



# The Differences in Students' Creative Problem-Solving Ability with and without Realistic Mathematics Comic Video

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## ABSTRAK

Prestasi matematika siswa di Indonesia masih lebih rendah dibandingkan siswa di negara lain. Hal ini disebabkan karena kemampuan kreativitas pada siswa masih rendah. Tujuan penelitian ini yaitu untuk menganalisis kemampuan kreatif pemecahan masalah siswa setelah menggunakan video komik matematika realistik. Jenis penelitian ini yaitu penelitian kuantitatif. Penelitian eksperimen kuasi dengan pretest posttest comparison design ini dilakukan pada penelitian ini. Populasi penelitian ini adalah seluruh siswa kelas VII SMP yang terdiri atas empat kelas yang paralel. Pemilihan sampel dengan teknik random sampling sehingga terdapat dua kelas sampel penelitian yaitu sampel kelas kontrol dan sampel kelas eksperimen. Penelitian ini menggunakan instrument pretest dan posttest kemampuan pemecahan masalah kreatif. Pada penelitian ini data skor pretes dan posttest berdistribusi normal dan homogen. Berdasarkan analisis data hasil penelitian dengan menggunakan uji independent sampel t test maka diperoleh keputusan bahwa terdapat perbedaan kemampuan pemecahan masalah kreatif siswa yang dibelajarkan dengan menggunakan video komik matematika realistik dengan kelompok siswa yang dibelajarkan dengan tidak menggunakan video komik matematika realistik. Jadi, disimpulkan kemampuan pemecahan masalah kreatif siswa yang dibelajarkan dengan menggunakan video komik matematika realistik lebih baik daripada yang tidak dibelajarkan dengan menggunakan video komik matematika realistik.

## ABSTRACT

Mathematics achievement of students in Indonesia is still lower than students in other countries. It is because the creative ability of students is still low. This study aimed to analyze students' creative problem-solving abilities after using realistic math comics videos. This type of research is quantitative research. A quasi-experimental study with a pretest-posttest comparison design was conducted in this study. The population of this study were all seventh-grade students of SMP, which consisted of four parallel classes. The sample was selected using a random sampling technique so that there were two classes of research samples, namely the control class sample and the experimental class sample. This study used a pretest and posttest instrument for creative problem-solving abilities. In this study, the pretest and posttest score data were normally distributed and homogeneous. Based on the research data analysis using the independent sample t-test, it was concluded that there were differences in the creative problem-solving abilities of students who were taught using real math comics videos with groups of students who were taught not to use fundamental math comics videos. So, it can be concluded that the creative problem-solving abilities of students who are taught using real math comic videos are better than those who are not taught using real math comic videos.

## 1. INTRODUCTION

Student creativity is one of the important educational goals. In the era of the Industrial revolution 4.0, students are expected to have more skills for their survival (Lestari et al., 2021; Oliveira et al., 2021). In addition, training to increase creativity is very important to improve the competitiveness of developed countries (Ayyildiz & Yilmaz, 2021; Huang et al., 2020). Mathematics achievement of students in Indonesia is still lower than students in other countries (Anisa et al., 2019; Aritonang & Safitri, 2021; Damayanti & Sumardi, 2018). Therefore, in 21st century learning, students need to be taught core competencies which include critical thinking, creative thinking, communication skills, and collaboration to help students master content and solve problems related to their real lives (Churchill et al., 2013; Sa'pang & Purbojo, 2020). The essential competence of the four competencies is creativity (Daggol, 2017; Istiq'faroh et al., 2020). Creative thinking skills are thinking processes that create new ideas widely and in various ways (Hidayat et al., 2018). Creativity is identical and related to the word innovation, both have different meanings and can be said to be different (Oliveira et al., 2021; Yang et al., 2018). Creative problem solving is a hallmark of higher intelligence and when it reaches its peak it can lead to the greatest progress (Kralik et al., 2016).

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In current conditions, procedural knowledge is part of creative thinking skills, and the decline of ideas, and declarative knowledge includes the domain level of one's knowledge task (Montag-Smit & Maertz, 2017; Serbin et al., 2020). The creative thinking process also focuses on the cognitive activities involved in creativity (Fatah et al., 2016; Lassig, 2020). In the search for problem solving solutions, students are asked to find their own creative ideas and choose the most creative ideas (Aziza, 2019; Van Hooijdonk et al., 2020). The creative problem-solving model consists of the process of identifying unstructured problems, reconstructing a problem with data, and finding ideas and solutions for solving the problem (Kim et al., 2019). Creative thinking requires many of the same cognitive demands as other complex tasks (Kartika et al., 2019; Redifer et al., 2021).

The creative process includes internal cognition (e.g., judgment based on multiple choices) and external behavior (e.g., sketching possibilities) (Aljarrah, 2020; Rubenstein et al., 2019). The creative thinking process is also related to insight. Insights describe a problem solving process in which solutions usually come suddenly and after restructuring the understanding of the problem (Martinsen & Furnham, 2019). Mental speed can be considered as the most basic cognitive ability that underlies higher-order cognitive functions to facilitate divergent thinking (Forthmann et al., 2019). Divergent thinking is currently the most widely used measure to assess creative thinking ability (Marliani, 2015; Wechsler et al., 2018). Convergent thinking is often contrasted with divergent thinking (creative idea formation), where there is no right answer but rather a large series of suitable, new, or interesting responses (Forthmann et al., 2019; Zabelina & Silvia, 2020). Tasks involve divergent thinking, creative imagination, use of metaphors, transformation, and a number of other thinking skills relevant to creativity (Groyecka et al., 2020). Based on its origins and uses, creativity also reflects a kind of novelty or originality or shows something new and useful and comes into being (Aljarrah, 2020).

The development of student creativity is the teacher's additional responsibility and task (Hadar & Tirosh, 2019; Soh, 2017). In psychology, the measurement of creativity is one of the most controversial issues (Segundo Marcos et al., 2020; Zabelina & Silvia, 2020). In mathematics, tasks and activities asking students to perform procedures on a regular basis are opportunities for students to think, but this is not creative thinking (Hadar & Tirosh, 2019). Creative thinking is a process of association and combination of elements (Cahyati et al., 2018; Segundo Marcos et al., 2020). Freudenthal expressed the notion of mathematics as a human activity. Mathematics must be connected to reality, stay close to children's experiences and relevant to society (Kartika et al., 2019; Sumirattana et al., 2017). Through this idea, the concept of realistic mathematics education (RME) emerged. RME can build students' mathematical cognitive knowledge at every stage of the creative thinking process that students go through (Sitorus & Masrayati, 2016). Realistic mathematics education is also adopted in Indonesia which is called Indonesian realistic mathematics education. Students must develop skills to know when and how to apply mathematics in everyday life (Dooren et al., 2019).

Students must take responsibility for being part of the problem-solving process (Abu Bakar et al., 2018; Andini et al., 2018). The teacher's task is to arrange appropriate didactic situations in the form of problems in such a way that if students solve them, students will get the desired target of knowledge. When students accept problems as their own, teachers need to refrain from intervening and suggest how to complete assignments until students find answers to problems (Norqvist et al., 2019; Sari et al., 2020). One of the media that can also be used in the delivery of material is comics. In addition, a learning model is needed. It is hoped that the learning model leads to developing creativity and mathematical thinking skills which must depart from learning that makes students active (Ibrahim & Widodo, 2020). In education, designing is establishing the focus and key points for teaching and learning as a process, usually with the aim of achieving certain learning outcomes (Jahnke et al., 2017; Wan Yunus & Mat Ali, 2018).

Comics as a teaching tool with students as active constructors of comics (Aggleton, 2019; Gavaldon & McGarr, 2019). Learning media in the form of cartoons are made with the aim that students do not get bored during the learning process (Saputri & Qohar, 2020). Comics are visual media that are presented in the form of images (Hidayah & Fathimatuzzahra, 2019; Lesmono et al., 2018). Comics as visual media are able to influence students' knowledge acquisition as a result of learning, because comics can attract students' interest and attention in receiving information (Cahyono et al., 2019; Tekle-Haimanot et al., 2016). Learning through e-comic characters is able to have a positive effect in motivating students to learn again (Hobri et al., 2021). In addition, it also motivates students to read, comic literature and also offers other benefits (Cahyono et al., 2019; Tekle-Haimanot et al., 2016).

Comics can be used as a learning approach (Rahajeng & Muslimah, 2020). Comics are a combination of text and images. In comics there are also speech balloons that are part of the graphic style which plays an important role in showing the relationship between images and text. Speech balloons are considered a key element in comics (Aeni & Yusupa, 2018; Karthika Devi et al., 2020). Media should be attractive because of innovative and innovative media. Interesting activities will encourage students to study with teachers

(Harmawati et al., 2020; Karthika Devi et al., 2020). Besides comics, video is also a medium for delivering material. Video is a sequence of images that has a temporal dimension that individual images do not have (Li et al., 2020). Videos can focus teachers' attention on the complex interactions between learning content, their students' actions and the teacher's own actions that can be played over and over again. The concreteness of video images can invite teachers to make an analysis of teaching and learning of certain subjects (Brouwer et al., 2017).

In particular, participants acknowledged that more emotions were aroused during watching long videos than text (Tarchi et al., 2021). Textual translation of video text with meaningful sentences provides the potential to bridge the semantic relationship between video and language (Xiao & Shi, 2020). Participants in conditions in which videos were statically segmented by images showed significantly better learning performance than those who watched videotapes non-stop or were shown static illustrations (Biard et al., 2018; Muhammad, 2018; Van Alten et al., 2020). If file size is an issue, videos can be hosted on Critical Commons or Google Drive and played directly from the internet. If the video is fully available on a platform such as YouTube or Netflix, the instructor can simply pause the video between segments and ask for response questions before continuing (Wooten, 2020). Participants who viewed videos on the topic of procedural knowledge in the presence of an instructor also had significantly higher levels of cognitive load (Wang et al., 2020). Previous research revealed that mobile learning (m-learning) had a positive effect on motivating students to learn mathematics (Cecep et al., 2019; Suprianto et al., 2019; Tetzlaff, 2017). The study also found a positive and significant relationship between mobile learning and the diversity of teacher training methods. Therefore, the idea emerged to design learning using other media, namely realistic mathematics comic videos, to analyze differences in the creative problem-solving abilities of groups of students who were taught using these media.

## 2. METHOD

The implementation of this quantitative research using a quasi-experimental method involves two groups, namely the group of students who are taught using realistic math comic videos and a group of students who are not taught using realistic math comics videos. This study uses a pretest posttest comparison design. This research was conducted at SMP Santo Yoseph Medan. The population of this study was all seventh-grade students of SMP Santo Yoseph Medan for the Academic Year 2020/2021 which consisted of four parallel classes, namely VII-A, VII-B, VII-C, and VII-D. Meanwhile, the research sample was all students of class VII-B as the sample of the experimental class and all students of class VII-C of junior high school as the sample of the control class. There are two variables in this study, namely the independent variable and the dependent variable. The learning method is the independent variable, while the creative problem-solving ability is the dependent variable. The research instrument used was a pretest and posttest of creative problem-solving abilities. The pretest grid can be seen in the following Table 1.

**Table 1.** Creative Problem-Solving Ability Pretest Grid

No.	Types of Troubleshooting Ability	Types of Creative Thinking Ability	Indicator	Question Number	Cognitive Level					
					C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>
1.	Understanding the problem		Can identify and write down what is known and what is being asked.	1a, 2a, 3a.		√				
2.	Planning for problem solving (strategy)	Fluency Flexibility Originality	Planning a problem in more ways than one. Able to change approach or way of thinking. Develop unusual or unusual plans.	1b, 2b, 3b.						√
3.	Solve problems according the plan made	Fluency Flexibility Originality	Solve problems with more than one answer. Solve problems in various or varied ways. Solve problems that are different (unique) from the usual.	1c, 2c, 3c.						√

No.	Types of Troubleshooting Ability	Types of Creative Thinking Ability	Indicator	Question Number	Cognitive Level					
					C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>
4.	Recheck answers		Re-check how to get the answer or double-checking whether there is another more effective way to work on the problem.	1d, 2d, 3d.				√		

Table 2. Creative Problem-Solving Ability Posttest Grid

No	Types of Troubleshooting Ability	Types of Creative Thinking Ability	Indicator	Question Number	Cognitive Level					
					C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>
1.	Understanding the problem		Can identify and write down what is known and what is being asked.	1a, 2a, 3a.		√				
2.	Planning for problem solving (strategy)	Fluency Flexibility Originality	Planning a problem in more ways than one. Able to change approach or way of thinking. Develop unusual or unusual plans.	1b, 2b, 3b.						√
3.	Solve problems according the plan made	Fluency Flexibility Originality	Solve problems with more than one answer. Solve problems in various or varied ways. Solve problems that are different (unique) from the usual.	1c, 2c, 3c.						√
4.	Recheck answers		Re-check how to get the answer or double-checking whether there is another more effective way to work on the problem.	1d, 2d, 3d.				√		

The sample of the research instrument trial was eighth grade students of SMP Santo Yoseph Medan Academic Year 2020/2021. In this study, statistical data analysis was carried out, namely data prerequisite tests and research hypothesis testing. The analysis prerequisite test includes normality and homogeneity tests. To test the research hypothesis using the t test (difference test). However, before testing the research hypothesis, it has met the analytical requirements test, namely normal and homogeneous.

### 3. RESULT AND DISCUSSION

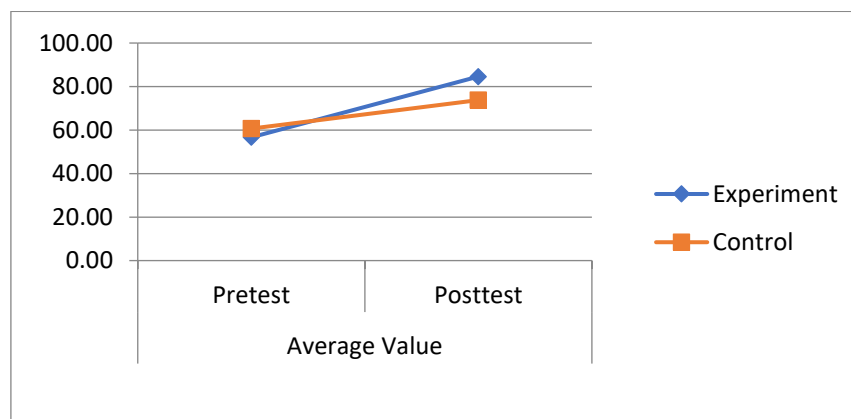
#### Result

##### Data Analysis

Before being treated with the learning method, a pretest was given to determine the initial creative problem-solving ability of the research sample students. After knowing the students' initial abilities, they were given treatment with different learning methods in the experimental class and the control class. The experimental class students applied the video-based learning method of realistic math comics, while the control class students applied learning without video-realistic math comics. The data on creative problem-solving abilities of 30 experimental class students based on the pretest results: an average of 56,67 and a standard deviation of 8,77 with a minimum score of 41,70 and a maximum score of 75,00. Meanwhile, based on the posttest results: the average is 84,59 and the standard deviation is 7,43 with a minimum score of 72,90 and a maximum score of 93,80. In addition, the table above also states that the data on creative problem solving abilities of 32 control class students based on the results of the pretest: an average of 60,67

and a standard deviation of 7,95 with a minimum score of 38,90 and a maximum score of 72,20. Meanwhile, based on the posttest results: the average is 75,72 and the standard deviation is 6,96 with a minimum score of 68,80 and a maximum score of 91,70.

The prerequisite test was carried out on the pretest and posttest score data for the experimental class and the control class. Prerequisite tests include normality and homogeneity tests. The significance value of Asymp. Sig (2-tailed) is 0,348; 0,254; 0,357; and 0,205 is greater than 0,05 so that  $H_0$  is accepted and  $H_1$  is rejected. In accordance with the basis of decision making in the Kolmogorov-Smirnov normality test, it was concluded that the data were normally distributed. The value of pretest sig. ie. 0,209 and posttest 0,458 > 0,05 then  $H_0$  is accepted and  $H_1$  is rejected or in other words that the data is homogeneous. This shows that the variance of the data pertest and posttest in the experimental class students and control class students is the same or homogeneous. To test the research hypothesis using the independent sample t test, which is to answer the suspicion of whether there are differences in students' creative problem-solving abilities given different learning methods or not.  $t_{count} (4,583) > t_{table} (2,000)$  or sig.(2-tailed) < 0,05 then  $H_0$  is rejected and  $H_1$  is accepted, which means that there are differences in students' creative problem-solving abilities who are taught using math comic videos. realistic with students who do not use realistic math comic videos. The table above also shows the significant difference in the mean of the two groups. The average difference can also be seen in the following figure 1. It can be seen that the average creative problem-solving ability of the experimental class students is higher than the control group's ability.



**Figure 1.** Graph of Average Pretest and Posttest Ability

## Discussion

The research hypothesis test concluded that there were differences in the creative problem-solving abilities of groups of students who were taught with realistic mathematics comic videos and groups of students who were taught without using realistic mathematics comic videos. In other words, the creative problem-solving ability of the group of students who were taught with realistic mathematics comic videos was better than the group of students who were taught without realistic mathematics comic videos. Learning videos are one of the learning media that can transmit messages and trigger students' thoughts and attention to encourage the learning process in students (Andriyani & Suniasih, 2021; Kor et al., 2014; Van Alten et al., 2020). The developed video becomes a tool in the learning process. Learning will not run optimally (Leatherman & Cleveland, 2020; Muhammad, 2018). The comic video developed provides audio and visuals to make it easier for students to reach. Other research also states that video media can increase students' interest in learning because students can listen and see pictures (Andel et al., 2020; Biard et al., 2018; Tarchi et al., 2021). Videos can present information, describe processes, explain complex concepts, teach skills, shorten or extend time, and influence attitudes. Videos can also be used for almost all topics, learning models, and every domain: cognitive, affective, and psychomotor. In addition, watching videos, after or before reading, can strengthen students' understanding of teaching materials.

Comics developed in the form of videos. Comics have short and exciting stories and are equipped with actions (Hobri et al., 2021; Taufiq et al., 2020). Comics can make the characters seem alive because they are accompanied by free colouring. Comics are simple, easy to catch and understand so that they are very popular with both children and adults. It causes students to be interested in learning (Hobri et al., 2019; Rahmata et al., 2020; Udayani et al., 2021). The advantage of the developed comics is that the presentation contains visual solid and story elements so that students can be emotionally involved when reading comics (Hobri et al., 2019; Lesmono et al., 2018). These results indirectly support the finding that mathematics e-comic has an effect on students' creative thinking skills (Hotbri, et al., 2021; Istiq'faroh et al.,

2020). In addition, it also support research findings which state that students' creative thinking processes can be explored by applying learning with realistic mathematics education (Sitorus & Masrayati, 2016; Sumirattana et al., 2017). The uses of videos can increase students' creativity and problem-solving abilities which are part of creative problem-solving abilities (Gamboa, 2019; Yasunaga et al., 2020).

#### 4. CONCLUSION

There are differences in creative problem-solving abilities between groups of students who are taught using realistic math comics videos and groups that are not taught using realistic math comics videos. The difference is significant where the ability of the experimental class students is higher than the ability of the control class students. It can be concluded that realistic math comic videos can improve students' creative abilities.

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