

**MATHEMATICAL PROBLEM SOLVING OF STUDENT BY APPROACH BEHAVIOR
LEARNING THEORY**

THE RESEARCH GRANTS TEACHER DEVELOPMENT BASED INTERNATIONAL
MATHEMATICS AND SCIENCE,

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ABSTRACT

The purpose of this research is to develop a behavioral learning theory to modify the type of cooperative learning Numbered Heads Together in mathematical problem solving of students on the course Theory of Numbers.

The steps were developed from the theory of behavior modification type of cooperative learning with Numbered Heads Together relation to solving mathematical problems in Number Theory course consists of 5 phases, namely: (a) Selection as a cooperative learning approach, (b) Constituent materials on specific topics of number theory in the form of paper, (c) Presentation of papers in rotation by members of the group in front of the class, (d) Other group members' responses to the presentation material of the group who has been appointed, and (e) Giving a summary or affirmation matter and negative reinforcement and positive reinforcement.

Based on the empirical test results in the implementation of learning through theory of behavior modification type of cooperative learning with Numbered Heads Together as follows: (1) both student participation and group renderers group of participants is very high so as to motivate the students to learn to identify and resolve their own problems on a particular topic in number theory, and (2) Achievement of student learning outcomes that first meeting: 37.5% and averaged 50.5, second meeting: 52.4% and averaged 52.9, and the third meeting: 72.5% and averaged 62.3.

Keywords: Mathematical Problem Solving, Behavioral Learning Theory

A. INTRODUCTION

General subject matter of number theory is abstract because the material contains symbols, axioms, definitions, and theorems. Moreover, this course programmed in the third semester, students generally learn ways still unfamiliar with how to learn how to calculate the high school is not the way of reasoning. Therefore, most of the students feel the weight of the material studied number theory.

At first, the learning process using a number theory course learning model directly, but student results are less satisfactory. It can be seen from the results of student answers that students are generally less able to solve the problem of proving the theorem. Indeed, the proof of the theorem is one of the high-level mathematical problem solving that requires skill and reasoning power are high.

Problem solving is part of the math curriculum which is very important because in the learning process and completion, students gain experience made possible using the knowledge and skills that have been held to apply to problem solving. This is consistent with the results of a survey on the current situation on mathematics and science education in Bandung, sponsored by JICA (Tim MKPBM, 2001: 83) that mathematical problem solving is one of the math activities that are considered important by both teachers and students at all levels from elementary through high school. However, it is considered the most difficult to learn and for teachers to teach. An issue typically includes a situation that encourages a person to solve it, but do not know directly what to do to solve it.

Therefore, the task is not just to teach science lecturer only to students, but to help students to learn to master concepts and solve problems with critical thinking, logical, systematic, and structured. Thus, it will look for a suitable learning model so as to enable the learning process and can satisfy the learning outcomes of students.

In this paper, focus on mathematical problem-solving skills of the students as want to find the solution of mathematical problem solving approach students on a regular basis. The author tries to give an approach to provide students mathematical problem solving solutions is behavioral theory. According to Skinner (in Budayasa, 1998: 14) The most important principle of behavioral learning theory is that behavior change according to the immediate consequences of such behavior. Unpleasant consequences that would "strengthen" behavior, while the consequences are not fun to "weaken" behavior. In other words, the consequences menyenangkan will increase the frequency of someone doing a similar behavior, while the unpleasant consequences will decrease the frequency of someone doing a similar behavior.

Based on the above description, it will be developed a model of learning behavior modification type of cooperative learning with Numbered Heads Together in mathematical problem solving of students in the course Theory of Numbers.

The problem is (1) How measures of mathematical problem solving of students in a course through the Theory of Numbers Theory of Learning Behavior modification type of cooperative learning with Numbered Heads Together, (2) Is learning model of behavior can increase student participation in the learning process and student learning outcomes.

B. METHODS RESEARCH

1. Subjects Research

The subjects were students of the Mathematics Education courses Number Theory programmed with the number of 40 people.

2. Implementation Research

There are two stages in the implementation of this study, namely: (1) Preparation of the syntax of behavioral learning model, (2) preparation of guidelines for observation and (3) the implementation of the behavioral model of learning trials on Mathematics Education Study Program students who programmed course Number Theory. Preparation of syntax learning model behavior refers to the behavior of the theory developed by *Skinner* and problem solving theory by *Dodson* and *Hollander*. While the guidelines refer to the observation sheet *Gagne theory* that changes in behavior are the result of learning can take the form: (1) verbal information, (2) intellectual skills, (3) cognitive strategies; (4) attitude, and (5) motor skills.

C. RESEARCH RESULTS AND DISCUSSION

1. Research Results

Based on the results of theoretical studies can be structured measures developed from the theory of behavior modification type of cooperative learning with Numbered Heads Together relation to solving mathematical problems in Number Theory course as follows.

Table 1: Syntax of behavior learning model students in solving mathematical problems in Number Theory course

Number	Stage / Phase	Activity
1.	Phase 1, Selection as a cooperative learning approach	a). Cooperative approach defined types Numbered Head Together (NHT), b). Lecturers break-out groups and assign numbers to each member of the group, c). Lecturer divide the course material on a particular topic to groups and each group can subdivide the material on each member of the group.
2.	Phase 2, Constituent materials on specific topics of number theory in the form of paper	a). Each member of the group assigned to study the course material that has been set by the lecturer, b). Each member of the group who has been assigned to study the course material required to give an account in the preparation of papers, c). Before the lecture material arranged in the form of paper first discussed in the group, so that the contents of papers that have been compiled are the result of thought shared by

		group members.
3.	Phase 3, Presentation of papers in rotation by members of the group in front of the class	Each member of the group presenting the course material that has been assigned in rotation on the front of the class.
4.	Phase 4, Other group members' responses to the presentation material of the group who has been appointed	<ul style="list-style-type: none"> a). Responses of other group members addressed to the same number of renderers. b). Other group members' responses addressed to a different number of renderers. c). Feedback by members of the group renderer material presented in accordance with, and may be assisted by other members of the group renderer.
5.	Phase 5, Giving a summary or affirmation matter and negative reinforcement and positive reinforcement	<ul style="list-style-type: none"> a). Lecturer gives a summary and affirmation matter and straighten the wrong grain material, b). Lecturers provide positive reinforcement to the renderer when grain satisfactory and negative reinforcement when the grain is less satisfactory. Similarly to other group members who responded.

While the guidelines for the implementation of the observation sheet to measure the behavior of the learning process as follows.

Table 2: observation sheet guidelines for measuring implementation of the learning process behavior

STUDENT CODE OF CONDUCT OBSERVATION SHEET IN THE PRESENT STUDY MATERIALS		
NAMBER	DIMENSIONS	STUDENT ACTIVITIES
1.	Verbal information	Presenting the material both orally and in writing with appropriate
2.	Intellectual prowess	a. Mastering the material presented b. Can resolve the problem in accordance with the concept
3.	Cognitive strategies	The steps in the order of presentation concepts
4.	attitude	a. In response to the problem calmly and responsibly b. Receiving advice / opinions of other group members
5.	of Motor skills	Resolve the problem or provide an example to the class
STUDENT CONDUCT CODE OF CONDUCT OBSERVATION SHEET STUDENT LEARNING IN FOLLOWING		
NAMBER	DIMENSIONS	STUDENT ACTIVITIES
1.	Verbal information	Giving the question according to the problem
2.	Intellectual prowess	a. Giving positive feedback from the presentation material b. Provide input on the presentation material is considered wrong
3.	Cognitive strategies	a. Provide input on how to present the material b. Provide input on the steps work solving problems
4.	attitude	a. Appreciate opinions / presentation of material in front of the class by the group renderer, b. Appreciate the response of the group renderers in answering problems
5.	of Motor skills	Give examples in class when the instance of the renderer is considered wrong

Based on the empirical test results in the implementation of learning through theory of behavior modification type of cooperative learning with Numbered Heads Together as follows:

a. Results of the Learning Process

Based on the results of the learning process with pembelaaran model of behavior, student behavior can be seen in both groups of presenters and other groups as follows.

- 1). The results of observations of students can be revealed that the group renderer:
 - (a) Approximately 90% of the group renderer can present material both orally and in writing with the right,
 - (b) Approximately 45% of the group renderer master the material presented,
 - (c) Approximately 45% of the steps in the order of presentation of the repeater group concept,
 - (d) Approximately 85% of the group renderers can respond to the problem calmly and responsibly,
 - (e) Approximately 95% of the group renderer can receive advice / opinions of other group members,
 - (f) Approximately 95% of the group renderer can resolve the problem or provide an example to the class.

- 2). The results of the student group is not a renderer observations (participants) can be revealed also that
 - (a) Approximately 85% of participants gave the group a question according to the problem,
 - (b) Approximately 65% of participants responded positively to the group of grain material,
 - (c) Approximately 5% of a group of participants to provide input on the presentation material is considered wrong,
 - (d) Approximately 3% of a group of participants to provide input on how to present the material,
 - (e) Approximately 5% of a group of participants to provide input about the steps work solving problems,
 - (f) Approximately 85% of the group of participants value the opinions / presentation of material in front of the class by the group renderer,
 - (g) Approximately 85% of the group of participants appreciate the answers from the group renderers in answering problems, and
 - (h) Approximately 2% of the participants gave examples in class when the instance of the renderer is considered wrong.

b. Student Learning Outcomes

Achievement of student learning outcomes for the following three meetings: the first meeting: 37.5% and averaged 50.5, second meeting: 52.4% and averaged 52.9, and the third meeting: 72.5% and averaged 62.3.

2. Discussion of Research Results

Based on the above results, it appears that the application of behavioral learning model can motivate students to learn to identify and resolve their own problems on a particular topic in number theory.

However, not all problems can be resolved primarily for group renderer when developing learning materials in a paper. Before the learning process and group renderers

both groups of participants were equally studied topic of learning material, but assessments of each of these have not been convincing truth. Later during the group discussion in the learning process, all issues on the topic can be completed. It can be powered by either the student interviews and group renderers group of participants as follows.

1). Results of interviews with presenters groups can be revealed that:

- (a) Initially the material they studied number theory is very difficult, but as the insistence that this material will be presented in front of the class so they have to try hard to understand,
- (b) All members of the renderer in presenting learning material with the expression of language and clear writing,
- (c) At the time of presenting the learning materials are not all members of the group to master the material presented. But by the time the class discussion, the group presenters strive to explain the concept they are presenting so that eventually they can master the material presented earlier,
- (d) Attitude and responsibilities of all members of the renderer in answering all of the responses from the participants is quite good.

2). Results of interviews with the group instead of the presenter (participants) can be revealed also that:

- (a) Initially the participants lack an understanding of the material presented by a group of presenters,
- (b) After the opening round of discussions, the participants try to provide feedback or questions that they have started strong understanding,
- (c) Question of the participants generally seek clarification on the description of the material, but there are few participants to explore the response description of the material that can give feedback if there is a false description of the material.

In addition, the learning process lecturer has provided reinforcement for the provision of additional value for participants who are active in both group discussions and group renderers participants. So that students are motivated to perform better and be able to respond in detail. Thus, students' understanding of the topic in the stronger material even repeated again at the next meeting. This is consistent with Skinner's theory that behavior changed in accordance with the immediate consequences of such behavior, and the consequences of that fun will "strengthen" behavior, while the consequences are not fun to "weaken" behavior. In other words, the consequences menyenangkan will increase the frequency of someone doing a similar behavior, while the unpleasant consequences will decrease the frequency of someone doing a similar behavior.

This theory is supported by an increase in student results from the first meeting until the third meeting.

E. CONCLUSIONS

Based on the research results and the discussion above, it can be concluded that the implementation of learning through theory of behavior modification type of cooperative learning with Numbered Heads Together as follows:

- (1) The measures developed from the theory of behavior modification type of cooperative learning with Numbered Heads Together relation to solving mathematical problems in Number Theory course consists of 5 phases, namely:
 - (a) Selection as a cooperative learning approach, (b) Constituent materials on specific topics of number theory in the form of paper, (c) Presentation of papers in rotation by members of the group in front of the class, (d) Other group members' responses to the presentation material of the group who has been appointed, and (e) Giving a summary or affirmation matter and negative reinforcement and positive reinforcement.
- (2) learning model of behavior can increase student participation in the learning process and student learning outcomes.

REFERENCES

- [1] Arthur L. Benton. (2008). *Problem Solving*. U.S.: Wikimedia Foundation, Inc. Tersedia: http://en.wikipedia.org/wiki/Problem_Solving. (7 April 2008).
- [2] Budayasa, I Ketut, 1998, *Teori-Teori Belajar Perilaku*, Makalah, Pusat Sains dan Matematika Sekolah, IKIP Surabaya.
- [3] Foshay, R. dan Kirkley, J. (2003). *Principles for Teaching Problem Solving*. [Online]. Tersedia: www.plato.com/downloads/papers/paper_04.pdf [27 Mei 2008]
- [4] Kadir. (2008). *Laporan Hasil Analisis Instrumen Tes Uji Coba: Tes Kemampuan Pemecahan Masalah Matematik dan Komunikasi Matematik Siswa Kelas VIII SMP Negeri 5 Kendari*. FKIP Unhalu Kendari. Tidak Dipublikasikan.
- [5] La Misu, 2013, *Pengembangan teori pembelajaran perilaku dalam kaitannya dengan kemampuan pemecahan masalah matematik siswa di SMA*, Proseding pada Seminar Nasional Matematika dan Pendi. Matematika UNY Yogyakarta (ISBN 978– 979–16353–9 – 4).
- [6] Matlin, M. W. (2003). *Cognition. Fifth Edition*. Rosewood Drive, Danvers, MA: John Wiley & Sons, Inc.
- [7] McIntosh, R. dan Jarret, D. (2000). *Teaching Mathematical Problem Solving: Implementing The Vision*. [Online]. Tersedia: <http://www.nwrel.org/msec/images/mpm/pdf/monograph.pdf> [12 Mei 2008]
- [8] Polya, G. (1985). *How to Solve It. A New Aspect of Mathematical Method. Second Edition*. New Jersey: Princeton University Press.
- [9] Toeti Soekamto, 1993, *Prinsip Belajar dan Pembelajaran*, bahan Ajar PEKERTI Untuk Dosen Muda.