

# The Cooperative Learning Management in the Course of Principles of Mathematics for Graduate Level

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**Abstract**—The aim of this research was to create collaborative learning activities in the course of Principles of Mathematics for graduate level by investigating the students' ability in proving the mathematics principles as well as their attitudes towards the activities. The samples composed of 2 main group; lecturers and students. The lecturers consisted of 3 teachers who taught the course of Principles of Mathematics at Rajabhat Suan Sunandha University in the academic year 2012. The students consisted of 32 students joining the cooperative learning activities in the subject of Principles of Mathematics in the academic year 2012. The research tools included activity plan for cooperative learning, testing on mathematics with the reliability of 0.8067 and the attitude questionnaires reported by the students. The results showed that: 1) the efficiency of the developed cooperative learning activities was 69.76/ 68.57 which was lower than the set criteria at 70/70. 2) The students joining the cooperative learning activities were able to prove the principles of mathematics at the average of 70%. 3) The students joining the cooperative learning activities reported moderate attitude towards the activities.

**Keywords**—Instructional Design, Pedagogical, Teaching/Learning Strategies.

## I. INTRODUCTION

It has been accepted that countries with advanced science and technology are the world leaders with good economic and good standard of life. The countries with less progress are called developing countries or under-developed countries which tend to rely on other countries. Problem solving ability is the foundation in scientific development [1].

'Principles of Mathematics' is the subject dealing with reasons, thinking process, proving, and the analysis of coefficient which can be explained by mathematics process. So, Principles of Mathematics is the subject that creates learners to become rationale, systematic thinking, diversification, with problem solving skills. Students can apply the principles to analyze problems and situation accurately and carefully. It is useful subject for everyday life. Moreover, mathematics is the basic tool in the advanced study of science and technology [2]. To provide effective mathematics teaching, the Ministry of Education defines guidelines to manage teaching and learning process in mathematics as mentioned in Part 4 Section 24 of Learning Management in Educational Institutes stating that related

organizations should provide contexts, contents, and activities relevant to learners' interest and aptitudes. This should be based on the individual difference in thinking skills, learning strategies, and situation facing. The knowledge application should be focused on the protection and solution of the problems by providing authentic activities for learners to practice. Students should be encouraged to be creative thinker and practical operator with lifelong learning attitude. Learning management should integrate the balance of theories and practice with ethic and moral in every subject. Institutes should provide environment, classroom, and teaching media suitable for teachers and create learning atmosphere. In addition, there should be an application of research as a part of learning process which is available anytime and anywhere [3].

However, there are problems with mathematics teaching as mentioned by Somdet Boonprajak that students had problems on mathematics proving in 3 aspects; 1) basic knowledge for proving such as logic, set, and real number 2) problems on method and technique in mathematics proving 3) problems on integration of existing knowledge to help in proving and the inability to identify the real problem [4]. With the problems about proving mentioned above, the researcher had an interest to develop cooperative learning activities for the course. Tissanana Kamanee stated that cooperative learning is a learning approach consisting of groups of learners. Each group consisted of 3-6 students with different ability to help each other to achieve the group target [5]. Some educationists supporting this idea included Slavin, David Johnson, and Roger Johnson. They mentioned that in general teaching management, the relation was between teacher and learners or between learners and lessons. They tended to ignore the relationship between learners. Several researches showed that learners' attitude towards themselves, friends, and school played important roles in effective learning. There were 3 types of relationship between learners; competition, indifference, and cooperation. Moreover, Tissanana Kamanee mentioned that cooperative learning activities had been widely accepted since the publication of the research in 1898 [5]. At the present, there had been researches and experimental researches related to cooperative learning about 600 researches and comparative study were about 100 researches. These researches showed that cooperative learning resulted in effective learning with higher learning achievement, effective work, learning retention, less self-center, and more self confidence.

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## II. OBJECTIVES

- 1) To develop cooperative learning activities for the subject of Principles of Mathematics
- 2) To investigate students' ability in mathematics proving in this subjects
- 3) To study students' attitude towards the developed cooperative learning activities

## II. SCOPE OF THE STUDY

### A. Population

The population in this study included 4 groups of 140 students registering in the subject of Principles of Mathematics of Rajabhat Suan Sunandha University in academic year 1/2012.

### B. Scope of the Content

The content of this study was based on the course description of the subject of Principles of Mathematics of Rajabhat Suan Sunanta University.

### C. Variables

- 1) Independent variable was the cooperative learning activities.
- 2) Dependent variables were students' ability in mathematics proving and their attitudes.

### D. Time

The study was conducted in semester 1/2012.

## III. HYPOTHESIS

The students taking cooperative learning activities had the mathematics proving knowledge at 70%.

## IV. RESEARCH PROCEDURE

This research has been designed as a semi-experimental study starting from surveying, theories, and related research about cooperative learning management and the content of the subject. The information was used to develop cooperative learning activities, testing on mathematics proof, and the attitude questionnaires.

### A. The Steps in Developing Cooperative Learning Activities

- Step 1. Study the present conditions and problems of cooperative learning management and the mathematics proof by setting discussion group and focus group of the teachers and students of this subject. The information was used to develop activities and scope the contents.
- Step 2. Present the 1<sup>st</sup> draft of the subject content for the teachers to discuss. The information was used for preparing document, theories, and framework for teaching this subject through cooperative learning activities.
- Step 3. Study guidelines in developing cooperative learning activities.

Step 4. Study principles, learning theories, documents, and researches related cooperative learning activities for this subject.

Step 5. Develop the lesson plan through cooperative learning activities.

Step 6. Present the developed lesson plan and activities to 3 specialists to validate the appropriateness and validity which the IOC value was 0.60.

Step 7. Revise and improve the lesson plan and the activities according to the specialists' suggestions.

Step 8. Pilot the lesson plan and the activities.

### B. Testing on Mathematics Proof

- 1) Study the contents of the subject, principles of mathematics, testing and evaluation.
- 2) Design the test specification to define the questions.
- 3) Write the 9 items of subjective test.
- 4) Check for content validity by 3 specialists with the IOC value between 0.6 and 1.0.
- 5) Select the item with the IOC value equal or not less than 0.6 to get the test of 7 items.
- 6) Pilot the test to find the P value and reliability. The P value should be between 0.4 and 0.7 with R value equal or higher than 0.5.
- 7) The test was analyzed to find alpha coefficient by Cronbach with the reliability value equal 0.8067 which was the right level for the sample group.

### C. Attitude Questionnaire

- 1) Study theory and documents related to attitude towards mathematics.
- 2) Write questions to ask about attitude towards mathematics in the form of 5 Likert's scales for 25 items.
- 3) The developed questionnaire was validated to find IOC and suggestions by 3 specialists.
- 4) Select 20 questions with IOC value over 0.6 to put in the questionnaire.

## V. DATA COLLECTION

- 1) Teach the sample group by using the developed cooperative learning activities.
- 2) After teaching, test the students' ability on proving mathematics principles.
- 3) Ask the students to complete the attitude questionnaire.

## VI. DATA ANALYSIS

- Part 1. Find the efficiency of the developed lesson and the cooperative learning activities.
- Part 2. Compare the students' ability on mathematics proof with the criteria of 70%.
- Part 3. Survey the students' attitude towards the developed cooperative learning activities.

## VII. RESULTS OF THE STUDY

The results from the analysis are as follows:

- 1) When applying the cooperative learning activities with the sample group for 11 units, the students were tested on

their exercises and the achievement test by using E1 E2. The efficient value was 69.76/68.57 which was lower than the set criteria at 70/70.

- 2) The scores of the two groups were compared by using T-test one group design. The results showed that the average achievement was 70% with no statistical difference.
- 3) The attitude questionnaires were analyzed with the result of the average level. The highest item was on "I usually attend the activities" followed by "The activities help me become rationale". The item with the least value was "It was boring to learn through cooperative learning activities followed by "Cooperative learning activities make me hate mathematics homework".

#### VIII. DISCUSSION

- 1) The efficiency of the developed activity was 69.76/68.57 which was a little bit lower than the set criteria at 70/70 which could be claimed that the developed activities and the lesson plan could make learners acquire knowledge, so, they could get the average test score at 68.57. The researcher arranged the content and the activities from less complexity to more complexity items. This made students understand the content and could follow the activities in each unit. Moreover, at the end of each unit, the students had to do the exercise to check their understanding. In class, the researcher motivated the students to join activities together. Let them exchange their knowledge and analytical idea about mathematics proof. This finding supported the idea of Yong mentioned that learners could learn better through communication [6]. In addition, the activities supported the idea of Bruner mentioned that the content should be related with the learners' experience and with the suitable approach [7]. The exercise consisted of introduction part, teaching part, and conclusion part on which each part the students had chance to discuss and express their opinions to find the proof of mathematics principles.
- 2) Students learning with cooperative learning activities got the average score with no statistical difference at 0.05. Their average score was 70%. This can be explained that the researcher arranged the content and the activities from less complexity to more complexity items. This made students understand the content and could follow the activities in each unit. Moreover, at the end of each unit, the students had to do the exercise to check their understanding. In class, the researcher motivated the students to join activities together. Let them exchange their knowledge and analytical idea about mathematics proof. Moreover, at the end of each unit, the students had to do the exercise to check their understanding. This supported the idea of Bloom stating that practicing was a better approach than lecture or showing formula or others [8].
- 3) The students reported their attitudes at the average level especially they reported very high on joining the activities. The activities helped them to be rationale with

good decision because the activities were systematically designed. This encouraged their will power to find the solution in mathematics proof resulting in good attitude towards the activities. This was congruent with the work of Siriporn Tipkong stating that exercise should consist of items with diverse difficulty to make learners feel success in problem solving [9]. William studied that mathematics solution through problem solving process made learners satisfy with the activity [10].

#### IX. SUGGESTIONS

Some suggestions for teaching and research were listed below.

##### A. Guidelines for Teaching

- 1) When teaching the topic on mathematics proof, there should be a revision on basic knowledge about proving before going to the details.
- 2) For the difficult items, students should be encouraged in cooperative group to help each other in finding solution.
- 3) The activities on mathematics proof should concentrate on exercise that created students' skills.
- 4) Before teaching the whole topic, there should be a pretest to check the students' background knowledge.
- 5) The content and the context of mathematics proof should relate to real life.

##### B. Suggestions for Further Study

- 1) There should be a study on cooperative learning activities based on the idea of Polya.
- 2) There should be the management of cooperative learning activities by e-learning.

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#### REFERENCES

- [1] The office of National Education Commission (2540). Plans National No.8 (AD. 19972001). Bangkok: Office of the prime Minister.
- [2] The institute for the promotion of teaching science and technology. (2008). Standard of learning and learning science and technology. Bangkok: The Institute for the Promotion of Teaching Science and Printing Technology.
- [3] Department of General Education Ministry of Education National Education Act AD 1999.(2000). Bangkok: ladphala press.
- [4] Sondet Boonprajake. (2008). A study of the ability of a mathematical proof. Students' Bachelor of Education course. Faculty of Science: Bangkok.
- [5] Kammanee T. (2011).Pedagogy: Knowledge for Make Effective Learning Process. Bangkok: Chulalongorn University Press.
- [6] Yong. Carolyn. (1972). "Team Learning," The Arithmetics Teacher. December.
- [7] Bruner, Jerome Seymour. (1966).The Process of Education. Cambridge: Harvard University Press.
- [8] Bloom, Benjamin S. (1976). Human Characteristics and School Learning. New York: McGraw-Hill.
- [9] SiriPom Tipkong. (2001) Solving mathematics problems. Bangkok: ladphala Press
- [10] Williams, Kenneth M. (2003, March). Writing about the Problem – Solving Process to Improve Problem – Solving Performance, Mathematics Teacher. 96(3):185 – 187.