META ANALISYS OF THE EFFECT OF THE USE OF VIDEO ON STUDENT LEARNING OUTCOMES IN PHYSICS AND SCIENCE LESSONS

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ABSTRACT

Physics and science are subjects that study the phenomena in the universe. Not all of the material studied can be visualized because not all of it is concrete. This makes it difficult for students to understand the material. The solution that fits this problem is to apply the use of video into the student learning process. Therefore, this study aims to determine the summary effect size of the effect of using video on student learning outcomes in high school physics and junior high school science subjects. This research method uses meta-analysis by collecting several articles, namely as many as 26 articles. The selected articles are articles that can be obtained summary effect size on the application of videos in physics and science lessons. The value of the summary effect size is then grouped into three indicators, namely based on education level, learning model at high school level, and research area. Based on this research, the conclusions obtained are: (1) Summary Effect size on the effect of video use when compared based on education level indicators, obtained the effect of video use in junior high school is higher than in high school, (2) Summary Effect size on the effect of video use when compared based on learning model at the high school level, it was found that Creative Problem Solving became the most influential with very high criteria, and (3) Summary effect size of the effect of video use when compared based on the indicators of the research area, it is found that Sumatra Island is the most influential area in the use of video with high criteria.

Keywords : *Meta analysis; video; student learning outcomes.*

I. INTRODUCTION

The 21st century is marked by globalization, meaning that human life in the 21st century demands quality in all human endeavors and results. By itself, the 21st century demands quality human resources. Human resources are produced by educational institutions that are managed professionally so as to produce superior results. Therefore, government efforts are needed to achieve the demands of 21st century education.

In accordance with the demands of the 21st century education century, the government finally issued a policy in the form of 8 educational standards. Educational standards that are directly related to learning are competency standards, facilities and infrastructure standards, process standards, and assessment standards. To carry out the learning process in accordance with these educational standards, appropriate media and learning resources are needed according to those mentioned in the facilities and infrastructure standards. One of the appropriate media used in the teaching and learning process is video learning.

Video is an electronic media that is able to combine audio and visual technology together to produce a dynamic and interesting show. The Video present more interesting than books, pictures, and audio media [1]. Meanwhile, instructional video media are media or tools that present audio and visuals containing good learning messages that contain concepts, principles, procedures and knowledge application theories, to assist understanding

of a learning material [2]. To find out the needs of students in the learning process in the form of learning media, namely contextual learning videos, a needs analysis was carried out. Contextual learning videos are designed according to what students expect with what students already have. Contextual learning videos are designed with several activity steps, one of which is collecting data on student characteristics, teaching materials and learning media used by teachers during the learning process [3]. This learning video is certainly good for use in learning physics and science.

Physics is a subject that is closely related to the environment or everyday life. Physics can be interpreted as a lesson that is closely related to natural phenomena so that it gets the rules or laws in physics [4]. Through logic physics education, students become systematically focused on looking at their natural environment, identifying existing problems, and solving them [5]. In science teaching, this aspect of the process appears in the form of learning activities. Whether or not there is a process aspect in teaching science is very dependent on the teacher. The theories in physics books should be taught by bringing the problem in a contextual and familiar form to students. Then students are guided to carry out various activities through investigation activities. This makes students more aware of scientific phenomena through their sensory experiences, compared to just being listeners in front of the class. In physics, learning can be obtained through physical events in the natural environment, so that not only theory must be studied in this field of physics, but also requires practice in proving theories that have been studied and implemented properly [6]. Therefore, the use of video as a medium for *audio-visual* in physics and science subjects is expected to improve student learning outcomes.

Learning outcomes are changes in behavior or responses caused by experience. Therefore, learning outcomes are abilities obtained by children after going through learning activities. In teaching and learning activities, the teacher sets several learning objectives. Students who are successful in learning are successful in achieving learning goals or instructional goals [7]. Learning outcomes can be seen when there is a change in students after going through various learning processes. Learning outcomes are learning achievements achieved by students in learning activities and bring about a change in one's behavior, which is marked by changes in one's attitudes and actions from not knowing to knowing [8]. In the science learning process, the teacher still uses very simple learning media, which is only in the form of displaying images and elaborating the material presented with the program Microsoft Word. In the appearance of the media, the teacher only provides an explanation of the material, causing the learning process that takes place to be dominated by the teacher [9]. The teacher is the key actor in the learning. In this case the teacher has a very important and fundamental role in guiding, educating, directing students in every learning process [10]. This causes students to be less interested in studying physics [11]. Based on the problems presented, it can be seen that there is a gap between the real conditions and the expected conditions. One solution to this problem is to apply the use of video to the students' physics and science learning process. Because students are actively involved in learning, video has the ability to improve students' learning motivation and hence support learning outcomes. Many prior researchers have conducted studies on the usage of video. The study's findings suggest that using video has a major impact on student learning outcomes. Therefore, the researchers tried to integrate all of these studies to find out how far the effect size was meaningfully obtained by using the meta-analysis method.

Meta-analysis is a word that refers to a quantitative and systematic method of reviewing previous studies. Meta analysis is included in one type of systemic review. Systematic literature review means identifying, evaluating and interpreting all existing relevant studies for a specific research question, or a particular topic area or phenomenon of interest to the researcher [12]. In addition, a meta-analysis is a study conducted by analyzing quantitative data from primary studies. The results of the analysis of the primary studies are used as the basis for accepting or rejecting the hypotheses proposed by several researchers [13]. Meta analysis has several purposes. The purpose of meta-analysis in general is not much different from other research, namely, the results of the research are used to find the truth, explain the relationship of a phenomenon and the most important thing is that the research can be useful for future researchers and most people. The objectives of the meta analysis are: (1) to increase the statistical power of the primary research results, (2) to obtain an estimate of the effect size, (3) to overcome the uncertainty of some research results. Effect size is a measurement of the practical significance of research findings expressed as a magnitude of correlation or difference, or as a magnitude of the effect of one variable on other variables. The ability to give firmness on the use of the same methodology in the literature review needed of a study is one of the purposes of meta analysis research that distinguishes it from other research [14].

Meta-analysis research was chosen as the method in this study for several reasons. First, previous research only affected one variable on the dependent variable. Second, previous research only covered one grade level. Third, previous research only measured one student's ability. Therefore, the meta-analysis research method is an appropriate research method used to summarize and conclude the results of studies more broadly. Based on this,

researchers are interested in conducting research using the method of review articles with analysis effects, often called Meta Analysis.

Based on the background of the problem that has been described, the researchers are interested in conducting a meta-analysis of the effect of video on students' physics learning outcomes. Therefore, researchers want to see how summary effect size on the effect of using video on learning outcomes in high school physics and junior high school science subjects based on education level, learning model at high school level, and region?

II. METHOD

Meta-analysis was employed as a research method in this study. Meta-analysis is a sort of research that involves summarizing, analysing, and evaluating data from previous studies. The meta-analysis include research that is quantitative because it calculates it with numbers and statistics from many data sources [15]. Meta-analysis is a quantitative study to process or analyze several research results using statistical methods to summarize and obtain general conclusions [16]. Meta-analysis is one type of review which is a form of identifying, evaluating and interpreting all relevant studies for a specific research question, or a particular topic area or phenomenon of interest to the researcher [17]. The collection of research data was carried out by browsing articles in online journals through the University E-Journal Web, Sinta, Proceedings of the National Seminar, and Google Scholar.

This research design consists of three stages. The first stage is the preparation stage where the researcher determines the domain based on the independent variable, the dependent variable, and the moderator variable. After that, the researchers set the research criteria based on the form of publication and year of publication. Furthermore, the researchers set the operating definition of the dependent variable, for example, the increase in student learning outcomes in physics learning obtained by students, both pre-test and post-test, which was expressed in the form of scores. The next stage is the implementation stage where at this stage the researcher begins to search for and collect the articles obtained and then the researchers divide them into several criteria, which include education level, learning model, and region. Data analysis is the final step. The researcher examines the effect size based on the target factors and methodological variables at this step. Then the researchers group the articles with effect sizes of low, medium, high, and very high. After that, they make a summary in a scientific report.

This study has three variables, namely independent, bound, and moderator. The independent variable for this research is learning video, while the dependent variable is student learning outcomes. The moderator variables for this research are education level, learning model at high school level, and region.

This study uses a meta-analysis method that was conducted on 26 articles related to the effect of using videos published in 2014-2021. The analytical technique used is a quantitative approach with calculations and data analysis in the article. To facilitate data analysis, data tabulation was carried out with the following steps: (1) Identifying the variables found, (2) Identifying the experimental and control groups' mean and standard deviation (3) Calculating the effect size with the following equation.

$$ES = \frac{\left(\overline{X}_{post} - \overline{X}_{pre}\right)_{eksperimen} - \left(\overline{X}_{post} - \overline{X}_{pre}\right)_{control}}{\left(\dfrac{SD_{precontrol} + SD_{preeksperimen}}{3}\right)} \qquad (1)$$

After finding the effect size results based on the above formula, effect size criteria can be seen in Table 1.

Table 1. Interpretation of Effect Size

ES	Category
ES ≤ 0,15	Very Low
0,15 < ES ≤ 0,40	Low
0,40 < ES ≤ 0,75	Medium
0,75 < ES ≤ 1,10	High
ES > 1,10	Very High

(Source: Ref [14])

Based on Table 1, the value *effect size* with a small effect size of 0.15 can be ignored while the effect size from 0.15 to 0.40 is included in the low category. The effect size from 0.40 to 0.75 belongs to the medium category. The effect size from 0.75 to 1.10 is included in the high category. And a large effect size of 1.10 includes a very high effect criterion.

The other formulas to find the *effect size* are as follows:

1. Average in one group

$$ES = \frac{\overline{X}_{post} - \overline{X}_{pre}}{SD_{pre}} \qquad (2)$$

2. Average in each group

$$ES = \frac{\overline{X}_{eksperimen} - \overline{X}_{control}}{SD_{control}} \qquad (3)$$

3. If the standard deviation is not known then it can be done by t test

$$ES = t \sqrt{\frac{1}{n_{eksperimen}} + \frac{1}{n_{control}}} \qquad (4)$$

After interpreting various research studies, it will be known how the effect of using video on learning outcomes in high school physics and junior high school science subjects based on education level, learning model, and region by calculating Effect Size using the described formula.

III. RESULTS AND DISCUSSION

A. Research result

The acquired effect size of the research sample was which was divided based on three factors, namely education level, research area, and learning model, based on the results of the analysis conducted on 26 articles.

1. The impact of video on learning outcomes when comparing education levels.

The results of the analysis related to the impact of using video on student learning outcomes through indicators of education level, obtained the summary effect which can be seen in Table 2.
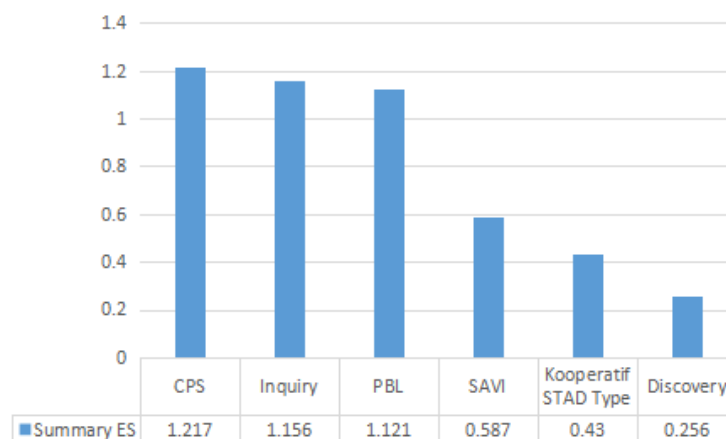
Table 2. The Summary Effect Size For The Education Level

Education Level	Article Code	Effect Size	Summary Effect Size	Criteria
SMP	A3	1,204	0.901	High
	A11	0,948		
	A12	0,98		
	A13	0,825		
	A14	1,028		
	A15	1,114		
	A16	1,448		
	A17	1,001		
	A18	0,4525		
	A19	0,93		
	A20	0,748		
	A21	0,505		
	A22	1,156		
	A24	0,735		
	A25	1,434		
SMA	A1	0,6	0.89	High
	A2	1,0773		
	A4	1,172		
	A5	0,26		
	A6	1,151		
	A7	1,08		
	A8	1,27		

Based on the table above, which is the result of using video based on education level, it can be seen that the biggest influence is at the junior high school education level, with an effect magnitude of 0.901 in the high category. In addition, the high school education level has an effect magnitude of 0.89 in the high category. Seeing the high results summary effect size from the two levels of education, it can be interpreted that video is very influential in the learning process and is also well used to improve student learning outcomes.

2. The impact of video use on learning outcomes when compared based on learning models at the high school level

The results of the analysis related to the effect of using video on student learning outcomes of learning model indicators at high school level, can be seen in Figure 1.
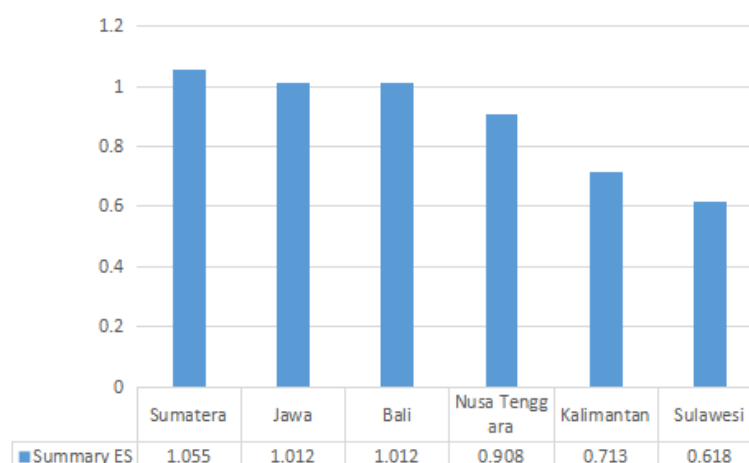

	CPS	Inquiry	PBL	SAVI	Kooperatif STAD Type	Discovery
■Summary ES	1.217	1.156	1.121	0.587	0.43	0.256

Fig. 1. Graph of summary effect size based on the learning model

Based on Figure 1, which is the result of the summary effect size of using video based on the learning model at the high school level, it can be seen that the biggest influence is on the use of the learning model, Creative Problem Solving, with an effect magnitude of 1.217 in the very high category. In addition, the discovery learning model is the learning model that has the smallest effect with an effect magnitude of 0.256 in the low category. However, when viewed as a whole, from the results summary effect size obtained, it can be interpreted that the use of video with a learning model is very influential in the learning process and is also well used to improve student learning outcomes.

3. The effect of video on learning outcomes when compared based on the research area

The results of the analysis related to the effect of using video on student learning outcomes through indicators of the research area can be seen in Figure 2.

	Sumatera	Jawa	Bali	Nusa Tenggara	Kalimantan	Sulawesi
■Summary ES	1.055	1.012	1.012	0.908	0.713	0.618

Fig. 2. Graph of summary effect size based on the research area

Based on Figure 2, which is the result of using video based on the indicators of the research area, it can be seen that the biggest influence is in the Sumatera Island area, with an effect magnitude of 1.055 in the high category. In addition, Sulawesi Island is the region with the smallest influence with an effect magnitude of 0.618 with a medium category. However, if viewed as a whole from the summary effect size results obtained, it can be

interpreted that video is very influential in the learning process and is also good for use to improve student learning outcomes in Indonesia.

B. Discussion

The findings of this research were based on three indicators: educational level, learning model at high school level, and research field. The findings of this study suggest that using video to teach high school physics or junior high school science can have an impact on students' learning outcomes.

The first result achieved is an indicator of video usage based on education level at the junior and senior high school levels. The level of education that has the largest summary effect size value is at the junior high school level with the effect magnitude being on the high criteria. As for the high school education level, the magnitude of the effect obtained is below the magnitude of the effect for the junior high school level but remains on the high criteria. Based on these results, it can be seen that the use of video at the junior high school level is higher than the high school level. Seeing the high summary effect size on the use of video based on education level, it can be interpreted that the use of video can improve student learning outcomes. This is in accordance with the results of research that has been carried out by previous researchers that the use of video is very influential on the learning process [18].

The result of the second study is the use of video based on the learning model at high school level. The researchers obtained data from 6 learning models. Based on the results of the summary effect size, the data obtained shows that creative problem solving is the most influential learning model among the others. This is because the effect size for this learning model is in the very high category. The advantages of the learning model Creative Problem Solving are (1) encouraging students to be more active in the learning process, (2) being able to foster student curiosity, (3) training students' thinking skills in solving problems, (4) fostering collaboration and interaction between students. shows that the learning model can improve student learning outcomes [19]. In addition, the learning model is the learning discovery model that has the smallest effect with the magnitude of the effect in the low category. The drawbacks of the model discovery learning are (1) it takes a lot of time because teachers are required to change their teaching habits, which generally serve as information providers to become facilitators, motivators, and mentors, (2) students' rational thinking abilities are still limited, and (3) not all students can follow the lesson in this way. When viewed as a whole, the use of learning models in the use of videos in the learning process is able to improve student learning outcomes [20]. This is in accordance with the opinion of researchers that the use of learning models together with videos can improve student learning outcomes [21].

Researchers acquired data from six Indonesian islands for the third study, which focused on the use of video based on the research area. The data acquired suggests that Sumatera Island has the highest influence on the usage of video on student learning outcomes, with an summary effect size in the high category. Furthermore, Sulawesi is the Indonesian island with the smallest effect, with a magnitude of effect in the medium category. Based on the overall statistics, this is consistent with past research findings, namely that incorporating video into the learning process can increase student learning outcomes in Indonesia [22].

IV. CONCLUSION

Based on the results of the meta-analysis of the effect of using video on student learning outcomes, the following conclusions were obtained: (1) Summary effect size on the effect of using video when compared based on indicators of education level; obtained high criteria for junior high school level and high school level; (2) Summary effect size on the effect of using video when compared based on the learning model at high school level; obtained high criteria for the learning model's Creative Problem Solving; (3) Summary Effect size on the effect of using video when compared based on indicators of the research area; obtained high criteria for the Sumatera Island region.

REFERENCES

[1] N. Suryani, Yurnetti, A. Putra, and Desnita, The Effect Of Use Video In The Model Of Guided Inquiry Learning On Traveling Waves And Sound Waves Materials In Class XI SMA Negeri 7 Sijunjung, *Pillar of Physics Education,* vol. 14, no. 3, pp. 187-195, 2021.

[2] Eldarni, *Media Video*. Padang: UNP Press. 2014.

[3] S. Hamida and Desnita, Analisis Kebutuhan Video Pembelajaran Fisika Berbasis Kontekstual Materi Suhu Dan Kalor Untuk Pembelajaran Abad 21, *Jurnal Pendidikan Fisika*, vol. 9, no. 1, pp. 42-49, 2020.

[4]   N. Syahdi, Desnita, Murtiani, and W. S. Dewi, Meta-Analysis Of The Effect Of Use Worksheets On Students Critical And Creative Thinking Skills In Learning Natural Science In Junior High School And Physics In Senior High School, *Pillar of Physics Education,* vol. 14, no. 3, pp. 235-241, 2021.

[5]   I. W. Suastra, *Belajar dan pembelajaran sains*. Bali: Jurusan Pendidikan Fisika Universitas Pendidikan Genesha. 2006.

[6]   D. Yarsina, S. Y. Sari, Y. Darvina, and Asrizal, Kajian Literatur Pengaruh LKS Inkuiri Terbimbing Terhadap Hasil Belajar Fisika Siswa Untuk Berbagai Jenjang Pendidikan, *Pillar of Physics Education,* vol. 13, no. 3, pp. 467-474, 2020.

[7]   Jihad and Haris. *Evaluasi Pembelajaran*. Yogyakarta: Multi Presindo. 2010.

[8]   F. Annisa, Murtiani, Desnita, and Asrizal, Comparison of Learning Outcomes Using CTL and PPT-based Videos at Adabiah High School on Newton's Laws of Motion and Gravity, *Pillar of Physics Education*, vol.13, no. 2, pp. 353-363, 2020.

[9]   H. R. Anjani, S. Y. Sari, Y. Darvina, and L. Dwiridal, The Effect of Hots-Oriented Worksheets on Heat and Kinetic Theory of Gases on Students' Critical and Creative Thinking Ability with Guided Inquiry Model in Grade XI SMA Al-Istiqamah Pasaman Barat, *Pillar of Physics Education,* vol. 14, no. 1, pp. 74-80, 2021.

[10]   D. Yunita and A. Wijayanti, Pengaruh Media Video Pembelajaran Terhadap Hasil Belajar IPA Ditinjau Dari Keaktifan Siswa, *Jurnal LP3M - Universitas Sarjanawiyata Tamansiswa Yogyakarta*, vol. 3, no. 2, pp. 153-160, 2017.

[11]   S. Yulianti, V. Haris, and A. N. Chandra, Penerapan Media Video dalam Model Pembelajaran SAVI *(Somatic, Audio, Visual and Intellectual)* terhadap Hasil Belajar Siswa Pada Mata Pelajaran Fisika Kelas X1 IPA di SMA N 1 Rambatan. *Seminar Nasional Pendidikan Matematika dan Sains, IAIN Batusangkar.* 2018.

[12]   B. Kitchenham, *Procedures for Performing Systematic Reviews*. Eversleigh: Keele University. 2004.

[13]   Sugiyanto, *Analisis Statistika Sosial*. Malang: Bayu Media Pub. 2004.

[14]   Anwar, Ruswana, *Meta Analisis.* Bandung: Fakultas Kedokteran UNPAD. 2005.

[15]   N. P. Tenti, Meta-Analysis of the Effect of Integration Stem Education in a Various Learning Models on Student Physics Learning Outcomes, *Pillar of Physics Education*, vol. 13, no. 4, pp. 520–528, 2020.

[16]   Merriyana, Rosa, Meta Analisis Penelitian Alternatif bagi Guru, *Jurnal pendidikan PENABUR*, vol. 5, no. 6, pp. 102-106, 2006.

[17]   S. Green, Systematic Reviews and Meta-Analysis, *Singapore Med J*, vol. 46, no. 6, pp. 270-4, 2005.

[18]   N. Magfirah, Peranan Video Youtube Sebagai Alternatif Media Pembelajaran Di Masa Pandemi, *Jurnal Riset dan Inovasi Pembelajaran*, vol. 1, no. 2, pp. 51-58, 2021.

[19]   J. Bahrudin, Penerapan Model Pembelajaran *Creatif Problem Solving* untuk Meningkatkan Hasil Belajar Teknologi Layanan Jaringan Materi Ragam Aplikasi Komunikasi Data, *Journal of Education Action Research*, vol. 4, no. 4, pp. 536-545, 2020.

[20]   M. Hosnan, *Pendekatan Saintifik dan Kontekstual dalam Pembelajaran Abad ke-21*. Bogor: Ghalia Indonesia. 2014.

[21]   N. Hasanah, R. Marlina, and Yokhebed, Pengaruh Model Problem Based Learning Berbantuan Video Terhadap Hasil Belajar Siswa SMPN 8 Pontianak, *Jurnal Pendidikan dan Pembelajaran Khatulistiwa*, vol. 8, no. 10, pp. 1-12, 2019.

[22]   M. Khairani, Sutisna, and S. Suyanto, Studi Meta-Analisis Pengaruh Video Pembelajaran Terhadap Hasil Belajar Peserta Didik, *Jurnal Biolokus*, vol. 2, no. 1, pp. 158-166, 2019.