META ANALYSIS OF THE EFFECT OF USING STUDENT WORKSHEETS ON ASPECTS OF KNOWLEDGE IN HIGH SCHOOL PHYSICS LEARNING

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ABSTRACT

Physics learning process is generally teacher-centered and does not provide opportunities for students to develop their potential by issuing their ideas. The learning is not by the demands of the 2013 curriculum, which is student-centered, students who find a concept in learning. Many studies use student worksheets that measure aspects of student knowledge. Therefore, this study aims to determine the effect size of worksheets on aspects of student knowledge. This research uses the meta-analyst method. Data collection was done by browsing e-journals, SINTA and Google scholar. The data used are several articles published from 2013-2021 through national and international accredited journals. The sample of this study was 55 articles, consisting of 45 national articles and 10 international articles. The articles used have met the criteria for calculating effect size. Three indicators compare the effect of using student worksheet based on student knowledge grade level, subject matter units, and learning models. Based on the study results, it was found that the effect size of the use of student worksheet on the three indicators was (1) The largest effect size is obtained on class level indicator, with high category in class XI of 0.73 with medium category. (2) on unit subject indicator, largest effect size is on the fluid material unit of 0.77 with a high category. And (3) on indicator of the learning model, the largest effect size on the project based learning model is 0.86 with a high category.

I. INTRODUCTION

Education is very important for the progress of a country. The better the quality of education, the more developed and developing the country. Good quality education can produce quality human resources. Education is an effort to realize a learning process that helps students develop their potential and can change students' attitudes and skills through the learning process. Learning is an interaction between students and teachers and learning resources in a learning environment that is expected to gain knowledge, mastery of skills and character, and the formation of better attitudes and beliefs[1]. Quality education learning will help students in living their lives, especially in the era of increasingly developing technology.

The development of increasingly advanced technology demands government policies to improve the quality of education, one of which is to improve the curriculum. The curriculum in Indonesia has suffered several times improvement, from curriculum KBK (Competency Based Curriculum), SBC (Education Unit Level Education), to the current curriculum of 2013. Curriculum 2013 has undergone a process of improvement to be the 2013 curriculum revision in 2017 in order to support quality better Indonesian education. 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. The 2013 curriculum contains various subjects that need to be taught to students, one of which is physics at the senior high school level equivalent .

Physics is knowledge of natural phenomena related to matter and energy[2]. Physics is a field of science that consists of scientific components such as patterns of thinking, acting and shown through scientific steps such as observation, problem formulation, hypothesis formulation, hypothesis testing, experimentation, concluding, to concept discovery through learning. The process of knowing physics through the interaction of teachers and students in a learning environment is called learning physics.

Learning physics was developed based on the principles of active learning that provides opportunities for students to develop their potential of students[3]. Students find facts, concepts, and phenomena in life days through learning physics. Students are required to have thinking skills to solve problems and find knowledge. However, in reality, students do not understand the concept of learning, so that students' learning outcomes in physics are still low. Based on the results of the analysis of 35 articles, it was found that the real conditions were not in accordance with the expected conditions.

The first real condition in classroom learning charecteristhics is teacher-centered learning[4]. Lack of student involvement in the classroom. Learning that has not made students active causes student saturation in learning . As a result student feeling bored and the desire to learn becomes lost. The second real condition is that students' physics learning outcomes in the knowledge aspect are still low[5]. The learning process carried out is mostly only knowledge transfer by providing complete concepts without going through the processing of the potential that exists in student. So that most students think that physics is a difficult subject to understand. The third real condition is the lack of students' ability to analyze problems[6]. The learning process is less able to improve students' thinking skills. Students usually tend to memorize and do not know how to apply it. As a result, students are not trained to solve problems in everyday life

Due to the difference between the real conditions and the expected conditions, a solution to this problem is needed. One solution is the use of worksheets in physics learning. Student worksheet is used as a means for teachers to increase student involvement in learning activities[7]. Students play an active role in we are changing teacher-centered learning into student-centered learning with the help of worksheets. The use of worksheets in physics learning is by the nature of physics learning which emphasizes learning on the process rather than learning the final result or product.

Many studies have been conducted to determine the effect of using student worksheet against learning outcomes. The results showed a significant effect of worksheets on student learning outcomes, especially in the knowledge aspect. So takes a form of a summary of the results of research studies that discuss the use of student worksheet on learning outcomes in knowledge aspects in physics learning

Previous research conducted by researchers in the form of research that uses methods experiment to see the effect of the CTL-based E-module in school. Researchers did not get research data because the increasing number of pandemic cases constrained them. School learning activity is not performed as usual given the potential for viral transmission covid-19 was higher, so researchers cannot conduct research appropriate research design. The researcher finally could not continue the experiment and was diverted by collecting data in the form of articles that were by this research, then summarizing and retesting the effectiveness of the research results. This study is to determine the effect size by using a meta-analysis research method. Meta-analysis research needs to be done because the results can be used as reinforcement for previous research[8]. The data obtained produce a new idea about the research being studied. Based on the background that has been explained , researchers are interested in conducting research entitled "Meta-Analysis of The Effect Using worksheets On Knowledge Aspect in High School Physics Learning" the research objectives are set, namely To determine the effect size of the effect of using worksheets on knowledge aspects based on grade level, unit subject and learning models

II. METHOD

The type of research used in meta analysis research with a quantitative approach. Meta analysis is a quantitative analysis of data by collecting and analyzing pre-existing research data. Data collection was carried out by browsing several online journals such as sinta, proceedings, university e-journals, and google scholar. Using the keywords worksheet, teaching materials, and student learning outcomes, several articles were obtained that met the criteria, namely the presence of data before and after being treated.

The first research design is the preparatory stage. At this stage, the researcher sets the domain based on the independent, dependent, and moderator variables. Furthermore, the researchers set the research criteria that were summarized based on the form of publication and year of publication. Next, the researcher determines the

dependent variable's operating definition, which can be seen both pre-test and post-test, which is expressed in the form of scores. The next stage is the preparation stage. At this stage, the researchers began to search for and collect articles in jounals obtained from the SINTA web, Garuda portal, Google Scholar, and University E-journals.

Furthermore, the researchers extracted the research covering the class levels, namely X, XI, and XII. Furthermore, the researchers calculated the effect size per study. They were analyzing the effect size by calculating the mean (mean) and standard deviation. The last stage is data analysis. Researchers analyzed effect size based on target variables and methodological variables. Researchers grouped journals with low, medium, high, and very high effect size values, then summarized them in a scientific report.

This study has three variables: the independentvariable, the dependent variable, and the intermediate variable (moderator).The independentvariable is thevariable that affects orcauses the change or emergence of the dependent variable. The independent variable of this research is the use of Student Worksheets. The dependent variable is the variable that is affected or becomes the result of the independent variable. The dependent variable of this research is studenthlearning outcomes in the aspect of knowledge. The intermediate variable (moderator) is a variable that strengthens or weakens the relationship between one variable and another[9]. The intermediary variables in this research are grade level, subject matter unit, and learning model.

The data analysis technique used in this research is a quantitative approach through calculating and analyzing the data already in the article. To facilitate data analysis, data tabulation was performed. The data tabulation steps were carried out, the data tabulation steps were carried out, namely: (1) Identifying the variables found. (2) Identify the mean and standard deviation of both the experimental and control groups. (3) Calculating the effect size using the equation.

After the required data is obtained, the next step is to analyze the data. The data analysis technique is an essential step in researching because data analysis serves to conclude research results. Data analysis can be carried out after the data and evidence supporting the research have been collected. This means that the data analysis process can be carried out after data collection.

After obtaining the value of the effect size of each article, then the value of the effect size that has been obtained is interpreted according to the established category. The following are the categories of effect sizes can be seen in table 1[10].

Tabel 1. Effect Size criteria (ES)

No.	ES	Kategori
1	$ES \leq 0.15$	Negligible
2	$0.15 < ES \leq 0.40$	low
3	$0.40 < ES \leq 0.75$	medium
4	$0.75 < ES \leq 1.10$	high
5	$ES > 1.10$	very high

III. RESULTS AND DISCUSSION

Based on the analysis of the effect of using worksheets on learning outcomes in the aspect of knowledge, 35 articles were obtained that could be processed. Of the 35 articles, 2 of them are internationally accredited articles. From the grouping of variables, three comparative indicators were obtained, namely based on grade level, material unit and learning models. The following are the results of the analysis of this study, For the first result is he effect of using worksheets on knowledge aspect based on grade level

Tabel 2. Effect Size the effect student worksheet on knowledge aspect based on grade level

No	Grade Level	Articles Code	*Effect Size*	Total	Average *Effect Size*	Category
1	X	A3	0.88	18	0.67	Medium
		A4	0.82			
		A5	0.8			

		A6	0.58			
		A7	0.75			
		A10	0.72			
		A11	0.71			
		A14	0.6			
		A16	0.58			
		A17	0.66			
		A25	0.29			
		A28	0.58			
		A29	0.99			
		A30	0.66			
		A31	0.68			
		A33	0.62			
		A34	0.52			
		A35	0.59			
2	XI	A1	1.38	17	0,73	Medium
		A2	1.19			
		A8	1.07			
		A9	0.79			
		A12	0.71			
		A13	0.77			
		A15	0.68			
		A18	0.99			
		A19	0.64			
		A20	0.54			
		A21	0.51			
		A22	0.51			
		A23	0.43			
		A24	038			
		A26	0.56			
		A27	0.58			
		A32	0.73			

Table 2 shows that the effect of using student worksheet on aspects of knowledge based on grade level. The results of the calculation of the effect size of the student worksheet on aspects of students' knowledge in class X and class XI respectively, namely 0.67 and 0.73 belong to the medium category. The second result is the effect of using worksheets on knowledge aspect based on unit of subject.

Tabel 3. Effect Size the effect student worksheet on knowledge aspect based on unit of subject

No	Unit of subject	Article code	Effect size	Total	Average *Effect Size*	Category
1	Fluid	A1	1.38	6	0.77	High
		A9	0.79			
		A18	0.99			
		A19	0.64			
		A23	0.43			
		A24	0.79			

No	Unit	Code	Effect Size	Total	Average Effect Size	Category
2	Mechanics	A3	0.88	14	0,72	Medium
		A6	0.58			
		A7	0.75			
		A8	1.07			
		A10	0.72			
		A11	0.71			
		A13	0.77			
		A16	0.58			
		A17	0.66			
		A22	0.51			
		A26	0.56			
		A28	0.58			
		A29	0.96			
		A31	0.68			
3	Vibration and wave	A2	1.19	6	0.70	Medium
		A12	0.71			
		A20	0.54			
		A21	0.51			
		A27	0.58			
		A30	0.66			
4	Thermodynamic	A5	0.80	5	0,60	Medium
		A14	0.60			
		A15	0.68			
		A25	0.29			
		A33	**0.62**			

In table 3 can know it the effect of student worksheet on aspects of student knowledge based on material units. From the results of the article analysis, there are four groups of material units in physics learning. The results of the calculation of the effect size of the student worksheet on the highest aspects of student knowledge are shown in the fluid material unit which has an effect size of 0.77 in the high category. And the last result is The effect of using worksheets on knowledge aspect based on learning models

Tabel 4. Effect Size based on unit of subjet Effect Size the effect student worksheet on knowledge aspect based on learning models

No	Learning Models	Code	*Effect Size*	Total	Average *Effect Size*	Category
1	Project Based Learning	A6	0,58	2	0,86	High
		A12	0,71			
2	Problem Solving	A1	1,38	5	0,83	High
		A2	1,19			
		A21	0,51			
		A22	0,51			
		A26	0,56			
3	Discovery Learning	A5	0,80	2	0.72	Medium
		A19	0,64			
4	Problem Based Learning	A4	1,38	4	0.70	Medium
		A15	1,19			
		A31	0,51			
		A33	0,51			
5	Inquiry	A6	0,58	4	0.67	Medium
		A12	0,71			

		A13	0.77			
		A14	0.60			
5	Cooperative	A3	0.88	2	0.66	Medium
		A23	0.43			

In table 4, it can be seen the influence of student worksheet on aspects of student knowledge based on the physics learning model. From 35 articles on the influence of student worksheet on aspects of knowledge in the physics learning model analyzed, 5 groups of learning models were found. The result of calculating the effect size of the student worksheet on the highest aspects of student knowledge is shown in the project based learning model, which is 0.86 with the high category.The effect of using worksheets based on the learning.

Research in education related to the use of student worksheets on student learning outcomes is very much done. The study can be in experimental research, descriptive, correlation, and other research that meets the criteria. Research on the effect of student worksheets on learning outcomes on aspects of student knowledge requires further research to see and evaluate the study results so that it can assess and strengthen the research[11]. A meta-analysis of student worksheets on aspects of student knowledge was conducted to determine and evaluate previous studies.

The results of this study were carried out based on three indicators, namely the effect of using worksheets on aspects of knowledge based on grade levels, material units and learning models. Of the 35 articles that have been analyzed both nationally and internationally and the results obtained from this study indicate that student worksheet can affect aspects of student knowledge.

The first result obtained is the use of worksheets on aspects of knowledge based on grade levels, namely class X and XI. Effect size values for class X and XI, respectively, are 0.67 and 0.73 both belong to the medium category. It can be seen that the value of the effect size of class XI is greater than that of class X. This indicates that the use of these worksheets has a positive impact on aspects of students' knowledge after being used in the learning process at the class level, especially in class XI. This is because the level of thinking and learning experience of students at the level of class XI is higher than class X[11].

The second result is the use of worksheets on aspects of student knowledge based on material units. After being analyzed from 35 articles, the researchers grouped the physics learning materials into 4 groups of material units. The unit of fluid matter consists of static and dynamic fluids. The unit of mechanics consists of work, energy, circular motion, Newton's laws, momentum and impulses, and rotational dynamics. The unit of vibration and wave matter consists of simple harmonic vibrations and mechanical waves. And the thermodynamic material consists of temperature and heat material, as well as the kinetic theory of gases. The effect size results show that the use of worksheets on aspects of student knowledge has the highest value in the fluid material unit with an effect size of 0.77 in the high category. While the matter of mechanics, wave vibrations and thermodynamics are in the medium category. This proves that the use of worksheets is suitable and has a positive impact on increasing student knowledge based on material units in physics learning. This statement is supported by the opinion of Ulhaq stating that understanding the concept of material is very important for students to develop thinking skills at a higher level by activating reasoning power to understand the suitability between the subject matter and the reality that occurs[12].

The third result is the use of worksheets on aspects of student knowledge based on models, methods, strategies and approaches to learning physics. In this indicator, researchers only take indicators of learning models that are widely used. After being analyzed from 35 articles, there are 5 groups of learning models that are most widely used, namely Project Based Learning, Problem Solving, Problem Based Learning, Discovery Learning, Inquiry and cooperative models. The results of the calculation of effect size show that the use of worksheets on aspects of student knowledge based on the learning model has a high category in Project based learning with an effect size value of 0.86. This proves that the use of worksheets has a positive impact on increasing students' knowledge based on the physics learning model. This is supported that the Project-based learning model is a learning model that uses problems as the first step in collecting and integrating new knowledge based on his experience in real activities[13].

This research has some limitations in its implementation. The limitations in this study are expected to be lessons and experiences for further research. The limitations in this meta-analysis research are the number of articles that do not describe the standard deviation or the number of samples in the study so that they cannot calculate the effect size in this study. And there are still several articles obtained from a collection of academic papers published through a seminar (proceedings). To overcome this problem, you can look for more articles in accredited journals so as to produce quality research results.

IV. CONCLUSION

In summary the value of effect size is the effect of using student worksheets on aspects of knowledge based on the grade level, namely in class X and XI, namely 0.67 and 0.73 in the medium category. So the use of worksheets on students' knowledge has a positive impact based on grade level, especially in class XI. Effect size value. The effect of using student worksheets has a positive impact on aspects of student knowledge based on the material unit in the fluid material unit, which has an effect size value of 0.77 with a high category. Meanwhile, the thermodynamic material unit has the lowest effect size value, which is 0.60 in the medium category.The value of the effect size of the use of student worksheets has a positive impact on aspects of student knowledge based on the learning model on the project based learning model, which is 0.86 with a high category. While the cooperative model has the lowest effect size value of 0.66 in the medium category.

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