MIND MAPPING LEARNING TO INCREASE MATHEMATICAL REFLECTIVE THINKING ABILITY OF JUNIOR HIGH SCHOOL STUDENTS

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ABSTRACT

This study investigated the effects of mind mapping learning on students’ reflective thinking ability in Mathematics. The participants were 48 seventh grade students from two classes in Junior High School 21 of Semarang; 25 students in experiment group and 23 students in control group. Control group were touch by using expository learning, and experiment group were taught by using mind mapping learning. Prezi presentation was used by researcher as a media to explain learning material. The research data was gathered through the test after entire treatment has given to the students. Based on the result of research, implementing the mind mapping learning can significantly improve the students’ mathematical reflective thinking ability. It indicated that mind mapping can help them to understand, clarify triangle concepts, and also enhance their interests in learning mathematics. It was recommended that the students should be encouraged by the teachers to represent the topics they are taught by using symbols and connections that will make lessons more permanent in their memory. The findings of this research indicated that when the students constructed mind maps they were able to achieve better understanding than the students who used expository learning. The other aspects that influence the understanding of material are the enthusiastic of mind map making and students enjoy to participate the mind mapping learning.

Keywords: mind mapping, media, reflective, thinking ability

INTRODUCTION

Mathematics is a tool that is not only used to assist students in developing thinking skills but also help them develop the basic skills to solve daily problems (Pimta, Tayaruakham, & Nuangchalerm, 2009). Mathematics in schools often be one lesson that less favored by the students. Their poorness anxiety in mathematics subject caused their math ability was bad, otherwise their math ability was bad because of their anxiety in mathematics subject were poor.

Mind map effective helping students learn more effective. Buzan (2012) was the originator of the mind mapping technique, along with the term “mind map” developed the technique as a way of helping people to learn more effectively. Mind mapping is a brainstorming technique that has many applications in many sectors such as government, business, and education as a creative method that is useful in training, brainstorming, organizing, and problem solving. A mind-map is a sketchily structured visual representation of one’s thoughts which may lead to a train of related ideas. It is based on radiant thinking, a concept which describes how the human brain processes ideas and information, whereby different ideas are associated to each other through relationship hooks (Buzan & Buzan, 2000).

By using mind maps, someone can quickly identify and understand the structure of a subject and the way that pieces of information fit together, as well as recording the raw facts contained in normal notes and mind maps can also be used as complementary tools for knowledge construction and sharing (Tsinakos & Balafoutis, 2009). A mindmap is a diagrammatic representation of words, ideas, tasks or other items associated with a study topic. These maps are useful tools that can be utilized to represent the structure of knowledge in a form that is psychologically compatible.
with the way human beings construct meaning (All & Havens, 1997).

In a mind map the main study topic is drawn at the center with keywords branching out in a divergent pattern. These key words correspond to subtopics and then smaller branches project from the subtopics with further details regarding the subject being included in a progressively branching pattern (Madu & Ifeoma, 2012). Brinkmann (2005) gave some rules for making mind-map. The rules are: (1) use a large sheet of paper, place the topic of the map at the center; (2) from the topic, draw a main branch for each of the main ideas linked to the topic; (3) write keywords relating to the main ideas directly as the lines; (4) starting from the main branches draw further lines (sub branches) for secondary ideas (sub topics) and so on; (4) the order follows the principle-from the abstract to the concrete, from the general to the specific; (5) use colours when drawing a mind map; (6) add sketches, symbols such as little arrows, geometric figures, exclamation marks or question marks, as well as self defined symbols.

Mind maps are very individual graphic representations. As different people have different associations with the same topic they also draw different mind maps (Brinkmann, 2005). Mind maps are essentially the visual representations of students’ thought, they allow for a greater retention of information (Long, 2011). Therefore, each student has a unique art sense, observe, and thinking way by themselves.

One of the thinking aspect that need to be developed in mathematics is the reflective thinking ability. Reflective thinking according to Dewey (Phan, 2008) is “an active, persistent, and careful of any belief or supposed form of knowledge in the light of the grounds that support it and the conclusion to which it tends.” Reflective thinking skills connect between new knowledge and understanding which has been owned by earlier student. Reflective thinking begins with a state of doubt, hesitation, or perplexity and moves through the act of searching to find materials that will resolve, clarify, or address the doubt. Reflective thinking is essential to identifying, analyzing, and solving the complex problems that characterizes classroom teaching (Spalding & Wilson, 2002).

The students would seek a relationship problem with what he/she had already knew before hand to be able to find a solution when he/she completed a reflective question. Starting out all the definitions about the reflective thinking, it can be defined as purposeful and proper activity process which the individual realizes to follow, analyze and evaluate his/her own learning in view of reaching learning targets, persistence of his/her motivation, gaining deep meanings, using proper learning strategies, making contact with his/her peers and teachers to reach learning targets to generate new learning approaches impacting directly to the advanced learning processes and performance (Gurol, 2011). The reflective thinking, one of the modes of thinking, is developed with learning essays, concept maps, mind maps, questioning, contractual learning, and self assessment activities.

Educational materials have recently emerged which aim to improve memory for triangle material by representing learning material in the form of “mind maps.” Our aim was to evaluate the effectiveness of using mind maps for learning mathematics and to analyze if there is any relation between mind maps made by the students of junior high school and their reflective thinking ability.

METHODS

A total of 25 seventh grade students from class VII-C and 23 students from class VII-H in Junior High School 21 of Semarang, Middel of Java, Indonesia were selected to participate in the study. Triangle material was selected from a recommended text book as study material especially area and perimeter of triangle. The researchers developed eight structured essay questions from the study text and required the recall of a specific piece of information to solve the problem in questions.

Initially the participants in the mind map group were given 2 × 40 minutes lesson on the mind mapping learning to train them on the application of the method. Prezi presentation was used by researcher as a media to explain learning material. After that, the students were allowed to make their own mind map based on their understanding about the learning material. During learning, the participants were given an opportunity to ask questions regarding the mind mapping technique and the learning material. Participants in the mind map group were advised to divide the time between reading the text book, observing the material in prezi presentation, and producing a mind map. This treatment given in three meetings. In fourth meeting, the written test about triangle material given to the students. It was used to measure the reflective thinking ability of the students.

RESULTS AND DISCUSSION

Before doing the research, the researcher determined the subject matter and appropriate learning technique with the problem, designed learning activities
with Prezi media presentation, created a syllabus and lesson plan, and prepared test instruments. Research was conducted on March 2013 up to April 2013 in SMP N 21 Semarang. The experimental group and the control group were treated in accordance with the instruments and learning tools that have been developed. Then test data of two groups were analyzed to obtain valid inferences for the population.

Based on the result of the test, the average mark obtained by the entire group was 73.8. The average mark obtained by the mind map group was 77.47. It was 70.00 in the expository learning group. Based on SPSS output analysis, known that there was a significant difference in average of the answers between the students in mind mapping group and expository group. The average score of mind mapping group was higher than the expository group. However, it was necessary to test the difference average test. This test aims to determine whether the average of the students' reflective thinking ability in mind mapping learning by using prezi higher than expository learning. Based on analysis from SPSS output, known that there are differences between the results of the test class that applied mind mapping learning by using prezi assisted with the applicable class expository teaching. Based on the hypothesis, it was concluded that the average of the students' reflective thinking ability in mind mapping group was higher than expository group.

On the other hand, the mind mapping technique didn't show any superiority over other conventional study techniques as a learning method. But the majority students of the mind mapping group perceived it as a useful way of summarising information also to connecting them one and others. Mind maps generated from learning mind mapping is an effective tool in the implementation of learning and can improve the creativity and students' visual intelligence and also it gives students the opportunity to express themselves freely and easily applied (Keleş, 2012). Mind maps made by the students can improve students' hinking skills and positively affects students' their creativity by using different colors and shapes on the mind maps.

In this research, the researcher has used a presentation media to explain the subject material called prezi. Prezi is a presentation software and internet-based media to share ideas and information that are placed on a virtual canvas. According to Diamond (2010), the use of Prezi can enhance the effectiveness on delivery of information in the mind map form. In essence, mind mapping is a way of spreading your ideas out onto a piece of paper or any canvas available instead of just writing a very dull (and linear) list of what’s needed in your Prezi presentation (Anderson, 2012). Interface of prezi can be seen at Figure 1.

In expository group, the teacher explains the subject matter in detail, gives examples of how to resolve the problem question in accordance with the subject material being taught. The students pay attention to the teacher's explanation, then they note what the teacher explained. Sometime the teacher gives students a little time to ask about material if they didn't understand. If anyone asks, the teacher will answer and explain classically. In line with the opinion from Şeyihoğlu & Geçit (2012) which states the mind maps can be said to have great contributions to securing the permanent learning since they mostly make the courses enjoyable, reflect the individuals’ inner worlds and knowledge, improve their high level thinking skills such as analysis and synthesis as well as their comprehension and practical skills.

Some students look serious in making their mind map. They were enthusiastic and enjoyed the lesson. So that when they makes their own mind map, they enjoyed each processes. This condition makes the learning process more fun and interesting. The students can freely express their imagination into the paper as mind map form. If the students can follow the lesson well, consequently the knowledge they gained from the lessons will certainly be better than students who are not enthusiastic about the lesson.

![Figure 1. Example of triangle material in Prezi presentation](image1)

![Figure 2. An octopus mind map made by student](image2)
Figure 2 is an example of mind map produced by the students. One of interesting and good mind map. It shows a shape that resembles an octopus with many arms, likened the material triangle can be divided in detail. The depiction of an attractive and appropriate to the students' favorite figure will make the students more enthusiastic in learning than in conventional notes through the linear notes tend to be boring. Suppose student who love animals like octopus, he can draw an octopus like in Figure 2. The students will be excited to learn because they unconsciously learn to use something that she loves, namely an octopus figure. Character in a mind map can be very widely developed by students in creating a mind map. Let's say that students who like certain animals or plants, students who like a certain cartoon character, students who like certain objects, etc. Students can create a mind map as their favorite shape. That way, their pleasure in learning will be increased rather than learning by ordinary linear notes. The more they enjoy learning, the more they understand the lessons he learned.

There were any kinds of the students’ mind map. Some of them were very simple and sober impressed in the mind map like shown in Figure 3. As if the students create a mind map wasn’t from their heart, maybe it because of the demands and duties from a teacher. It will indirectly affect their understanding about material they learned. If they were not keen to make a note in the mind map form, automatically they also didn’t interested to learn their mind maps. Every student has thir own style in learning. We can’t look them just from one point of view. Maybe the other student can achieve maximum understanding in other learning style.

Some other examples of mind map created by the students can be seen in Figure 4. Various forms created by the students according to their shapes or favorite picture. Many form that can be used to create a mind map is not restricted, they can combine many elements into their mind map. Combination of images and colors that appeal will certainly make students feel more happy to learn. The combination of left brain and right brain makes the entire brain work more effectively so as to produce maximum result. Left brain is oriented to thinking, calculation, memory coupled with the right brain is oriented to forms and colors will produce the maximum brain works.

Thinking ability that measured in this research is the reflective thinking ability. Reflective thinking steps according to Dewey (Trianto, 2007), namely: (1) students recognize a problem, the problem came from outside the students’ selves; (2) the students investigate and analyze the difficulties and determine the issues they faces; (3) students link the descriptions or results of the analysis to one and other, and collect a variety of possibilities to solve these problems based on the experience that has been previously owned; (4) students weigh the possible answers or hypothesis with the consequences of each hypothesis; (5) students try to practice one solution which student considers the best possible solution to find a solution that really right from several possible student was trying.

Henderson, Napan, & Monteiro (2004) describe indicators reflective thinking skills into five components, namely: (1) reporting, the student describes, reports or retells with minimum transformation and no added observations or insights, (2) responding, the student uses source data in some way, but with little transformation or conceptualisation; (3) relating, the student identifies aspects of the data which have personal meaning or which connect with their prior or current experience. The student gives superficial explanation of the reason why something has happened or identifies something that they need or plan to do, or change; (4) reasoning, the student integrates the data into an appropriate relationship involving a high level of transformation and conceptualisation and seeks deep understanding of why something has happened exploring the relationship of theory and practice in some depth; (5) reconstructing, the student displays a high level of abstract thinking to generalise or apply learning. The student draws original conclusions from their reflections, generalizes from their experience, extracts general principles, formulates a personal theory, or takes a position on an issue. The
student extracts and internalises the personal significance of their learning or plans their own further learning on the basis of their reflections.

The students’ answer sheet requires a complete answer tested that fulfill the components of mathematical reflective thinking ability. Thinking component that required are reporting, responding, relating, reasoning, and reconstructing. The following shows an example of the student test answers elaborated based its reflective thinking components.

Figure 5 shows the components of the students’ reporting ability to describe, inform, or retell the information in question.

Responding components can be seen in Figure 6. The students are able to use a temporary data that has been obtained is then formulate the problem of matter.

In Figure 7, the student’s answer gave rise relating component. This component demonstrates the ability of students to identify those aspects of the data that they obtained later connect with prior knowledge and start designing the initial stages of completion.

Students are able to combine the data in more detail and develop it to try to find a solution of the problem is the reasoning component of reflective thinking skills. It can be seen in Figure 8.

Figure 9 shows the students’ ability to perform testing to test problem solving and using it as a material consideration to make the conclusion. It is a component of the students’ answers reconstructing.

There are different types of variations in the responses of the students working on the post-test. In general, some examples of students' responses had a positive relationship with the mind map that made the students. Here are shown some examples of students' responses in working on the post-test.

Students with a mind map perfunctory and unstructured uncertainty tends to lead unsystematically and students in deliver their ideas in written form about the post test charge. Not that the students are not good at drawing or making artistic shapes the mind map that will lead to understanding and ability to work on the problems the weak. Relationships can be drawn that if the student does not enjoy the process of making a mind map, the students tend not enthusiastic in participating the lesson. It resulted the incuriously of the students to study the mind map they had made. Thus resulting in the students' lack of understanding of the subject matter.

CONCLUSION

From the research that has been carried out, it can be concluded that the average of students’ reflective thinking ability from students aplied with mind mapping learning was higher than expository learning. The enthusiastic of students when they make mind maps also can influence their mind maps’ quality. Students more enjoy the process and more understand the concepts of the subject material. It can be concluded that the study of mathematics by mind mapping learning aided by Prezi media can be used as an alternative learning in mathematics lesson at Junior High School.
REFERENCES


