

The effect of information mapping strategy on mathematics conceptual knowledge of junior high school students

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Abstract: The purpose of this study was to determine the effect of information mapping strategy on mathematics conceptual knowledge of junior high school students in Rokan Hulu Riau, Indonesia. The study also examined the relationship between mathematics conceptual knowledge and mathematics achievement. Using a quasi-experimental method, the study was carried out on 132 students from one junior high school in Rokan Hulu Riau, Indonesia. It was completed in 6 weeks. Instruments used in this study were mathematics conceptual knowledge test and mathematics achievement test. The results of this study indicated that there were significant differences in mathematics conceptual knowledge between the information mapping strategy group and the traditional group. It was concluded that using information mapping strategy may impact students' conceptual knowledge. There was a relationships between mathematics conceptual knowledge and mathematics achievement.

Key words: information mapping strategy; mathematics; conceptual knowledge; mathematics achievement

1. Introduction

It is evident that environment plays a significant role in the learning process. According to Maryunis (1989), teachers should create a learning environment that is able to motivate students to enjoy educational lessons and thus enhance students' activity and engagement according to the chosen methods (Maryunis, 1989). The success of learning process is influenced by the methods of learning, in a sense that it stimulates students to become active in learning activity (Djamarah, 2002). During instruction, the teachers often clarify the subjects, provide examples of questions and consequently give out exercise to students. In that sense, the teachers are giving information whereas the students are portrayed as receiving information. Giving information to students does not create understanding. Understanding comes from an interactive process within the student as they use prior knowledge, present instructional strategies and activities, and dynamically interact with and engage the new information. The usual learning method often expected by students is the norm of giving out notes to students. No matter how the mathematics teachers attempt to apply the learning technique of pursuing students to engage in inquiry and constructivism approach; the students themselves usually found their way still longing for simpler technique to allow maximum transfer of information (Lilia, et al., 2002). Therefore, the teachers need to inspire students to have a strong conceptual knowledge with the intention that the students are able to solve any problems given to them. The teachers should make instructional decisions to choose and employ methods of learning that could engage students actively in learning activities mentally, physically and also socially. The teachers should

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emphasize on the understanding of concept and the ability to solve mathematical problems in the learning of mathematics (Depdiknas, 2005).

According to Maryunis (2003), learning materials arranged in the form of information mapping allows students to understand the learning materials better because they involve basic concepts and executing procedures. Information mapping (IM) offers a strategy to effectively manage information (information mapping, 2004). The information mapping method is a research-based approach to the analysis, organization and visual presentation of information. It enables authors to break complex information into its most basic elements and then present those elements optimally to readers (information mapping, 2004). The strategy of information mapping mentioned in this study is a strategy that was developed by Horn (1976). The strategy emphasizes activity and students' responsibility to obtain information. The information mapping is in the form of structured writing, planned and arranged in the form of text, where one of the priorities is to utilize facilities to students. Maryunis (1989; 2003) explains that learning activities are not only defined as the activity of delivering learning materials or information but also contain the activities of information arrangement and implementation by students.

Horn (1976; 2004) presents the definition of information concept and information mapping procedure as follows: Information mapping concept is a chain of words or sentence that rationally could answer questions, such as name, definition, examples, and so on. Information mapping procedure is the technique employed to obtain certain results (including desired results). Horn (1976; 2004) also expresses that each information box contains required and selectable information boxes. Boxes are needed in order to organize a conceptual information map and contain name, definition and examples. Chosen box from conceptual mapping is further defined as introduction, formula, diagram, usage, generalization, regulations, analogy, non-example and comments. Those boxes are needed in order to arrange information procedure and contain mapping name, either one of schedule of result, flowchart and work sheet. Chosen box from procedure mapping contains introduction, usage, synonym, diagram, example, starting date, closing date and linking pages. The conceptual information mapping in this study will have seven boxes. Researcher adds the box of symbol in order to organize mathematical phrase which is expressed using symbol.

2. Conceptual framework

This study was based on the assumption that a using information mapping strategy is more likely to lead to a worthwhile learning compared to using the regular teaching method (Horn, 1976; 2004). Figure 1 shows the related variables by using strategies of information mapping, achievement and conceptual knowledge respectively.

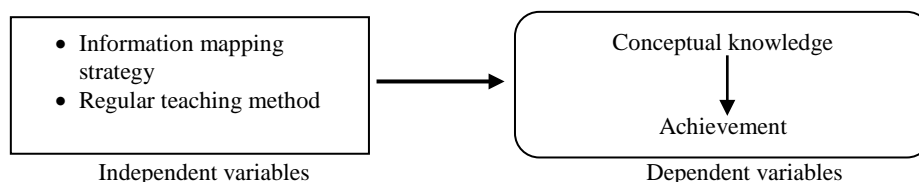


Figure 1 Conceptual framework

3. Purpose and objectives of the study

This study was designed to determine the effect of using information mapping strategy on students'

conceptual knowledge in mathematics. Its specific objectives were:

(1) To determine whether there is a statistically significant difference in conceptual knowledge between students exposed to information mapping strategy and those taught by using regular methods.

(2) To determine whether there is a statistically significant relationship between students' conceptual knowledge and mathematics achievement.

4. Hypotheses of the study

The following null hypotheses were tested:

(1) There is no statistically significant difference in conceptual knowledge between students exposed to information mapping strategy and those exposed to regular methods;

(2) There is no statistically significant relationship between students' conceptual knowledge and mathematics achievement.

5. Methodology

The design of this study is a quasi-experimental, pre-test and post-test, non-equivalent control group design (Creswell, 2005). Pre-test is used to investigate whether there is equivalence between groups and also to function as statistical control. The steps are as follows: (1) identifying the treatment group and control group; (2) conducting pre-test on all subjects, 66 for each group respectively; (3) employing information mapping strategy to treatment group and conventional strategy on the control group; (4) conducting post-test to all subjects; and (5) collecting and analyzing data.

Table 1 Design of experimental and control group

Group	Pre-test	Methods	Post-test
Treatment group	O_1	X_1	O_2
Control group	O_3	X_2	O_4

In this design (see Table 1), O_1 and O_3 represent treatment and controlled group for pre-test respectively, whereas O_2 and O_4 represent treatment and controlled group for post-test respectively. X_1 and X_2 represent the methods of learning given to both group which are information mapping group and conventional group respectively. Both groups are given a pre-test before the study commenced. At the end of the study, both groups are given a post-test which consists of a conceptual knowledge test and an achievement test.

6. Population and sample

The population consists of all secondary standard two students in Sekolah Menengah Pertama Negeri 1 Rokan IV Koto Kabupaten Rokan Hulu, Indonesia. One school was randomly selected. A total of 132 students participated in the study. 66 students were in the treatment group and another 66 students were in the controlled group.

7. Instrumentation

Two instruments were used in this study: the conceptual test and the achievement test. The researchers developed the instruments. The conceptual test contained 8 items which aimed at assessing the conceptual knowledge of students in the topic of circle. Each item was given 4 marks and overall total score was 32. The achievement test contained 9 items. Both instruments were given to experts in mathematics education for validation. The reliability coefficient for the conceptual test was found to be 0.79. According to Fraenkel and Wallen (2003), an alpha value of 0.70 is considered suitable to make possible group inferences that are accurate enough. Therefore, the instrument was found to be reliable enough.

8. Results

8.1 Pre-test analysis

Table 3 shows the pre-test mean score of conceptual knowledge for the experimental and control groups. The results indicate that the mean score for experimental group was 7.53 with a standard deviation of 2.67 and that for the control group was 7.44 with a standard deviation of 2.63. The results also indicate that the difference between experimental and control groups with respects to conceptual knowledge, $t_{(130)}=0.197$ is not significant at the alpha level of 0.05. This, therefore means that the experimental and control groups were at the same level of conceptual knowledge at the start of the treatment.

Table 3 Pre-test of conceptual knowledge between experimental and control groups

	N	Mean	Standard deviation	t-value	Sig.
Experimental	66	7.53	2.67	0.197	0.844
Control	66	7.44	2.63		

8.2 Post-test analysis

Table 4 shows the post-test mean score of conceptual knowledge for the experimental and control groups. The results indicate that the mean score for experimental group was 22.21 with a standard deviation of 4.14 and that for the control group was 19.30 with a standard deviation of 4.48. The results also indicate that the difference between experimental and control groups with respects to conceptual knowledge, $t_{(130)}=3.876$ is significant at the alpha level of 0.05. This, therefore means that there is a statistically significant difference in conceptual knowledge between the experimental and control groups.

Table 4 Post-test of conceptual knowledge between experimental and control groups

	N	Mean	Standard deviation	t-value	Sig.
Experimental	66	22.21	4.14	3.876	0.000
Control	66	19.30	4.48		

8.3 Relationship between conceptual knowledge and students' mathematics achievement

Pearson correlation test was used to observe the relationship between conceptual knowledge and students' mathematics achievement. Result of the analysis shows the relationship between conceptual knowledge and students' mathematics achievement ($r=0.736$, $p<0.05$). The higher the level of conceptual knowledge of the students will result higher level of students' achievement and vice versa.

9. Discussion

9.1 The effects of information mapping strategy on students' conceptual knowledge

The results of this study indicate that the information mapping strategy resulted in higher students' conceptual knowledge than the traditional teaching methods. This is because information mapping strategy provides better understanding of the given subjects conceptually. This is achieved by frequent exposure of learning materials. Information mapping strategy employs participation of both the teachers and the students where in this situation the teachers act as the ones who point out learning objectives, motivate students, give out learning materials, give out lectures, supervise and guide students' activities. Students on the other hand understand, inquire relevant questions, present their understanding and conclude as well. Each step helps the students to develop understandings of the lesson learned. The effect of learning in this way cannot be materialized if we followed the conventional learning strategy (Rika Kurniati, 2001).

9.2 Relationship between conceptual knowledge and students' mathematics achievement

The results indicate that there is a significant relationship between conceptual knowledge and students' mathematics achievement. The results of this study concurred with the result of a study done by Johari Yaakob (2007), who concludes that there is evidently strong relationship between conceptual knowledge and mathematic achievement.

10. Implications and conclusion

The findings of this study have indicated that the use of information mapping results in higher conceptual knowledge. This would, therefore imply that its incorporation in teaching and learning would enhance the learning of mathematics with regards to conceptual knowledge. Educators in their effort to improve the effectiveness of mathematics teachers should emphasize the use of information mapping strategy. Teachers training institutions should also incorporate information mapping in their training curriculum.

The researcher discovers that the teachers should plan proper learning materials appropriate to students' ability. Systematically planned learning material could facilitate better understanding among students (Maryunis, 2003). According to Pressley and Ghatala (2003), conducive learning environment yields effective learning. Clarke and Kazinou (2001) stated that learning does not only involve teacher teaching alone but students' abilities to absorb information as well. Students play a big role in the process of receiving new information and be able to integrate the information accordingly based on self learning experience. According to Houssman (1991), students who are taught to realize the process of learning could control their learning and are more likely to be more intelligent compared to those who do not.

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