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Meta-Analysis the Effect of Cooperative Learning Think Pair Share Type on Student Physics Learning Outcomes in Senior High School

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Abstract: Various efforts have been made to realize ideal physics learning, one of which is by applying the right learning model. This study's objective was to ascertain the impact of cooperative model type think pair share on students' physics learning outcomes based on instructional materials and media. This study collected 17 articles from national and international journals to be discussed using the meta-analysis method. Articles used in this study have been analyzed and meet the categories for effect size calculation and are grouped based on two indicators, namely based on subject matter and learning media. The results showed that the think pair share learning approach had an overall positive effect of 1.98 on students' learning outcomes in physics, with a high influence category. According to the learning materials, the material with a magnitude and measurement of 5.03 and a high influence category is where the think pair share model has the most impact. Based on learning media, the most effective influence on animation media is 1.61 with a high influence category. The TPS learning model is most effective in improving the physics learning outcomes of students on the material of quantities and measurements. The most effective learning tool for enhancing students' physics learning outcomes when using the TPS model is animated learning material.

Keywords: A meta-analysis; Physics learning outcome; Think pair share learning model

Introduction

The world has now been welcomed by the 21st century. At this time science and technology are developing very rapidly. Along with these developments, the quality of human resources must also be qualified to answer the challenges in the current era. The fundamental factor that has always improved the caliber of human resources is education. To confront the challenges of the 21st century, education must be adaptive to the times. With good education, human resources will also be built well. As for the implications for the demands of the present, education has a great responsibility in honing and creating quality human resources so that they are able to compete globally with an understanding and skills that develop no less than the times. The goal of education should be to provide students with the knowledge and abilities necessary to master these talents and lead fulfilling lives. (Mufit et al., 2020).

To ensure the effective growth and continuation of the life of the country and state, education is one of the most crucial factors in life (Saputra et al., 2019). Successful learning activities are those that result in positive learning results for the pupils, whereby learning objectives serve as the foundation for assessing how well pupils have mastered a topic. Learning outcomes are the degree of a person's success in applying a lesson, which has been expressed in the form of numbers obtained from the evaluation process (Sobri, 2021).

Physics has a huge influence on technology and scientific advancement (Siregar et al., 2023). Physics learning is ideally directed at developing students' habits of constructing their understanding in order to have good learning outcomes. This indicates that in physics learning, students who receive the learning are

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expected to have cognitive abilities and have good learning outcomes.

The facts that occur in the field do not fully show the implementation of ideal physics learning. Considering research that has been done by Nugrahanggraini et al. (2014), we found several problems in physics learning where students consider physics to be a difficult and boring subject, so that students lack interest and become passive in receiving learning. This has an impact on student learning achievement which is relatively low.

The same thing was also found in the research Urwati et al. (2019) who found that learning that still uses conventional methods has an influence on students' low learning results. the average score of students after receiving lessons is still categorized as low or has not reached the KKM score of 73. Most students scored below KKM, namely 24 students who were not complete with a percentage of 66%, while only 10 students scored above KKM with a percentage of 34%. Ritonga et al., (2021) revealed that students also struggle with the topic and have negative impressions of it, which has an impact on the learning results they achieve in class X at SMA Negeri 1 Batang Kuis.

Many parties have provided various alternative solutions to overcome these problems. One of them is by using the appropriate and cutting-edge learning model to enhance students' learning results in physics. The learning model must be appropriate with basic competencies and material characteristics of learning (Mulyana et al., 2021). The cooperative learning model, or learning in groups, is one of the effective teaching strategies used to enhance students' understanding of physics. The idea behind cooperative learning is that when students collaborate and can share knowledge, the learning process becomes more meaningful (Hasanah, 2021).

There are several varieties of cooperative learning models, and TPS is one of them. The TPS learning paradigm is a useful substitute for changing the tone of class discussions. The TPS model's protocols can offer students enough time to reflect, respond, and assist one another (Nurhayati, 2017). This model consists of three syntaxes as the name suggests, namely think, pair, and share.

Kule et al. (2018), in his research explained several benefits of the cooperative model of the TPS, namely students can take a more active role in their education, students get the opportunity to construct their own knowledge, students can improve their own abilities, and give students motivation to learn. To enhance student learning results, the TPS type cooperative learning model is a great tool to use in the classroom.

Many studies have been conducted and shown positive results from the use of the TPS-type cooperative learning approach, which can enhance students' learning results in physics. Research by Isnaniah et al. (2022) shows that learning with cooperative models can improve learning outcomes and students concept understanding. Through cooperative learning, students are required to actively discuss and share knowledge with fellow group members, facilitating the understanding of the subject topic by students. This is because students can help each other in understanding and interpreting difficult physics material.

The same is also revealed through research Zuriatun et al. (2021) shows that there are many variations of learning with cooperative models, TPS type is one of them. which shows good learning outcomes after its application in learning. Meanwhile, according to research by Tampubolon et al. (2014) learning carried out by utilizing a cooperative learning model of the TPS kind shows good results from student learning achievement.

This research uses meta-analysis method to summarize research results from a number of studies with the same topic. The topic discussed in this study is the impact of a cooperative learning model identical to TPS on students' learning outcomes in physics. The level of education chosen in this research is senior high school. In general, students' learning outcomes include the emotive, cognitive, and psychomotor domains. However, this study exclusively looks at physics learning outcomes that lead to the cognitive domain, and uses students' comprehension and interpretation of the material as its standard. There are six levels of cognitive student knowledge. Remembering (C1), comprehending (C2), integrating (C3), analyzing (C4), evaluating (C5), and producing (C6) make up the cognitive domain.

The method used in the research in question is meta-analysis. By doing this meta-analysis research, it will be very useful to get detailed and valid information, because the meta-analysis basically presents a summary of the research results about the effect of the model. Basically, presents a summary of the results of research on the effect of the Think Pair Share type cooperative model on students' physics learning outcomes and the extent of the relationship between variables in the research conducted and covers a wide area.

This study's objective was to ascertain the impact of the cooperative model of the think pair share type on students' overall learning results in physics, depending on the course material and teaching methods.

Method

The method adopted for this study is meta-analysis with a quantitative approach. Meta-analysis is a

statistical technique in the form of a combination of two or more similar studies so that a quantitative blend of data is obtained. Meta-analysis is also quantitative because the calculations use numbers and statistics that aim to process information from many data sources.

This study used 3 research variables, namely: Physics learning outcomes as dependent variable, TPS model as independent variable, and subject matter and learning media as moderator variables. This research uses articles contained in national and international journals or proceedings with a time span between 2014-2022 (the last 10 years). this research is carried out in a structured manner based on predetermined procedures, this research procedure can be seen in Figure 1.

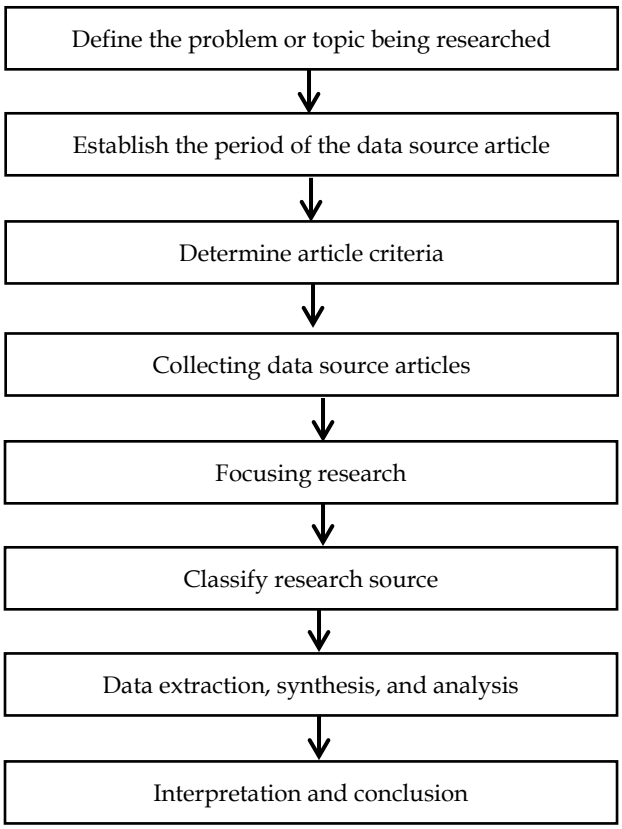

Figure 1. Procedures of Research

Data analysis used effect size calculation techniques for each article using Cohen's equation and summarized the study's findings utilizing the fixed effect model and random effect model. Interval analysis in Table 1 is used to interpret effect magnitude. (Borenstein et al., 2009).

Table 1. Interpretation of the Effect Size Value

ES	Category
$ES \leq 0.15$	Can be ignored
$0.15 < ES \leq 0.40$	Small
$0.40 < ES \leq 0.75$	Medium
$0.75 < ES \leq 1.10$	High
$1.10 < ES \leq 1.45$	Very high
$1.45 < ES$	High influence

Result and Discussion

This study aims to ascertain how students' learning results in physics are affected by the cooperative learning model type think pair share both in general and based on learning materials at the high school unit level and learning media used. The research data used is primary data by tracing articles from international national indexed journals. After searching the primary data, a total of 17 articles were obtained that met the specified criteria. Furthermore, the statistical data of each article was processed to be used as research results. Statistical data is processed to obtain effect size. The findings of the calculation of each article's effect size can be seen in Table 2.

Table 2. Effect Size of Each Article

Article Code	Effect Size	Category
T1	1.265	Very high
T2	0.696	Medium
T3	2.282	High influence
T4	0.527	Medium
T5	0.478	Medium
T6	2.306	High influence
T7	5.658	High influence
T8	1.978	High influence
T9	0.803	High
T10	1.164	Very high
T11	0.632	Medium
T12	7.162	High influence
T13	0.616	Medium
T14	0.163	Small
T15	1.083	High
T16	0.112	High
T17	3.194	High influence

These reults demonstrate the amount of each article's impact on the outcomes of students' cooperative think-pair-share physics learning. The effect size value is the hedge's value obtained through the correction factor. The distribution of these data varies from low to very high categories.

From this, it can be seen that almost all articles are in the medium to high effect size category. There are 8 articles in the very high category with a percentage of 47.06%. For the medium category, there are 5 articles in this category. The medium category is the second most article effect size category with a percentage of 29.4%. The high category is the third most article effect size category with a percentage of 17.65% which contains 3 articles. While there is 1 article in the low category with a percentage of 5.8%.

The number of articles in the medium, high, and very high categories indicates the impact of the cooperative think-pair-share paradigm on students'

learning results in physics. However, the overall effect size cannot be determined through the average of all articles. This is because the overall population of articles needs to be tested whether it is uniform or varied. In obtaining the overall effect size value, the summary effect size calculation is the right thing to do and is done with a fixed effect or random effect model. Summary effect size of the effect results of the think-pair-share cooperative approach on students' learning in physics can be seen in Table 3.

Table 3. Summary effect size of the effect of TPS model on students physics learning outcomes

N	M^*	SE_M^*	Category	P	α Lower	α Upper
17	1.98	0.40	Very High	0.00	1.09	2.68

The results of data processing in Table 6 show that the impact of the cooperative model of think pair share type has an impact size of 1.98 in the strong influence category on students' learning outcomes in physics. The lower limit value is 1.09 and the upper limit is 2.68. The range is in a very high category, the p-value test value obtained is 0.000 and the confidence interval is 95% then $p < \alpha$ so that h_o is rejected. The rejection of this h_o means that there is an effect of the cooperative model of TPS on the physics learning outcomes of students.

This is relevant to research Choirunisa et al. (2019) It claims that an increase in students' physics learning outcomes After the use of the TPS model. Another research by Tanjung et al. (2016) It claims that the experimental class, which used the think pair share model, and the control class, whose learning was carried out through conventional learning. Doyan et al., (2020) According to his research, the experimental class and the control class had different student learning results. The results showed that learning with the TPS type cooperative model effectively improved student learning outcomes.

The study's second finding displays the overall impact size of the cooperative model's think pair share type on students' learning results in physics seen based on learning materials. Analysis of learning materials from 17 articles obtained 7 identified materials. Of the seven learning materials, only 5 learning materials meet the criteria so that the calculation of summary effect size can be done. The following is a summary of the effect of the implementation of the TPS model depending on the subject matter and the results of students' learning in physics as in Table 4.

Table 4. Summary effect size based on subject matter

Leason Material	N	M^*	SE_M^*	Category	P	α Lower	α Upper
mechanical wave	3	1.43	0.58	Very high	0.00	0.29	2.57
temperature and heat	2	1.24	1.18	Very high	0.10	-1.07	3.55
quantity and measurement	3	5.03	1.57	High influence	0.00	1.95	8.10
kinematics of motion	2	1.25	0.21	Very high	0.00	0.60	1.40
elasticity	2	1.62	0.40	High influence	0.00	0.82	2.41

Based on table 4, the highest summary effect size value is 5.03 with a high influence category, namely on the material of quantities and measurements. The lower limit value obtained is 1.95 and the upper limit of 8.10 is in the high influence category. If the confidence interval used is 95% and based on the p-value test value obtained 0.000 so that the $p < \alpha$ which means h_o is rejected. The rejection of this h_o means that there is an effect of the cooperative model of TPS on the physics learning outcomes of students on the material of quantities and measurements.

This is consistent with analysis by Alwia et al. (2021) showed that the physics learning outcomes of students on the material of quantities and measurements increased after applying the cooperative model of TPS. Other research conducted by Tinus et al., (2019) The findings demonstrated that students in the experimental class who were exposed to cooperative learning of the TPS kind outperformed those in the control class who were exposed to traditional learning models in terms of their learning outcomes..

Meanwhile, The use of the cooperative think-pair-share paradigm to mechanical wave content benefits students' learning results in physics. The overall impact size value of 1.43, which is in the extremely high category. The lower limit value obtained is 0.29 and the upper limit is 2.57 which is also in the high influence category. If the confidence interval used is 95% and based on the p-value test value obtained 0.000 so that the value which means rejected. The denial of this indicates that the cooperative model of think pair share type has an impact on students' learning results in physics with regard to mechanical wave content.

This is consistent with analysis by Pangkali et al., (2016) It claims that using the TPS type cooperation model and the direct Instruction learning model results

in significantly different cognitive learning outcomes for students'. The cooperative learning model of TPS is effective in improving students' learning outcomes on mechanical wave material. learning by using small groups allows students will collaborate to accomplish learning objectives.

The cooperative model of the TPS also has a positive effect on motion kinematics material. This can be seen from the summary effect size of 1.25 with a very high category. The lower limit value obtained is 0.60 and the upper limit is 1.40. If the confidence interval used is 95% and based on the p-value test value obtained 0.000 so that the value which means rejected. Rejection of this means that there is an effect of the cooperative model of TPS on the physics learning outcomes of students on motion kinematics material.

This is consistent with analysis by Choirunisa et al., (2019) It claims that the cooperative learning paradigm of the TPS with mind mapping techniques is very well implemented and after applying the Cooperative learning model of the TPS using mind-mapping techniques, the results of students have increased significantly as evidenced by the t-test significance.

The TPS cooperative learning model is also appropriate to be applied in learning physics elasticity material. This is evident from the summary effect size value of a number of articles that show a value of 1.62 including in the high influence category. If the confidence interval used is 95% and based on the p-value test value obtained 0.000 so that the value which means rejected. The denial of this indicates that the cooperative model of the think pair share type has an impact on students' learning results in physics with regard to elastic material.

This is consistent with the findings made by Suhaida et al. (2020) showed that the cooperative model of TPS with experimental method can improve learning outcomes and students' activities. Learning activities that can be developed with the TPS learning strategy accompanied by experimental methods are conducting experiments, summarizing experimental results, asking questions, listening to presentations and expressing opinions and taking tests.

The smallest summary effect size value is 1.24 with a very high category in temperature and heat material. The lower limit value obtained is -1.07 and the upper limit is 3.55. If the confidence interval used is 95% and based on the p-value test value obtained 0.1 so that the $p > \alpha$ value which means h_o is accepted. Acceptance of this h_o means that there is no effect of the cooperative model of TPS on the physics learning outcomes of students on temperature and heat material. Summary effect size shows that enhancing the way kids learn about temperature and heat through the use of the TPS cooperative model is not particularly effective.

The third research result is the summary effect size of the impact of the think-pair-share cooperative approach on students' learning outcomes in physics based on instructional media. Based on the results of data analysis, 5 learning media were obtained which were classified as moderator variables. However, only 2 learning media can be determined summary effect size, namely animated learning media and concept maps. The overall impact size value of the cooperative model of the think-pair-share type on students' learning outcomes in physics based on instructional media can be seen in Table 5.

Table 5. Summary of effect sizes by learning media

Learning Media	N	M^*	SE_M^*	Category	P	α Lower	α Upper
Animation	2	1.61	0.36	High influence	0	0.91	2.31
Concept map	2	0.66	1.18	Medium	0	0.58	1.42

Based on Table 5, animation learning media is known to affect student learning outcomes seen from the summary effect size value of 1.61 in high influence category. Likewise with concept map learning media which also affects student learning outcomes with a summary effect size of 0.66 in the high category. This is in line with research conducted by Simamora & Dalimunthe, (2014) This demonstrates how including digital animation into sessions that cover learning content may encourage students to comprehend the topic and apply it appropriately to post-test questions.

Conclusion

Considering the findings of the performed research, It may be concluded that the cooperative learning model of the think pair share type significantly enhances students learning results in physics. The cooperative learning model of think pair share type has a positive influence on students' physics learning outcomes, it can be seen from the effect size of 1.98 with high influence category. The TPS model has the best effect in improving learning outcomes on the material of magnitude and measurement with an effect size of 3.05 with a high influence category.

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Author Contributions

Tiara conceptualized the research idea, methodological design, data analysis, investigation process, initial draft writing, and implementation of research activities. Wahyuni Satria Dewi, Gusnedi, and Putri focus on methodology, supervision, and writing review.

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Conflicts of Interest

No conflicts of interest.

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