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Meta-Analysis: The Effect of Contextual Teaching and Learning (CTL) Learning Model on Student Skills

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ABSTRACT

This research literary study that discusses the meta-analysis that examined 17 national and international scale journals articles from 2009 to 2020. The data collection technique that will be analyzed is observation of journals based on the components of student skills. Based journals articles using the Contextual Teaching and Learning (CTL) learning model. The 17 journals articles average effect size value was 0.71 in the medium category, based on the educational level of the CTL model, the skills of students were more influential at the junior high school education level with an average effect size value of 0.952 in the large category compared to kindergarten, elementary, high school and university education levels. Based on the teaching materials used by the CTL model, students' skills are more influential in using solar system teaching materials with an average effect size value of 1.24 in the large category. As for the influence of the CTL model on student skills, the science process skills obtained are greater than critical thinking skills and creative thinking with an average effect size value of 0.816 in the large category.

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INTRODUCTION

One of the most important elements in this era is education. Because the beginning of education will be the creation of human resources who are able to create change towards a more advanced and resilient nation and state. In order to have quality human resources and have global competitiveness, 21st century learning plays an important role in increasing students' understanding of the demands of the 21st century (Mufit, 2020). In the 21st century education today demands a balance between technology and learning. So that later it is hoped that students will have broad insight into critical thinking skills, creative and scientific processes. The application of student skill-based learning is so that it can have an extraordinary impact on students so that they are able to compete in facing the times.

According to Mundilarto (2011) improving student learning outcomes is certainly inseparable from the learning experiences experienced by students in carrying out a learning process.

One branch of learning science is science. Science is a constructive activity that refers to everyday knowledge (Hasanah, et al, 2013). In education in Indonesia science learning skills are a problem that is relevant in daily activities, but the use of science learning cannot be implemented properly (Asrizal, 2018). Physics which is one of the most fundamental branches of science or knowledge because physics is the basis of all branches of science (Purwanto, 2012: Tripler, 1998). The low understanding of concepts in physics learning is often a problem of misunderstanding in learning. This has an impact on the low student learning outcomes. One of the causes of the low understanding of concepts in students is that the use of models in learning is not optimal, so solutions are needed to overcome these misunderstandings (Mufit, 2018). An indicator that can measure the quality of educational success is seen from the success of the learning process at school. Learning method applied by the teacher at school will determine the success of a learning process. According to Areands (in Trianto, 2011) a learning model refers to the learning approach used, including learning objectives, stages in learning activities.

To assist teachers in achieving the expected learning objectives, teachers should use an effective learning model to help students understand difficult physics concepts. One learning model that can be used to improve student skills is Contextual Teaching and Learning (CTL). Learning that applies CTL will provide experience for students to develop students' potential skills in Physics lessons. Through this CTL learning model the teacher can help students to get to express ideas, skills, ways of thinking and information. In research (Asrizal, 2018) the application of integrated science-adaptive contextual models by integrating digital age literacy can improve students' literacy competence, knowledge, attitudes and skills. A learning can be said to use the CTL approach if it has applied the seven main components of the CTL model. According to the Ministry of National Education (2003) CTL learning has seven main components, namely constructivism, questioning, inquiry, learning community, modeling and authentic assessment. Julianto (2011) also explained the characteristics of the CTL learning model, namely (a) collaboration, (b) creating fun learning not boring, (c) mutual support, (d) learning with passion, (e) integrated learning, (f)) Learn to use various sources, (g) Students are more active, (h) Share with friends, (i) Create active students and creative teachers, (j) Improve student work results, and (k) student work is not just a report card.

In an effort to improve students' skills, the CTL model can train students to improve science process skills, critical thinking skills, and creative thinking skills to make learning more meaningful. Science process skills are skills that involve students' ability to acquire a knowledge based on phenomena. Therefore, learning Physics should not only focus on achieving the final results of students, but also pay attention to increasing the achievement of the science process skills themselves. Science process skills according to Suryani (2015) are skills that must be trained in students because of innovation in learning so that students gain knowledge by finding. In learning science process skills include making observations, determining variables, making hypotheses, making measurements, and making reports. Learning science process skills students are trained to find and develop a concept and provide their experience more broadly. So that students can find and develop the attitudes, facts and concepts required.

Implementing learning using the CTL model, students are not just listening and taking notes, but learning will be more meaningful if they apply the learning process directly. So that the teacher can make an overall (authentic) assessment of students. Learning science process skills students are trained to find and develop a concept and provide broader experience. So that students can find and develop the attitudes, facts and concepts required. By implementing learning using the CTL model, students are not just listening and taking notes,

but learning will be more meaningful if they apply the learning process directly. So that the teacher can make an overall (authentic) assessment of students. Learning science process skills students are trained to find and develop a concept and provide their experience more broadly. So that students can find and develop the attitudes, facts and concepts required. By implementing learning using the CTL model, students are not just listening and taking notes, but learning will be more meaningful if they apply the learning process directly. So that the teacher can make an overall (authentic) assessment of students. By implementing learning using the CTL model, students are not just listening and taking notes, but learning will be more meaningful if they apply the learning process directly. So that the teacher can make an overall (authentic) assessment of students. By implementing learning using the CTL model, students are not just listening and taking notes, but learning will be more meaningful if they apply the learning process directly. So that the teacher can make an overall (authentic) assessment of students.

Broadly speaking, thinking skills are divided into two parts, namely critical thinking and creative thinking. Student skills that are expected in current learning are critical thinking skills and creative thinking. Critical thinking and creative thinking are the main factors in learning science and physics. Critical thinking is one of the skills students must have to compete in a global world. Critical thinking requires skills in habituation, which are trained gradually and continuously. Critical thinking is the ability to analyze ideas or ideas. to solve a problem. Learning to think critically can help students intervene to increase their curiosity in a deep and scientific way. The ability to think creatively has five characteristics which include (1) fluent thinking, (2) flexible thinking, (3) original thinking, (4) elaboration, (5) assessing. Creative thinking requires a process that supports the achievement of these abilities. One effort to apply these critical and creative thinking skills is by applying them through learning with the CTL model because this model is able to help students find the meaning of learning by connecting subject matter to the context of everyday life. Based on the problems that have been described, the researcher is interested in conducting a meta-analysis of journals that influence the Contextual Teaching and Learning (CTL) model. The purpose of this study was to determine the effect of learning models on students' skills. From the results of this meta-analysis, the authors hope to provide a uniform view of the overall findings.

METHODS

In this study, a meta-analysis method was used by examining 17 national and international scale 17 journals articles that were published online in the 2009 to 2020. The meta-analysis is quantitative in nature because it uses numerical calculations. The data collection technique that will be analyzed is observation of journals based on the components of student skills. Of the 17 samples used in journals articles using the Contextual Teaching and Learning (CTL) learning model. The distribution of CTL Model data distribution from 17 research subject journals can be seen in the following table groups:

Table1. Distribution of CTL Model Data Distribution Based on Educational Level, Teaching Materials, and Student Skills

Code	Educational level	Teaching Materials	Skills
J1	Elementary School	Change in the nature of things	Process Science
J2	Junior High School	Simple Plane	Process Science
J3	Elementary School	Science lessons	Process Science
J4	Elementary School	Science lessons	Process Science
J5	Junior High School	Physics	Process Science

J6	University	Dynamics	Process Science
J7	Kindergarten	Science Learning for Early Childhood	Process Science
J8	Junior High School	Solar system	Process Science
J9	Senior High School	Physics	Creative Thinking
J10	Senior High School	Physics Module	Think critically
J11	Junior High School	Science lessons	Think critically
J12	Elementary School	Science lessons	Think critically
J13	Elementary School	Heat Energy	Think critically
J14	Elementary School	Science lessons	Think critically
J15	Junior High School	Science lessons	Think critically
J16	Senior High School	Impulse and Momentum	Creative Thinking
J17	Senior High School	Physics	Think critically

The meta-analysis steps are recommended by Anwar (2005) and Dahlan (2012) as follows: a) Choose a topic to be researched, namely CTL, b) Determine the results of research used as a source for 2009-2020, c) Browse research reports that discuss the application of CTL, d)Read abstract and content, e) Record all variables and prices in the data table, f) Calculating the Effect Size of each study, g) Calculates the combined Effect Size, h) Analyzing the influence of the moderator variable on the Effect Size, and i) Write a Summary. To analyze the data, the formula proposed by Glass (1976) can be used. As follows:

$$ES = \Delta = \frac{\bar{x}\text{ eksperimen} - \bar{x}\text{kontrol}}{\text{SD kontrol}} \quad \text{.......... (1)}$$

Table 2. The Criteria of Effect Size

Effect size value	Criteria
effect size ≤ 0.15	Very small
0.15 < effect size ≤ 0.40	Small
0.40 < effect size ≤ 0.75	Currently
0.75 < effect size ≤ 1.10	Big
1.10 < effect size	Very large

(Dincer, 2015)

If the research article only presents statistical results, then the ES price is calculated using several statistical tests derived from effect size derivative formulas. As follows :

1. Z-test

$$ES = t + \sqrt{\frac{1}{ne}}\sqrt{\frac{1}{nc}} \quad \text{.......... (2)}$$

2. t-test

$$ES = t + \sqrt{\frac{1}{ne}}\sqrt{\frac{1}{nc}} \quad \text{.......... (3)}$$

Information :
t = score of valuez-test
ne = number of experimental class samples
nc = number of control class samples

3. Uj-F Correlation (r-Test)

$$\Delta = F\,\Delta\sqrt{\frac{2}{n}} = \frac{2r}{\sqrt{1-r}} \quad \text{.......... (4)}$$

Information :

t = score of valuez-test
ne = number of experimental class samples
nc = number of control class samples
F = score of the F test value
n = many samples
(Sutrisno, et al: 2007)

RESULTS AND DISCUSSION

Results

In this study, the total number of journals in accordance with this research study was 17 journals articles on the application of the CTL learning model to student skills. The journals analyzed were published from 2009 to 2020. The results of the average effect size based on the CTL model on students' abilities based on each journal, educational level, subject can be shown as follows:

a. Effect Size the Contextual Teaching and Learning Model of Student Skills in Each Journal

The first step taken to calculate the effect size analysis is to calculate the average effect size in all journals. Based on table 2 it is shown as follows:

Table2. Data on Effect Size Model CTL in Each Journal

Code	*Effect Size*	Category
J1	0.92	Big
J2	0.72	Currently
J3	0.77	Big
J4	0.71	Currently
J5	0.84	Big
J6	0.75	Big
J7	0.58	Currently
J8	1.24	Very large
J9	0.80	Big
J10	0.36	Small
J11	1.07	Big
J12	0.87	Big
J13	0.23	Small
J14	1.68	Very large
J15	0.78	Big
J16	0.50	Currently
J17	0.64	Currently
Average	**0.71**	**Currently**

The results of the Effect Size meta-analysis based on Table 2 recapitulates the influence of the CTL model on student skills from 17 journals articles with an Effect Size value, there are two research journals that obtain an Effect Size with a very large category, eight journals with a large Effect Size category, five journals with a medium category, and two journal with small category. With the acquisition of an average Effect Size of 17 journals of 0.71 which according to Dincer's criteria (2015) this value is in the range of $0.40 < \text{Effect Size} \leq 0.75$ in the medium category. From the results of this data analysis, it can be concluded that there is an influence of the CTL model in improving students' skills.

b. Effect Size the Contextual Teaching and Learning Model of Students' Skills Based on Education Level

The analysis is continued by looking at the influence of the CTL model based on educational level. Of the 17 journals articles that will be grouped by kindergarten, elementary, junior high, high school, and university levels, the average effect size will then be calculated. The following is the result of the recapitulation of the distribution of the average Effect Size calculation from the CTL model on student skills based on educational level as follows:

Table3. Distribution of Effect Size Based Data Based on Education Level

Educational level	N Journal	$\overline{X}$ *ICE*	Category
Kindergarten	1	0.58	Currently
Elementary School	6	0.86	Big
Junior High Scholl	4	0.95	Big
Senior High School	5	0.63	Currently
University	1	0.75	Currently

The results of the meta-analysis of 17 journals articles that have been grouped, in the CTL model on students' abilities based on educational level. The result of the calculation of the effect size at the Kindergarten level is 0.58 with the medium category, the result of the calculation of the effect size at the elementary level is 0.86 with the large category, at the junior high school level the result of the calculation of the effect size is 0.95 with the large category, in high school the result of the calculation of the effect The size is 0.63 in the medium category, and for the Higher Education level, the effect size is 0.75 in the medium category. Based on the overall data, the use of the CTL model on students' skills produced a moderate to large range effect, seen at the SD and SMP levels it had a large effect while for the TK, SMA and PT levels it obtained a moderate effect.

c. Effect Size Contextual Model of Teaching and Learning Against Student Skills Based on Subject Matter

Then the analysis carried out was to see the effect of the CTL model on students' skills. Based on the 17 journals articles that were analyzed and grouped based on teaching materials, there were ten different materials, which then calculated the average effect size. The results of data analysis recapitulation can be seen in table 4 below:

Table 4. Data on the Effect Size of the CTL Model on Student Skills Based on Teaching Materials

Teaching Materials	N Journal	$\overline{X}$ *ICE*	Category
Change in the nature of things	1	0.92	Big
Simple Plane	1	0.72	Currently
Science lessons	6	0.98	Big
Dynamics	1	0.75	Currently
Solar system	1	1.24	Very large
Heat energy	1	0.23	Small
Impulse and momentum	1	0.50	Currently
Science Learning for Early Childhood	1	0.58	Currently
Physics Module	1	0.36	Small
Physics	3	0.76	Big

There are 17 journals articles that were analyzed then grouped based on teaching material, the results of the meta-analysis showed that the influence of the CTL model on the skills of students who had used the Effect Size value existed as a whole, giving a variety of effects, starting from a small scale to very large. The highest Effect Size value was found in the material solar system with an Effect Size value of 1.24 with a very large effect category; science lessons with an Effect Size value of 0.98; changes in the nature of objects with an Effect Size value of 0.92; physics teaching materials with an Effect Size value of 0.76; Dynamics with an Effect Size value of 0.75; Simple Plane with an Effect Size value of 0.72; Science Learning for Early Childhood with an Effect Size value of 0.58; Impulse and Momentum with an Effect Size value of 0, 50; Physics Module with an Effect Size value of 0.36; and Heat Energy with an Effect Size value of 0.23. If you look at the table using the most material in research using science subject matter as many as 6 journals articles, with an Effect Size value of 0.98 in the large category. Overall, the CTL model on students' skills has almost a positive effect on all teaching materials.

d. Effect Size Contextual Model of Teaching and Learning on Student Skills

Analysis of the influence of the CTL model learning based on student skills obtained can be seen in Table 5 below:

Table5. Data Effect Size Results Based on Student Skills

Skills	N Journal	$\overline{X}$ *ICE*	Category
Process Science	8	0.816	Big
Think critically	7	0.804	Big
Creative Thinking	2	0.65	Currently

Based on students' skills in learning science and physics, learning with the CTL model has the highest influence on science process skills with an effect size value of 0.816 in the large category. For Critical Thinking skills with an Effect Size value of 0.804 in the large category. Then for Creative Thinking skills with an Effect Size value of 0.65 in the medium category. Visually, the large effect size of the CTL model on student skills can be seen in the following figure:

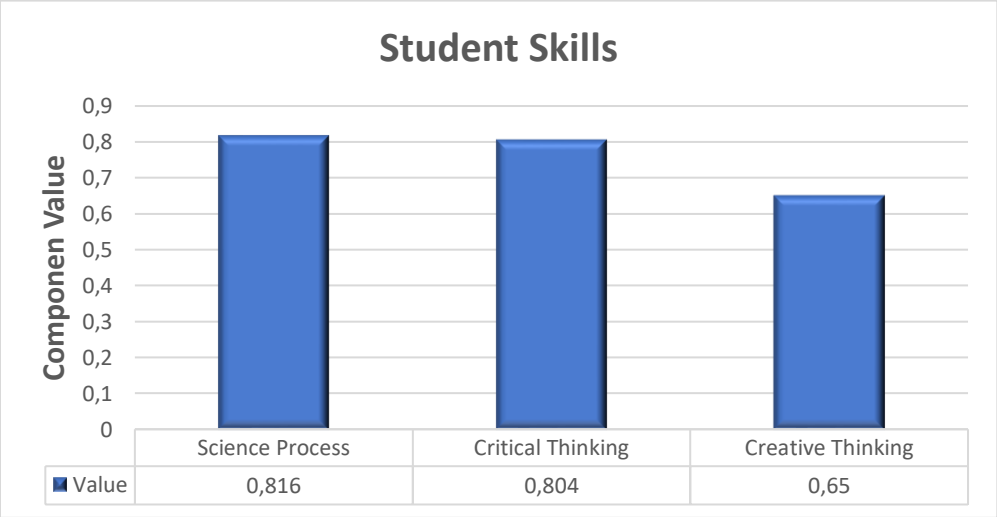

Figure 1. The Effect Size of the CTL model on Student Skills

Overall the CTL model learning has almost a positive effect on students' skills. Based on the graph in Figure 1, science process skills and critical thinking skills are in the large category, while creative thinking skills are in the medium category.

Discussion

Based on the results of the study as many as 17 journals articles as a whole from the calculation of the average effect size of 0.71 with the moderate effect category. It can be concluded that the application of the influence of the CTL model on student skills is also very helpful for teachers in carrying out the learning process. In the analysis of education levels, it was found that the CTL learning model was more effective when applied to learning at the junior high school level compared to kindergarten, elementary, high school, and university education. Because according to Piaget's theory, the development of junior and senior high school students aged between 11-18 years is already able to think logically and abstractly. This means that the influence of CTL learning can be applied to students at the junior and senior high school levels. However, after conducting a meta-analysis and effect size, it shows that the application of CTL is more effective at the junior high school level.

CONCLUSION

Based on the results of the meta-analysis in this study, it can be concluded from the 17 journals articles, the average effect size value is 0.71 in the medium category. Of the 17 journals articles based on the educational level of the CTL model, the skills of students were more influential at the junior high school education level with an average effect size value of 0.952 in the large category compared to kindergarten, elementary, high school and university education levels. Based on the teaching materials used by the CTL model, students' skills are more influential in using solar system teaching materials with an average effect size value of 1.24 in the large category.

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