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The Effectiveness of STAD-Type Cooperative Learning Model Based on Online Media in Comprehending Physics Concepts

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ABSTRACT
The concept comprehension of physics learning becomes the most important aspect that must be considered due to the conditions in the COVID-19 pandemic, the school implements online learning system that has potential to cause misconceptions among students. This research aims at finding out the effectiveness of STAD-type Cooperative Learning Model based on online media in comprehending physical concepts in class X MIA 1 SMAN 1 Tinambung. The research type is quasi-experiment that the data collection applied the concept comprehending test. The data were then analyzed using independent sample t-test. The results revealed that there was a difference in comprehending the concept among students who were taught using online media-based on the STAD-type in cooperative learning model with students who were taught using conventional learning based on online media. The results of effectiveness test conducted by comparing variance values showed that cooperative learning of STAD type effectively improved the concept comprehension. The findings in this study imply that the learning process during the Covid-19 pandemic can implement a media based on STAD-type cooperative learning model so that students still have appropriate comprehension of the learning material concept.

INTRODUCTION

The outbreaks of Covid-19 in the world including Indonesia caused a big impact especially in education field. Basar on his research revealed that the learning process in schools during the Covid-19 pandemic has faced many problems in implementing the education policies due to the Covid-19 pandemic related to the virtual learning policies [1]. The process of virtual learning is a solution that its implementation has not been optimal overall. Many things must be considered in virtual learning such as; teacher resources must be improved in quality and even the students become less active in joining that virtual learning, it is because of unstable internet network or limited internet quotas. Azzarkasyi, Armanda, Rizal, & Fatmaliana research argued that the research results on potential misconceptions in the basic physics learning during the Covid-19 pandemic, can be categorized as low

achievement because student response positively to the media that showed the average value of overall student response is 3.7 in a good category [2]. Andiani & Fitria stated on the same research field that the Covid-19 Pandemic has made Indonesia and the rest of the world exchange the face-to-face learning system to virtual learning system [3]. The study results revealed that virtual media were used among students, where the research was conducted via Whatsapp group, Youtube, and Quizziz. The use of online media is considered quite effective in learning of students of State Elementary School 103 Palembang. The disadvantages of virtual learning are the teachers gave many assignments to students and the teacher's explanation related to the assignment and the subject is unclear. So that students got difficult to understand the subject/ material in following the learning process because it is dominated by lot of assignments.

It is also found on the research which revealed that the online-based teaching and learning activities caused most students try to comprehend based on their own concepts, and infer the concept itself. It cannot be let it continuously, because students will experience a misconception [4]. Therefore, it needs more efforts to maintain the concept comprehension of students even in the Covid-19 pandemic conditions through virtual learning.

There are various related literatures show the concept comprehension that can be improved through cooperative learning based on STAD-type (Student Team-Achievement Division). First, Maidiyah argued that there are 2 methods in STAD type cooperative learning [5]. They were STAD Preparation and Teaching process itself, the preparation method is divided into 5 sections, first is material. it must be designed in such a way for group learning, secondly assigning students in heterogeneous groups formed, third determine the initial score, the fourth is group work before starting cooperative learning, and the fifth is the activity schedule. While the teaching method consists of 7 parts, the first introduction which aims to engage students' curiosity, the second development. In this section the teacher emphasizes students to learn and understand the meaning (not memorizing), the third controlled practice. In this section the teacher calls students individually. random to answer the questions given, the fourth. group activities. in this section the teacher explains what it means to work in groups, the five quizzes or tests in this section the teacher gives quizzes or tests individually, the six group awards by calculating individual scores, groups and group learning outcomes, and the seventh returns a collection of quizzes to students.

Virgana & Ningsih who revealed that there is an interaction influence of cooperative learning model and learning motivation on comprehending mathematical concepts [6]. Detri, Verawati, & Rahayu added on their research that there was an influence on the application of cooperative learning models of STAD and Jigsaw types on the mastery of the physic concept [7]. This finding is in line with Saila who found the improvement in the concept comprehension of students who were taught using the STAD model rather than taught by conventional model [8]. This findings is in line with the researchers found, by looking at the effectiveness of the online media-based STAD type cooperative learning model during the current COVOD 19 pandemic by using certain learning media such as WhatsApp, Zoom, Google From and other online media platform, it has been proven to be able to make students more active, confidently, motivated, more caring and more understanding of learning compared to students who were not taught using the STAD type cooperative learning model. This proves that the effectiveness of learning can be achieved through using learning media in the learning process that is in accordance with the situation and conditions, both the material content and the situation of the student's environment. The concept delivery to students will be conveyed well if the students are involved in learning process rather than the students only pay attention to the materials [9].

Cooperative learning in this pandemic period requires the materials delivery using online media because teachers and students do not meet directly in the classroom. The online media that are usually used such as Telegram, WhatsApp, Google Classroom, Zoom, and so forth. In virtual learning, the students can also interact with their teachers at the same time, such as using video calls, live-chat, and etc [10].

One of the efforts that the researchers made to provide the concept comprehension towards students is by carrying out learning treatment using a cooperative model of STAD type based on online media. Based on the problem formulation as the basis in findings, the researchers' purpose on this research are namely, (1) is there any difference in concept comprehension of students who are taught using the cooperative learning model of online media-based STAD type and those who are taught using conventional teaching media, and (2) is the cooperative learning model of online media-based STAD type effective in improving the students' concept comprehension?

Cooperative learning model is a learning model that groups students into some teams that have different levels of ability [11]. Cooperative learning model can be used to teach about complex materials, and it actually can help teachers to achieve learning goals in social dimensions and human relationships [12].

Cooperative learning model of STAD type is a cooperative learning approach that emphasizes on the students' activities to motivate and help each other in mastering the subject matter to achieve the maximum achievement [13]. STAD learning is about the students placed in a four-member learning team that is a mixture based on their performance level, gender and ethnicity [13].

Virtual learning media is learning that is conducted virtually, using learning applications and social networks. The comprehension comes from the word "comprehend" which means to understand a thing. While comprehension is a process, an act, a way of comprehending [11]. Comprehending the concepts is the level of ability that applies to students who are able to comprehend the meaning or concepts, situations, and known facts [14].

The researchers expect this research can prove the effectiveness of concept comprehension after the students are treated using cooperative learning model of online media-based STAD type which the results of this research can be useful in improving the learning quality even in the Covid-19 pandemic.

METHOD

This is quasi-experimental research with the matching only post-test only group design that has population of 4 classes (X MIA) in SMAN 1 Tinambung. Sampling technique is done by applying the convenience sampling which is combined with matching techniques (matching sample). The sample was, namely: 1) class X MIA 1 as an experimental class taught using the STAD-type cooperative learning model, and 2) class X MIA 2 as a control class taught using the conventional learning model. The instruments used in data collection, namely: Lesson Plan (RPP), Concept Understanding Test, Teacher Observation Sheet and Student Observation Sheet.

The researchers collected data using concept comprehension tests in experimental class and control class. The data analysis technique used is an independent sample t-test that has previously passed through the analysis prerequisite test (Normality Test, Homogeneity Test) and then continued with the Variance Effectiveness Test.

RESULTS AND DISCUSSIONS

The overview of physic concept comprehension taught using cooperative learning model of STAD-type is presented in this part. The findings showed that in experimental class, the students who were taught using the model were very enthusiastic in following learning activities which can be seen based on the observation sheet of students who showed the activities of students in learning process. It was also found that there was a significant increase in concept comprehension in the experimental class that was compared to the control class which can be seen from the final results using the concept comprehending test.

Table 1. Students' Concept Comprehension Test Results

	Posttest of Experimental Class	**Posttest of Control Class**
Minimal score	66	48
Maximun score	100	87
Mean Score	84.60	71.53
Standard Deviation	10.22	10.47
Variance	104.54	109.55

The results showed the differences in the results of students' physics concept comprehension in experimental class and control class that were proven through descriptive analysis that revealed the differences in mean scores between the experimental and control class. The concept comprehension score in the experimental class was higher (84.6) than the concept comprehension score in the control class (71.53).

The differences in concept comprehension results between experimental and control class are supported by inferential analysis results using independent sample t-test analysis that has previously been examined by normality and homogeneity tests. The results of the normality test using Kolmogorov-Smirnov in the experimental class obtained a sig value of 0.139 ($p > 0.05$) and the control class obtained a sig value of 0.137 ($p > 0.05$) that was concluded that the value of comprehending the concept of students in the experimental and control class was in normal distribution. It is similar with the results of the homogeneity test obtained a sig value of 0.933 ($p > 0.05$) which showed that both classes compared had the same variance or homogeneous.

The independent sample of t-test showed that $T\text{-}_{count}$ score of 3.87 with a degree of freedom of 28 was at a significant level of 0.05, $T\text{-}_{table} = 2.131$. Therefore, it can be noted that $T\text{-}_{table} < T\text{-}_{count}$ ($2.131 < 3.8$) which showed that there is a significant difference in concept comprehension between students who were taught using an online media-based STAD-type cooperative learning model with students who were taught using conventional learning model.

The results of this study showed that there are differences in comprehending the concepts of students who were taught using STAD-type cooperative learning model with the students who were taught using conventional learning model. The mean score of physics concept comprehension showed that the students who were taught using the cooperative learning model type STAD physics has mean score of 84.60, which more different from students who are taught using conventional learning model that has mean score of 71.53. The results showed that the concept comprehension of students who were taught using the STAD type cooperative learning model based on online media was different from the students who were taught using conventional learning model.

The findings of this research are in line with Arung's findings, who revealed that cooperative learning method was superior to the classical (conventional) learning method in influencing the learning outcomes of physics [15]. Putra, Tegeh, & Wibawa also found that there are significant differences of concept comprehension between students who were taught using the STAD model and students who were not taught using the STAD model [16]. Durrotunisa, Septiani, & Pambudi revealed on their research that there are difference results of learning mathematics of students who were taught with a cooperative learning model of STAD-type with the results of learning mathematics of students taught with a direct model [17]. Nurul Saila's research also showed that there are differences in learning outcomes between students who were taught with the STAD-type cooperative learning model and students who were taught with conventional learning models. Sumilat & Matutu on their research argued that there is an increase in the achievement of the students' learning outcome who were taught using the STAD type cooperative learning model both individually and classically, this happened because the teachers were able to foster the students' motivation in using the STAD type cooperative

learning model [18]. Teguh, Suyadi & Suherman obtained on their research that STAD-learning model has better influence on the formation of students' moral character that was compared to the PBL learning model [19]. Therefore, the researchers believed that the STAD model can be used as a solution in learning.

Based on the description results of the concept comprehension data that is obtained, it showed that the STAD-type cooperative learning method is able to activate students in the learning process. This is because the main purposes of STAD model is to motivate students to be able to support and help each other in mastering the skills that are taught by their teachers [12]. This method is also emphasized on the students' activity to remember the material easily so they can learn and involve directly in solving the problems that are given based on the instruction which caused the activities carried out the learning trigger students' concept comprehension. The model of cooperative learning emphasized the activity and interaction among students to achieve their goal of mastering the material [12].

The Effectiveness of Cooperative Learning Model of STAD Type-Based Online Media in Improving the Concept Comprehension

The way to reveal the effectiveness of the implementation of cooperative learning model of STAD type-based online media is based on the following formula:

$$R(\theta_2, \theta_1) = \frac{\sum(\theta_1 - \theta)^2}{\sum(\theta_2 - \theta)^2} = \frac{\text{Varians } \theta_1}{\text{Varians } \theta_2} \quad (1)$$

If R > 1 is relatively θ2 more efficient than θ1, it is conversely if R < 1 then θ1 is more efficient than θ2. The results showed that the online media-based STAD type cooperative learning model was effectively used among students which is compared to the learning process without implementing online media-based STAD (conventional) cooperative learning model treatment. This is evidenced by the results of the effectiveness test conducted by comparing the variance of the experimental class (12.7) and the control class (13.32), so that the R value of 0.953 (R<1) can be categorized as θ1 (cooperative learning model type STAD) which is more effective than θ2 (conventional learning). Thus, it can be concluded that the STAD-type cooperative learning model effectively improves the comprehension of the students' physics concepts in class X MIA SMAN 1 Tinambung.

The research results revealed that the online media-based STAD-type cooperative learning model become effective among students (R 0.953 < 1). Those findings are in line with Aziz & Yusnita who found that the STAD-type cooperative learning model is effective in improving students' math learning outcomes [20].

Many existing literatures revealed the various advantages of cooperative learning. One of them is Pradevi, Susanti, & Rustamti who proved that the application of cooperative learning model successfully increases students' learning interest and creativity [21]. Especially, if the learning conducted using cooperative learning model of STAD type, as in Detri, Verawati, & Rahayu who believed that the concepts comprehension is increased after the application of STAD-type cooperative learning [7]. Kusumawardani, Siswanto, & Purnamasari also showed the increase in students' learning outcomes after the implementation of STAD-type cooperative learning model [22]. The research by Virgana et al., showed that there is an influence of learning motivation on the comprehension of mathematical concept, and the cooperative learning model of Student Team Achievement Devision (STAD) has a high effectiveness on comprehending students' mathematical concepts. Finally, the researchers found that using the online-based STAD learning model during the current COVID-19 pandemic was effectively, it was also able to provide a very significant increase in the area of awareness, confidence, and understanding of physics concepts being taught during the pandemic.

Other studies also revealed the same findings such as; Virgana & Ningsih [6], who showed that there was an increase in the achievement of learning outcomes individually and classically by using cooperative learning of STAD type, Darmayanti [23] also found that there is an influence of portfolio-

based STAD learning model on the competence of mathematical knowledge in students. Jafar assumed that there is a significant difference in comprehending the concept of physics among students who are taught with cooperative learning strategies and the students who are not taught using the cooperative learning model [24]. Prayektil on his research also revealed that learning outcomes of comprehending and applying physic concepts using STAD-type cooperative learning models are better than expository learning strategies [25].

Gusniar on her research also found that the improvement in learning using the STAD-type cooperative learning model can improve the students' learning outcomes in class IV at SDN 2 Ogoamas II [26]. Nuriansyah also stated that there is an increase in the learning outcomes of economics students in using online-based media [27]. Kristin argued that the results of the study obtained that the STAD learning model is more effective than conventional model in improving Social Science (IPS) learning outcomes [28]. This is evidenced from the data obtained that $t_{\_count} > t_{\text{-table}}$, which is 3.392 > 2.000. Pradevi, Susanti, & Rustamti on their research stated that there is an increase in interest in learning and creativity of students in grade III of Kanisius elementary school year 2020/2021 [21].

Related to the media used in cooperative learning model of STAD type are in various findings. During the Covid-19 pandemic, the use of online media has variations. Mustakim suggested that teachers are in the right choice to do virtual learning media because it will greatly affect the effectiveness of the delivery of learning materials [29]. Azhariansah showed that students' explanatory text writing skills were successfully improved after the implementation of the student team achievement division (STAD) cooperative learning model assisted by animation videos [30]. Wijaya & Arismunandar on their research before pandemic of Covid-19 argued that the actual use of social media for teaching and learning was considered to be in a minimum level [31]. This happened due to the use of online media before the pandemic that was only used for supporting the learning process not as a priority. Then, the existence of the Covid-19 pandemic makes online media as the main alternative to facilitate learning process.

The Research of Simatupang, Sitohang, Situmorang, & Simatupang revealed that the increasing outbreak of coronavirus (Covid-19) as well as large-scale restriction systems (PSBB) of several other district, can be seen directly about the effectiveness of virtual learning in the pandemic period by presenting instruments used in the form of questionnaires distributed online using microsoft form link [32]. They obtained that the implementation of virtual learning has been implemented effectively in the view of teacher readiness, the ability to use applications, responses, and benefits obtained.

Salsabila, Lestari, Habibah, Andaresta, & Yulianingsih on their research stated that technology has many roles and benefits in the education field especially during virtual learning in the midst of the Covid-19 pandemic [33]. They interviewed teachers and students, who assumed that the learning media technology that is widely used by elementary schools is WAG (WhatsApp Group) and Google Classroom.

Based on the description above, it showed that the results of the research obtained are in accordance with previous research who said that the STAD learning model is effective in improving the students' concept comprehension in class X MIA SMAN 1 Tinambung.

CONCLUSION AND SUGGESTION

Based on the research process that has been carried out, it was found that students were very enthusiastic, motivated, and very enthusiastic in participating in the online learning process using the STAD cooperative learning model compared to students who were taught online without using the STAD cooperative learning model.

Based on the data results, there was a significant difference in physics concept comprehension between class X MIA 1 (experimental class) which was taught using an online media-based STAD

type of cooperative learning model and class X MIA 2 (control class) that was taught using conventional learning model. The online media-based STAD type of cooperative learning model has been shown to be effective in improving the comprehension of students' concepts if compared to the conventional learning model based on online media.

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