Promoting students’ mathematical problem-solving skills through 7e learning cycle and hypnoteaching model

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Abstract. The aim of this research was to find out whether 7E learning cycle under hypnoteaching model can enhance students’ mathematical problem-solving skill. This research was quasi-experimental study. The design of this study was pretest-posttest control group design. There were two groups of sample used in the study. The experimental group was given 7E learning cycle under hypnoteaching model, while the control group was given conventional model. The population of this study was the student of mathematics education program at one university in Tangerang. The statistical analysis used to test the hypothesis of this study were t-test and Mann-Whitney U. The result of this study show that: (1) The students’ achievement of mathematical problem solving skill who obtained 7E learning cycle under hypnoteaching model are higher than the students who obtained conventional model; (2) There are differences in the students’ enhancement of mathematical problem-solving skill based on students’ prior mathematical knowledge (PMK) category (high, middle, and low).

1. Introduction
Mathematics deals with abstract ideas that are hierarchically arranged and deductive reasoning. Such a thing will certainly lead to the occurrence of the process of learning mathematics that leads to mastery of student mathematics. Lack of mastery of mathematics, especially in solving math problems such as students are not learning and not accustomed by educators solve mathematical problems that appeal to students of the phenomenon encountered. In the curriculum, it is emphasized that the problem-solving approach is the focus of mathematics learning covering closed problems with single solutions, open issues with non-sole solutions, and problems with various solutions. This is in line with the standard process based on the National Council of Teachers of Mathematics [1] which states that the standard process in learning mathematics include problem-solving skills, reasoning ability, communication skills, make connections (connections), and the ability of representation (representation).

Educator as facilitator should have the ability to create learning situations involving students actively so that leads to improving students' mathematical skills, especially problem-solving skills. Efforts that can be done, among others, by applying the appropriate model of learning and more meaningful learning model that involves students in learning, one of the learning model is the learning cycle.

The learning cycle is one of the learning models that adopt constructivist in learning. The rationale of the constructivist is an effective learning process requires that educators know how the students
bring the facts and phenomena that become the subject of learning. Implementation of this model in learning activities can help students understand the concept through the stage of data collection (exploration), the introduction of the concept (concept introduction), and the application of the concept (concept application). Three cycles (phases) have been developed into five stages consisting of engagement, exploration, explanation, elaboration, and evaluation, and now developed into seven cycles (phase) consisting of elicit, engagement, exploration, explanation, elaboration, evaluation and extend [2]. In this research will be used 7E learning cycle that is elicit, engagement, exploration, explanation, elaboration, evaluation and extend.

In the 7E learning model, students are trained to identify a mathematical problem, connect their own mathematical understanding, express opinions, ask questions, present and explain answers, reformulate mathematical concepts with their own language, solve problems of challenge, evaluate and develop answers - more innovative answers. A teacher is student facilitators in learning, guiding and directing students during the learning process. Opinions or ideas raised by students, well appreciated by lecturers, so that students feel themselves have contributed to learning in the classroom.

Hypnoteaching is a unique, creative and imaginative way of teaching that can make students feel comfortable in the teaching and learning process, since the lesson begins until the ending lesson is done by using subconscious language which gives students the impression to concentrate fully on the learning process. Hypnoteaching is the art of communicating by giving suggestions that students become smarter. With the suggestion given they are expected to be awakened and enlightened that there is tremendous potential that they have never optimized in learning. By utilizing hypnoteaching expected barriers or difficulties faced by students in every cycle of the 7E learning cycle can be overcome.

Based on the above description, the authors are encouraged to conduct research entitled "The Enhancement of Students’ Mathematical Problem-solving Skill Through 7E Learning Cycle Under Hypnoteaching Model". In this course, students’ mathematical problem-solving abilities are reviewed as a whole based on the student’s prior mathematical knowledge (PMK).

2. Mathematical problem-solving skill

Problem-solving in the context of mathematics is seen as a very important activity in learning, because it demands critical and creative thinking. Solving mathematical problems is a complex mental process such as creating new ideas in determining problem-solving, or finding new techniques or products. To develop problem-solving skills, Polya [3] provides an overview of the framework for solving mathematical problems as: (1) Understanding on the problem (identification of purpose); (2) Create a problem-solving plan; (3) Implement the plan; and (4) Looking back.

Furthermore, in this research, the ability to solve mathematical problems developed against students are: (1) Understanding the problem, ie the ability to identify known elements, being asked, checking the adequacy of the data and creating a mathematical model of the problem; (2) Plan for problem-solving, ie the ability to choose or develop problem-solving strategies; (3) Carry out calculations, namely the ability to solve mathematical problems according to plan; and (4) Examines the truth of the results, ie the ability to interpret the results according to the original problem.

3. Hypnoteaching

According to Dale [4] hypnosis is a state of mind that shows high-level suggestions. Kurniawati [5] concluded that hypnoteaching is a learning method that seeks to decrease the frequency of brain waves by making the students focus (focusing), either with video shows, inspirational stories, and yelling and using relaxation and imagination so that students' attention becomes centered, students become relaxed and more suggestive in capturing the positive values of a learning process. According to the steps of learning hypnoteaching among others as follows: identify the needs of the students first; plan learning by using hypnosis media such as voice, picture, writing and symbols; start teaching by making students focus well with games, singing together, inspiring stories, and yelling (focusing); perform relaxation and imagination; divide the students into groups (grouping) where each group discusses,
shares knowledge and teaches and praises; declare something positive from the student (affirmation); repeating the words of inspirational motivation (repeating); evaluate, and before the learning ends, the student reflects on the lesson learned.

4. 7E learning cycle under hypnoteaching model

The learning cycle is an active teaching approach based on Piaget's theory of mental development and constructivism. Through development by researchers for a long time, the learning cycle model comes in three types, depending on the number of phases it contains (4, 5 or 7). The latest version has the following 7 stages: elicit, Engage, explore, explain, elaborate, evaluate and extend. Research has shown that learning cycle models have a positive effect on specific learning products, proving to be an important tool for teaching concepts, influencing students' academic performance in a positive way, enabling students to develop or improve positive attitudes toward learning and improve students' ability to think scientifically, experimental and practical skills [6].

In the next research, researchers will combine the learning of 7E cycles with hypnoteaching. The steps of the 7E cycle according to Eisencraft [7] are as follows:

1) Elicit phase, intended to identify the initial knowledge of the students, to ensure whether the students already know the lesson to be learned.

2) Engage phase, intended to attract attention or arouse students' interest and motivation towards concepts to be taught by asking questions, telling stories, giving demonstrations, or by showing an object, image or video.

3) The explore phase is intended to provide students with the opportunity to acquire knowledge with immediate experience related to the concepts to be studied, where students observe, isolate variables, plan inquiry, interpret results and develop hypotheses and organize conclusions and learning materials that have been provided previously.

4) Explain phases, students give explanations of concepts, introduce concepts, terms and summarize the results obtained in the exploration phase.

5) Elaborate phases, students are given the opportunity to apply their newly discovered knowledge to problems related to the example of the lesson learned, for example, providing practice questions with a deeper level of analysis to the students.

6) Evaluate phase, is an advanced cycle to evaluate students' knowledge. By using formative assessments to see student progress, the desired developments in the students' understanding of concepts, principles and abilities apply the concept.

7) Extend phase is the phase of students encouraged to link and explain examples of the application of concepts they learn with everyday life.

5. Method

The research method used in this research is quasi-experiment with the design of Nonequivalent group pretest-posttest design [8] consisting of two groups: experimental group and control group. The experimental group is a group that gets 7E learning cycle under hypnoteaching model (LCH), while the control group is a group that gets conventional learning (CL). The data to be analyzed in this research is N-Gain data (normalized gain) from students’ mathematical problem-solving test. This normality and homogeneity test used the Kolmogorov-Smirnov and Levene tests. The difference test and interaction analysis using the t-test and ANOVA. All statistical calculations use the IBM SPSS 21 computer program.

6. Results and Discussion
6.1 Description of mathematical problem-solving ability

Data analysis of students' mathematical problem-solving ability is done by data which is derived from mathematical problem-solving test. The result of descriptive statistical improvement of students' mathematical problem-solving abilities is presented in Table 1.

![Table 1. Descriptive statistics of improved mathematical problem-solving ability](image)

Based on Table 1, the PMK category (high, medium, low) the average N-Gain of the students’ problem-solving ability in the class by LCH learning is greater than in the class taught by CL. This can be seen from the total N-Gain average of LCH and CL is 0.6244 > 0.5079. This result shows that the students’ problem-solving abilities improvement based on the overall data and CL categories PMK (high, medium, low) in the classroom with the students by LCH learning better than the control class with the students by CL.

6.2 Mathematical problem-solving skill improvement based on learning analysis and PMK

Based on the normality analysis data, the category PMK each data is normally distributed. Further analysis to determine the improvement of the ability of PM based on the overall data and category PMK (high, medium, low) between the experimental class and the control class is done by using the t-test. The different test results between the experimental and control classes are presented in Table 2.

![Table 2. Different test enhancement mathematical problem-solving](image)

Based on Table 2, the difference test between the two classes of experimental class and control class in overall data and medium category of PMK with the probability result is 0.0025 < α = 0.05 and 0.010 < 0.05, means reject the H₀ hypothesis. These results show that the improvement of students' mathematical problem-solving abilities based on the overall data and PMK medium category in the experiment class with LCH learning better than the control class with CL learning.

While to know the difference test between experimental class and control class in high and low category with result of probability value is 0.285 > α = 0.05 and 0.165 > 0.05 so Ho accepted. These results show that the improvement of students' mathematical problem-solving abilities based on LCH learning less than problem-solving learning in category high and low PMK.

6.3 Interaction analysis of mathematical problem-solving ability

Interaction analysis between learning model and PMK was done by ANOVA Analysis. The ANOVA Analysis results are presented in Table 3 below.

![Table 3. Interaction between learning model and PMK](image)
Table 3 above shows that the value of significance 0.825 > 0.05, so that the Ho hypothesis is accepted. It means that there is no interaction between learning model (LCH, CL) and PMK category (high, medium, low). This means that the difference in mean score of mathematical problem-solving ability of mathematical knowledge students (high, medium, and low) who treated by LCH does not differ significantly with students who have treated by CL.

7. Conclusion
Based on the analysis of results obtained in this study it can be concluded several things as follows: (1) The students’ achievement of mathematical problem-solving skill who obtained 7E learning cycle under hypnoteaching model are higher than the students who obtained conventional model; (2) There are differences in the students’ enhancement of mathematical problem-solving skill based on students’ prior mathematical knowledge (PMK) category (high, middle, and low).

References
[1] NCTM 2003 Program for Initial Preparation of Mathematics Specialists (http://www.ncate.org/ProgramStandards/NCTM/NCTMStandards.pdf)
[2] Eisenkraft A 2003 A proposed 7E model emphasizes “transfer of learning” and the important of eliciting prior understanding The Science Teacher 70 (National Science Teachers Association NSTA)
[3] Polya G 1985 On solving mathematical problems in high school In S Krulik eds Problem Solving in School Mathematics (Reston, Virginia: NCTM) p 5
[4] Dale R A 2014 Hypnosis and Education (http://eric.ed.gov/?id=ED087710)
[5] Kurniawati L 2014 Meningkatkan kemampuan berpikir intuitif-reflektif, pembuktian matematis dan disposisi mahasiswa melalui pembelajaran berbasis masalah dengan metode hypnoteaching Disertasi (Bandung: Program Pascasarjana Universitas Pendidikan Indonesia)
[6] Celik H 2013 The Effect of the computer-aided 7E teaching model on students’ science process skills, Mediterranean Journal of Educational Research 14a 926
[7] Pitriati 2014 Pengaruh penerapan model learning cycle 7E terhadap peningkatan kemampuan penalaran dan kemampuan komunikasi matematis siswa SMP Tesi (Bandung: Program Pascasarjana Universitas Pendidikan Indonesia)
[8] Ruseffendi E T 2010 Dasar-dasar penelitian pendidikan dan bidang non-eksakta lainnya (Bandung: Tarsito)