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Implementation of learning video on mathematical analogic thinking ability in solving pythagoras theorem problems

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A B S T R A C T
The problem in this study is related to the low ability to think mathematically analogies of junior high school students which can be seen when students work on the board they are still confused about which formula to use, and if they can determine which formula to use the numbers or questions that are included in the formula are not appropriate. One solution to this problem is the use of video-based learning media that students can access at any time. This research is a qualitative research. The results of this study were students with low ability to think mathematically analogies (A_1) were unable from the start, at the encoding, inferring, mapping and applying stages. Students with moderate mathematical analogy thinking skills (A_2) were able to pass the encoding and inferring stages but failed at the mapping and applying stages. Students with high mathematical analogy thinking skills (A_3) were able to pass the encoding, inferring, and mapping stages but failed at the applying stage. This proves that there are still students who are less able to think mathematical analogies even though they have been assisted by the use of learning video media.

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1. PENDAHULUAN

Education is a conscious and planned effort to create an active learning atmosphere and learning process. The purpose of education in general is to achieve perfect human beings, nothing else to motivate humans to always develop their natural potential to the fullest through continuous education, both through learning in the classroom and learning outside the classroom, this understanding can also be called lifelong education (Munir, 2018). While learning is a system that aims to help the student learning process arranged in such a way (Ahdar, 2019). Or it can also be said as the assistance provided by the teacher so that students gain knowledge, and also the formation of attitudes (Endang, 2014).

Along with the times, education is supported by innovative learning. Because innovative learning has a positive impact on students' thinking processes (Nugroho, 2019). Even students who are taught using innovative learning are better than traditional learning (Adriani, dkk 2020). Students with innovative learning generate more ideas, improve problem-solving skills, conceptual understanding skills and solve mathematical problems (Herawati & Widada, 2018). Students with innovative learning generate more ideas, improve problem-solving skills, conceptual understanding skills and solve mathematical problems (Shoimin, 2014). So we need

learning that is in accordance with the times and so that it is able to solve problems and generate ideas, especially in mathematics.

Quality education requires new things in learning that can explore the era, especially the era of the digital society 5.0 revolution (Kaban, 2022). In the current era of globalization, various technologies have developed, one of which is the internet. The development of this technology can be used to improve the learning process. Technological developments in the communications sector, both in the form of hardware and software, have affected all sectors, without exception, the education sector. The use of media is expected to optimize the learning process. The attractiveness of a media lies in how attractive the media is. Because by utilizing the media can help achieve learning objectives (Titi, dkk 2016). Media in learning can help students to understand the material faster, better, so that the knowledge gained can last a long time (Astuti & Mustadi, 2014). Media in learning can help students to understand the material faster, better, so that the knowledge gained can last a long time.

Learning media consists of various types, ranging from the usual blackboard to sophisticated media. Learning media are divided into several types, namely print media, video media, and audio media. Video learning itself is an audio-visual learning medium with the aim of making it easier for students to understand the material. Video-based media in general makes it easier for students to understand lessons and remember them. Given the use of this media involves more than one kind of senses.

There are several advantages of using learning video media, namely (a) Videos can complement the knowledge that students get when examining, reading and practicing. (b) The video can show images that may not be displayed on the blackboard, in mathematics and the Pythagorean theorem regarding the construction of the Pythagorean theorem in constructing buildings. (c) Videos can bring out different points of view to students. (d) Videos can be used for students to reflect and discuss with their study groups (Siti Rahma, dkk 2022). With the learning videos, the material is delivered systematically and uniformly.

Mathematics is closely related to solving and solving problems. One of the objectives of learning mathematics is solving problems which include the ability to understand problems, design mathematical models, solve models, and interpret the solutions obtained (Delyana, 2015). Learning to solve problems in the learning process allows students to think more critically in investigating problems, thus making students better at responding to and solving a problem (Nunung & Masri, 2020). The process of solving mathematical problems is one of the basic skills students must have (Shovia, 2016). However, the ability to solve problems does not only function or is about mathematics, but is also useful for other fields of study (Russeffendi, 2010). Problem solving ability is a stage of thinking at a high level (Harahap & Surya, 2017). Someone who faces a problem, indirect experiences the process of acquiring knowledge which is marked by questions that arise how the problem can occur, how to solve the problem, or how the problem arose. (Lela, 2015).

The abilities that must be possessed by students include, namely, the ability to speak, which is good and right (Suarsana & Pratiwi, 2020). Good and correct language skills make it easier for students to be able to understand learning with the media presented by educators. Understanding the language properly and correctly can have an effect on solving some of the problems you face, including problems related to solving math problems. Although in learning one of the influences is what media is used in order to achieve or succeed in a lesson, in mathematics it is also closely related to the ability to think analogically. Thinking analogies helps students understand the material, remembering that new knowledge is difficult to understand if it is not related to previous experience and knowledge. Analogies are believed to be able to help visualize abstract concepts with things in common (Ibrahim & Mudzalim, 2017). An analogy is a similarity in the perspective of 2 different concepts. The ability to think analogically is closely related to learning mathematics. The ability to think analogically plays an important role both in understanding concepts and solving problems (Dwi Agustina, 2020). In analogical thinking, there are a source problem and a target problem. The target problem is related to the problem faced by students, while the source problem is a problem that was previously obtained

to solve the problem faced (target problem). To be said to be analogous, one must be able to *Encoding, Inferring, Mapping ,Applying.*

Table 1. Analogical thinking ability

Number	Category of Ability to Think Analogy	The analogy thinking stage is reached
1.	Low analogy thinking skills	The achieved analogical thinking stage can only fulfill ≤ 1 analogy stage
2.	Medium analogy thinking skills	Can fulfill ≥ 2 stages of analogy
3.	High analogy thinking skills	Can fulfill ≥ 3 stages of analogy

From the results of observations, it is known that the ability to think analogically junior high school students is still low, this makes researchers use learning videos to support or improve students' ability to think analogically. As previously known, research from Gusmania and Wulandari stated that learning using video learning is more efficient than learning that still uses conventional videos. This is also supported by research conducted by Akram which has succeeded in concluding that instructional videos are very effective as a medium to support the teaching and learning process. So thus the lack of students' ability to think mathematical analogy and the formation of learning videos as a medium to achieve learning goals. Making researchers aim to analyze the implementation of instructional video media students' mathematical analogy thinking skills on the Pythagorean theorem material.

2. RESEARCH METHOD

The research method this time is a descriptive qualitative method. This research was conducted in the 2022/2023 academic year. The research subjects in this study were of junior high school students. The instrument used is a test of the ability to think analogically. The preparation of the instrument is based on analogical thinking indicators and the curriculum used. The selection of research subjects was based on questions that had been previously distributed. Based on the results of the test questions, students were grouped into 3 groups, namely the low analogy thinking ability group (A_1), the moderate analogical thinking ability group (A_2), and the high analogical thinking ability group (A_3). Meanwhile, the results of the study showed that students' analytical thinking skills were generally low.

The test instrument used is a question test in the form of a description. The analogical thinking ability test only amounts to one question. There are several stages of solving questions related to analogical thinking, namely *encoding* or stages of identifying source problems and target problems by looking for the characteristics or the structure of the problem. *Inferring* is the stage of looking for a relationship to the source or problem. *Mapping* is looking for the same relationship which can later build or draw conclusions from the similarity of the target problem with the source problem. *Applying* is choosing the right answer. This is to provide a suitable concept between the source problem and the target problem.

3. RESULTS AND DISCUSSION

After using video-based learning media that can be accessed on YouTube (link: **https://youtu.be/NM1BK-OihOw**) to improve students' analogical thinking skills in Pythagorean theorem material, the results are as follows.

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Figure 1. Learning video clips

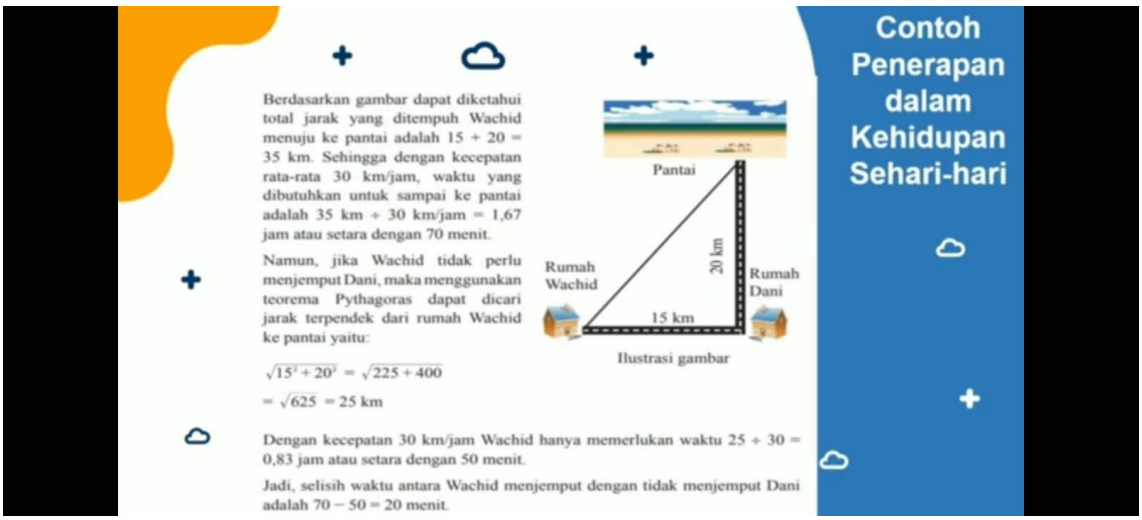

Figure 2. Learning video clips

A. Low Analogical Thinking Ability (A_1)

Table 2. Low Analogical Thinking Ability (A_1)

Number	Quality Stages of Ability to Think Analogy
1)	On hold *encoding*, students are able to code, but in ag c = slanted side, a = upright side, and b = base side students are still wrong.
2)	In the target problem students also enter the wrong formula with the target problem or problem
3)	At this stage, the quality of the *encoding* is low because students do not understand the source problem used or it could be because they are not thorough
4)	At the *inferring* stage it is also almost the same because students are less thorough

5) Students with A_1 abilities have not been able to *mapping*

6) At the *applying* stage, the results obtained are still wrong

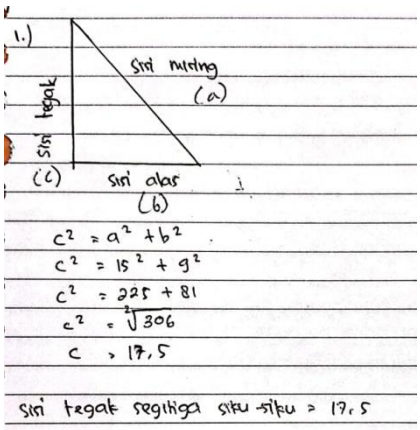

Figure 3. Test results for low analogy thinking skills

Based on the explanation above, it can be seen that A_1 in doing the test questions correctly, but has not been able to carry out the encoding and inferring stages correctly, and it can be seen on the encoding stage of the source problem and target problem in solving the problem. A_1 made a mistake in determining the formula and drawing the right triangle. As a result of errors at the encoding and inferring stages, A_1 students are unable or fail at the mapping and applying stages. Because the initial formula or the initial stages are wrong. And you can be sure that the next stage will fail, or produce the wrong answer.

B. Moderate Analogy Thinking Ability (A_2)

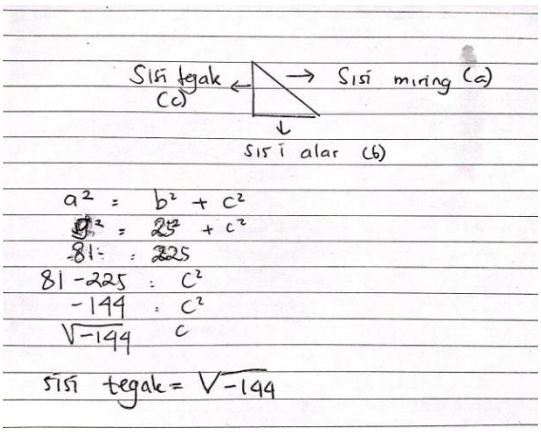

Figure 4. Test results for moderate analogical thinking skills

Table 3. Moderate Analogical Thinking Ability (A_2)

Number.	Quality Stages of Ability to Think Analogy
1)	At the *encoding* stage, students can already code the target problem and the source problem by determining which includes the slanted side, the upright side and the base side.
2)	A_2 has been able to determine the formula used in solving the target problem
3)	Even though they have been able to determine the formula and have correctly shown the relationship between the source problem and the target problem, in practice students are still

not able to find the relationship between the source problem and the target problem or enter the wrong number in the formula.

4) At the *applying* stage, students fail to provide answers correctly, as a result of their inability at the mapping stage.

5) At the *encoding* stage, students can already code the target problem and the source problem by determining which includes the slanted side, the upright side and the base side.

6) A_2 has been able to determine the formula used in solving the target problem

Based on Figure 4, it can be seen that A_2 students have been able to understand the questions well, it can be seen from the *encoding and inferring* stages of students who are correct. Students can already determine which is meant by the slanted side, the upright side and the base. However, at this stage students are still wrong in entering the target problem into the source problem. Or fail to connect the target problem with the source problem. This can be seen when A_2 students are right at the encoding and inferring stages, but there are still difficulties at the *mapping* stage which result in students' inability in the *applying* stage.

C. High Analogical Thinking Ability (A_3)

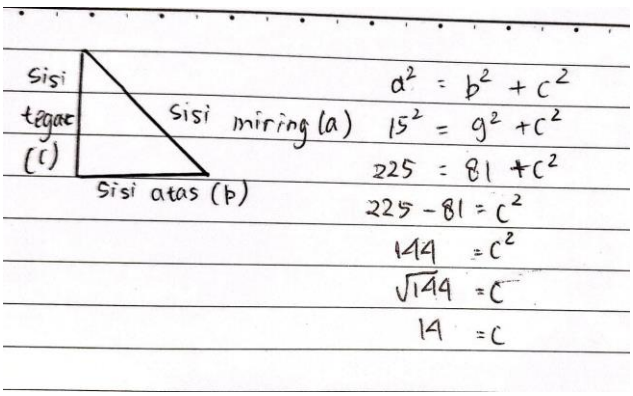

Figure 5. Test results for high analogical thinking skills

Table 4. High Analogical Thinking Ability (A_3)

Number	Quality Stages of Ability to Think Analogy
1)	At the *encoding* stage, students have been able to code the target problem and the source problem correctly, namely by determining the sides of the triangle correctly.
2)	This is also the case at the *inferring* stage because A_3 students can determine the similarity between the sides of the triangle and the letters which will make it easier for students to solve the target problem.
3)	At the *mapping* stage, students have also been able to determine the relationship between the target problem and the source problem properly, it can be seen that students can use the

source problem to solve the target problem correctly. Namely, the use of an existing formula (source problem) and the numbers in the question correctly (target problem).

4) However, at the *applying* stage, A_3 students were not yet able to determine the answer.

Based on table 4 it can be seen that student A_3 has been able to work on the test questions. This can be seen from the answers of students who have fulfilled or are right in the *encoding and inferring* stages. In addition, students have also been able to look for relationships at the mapping stage, but are still not quite right in finding answers. This is due to a lack of understanding or it could be less thorough at the application stage.

D. Low Level Analogical Thinking Ability

At the *encoding* stage, students with low abilities do not master the prerequisite skills of analogical thinking, that is, they have not been able to identify the characteristics of the target problem and only identify the characteristics of the source problem. This can be seen because students have not been able to understand the problem correctly. At the *inferring* stage, students have not been able to conclude which source problem can later be used to solve the target problem. This resulted in the failure of students in the following stages, namely the *mapping* and *applying* stages.

E. Moderate Level Analogical Thinking Ability

At the *encoding and applying* stages, students have been able to master the prerequisite skills of analogical thinking, namely being able to determine the right source problem to solve the target problem. However, in the *mapping* stage students with the ability to think analogically are not able to connect or find relationships from the common source problem with the target problem. Because it failed on the *mapping* stage, at the *applying* stage students also could not determine the answers correctly.

F. High-level Analogical Thinking Ability

At the *encoding* and *inferring* stages, students can complete the questions correctly. Because students can identify questions with the right answers, and can also determine source problems that can be used to solve target problems. At the *mapping* stage as well, students can also look for relationships that can finally draw conclusions from a problem properly. However, there were errors at the *applying* stage because the students were not careful enough so that the final results or answers obtained were not quite right.

4. CONCLUSION

From the explanation above, after carrying out the learning process by applying video-based learning media that can be accessed on YouTube, it can be concluded that students' ability to think analogically, both A_1, A_2, and A_3, is generally lacking. Students A_1 in doing the test are still unable to understand the questions, this can be seen by the failure of the student A_1 at the *encoding* and *inferring* stages. This has an unfavorable impact on the following stages, namely the *mapping* stage and also the *applying* stage. A_2 students are actually able to understand the questions well, this can be seen when A_2 students are able to complete *encoding and inferring* correctly. But it still failed at the *mapping* stage, which resulted in a failure of the *applying* stage. A_3 students were able to carry out the 3 stages of analogical thinking, namely the stages of *encoding, inferring and mapping*, but failed at the *applying* stage because the students were not thorough.

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