Implementation of "*Magic Trick Physics*" learning in the Covid-19 pandemic era to improve the student's critical-thinking skills

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Abstract. The Covid-19 pandemic led to a change in learning patterns to online learning. One of the obstacles in online learning is the students' lack of understanding of the learning material because students are used to meeting face-to-face and listening directly to the teacher's explanations. This pattern is used in online learning using a virtual face-to-face platform so that students are reluctant to learn. This situation unconciously makes students feel bored. One of the media that can reduce student saturation is using magic trick physics. The use of magic trick physics will make students try to analyze how this event can happen by applying physics. This is inaccordance with the definition of critical-thinking were critical thinking is a complex process that requires high-level cognitive. Therefore, this study aims to determine the improvement of students' critical thinking skills after the application of magic trick physics in learning during Covid-19 pandemic era. This type of research is quasi experimental with one group pretest-posttest design. The critical thinking skills test data were analyzed by using the statistical difference test, effect size, and normalized n-gain. The results showed that the use of magic trick physics in learning on the Covid-19 pandemic era was effective in improving students' critical-thinking skills. Learning magic trick physics has positive benefits for students based on the questionnaire responses that have been filled in by students, including students feel enjoy and are motivated in learning physics, make students think critically and understand the material being taught more easily, and students remain excited to learn even though the learning is done by online. The implication is that magic trick physics can use in physics learning in the learning process.

1. Introduction

At the end of 2019, the world was shocked by the outbreak caused by the Corona virus or better known as COVID-19 (Corona Virus Disease-2019) in Wuhan, China. WHO (World Health Organization) declared the Corona virus outbreak a global pandemic [1]. This is indicated by the existence of 17,660,523 confirmed positive cases in 216 countries (Update: 03 August 2020). Since early March 2020, Indonesia has been affected by the corona virus. As of August 3, 2020, the number of positive cases in Indonesia has reached 113,134 people throughout Indonesia [2]. With the COVID-19 pandemic spreading rapidly, the government is working to stop the spike in positive cases, from physical distancing to large-scale social restrictions.

Various areas of life have an impact during the COVID-19 pandemic. The education sector is one of the areas that has an impact so that educational activities at various levels are temporarily eliminated or

postponed. Distance learning or online learning is an effort to prevent the spread of covid-19 and solution to overcome the limitations caused by this pandemic in accordance with the circular issued by the minister of education and culture of Indonesia Nadiem Makarim No 4 Tahun 2020 in the Education Unit and Number 36962/ MPK.A/HK/2020 concerning the Implementation of Education in the Coronavirus Disease (COVID-19) Emergency Period [3]. According to Thorne, online learning is learning that uses multimedia technology, virtual classes, CD ROM, video streaming, voice messages, e-mail and conference calls, animated online text, and online video streaming [4]. This presents a challenge for all elements and levels of education to maintain the teaching and learning process even though schools and colleges are closed [1]. This condition results in teachers and students being required to take advantage of technology by learning through the internet network. However, not all teachers understand how to use online facilities as a medium for teaching and learning activities. This results in students feeling depressed because of the many tasks given by the teacher without paying attention to the cognitive, affective, and psychomotor aspects of students [5]. Another psychological burden is experienced because students are used to learning face-to-face with the teacher, while the ability of students is different from one another to do distance learning. Besides that, studying at home is also a big surprise for parents who are usually busy with work outside the home [6].

Obstacles to distance learning include the limited mastery of information technology by teachers and students, limited internet access because the internet network is still not evenly distributed throughout the country [6]. Parents' lack of understanding with learning materials or technology used as learning media makes it difficult for children to understand learning material and are reluctant to learn. So that unconsciously, the uncomfortable condition of students to learn makes students enter at a point of saturation [5]. To overcome student saturation, learning media should be made as attractive as possible. One of the media that can reduce student saturation is using magic trick physics. Many educational practitioners have described that the use of magic tricks can attract attention, involvement, curiosity, and critical thinking from students [7].

Student ability is an important aspect in the order of life, one of which is the ability to think critically. The purpose of critical thinking is to consider and evaluate the information that it ultimately allows to create decision. Critical thinking includes a higher level of thinking which has two coverage, namely critical thinking abilities and dispositions critical thinking (critical thinking disposition). Ability refers to aspects cognitive and disposition (disposition) refers to the affective aspect [8]. The ability to evaluate and analyze information received in the learning process can be a reference for students' critical thinking [9]. By using magic trick physics can arouse students' curiosity where something that is illogical or magic can be explained by physics. Students must learn or solve problems that they have never seen in their academic process by demonstrating something more enjoyable than usual [10] such as the use of physics magic tricks to improve students' critical thinking skills. Magic tricks have many benefits in teaching such as breaking down ignorance, capturing and maintaining student attention, making students more receptive, broadening students' understanding, increasing opportunities for memory recall, creating an environment for learning, improving communication skills, providing stress relief and creating an environment of trust [11]. Magic may offer a useful tool for gaining new insights into developmental psychology across life spans [12]. The influence of magic can provide valuable tools to investigate human perception and cognition [13]. The use of magic trick physics media in the learning process will make students try to analyze how this event can occur by applying physics in it. This has the same perception of critical thinking skills according to [14] where critical thinking is an activity of processing complex information that requires high-level knowledge. Therefore, this study aims to implement magic trick physics in learning in the COVID-19 pandemic era to improve students' critical thinking skills.

2. Method

This study used one class as the object of research, namely high school students of class XII SMAN 8 Surabaya. This type of research is a quasi-experimental one group pretest-posttest design.

In simple terms, the research design used can be described as follows:

O_1 --- X --- O_2

Explanation :
O_1 : pretest
O_2 : posttest
X : Treatment (learning physics using magic trick physics)

In this study, the research subject was given a pretest to determine the students' initial ability before being given physics learning using magic trick physics. After being given a pretest, students were given treatment, namely learning physics using magic trick physics. After completing the treatment, students are given a posttest to determine the effect of learning physics using magic tricks physics on students' critical thinking skills. The research instruments used to collect data in this study were the pretest, posttest and response questionnaire sheets. The pretest and posttest instruments were used to determine the improvement of students 'critical thinking skills, while the student response questionnaire sheet aimed to assess students' responses to the implementation of magic trick physics in learning in the Covid-19 pandemic era. The pretest and posttest data analysis techniques were the normality, homogeneity, hypothesis testing is done by t test, normalized gain n, and effect size. The results of the effect size calculation are interpreted using Cohen's classification. The results of the effect size calculation are interpreted using the classification according to Cohen, where $0.8 \leq d \leq 2.0$ has a large effect size, $0.5 \leq d < 0.8$ has a moderate effect size, and $0.2 \leq d < 0.5$ has a small effect size [15]. As for the response questionnaire using the Guttman scale which is analyzed by classifying several criteria.

3. Result and Discussion

3.1. Application of magic trick physics

Some text. Learning using magic tricks can be used to help focus attention, involvement, curiosity, and critical thinking processes experienced by students. Physics magic is a way to present science in the learning process through phenomena similar to magic. Learning using physics magic trick in the Covid-19 pandemic era was done by giving magic tricks in physics phenomena in the form of videos. The teacher can show videos about phenomena related to physics and students are asked to explain the four dimensions of knowledge including facts dimension, concepts dimension, processes dimension, and meta-cognitive dimension [16]. From the video used, it can increase students' knowledge about a phenomenon that is displayed [17] and [18]. The video used will attract and arouse students' curiosity about magic tricks in the phenomena shown [19]. Students are given two videos about magic trick physics on static fluid material, archimedes law sub material. The videos given to the students were: 1) a glass containing three different liquids but unable to combine then several objects were inserted into the glass but these objects were also in different positions, 2) three oranges with the shape of a whole orange, half peeled, and completely peeled when put in a container filled with water has different positions. The two videos are shown in the following image:

Figure 1. Screenshot on magic trick physics's video.

In learning using magic trick physics, students are given the two videos where in the first video students are asked to analyze why the three liquids cannot coalesce and some objects have different positions. In the next video, students were asked to analyze why the positions of the three oranges with

varying orange peel conditions had different positions when put in the water. The two videos are then linked to the archimedes' laws of floating, hovering and sinking. The video used is sourced from youtube. On the first video downloaded from DaveHax's youtube channel and the second video downloaded from the 5-Minute Crafts MEN's youtube channel.

3.2. Implementation of Learning

Learning using magic trick physics in the Covid-19 pandemic era was carried out using a problem-based learning model in the archimedes law sub-material. the results of observations of the implementation of learning are listed in the table below.

Table 1. Observation results of learning implementation.

Activity	Observed Aspects	Score
Preface	Teachers orient students on problems	20
	The teacher organizes students to learn	10
Core	The teacher guides students in investigating the material	20
	The teacher guides students in developing and presenting works	20
Closing	The teacher asks students to conclude the material that has been delivered and evaluate learning activities	15

Based on the table above, the total score of learning implementation is 85. So, that if calculated as a percentage it produces a value of 85%. This is because in the aspect of the teacher organizing students to learn and asking students to conclude that the material that has been delivered is not well implemented. In the aspect of organizing students to learn, it is not carried out well because learning is carried out online so that the teacher cannot directly coordinate students to learn. In addition, the learning time has exceeded the specified time so that the aspect of asking students to conclude that the material is not implemented is that the teacher immediately concludes the learning activities that have been carried out.

3.3. Student's critical thinking skills

Students' critical thinking skills are measured by the results of the pretest-posttest given to students based on indicators of critical thinking. [20] states that someone who has the ability to think critically must meet 12 indicators of critical thinking skills which are summarized in 5 abilities including basic classification, providing reasons for a decision, concluding, further classification, and conjecture and integration. The number of students as respondents was 25 people. The average student pretest score was 46. While the average posttest score of students was 68.6. The results of students' critical thinking skills are shown in the table below with a maximum value of 20 for each indicator:

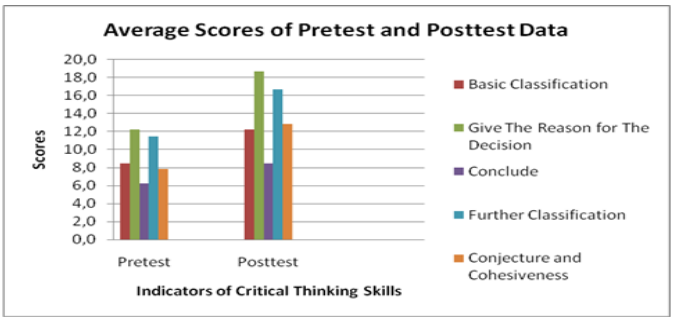

Figure 2. Average scores of pretest and posttest data.

Based on the figure above, the lowest average score on both the pretest and posttest is found in the concluded indicator. In the conclusion indicator, the questions given are in the form of a table containing

different liquids with the same mass but different volumes. The three liquids when mixed do not combine. Students are asked to conclude which liquid is in the top position. The majority of students answered that the liquid with the smallest volume was at the top. This is what causes students to get low scores on this indicator. On indicators provide reasons for a decision, the average score obtained by students is the greatest score both on the pretest and posttest. The questions given to this indicator are students are asked to provide reasons why humans can float in the Dead Sea. In the basic classification indicators, further classification, conjecture and cohesiveness there is an increase in the score from the pretest to the posttest that has been given.

Table 2. Pretest and posttest data statistics.

Test Type	Statistics	Pretest Data	Posttest Data	Conclusion
Normality Test α = 0,05	L_{count} L_{table}	0,1149 0,173	0,1587 0,173	Normally distributed data
Homogeneity Test α = 0,05	Variance F_{count} F_{table}	422,88 1,3523 3,8841	312,72	The variance is homegeneous
t-test α = 0,05	t_{count} t_{table}	5,16 1,98		There are differences in critical thinking skills before and after implementing magic trick physics
n-gain		0,4185		There is an enhancement in students' critical thinking skills after implementating magic trick physics
Effect size		1,4		The implementation of magic trick physics affects students' critical thinking skills in the high category

The data normality test is used to determine whether the data is normally distributed or not. The data normality test in this study was carried out by using the Liliefors test. The results of the pretest normality test as the control class were 0,1149 and the posttest as the experimental class was 0,1587. This shows that both the pretest and posttest results are normally distributed because $L_{count} < L_{table}$ where L_{table} is 0,173. The homogeneity in this study was obtained by a homogeneity test of 1,3523. This shows that the data is homogeneous because $F_{count} < F_{table}$ where F_{table} is 3,8841. Hypothesis testing used in this study is to use the t-test. Based on the calculation results obtained t_{count} of 5,16 and t_{table} of 1,98. Because $t_{count} > t_{table}$. This means that the average value of learning implementation using physics magic trick at posttest is higher than the average value at pretest. Normalized N-gain is as an indicator of improvement from the treatment performed, namely the implementation of magic trick physics of 0,4185. To find out how much the increase in the treatment has been given, the effect size is calculated. The effect size obtained is 1,4, which means learning using physics magic trick is effective for improving students' critical thinking skills in learning during the covid-19 pandemic era because based on Cohen classification where $0.8 \leq d \leq 2.0$ includes a large effect size category. This is in accordance with the research conducted by Wiwin which states that learning physics using physics tricks is effective and can train students' critical thinking skills [19].

Based on the analysis that has been done, the implementation of magic trick physics in learning in the Covid-19 pandemic era is effective in improving students' critical thinking skills. In addition, learning in the era of the Covid-19 pandemic that was carried out online also had obstacles. Some of the obstacles experienced are the unstable internet connection, the teacher cannot condition the students directly so that the students sometimes do not pay attention to what is said by the teacher and other activities carried out by students at home make the students focus divided.

3.4. Student response

Student response questionnaires were given to determine student responses after learning using magic trick physics in the Covid-19 pandemic era. The student response questionnaire was analyzed using the Guttman scale where students who answered yes got a value of 1 and the answers did not get a value of 0 [21]. In detail the following table is the result of the response questionnaire given to students.

Table 3. Student response results.

No.	Statement	Response	
		Total Answers of Yes	Total Answers of No
1.	Learning using Magic Trick Physics videos is very interesting and not boring	25	0
2.	I feel not interested and bored with learning using Magic Trick Physics videos	0	25
3.	The Magic Trick Physics video used in the lesson made it easier for me to understand the material being taught	25	0
4.	I have a hard time understanding the material using the Magic Trick Physics video	0	25
5.	The existence of learning using Magic Trick Physics increases my enthusiasm for learning	23	2
6.	I am not motivated by learning to use Magic Trick Physics videos	1	24
7.	The Magic Trick Physics video used in the lesson made me think more critically	25	0
8.	Learning Magic Trick Physics videos is a waste of my time	0	25
9.	I enjoy it and I am more motivated to continue learning physics	23	2
10.	I find it easier to remember the material with the lessons using Magic Trick Physics videos	24	1
11.	I am still excited even though teaching and learning activities are carried out online	25	0
12.	Learning to use face-to-face online applications is quite effective for teaching and learning activities	21	4
13.	Online learning makes me lazy to study	1	24
14.	I feel online learning is not effective	5	20
15.	Online learning makes me more relaxed	24	1

The student response questionnaire given was divided into three aspects. The following is the percentage of student responses:

Table 4. Percentage of student responses.

Aspect	Number of Statement		Percentage of Student Responses
	Positive	Negative	
Show students' interest in learning physics using the Magic Trick Physics video	1, 5, 9	2, 6	57,60%
Demonstrate the use of taking physics lessons using the Magic Trick Physics video	3, 7, 10	4, 8	59,20%

Shows the implementation in physics learning which is done online	11, 12, 15	13, 14	60.8%

Based on the table above, it shows that the implementation of online physics learning received the highest response from students after the implementation of learning using magic trick physics in the Covid-19 pandemic era. In addition, students also feel enjoy and are motivated in learning physics. Another positive benefit that students have after the implementation of learning using magic trick physics is that it makes students think critically and it is easier for students to understand the material being taught.

4. Conclusion

The conclusion of this research is that learning physics using magic trick physics is implemented with a percentage of 85%. The use of magic trick physics in learning in the Covid-19 pandemic era is effective in improving students' critical thinking skills. Learning magic trick physics has positive benefits for students based on the questionnaire responses that have been filled in by students, including students feel enjoy and are motivated in learning physics, make students think critically and understand the material being taught more easily, and students remain excited to learn even though the learning is done by online. The implication is that magic trick physics can be used in the physics learning process.

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