children at this level is already able to be encouraged to construct their own knowledge so that it influences their learning outcomes.

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