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META ANALYSIS EFFECT NATURAL SCIENCE OF MODULE WITH CONNECTED MODELS ON THE LEARNING OUTCOMES OF JUNIOR HIGH SCHOOL STUDENT

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ABSTRACT

Education in the 21st century is one of the characteristics of the era of globalization with the development of Science and Technology. 21st century learning really expects integrated science learning that can be packaged into one between chemistry, physics and biology learning materials. The purpose of this study was to determine the *effect size* and *summary effect size* of the use of integrated science modules with connected models based on four categories, namely grade level, learning materials, connected models and learning outcomes. The solution to overcome this problem is to conduct a meta-analysis of the effect of integrated science modules with connected models in science learning on junior high school students' knowledge. The research data consists of 10 national and 1 international article and 9 theses. The data analysis technique in this study uses the calculation of the effect size in each article and the calculation of the *summary effect size*. Based on the data analysis, three results of this study can be stated. First, the *effect size* obtained on student learning outcomes vary. Second, the influence of integrated science modules with connected models at the level of class VII and class VIII with high categories. Third, the effect of integrated science modules based on learning many materials are high.

Keywords :*Meta Analysis; Modules; Natural Science; Connected Model; Learning Outcome.*

I. INTRODUCTION

This 21st century education is described by the development of science and technology. Facing the development of science and technology in the 21st century, the government has prepared life skills through educational reforms that guide new changes and the best steps to achieve these educational goals. The government distributes scholarship assistance to teachers and students, improves the quality and quality of teachers, and builds educational facilities and infrastructure, and makes curriculum changes [1]. Educational changes not only prepare students' skills to be ready to compete with global jobs, but also for education can also create the ability to integrate ICT skills, attitudes and knowledge and technology.

One way the government can move forward in the world of 21st century education is to change the curriculum by implementing the 2013 curriculum. The 2013 program develops productive, creative, innovative and affective students by changing attitudes, skills and knowledge. The 2013 curriculum aims to prepare people to have the ability to live as citizens who are faithful, productive, creative, and affective and able to contribute to social life [2]. It can be stronger student enthusiasm will add to the level of student activity in the teaching [3]. The curriculum in the learning process can prioritize face-to-face experiences through the process of observing, asking, discussing and testing (information-based learning) to increase student creativity and familiarize students.

21st century learning requires education to prepare teaching materials, namely modules. A module is a learning tool or structure that contains learning materials, methods, limits of learning materials, instructions for learning activities, exercises and assessment modalities that are designed systematically and attractively to achieve the expected skills and can be used independently. Module can be use to the electronic books consist of materials, pictures and videos that can be accessed electronically and can be used on devices such as laptops or gadgets [4]. Electronic modules, the learning process includes interactive and audiovisual displays that make it easy to understand their use so that they can be used as excellent teaching materials [5]. The module is in the form of a written book with the aim that students can study independently without or with the help of a teacher.

The criteria that must be met by students are in the form of knowledge, skills, and actual learning experiences. The learning materials developed is said to be valid if it is based on the score interpretation criteria [6].

Integrated science learning is one example of implementing the 2013 curriculum where this learning is packaged as one between chemistry, physics and biology learning materials. This integrated science learning includes learning materials from various perspectives or scientific disciplines that are easily understood and recognized by students. The learning model has several objectives for learning activities. In general, the learning model aims to make it easier for teachers to choose process components in learning techniques, strategies, and learning methods to achieve learning objectives [7]. Learning that better explains the interaction of conceptual elements will create a more effective learning process. The combination of themes in integrated science learning is relevant to using the essential principles of 21st century learning, and the geographical requirements of the Indonesian region and integrated learning are intended to build more meaningful, effective, and efficient science learning [8]. The learning material was studied in one field of science *(interdisciplinary)* with integrated learning using connected, integrated, shared, and webbed models. This integrated science learning can be discussed in a variety of learning materials from various perspectives or scientific disciplines that are easily understood and recognized by students [9].

The reality in the field has not described the requirements needed according to the analysis based on the articles collected. There are some real terms found in the article. The first real condition is the limited supply of textbooks or other handbooks in schools as a result that is inadequate for students. The second real condition is that the textbooks provided have not presented science in an integrated manner [10]. Learning is still lecturing and teachers have not implemented learning that involves students finding facts, concepts, principles, and rules in science lessons [11]. The third real condition is that the learning output of students in schools has not yet reached the minimal score and is still relatively low. The low output of students' learning is the impact of the lack of students' willingness to learn and the lack of desire to understand students' learning material [12]. In the learning process, the teacher also does not put students' activities that point to specific skill activities [13]. This has resulted in students not exporting their own inspiration, as a result, students only memorize material concepts and do practice questions. Even in learning activities, there is no teacher inviting students to learn to be independent and when testing students using questions only a small number are able to answer [14]. The implementation of the learning carried out was not effective and the learning output obtained by the students was also less than optimal.

This explains that there is a gap between the ideal requirements using the real conditions, so a solution is needed to overcome this feud. This is an integrated science module. A module can be said to be good and of good quality if it meets the criteria for a good module. Science learning can apply the scientific method by getting students to do scientific work [15]. E-module can be use that online learning is a type of teaching and learning that allows teaching materials to be delivered to students using the Internet [16]. Students are treated using the Integrated Science module to motivate students to use divine attributes such as honesty, justice, wisdom, social, affection and so on to provide a synchronized vision of the object to be studied [14]. The reason the researcher chose this meta-analysis study was for several reasons. First, look at the consistency based on the research results. Second, there is no research on the summary *effect size* of using an integrated science module using a connected model. Third, there is no research on meta-analysis of integrated science modules using the connected model.

On the other hand, this study has limitations based on previous studies, namely, first, the researcher uses limited learning materials. Second, the application of science learning only uses one integrated science model, namely the connected model . Third, the limitations of the researcher in testing the learning outcomes of a group of students using two different classes, namely class VII and class VIII. Thus, the solution to this limitation is the existence of further research on the use of integrated science modules.

This meta-analysis research is the right solution for the selected researchers. Meta-analysis has advantages in its application. Meta-analytical research has four advantages. First, the meta-analysis procedure applies useful disciplines in the process of synthesizing research results. Second, this research is a research conducted in a more sophisticated way than conventional review procedures which tend to rely on qualitative summaries. Third, this search is able to find influence in other synthetic search approaches, fourth, it provides an organized way to manage information from a large number of search results [17].

From the data obtained, discussing the effect of the integrated scientific module, this model is linked to the results of previous researchers' research regarding the integrated science module on student learning outcomes which raised the research title entitled "Meta-analysis of the effects of the integrated science module with the connected model on learning outcomes. junior high school students" with three moderators based on: 1) knowledge aspect, 2) grade level 3) subject.

II. METHOD

This study uses a meta-analysis method. Meta-analysis is a secondary integrative analysis by applying statistical procedures to the results of testing research hypotheses.. Meta-analysis is quantitative. Meta-analysis uses previous studies which were analyzed systematically and quantitatively to obtain accurate conclusions [17].

The research criteria used in this study examine 9 theses and 11 articles in international and national articles starting from 2010 to 2020. There are several criteria for articles used as follows (1) selected articles, namely the topic of using integrated science modules with models connected to the knowledge aspect. (2) articles consist of national articles and international articles. (3) Selected articles published in the last 10 years, namely from 2010-2020. (4) selected articles review the effect of integrated science learning modules with connected models on aspects of junior high school students' knowledge. (5) the selected articles are SMP Integrated Science subjects consisting of 10 national articles with ISSN, 1 international article.

There are six steps in conducting a meta-analysis in this study. The first research step is to determine and study the research topic to be summarized. Second, looking for and collecting a number of studies with predetermined topics and selecting them. Third, statistical data from each study were recorded, including the mean score, standard deviation, and t-value. These values were converted to the *effect size* (ES) metric. Calculating the effect size of each article using Cohen's d equation. Fourth, after calculating the *effect size* of each article. then tested the data whether there is heterogeneity of effect. Then the ES results were corrected with Hedges' g [18]. After the effect size, variance, and standard error of the *effect size* have been obtained, the analysis procedure is continued by calculating the *summary effect size. Summary effect size* there are two models, namely the *random effect* model and the *fixed effect*.

At this stage, if the heterogeneity of effects is identified, then calculate the *summary effect size* using the *random effects model.* However, if the heterogeneity of effects is not identified, then calculate the *summary effect* using the *fixed effects*. Fifth, analysis of moderator variables. Sixth, drawing conclusions and interpreting the results of meta-analysis research. Conclusions are drawn when the data has been processed and the *summary effect size* is large.

Data analysis techniques are needed in processing data in research. Technical analysis of the data in this study using descriptive statistical analysis and effect sizes. Descriptive statistical analysis serves to explain a symptom or phenomenon without intending to draw conclusions that apply to the general public. Data analysis techniques on effect sizes are to calculate *effect size* and calculate *summary effect sizes.* After the got of *effect size* and *summary effect size* are obtained, then the results obtained are categorized at the following levels can be seen in Table 1 [18].

Tabel 1. *Effect Size Criteria (ES)*

No	ES	Category
1	ES ≤ 0,15	Can be ignored
2	0,15 < ES ≤ 0,40	Low
3	0,40 < ES ≤ 0,75	Medium
4	0,75 < ES ≤ 1,10	High
5	ES>1,10	Very high

III. RESULTS AND DISCUSSION

In reviewing the meta-analysis of the influence of the integrated science module with the connected model on student learning outcomes, thesis and related articles will be analyzed and several indicators will be discussed such as learning outcomes, grade levels, and learning materials. The analyzed thesis and articles have been selected into twenty data. First, in the meta-analysis of the influence of the integrated science module with the connected model in terms of learning outcomes from the knowledge aspect. The value of *size* outcomes in the following aspects of knowledge obtained by using Cohen's d equation and changing the value of d to Hedges' g [18]. The results obtained from the study of theses and articles are presented below, *effect* learning knowledge can be seen in Figure 1.

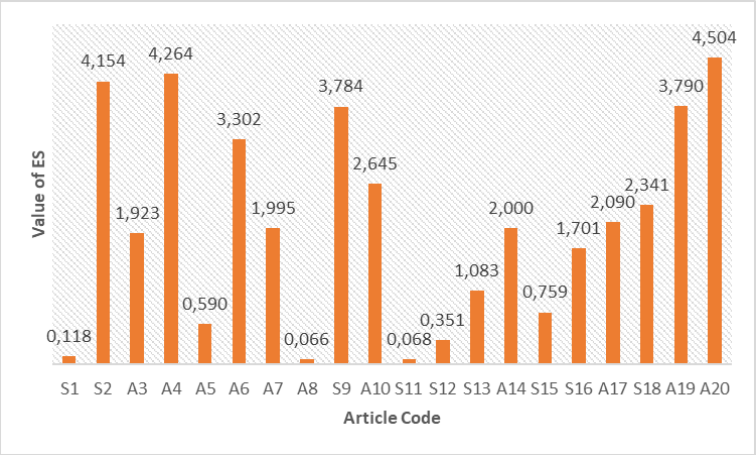

Fig 1. *Effect Size* of the Natural Science Module With Connected Model on Knowledge

Actually lies in the value of g or Yi. The *effect size* meet the criteria related to this study by producing different values. The results of *effect size* with the category of being ignored are 2 articles. The result of *effect size* in the low category is 1 article. The results of *effect size* in the medium category contained 1 article. The results of *effect size* in the very high category contained 16 articles. The results of each *effect size* then analyzed to obtain a *summary effect size*. Before obtaining *summary effect size* of the article, heterogeneity testing was carried out to obtain the average summary effect size of the influence of the integrated science module with the connected model on student learning outcomes. The following are the results of processing the average *summary effect size* obtained using the *random effects* can be seen in Table 1.

Table 1. *Summary Effect Size* of Integrated Science Module Connected Model of Learning Outcomes to Knowledge

N	ES	SE	Categori	*P*	95% Confidence Interval	
					Lower	Upper
20	1,994	0,311	Very High	0,000	1,382	2,605

Based on the results of data processing in the table the effect of integrated science learning with the connected model on student learning outcomes in the knowledge aspect has an *effect size* of 95% confidence interval from 1.382 to 2.605. *effect size* shows that integrated science learning with the connected model is in the high category. The confidence interval used is 95% ($\alpha = 0.05$) and the results of testing the null hypothesis by showing that h_0 is rejected because the p-value test obtained is 0.000 where the p value $<\alpha$ so that integrated science learning with a connected model has a significant effect. significant to student learning outcomes.

Second, in the meta-analysis of the influence of the integrated science module with the connected model in terms of learning outcomes at the grade level. There are two grade levels in this study, namely class VII and class VIII. At these two grade levels, to obtain a *summary effect size* using the *random effects* results *summary effect size* can be seen in Table 2.

Table 2. Results *Summary Effect Size* Integrated Science Module Connected Model Learning Outcomes at Class Level

Class Level	N	ES	SE	Categori	*P*	95% Confidence Interval	
						Lower	Upper
Class VII	11	2,677	1,333	Very High	0,00	0,063	5,291
Class VIII	9	1,804	0,516	Very High	0,00	0,791	2,817

Based on the results of data processing in the *summary effect size* of integrated science learning with a connected model on student learning outcomes at the seventh grade level. and VIII have varying values. At the seventh grade level, it has an *effect size* of 95 % confidence interval from 0.063 to 5.291. Meanwhile, class VIII

has an *effect size* of 95 % confidence interval from 0.791 to 2.817. *effect size* indicates that integrated science learning with a connected model at grade VII and VIII levels is in the high category and the results of testing the null hypothesis indicate that h_0 is rejected because the p-value test value obtained is 0.000 where the p value $<\alpha$ so that science learning integrated with the connected model has a significant effect on student learning outcomes.

Third, in the meta-analysis of the influence of the integrated science module with the connected model in terms of learning outcomes on learning materials. The moderator of this study contained 16 (sixteen) learning materials. The results of the average *summary effect size* calculated by the *fixed effect* can be seen in Table 3.

Table 3. Summary *Effect Size* Results of Integrated Science Module Connected Model Learning Outcomes of Many Learning Materials

Subject	N	M	SEM	Category	p	α=0,05	
						Lower	Upper
Antacids	1	0,118	0,339	Can be ignored	0,36	-0,546	0,782
Making Tofu	1	4,154	2,013	Very high	0,01	-2,013	4,945
Energi	3	1,398	0,165	Very high	0,00	0,674	1,325
Barbaque	1	4,264	2,039	Very high	0,01	-2,997	4,997
Coastal Environment	1	3,302	1,793	Very high	0,03	-2,514	4,514
Water Limbar Batik Industry	1	1,995	0,303	Very high	0,00	0,405	1,594
Objects	1	6,066	2,444	Very high	0,00	-3,790	5,790
Heat	2	3,073	0,350	Very high	0,00	0,312	1,687
Air Pollution	1	0,068	0,244	Can be ignored	0,39	0,519	1,480
Healthy Food and My Body	1	0,351	0,586	Low	0,27	-0,149	2,149
Household Wastewater	1	1,083	0,266	Very high	0,00	0,406	1,522
Addictive and Health Substances	1	0,759	0,262	Very high	0,00	0,485	1,514
Photosynthesis	1	1,701	1,294	Very high	0,09	-1,537	3,537
Business and Energi	1	2,341	1,516	Very high	0,06	-1,972	3,972
Visualization	1	3,790	0,428	Very high	0,00	0,159	1,840
of the Impact of Household Waste	1	4,504	0,467	Very high	0,00	0,082	1,917

Based on the data in the table above, there are 16 sub learning materials obtained *effect size* . *effect size* is 0.118 for antacid material, 4,154 for tofu making material, 1,398 for energy material, 4,264 for barbaeque material, 3,302 for coastal environment material, 1,995 for batik industry wastewater material, 6,066 for material change of object shape, 3,073 for heat material, 0.068 for air pollution materials, 0.351 for healthy food and my body, 1.083 for household wastewater, 0.759 for addictive substances and health, 1.701 for photosynthesis, 2.341 for work and energy materials, 3.790 for visualization materials, and 4,504 for household waste impact materials. The results of testing the null hypothesis or p-value test that meet $p <\alpha$ with h_0 rejected there are 11 articles it can be stated that the use of integrated science learning with a connected model has an influence on student learning outcomes on learning materials while 5 articles do not meet the null hypothesis testing or test p-value with $p>\alpha$ due to the grouping of learning material data that does not exceed two data and the results of the *effect size* for each material obtained are small.

From the results of research based on these three moderators, it shows the variation in results between studies with similar topics, then it is necessary to calculate the *effect size* by showing the amount of treatment so as to produce a conclusion. The first result is that the results obtained have a major influence on the learning outcomes of junior high school students. Students can understand knowledge with scientific disciplines. This result is also in line with the statement that is supported by the results of research conducted which states that the module uses an effective theme to improve student learning outcomes in the cognitive domain of integrated science learning [19]. The same thing was expressed that the use of themes can be used to see generic skills that are in accordance with the characteristics of the module that can increase students' knowledge [20].

The results of the second study are based on grade levels at the junior high school level. The integrated model of science learning module is connected at the grade level, namely VII and VIII which shows significant results. Integrated science learning which consists of various fields of study is to provide a learning environment that allows students to get a learning experience that can connect and relate concepts of various fields of study. This is in line with the student learning experience which states that learning using the integrated

science module shows positive results and the use of textbooks is the main learning source or compulsory teaching material for students which can also facilitate students in understanding abstract material [21].

Furthermore, the results of the study *effect size* student learning outcomes based on learning materials. Most of the results obtained can affect the integrated science module with a connected model on student learning outcomes on learning materials. This result is in line with states that through the application of the connected type interactive module with the theme of Integrated Science on energetic material, based on student self-assessment there is an increase in learning independence [22]. It means that students' attitudes and students' understanding of concepts influence each other [23]. It can be stated that if the dimensions of knowledge and the level of thinking processes can be carried out in an integrated manner, then the learning objectives can be achieved [24]. This is in accordance learning is most effective when applied through a learning model that includes information processing clusters [12]. It is concluded that the integrated science learning module with a connected model has a significant influence on student learning outcomes.

IV. CONCLUSION

Based on the results of the research obtained by the discussion, it can be concluded that first, the use of an integrated science module with a connected model in terms of learning outcomes on the knowledge aspect has a significant effect with a *summary effect size* of 1,994 which is included in the very high category. Second, the use of an integrated science module with a connected model has a significant effect on class VII with a *summary effect size* of 2,677 which is included in the very high category, while in class VIII with a *summary effect size* of 1,804 which is included in the very high category. Third, the use of an integrated science module with a connected model has a significant influence on the learning materials of heat, energy, photosynthesis, tofu making, barbecue, batik industry wastewater, household wastewater, addictive substances and health, healthy food and my body, changes in the shape of objects, the beach environment, healthy food and my body, photosynthesis, visualization and change of substances.

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