

# Constructivism Learning Management in Mathematical Analysis Courses

K. Paisal

**Abstract**—The purposes of this research were (1) to create a learning activity for constructivism, (2) study the Mathematical Analysis courses learning achievement, and (3) study students' attitude toward the learning activity for constructivism. The samples in this study were divided into 2 parts including 3 Mathematical Analysis courses instructors of Suan Sunandha Rajabhat University who provided basic information and attended the seminar and 17 Mathematical Analysis courses students who were studying in the academic and engaging in the learning activity for constructivism. The research instruments were lesson plans constructivism, subjective Mathematical Analysis courses achievement test with reliability index of 0.8119, and an attitude test concerning the students' attitude toward the Mathematical Analysis courses learning activity for constructivism. The result of the research show that the efficiency of the Mathematical Analysis courses learning activity for constructivism is 73.05/72.16, which is more than expected criteria of 70/70. The research additionally find that the average score of learning achievement of students who engaged in the learning activities for constructivism are equal to 70% and the students' attitude toward the learning activity for constructivism are at the medium level.

**Keywords**—Constructivism, learning management, Mathematical Analysis courses.

## I. INTRODUCTION

It is clear that the country's advances in science and technology have become the world leaders. Those countries seem to have a good economy, high level of population well being, and have ability to help other countries. On the other hand, the countries with a low level of technology and science will be seen as less development or underdeveloped countries. The underdeveloped countries need assistance from developed countries or high-income countries. However, the progress of science and technology may bring about many complicated problems. Thus, the person will be happy in a society requires the ability to critical thinking and solve problem [3].

Mathematics is subject that reason, thinking and problem solving skill so potentially beneficial subjects for students in which they are able to develop logical and critical thinking skills. Consequently, the student will be able to carefully and effectively analyze problems and difficult situations, predict, plan, make appropriate decisions, and solve problems in their diary lives. In addition, mathematics can also help human analysis problem, planning and decision correctly [5].

According to the National Education Act in chapter 4 section 24, The Ministry of Education has set up a guideline

Paisal, K is with the Faculty of Sciences and Technology, Suan Sunandha Rajabhat University, 1 U-tong Nok Road, Dusit, Bangkok 10300, Thailand (e-mail: komon.pa@ssru.ac.th).

for establishing a learning process for educational institutions and agencies. The guideline enforces the educational institutions and agencies concerned to (1) provide substance and arrange activities in line with the learners' interests and aptitudes, bearing in mind individual differences; (2) provide training in thinking process management, and application of knowledge for solving problems; (3) organize activities for learners to draw from authentic experience; drill in practical work for complete mastery; enable learners to think critically and acquire reading habits and a continuous thirst for knowledge; (4) achieve, in all subjects, a balanced integration of subject matter, integrity, values, and desirable attributes; (5) enable instructors to create the ambiance, environment, instructional media, and facilities for learners to learn and be all-round persons, able to benefit from research as part of the learning process. In doing so, both learners and teachers may learn together from different types of teaching-learning media and other sources of knowledge; and (6) enable individuals to learn at all the times and in all places [4].

It is found that problems in teaching mathematics unsuccessful as the study of Plangprasopchok [9], because the students still lack adequate mathematics background knowledge, because they are unable to apply their knowledge to solve the problems in real situations, hesitate to think critically and avoid making mathematical calculations. In the same respect, undergraduate curriculum stipulates mathematics as a basic subject; however, large number of candidates cannot achieve the expected criteria. This researcher, a lecturer of Suan Sunandha Rajabhat University found that the students of Suan Sunandha Rajabhat University have a low mathematic learning achievement. In considering the problem that exists in mathematical learning, the researcher was interested in developing a learning activity for stimulating students' knowledge building. Thagthong pointed that constructivism is a learning theory based on individual differences. The learning process in constructivism, therefore, relates to providing substance and arranging activities in line with the learners' interests, in order to enhance students' knowledge. In doing so, the students will be stimulated to learn, analyze, and try out. Hence, the role of the instructors will be as a cooperator and facilitator for the student [6].

## II. PURPOSES

The objectives of this research are to:

- 1) Create learning activities for constructivism.
- 2) Study the Mathematical Analysis learning achievement
- 3) Study students' attitude toward the learning activity for constructivism.

### III. SCOPES

The scope of this research is as follows:

#### A. Scope of Population

Population is students who are studying Mathematical Analysis of Suan Sunandha Rajabhat University.

Participants were 17 students who are studying Mathematical Analysis that the sample group was conducted under simple random sampling.

#### B. The Scope on Content

This research was based on Mathematical Analysis content, according to the curriculum of Suan Sunandha Rajabhat University.

#### C. Scope on Variables

Independent variable was the learning activity for constructivism.

Dependent variable was Mathematical Analysis learning achievement and students' attitude toward the learning activity for constructivism.

#### D. Scope on Time

Scope on time of the study was 1 semester.

### IV. METHODS

This research was designed as quasi-experimental research. The research methodology was divided into 4 phases:

*Phase 1* is the study of theory and review literature and related research concerning the learning activity for constructivism and the content of Mathematical Analysis, in order to, create learning activity plans, Mathematical Analysis achievement tests and an attitude test toward the Mathematical Analysis learning activity for stimulating students' knowledge building. The process of learning activity plans was separated into 2 main parts:

1) The process of establishing learning activities started from (1) studying the concept of the learning activity to stimulate students' knowledge building and mathematical method of proofs. Then, (2) the learning activity to stimulate students' knowledge building was created which was divided as follow:

First, the researcher collected the data on problems and limitations of organizing the learning activity to stimulate students' knowledge building by collecting the data from the focused group interview that including mathematics instructors and students. The data were used as basic information for establishing main topic of the workshop for Mathematical Analysis instructors.

Second, the workshop was held, in order to, set up the learning activity plans to stimulate students' knowledge building. The data from the first process, the related documents, concepts, principals, learning theories, and related research concerning the learning activity to stimulate students' knowledge building were presented and discussed in the workshop. Moreover, the experiences on learning activity of

the participants were taken into account of the workshop's discussion.

Third, the researcher analyzed the data from the first and second process to design the guideline for creating a learning activity to stimulate students' knowledge building.

Forth, the researcher continued to study the concepts, principals, theories, literature, and related research on Mathematical Analysis learning activity plans.

Fifth, the data from the forth process was utilized for developing learning activity to stimulate students' knowledge building.

Sixth, the learning activity plans to stimulate students' knowledge building was approved as content validity by 3 scholars. The learning activity plans with Index of consistency (IOC) ranged higher than 0.6 were selected.

Seventh, the research followed the suggestion from the scholars to revise the learning activity plans to stimulate students' knowledge building.

Finally, the final learning activity plans for stimulating students' knowledge building were tried out with the sample.

2) Mathematical Analysis achievement test was separated into 7 processes as follow:

- (i) studying of Mathematical Analysis content and measurement and evaluation techniques.
  - (ii) constructing the table of content analysis for establishing questions.
  - (iii) collecting questions from 2.2 process to create 7 subjective Mathematical Analysis achievement test. The test was approved as content validity.
  - (iv) the test being approved IOC of each item at 0.6 – 1.0.
  - (v) selecting the 6 subjective Mathematical Analysis achievement test which approved IOC at 0.6.
  - (vi) trying out the Mathematical Analysis achievement test with the research population who are not the sample of the research for finding the difficulty index.
  - (vii) selecting 5 subjective Mathematical Analysis achievement test from 2.5 with the reliability of 0.8119 by using Cronbach's Alpha Coefficient.
- 1) Attitude test on the Mathematical Analysis learning activity for stimulating students' knowledge building.
- (i) studying of theories and research concerning students' attitude toward mathematical learning.
  - (ii) attitude test about students' attitude toward mathematical composing of 25 questions, used a Likert 5-point rating scale to divide attitude level.
  - (iii) the questions for investigating the level of students attitude toward mathematics being approved as content validity.
  - (iv) selecting 20 questions for investigating the level of students attitude toward mathematics which approved IOC higher than 0.6.

*Phase 2* is the comparison Mathematical Analysis learning achievement of the students to the expected criteria of 70%

*Phase 3* is the process of trying out the efficiency standard of the learning activity for constructivism, in order to study learning achievement from both modules and overall of Mathematical Analysis learning.

*Phase 4* is the study of students' attitude toward the Mathematical Analysis learning activity for stimulating students' knowledge building.

## V. RESULTS

- A. After use the learning activity for constructivism and collecting the data of the learning achievement of the sample was compared to expected criteria of 70/70. Consequently, it was found that the efficiency of the learning process was at the level of 73.05 that was more than criteria at 70. The efficiency of the learning achievement was 72.16 more than of at 70.
- B. Then, the learning achievement of the sample was compared to the expected criteria by using t-test one group. The comparison of learning achievement of the students showed does not statistically significant different. In other words, the learning achievement of the students who engaged in the leaning activity for constructivism was equal to 70%.
- C. The data from attitude test about students' attitude toward learning activity for constructivism was analyzes. It was found that the level of students' attitude toward the learning activity for constructivism was at a medium level.

## VI. DISCUSSIONS

- A. The efficiency of the Mathematical Analysis learning activity for constructivism was 73.05/72.16, which was more than the expectation criteria of 70/70. General speaking, the mean of doing exercise of the sample was 73.05 that was more than 70%, indicates that the material presented in this subordinate of the learning activity for constructivism have effective on the development of learning behavior was more than a predetermined threshold. However, the mean of activity achievement of the sample was 72.16, more than 70 % indicates that the present content in the whole of learning activity for constructivism have effective on the development of learning behavior was more than a predetermined threshold. This is because plan was arranged from easy to more complicated, and provided extra learning activities, and post-learning practices in each learning unit. Moreover, the researcher encouraged the students to participate in classroom activities, in order to create the opportunity for exchanging knowledge in Mathematical Analysis problem solving. In doing so, the students were able to enhance their knowledge and understanding. According to Yong [11], the students can learn better and faster from their peers because language used between students is at the same level. Bruner [2] inserted that providing appropriate learning content of mathematical problem solving that relates to students' lives are able to stimulate students' learning and thinking. This study applied Polya's four-step method, which was also conducted in the research of Noypitaksa [7], to develop mathematical problem solving skill of the students. Prachumkayormat [8] additionally asserted that the

guideline for developing students' ability in mathematical problem solving skill initially introduced the student to understand the problem, devise a plan, carry out the plan, and review results.

- B. The learning achievement of the student had not a statistically significant difference at the level of .05. It can be explained that, in doing group activities, the students did not pay adequate attention on brainstorming within their own group; instead, they only waited to copy from other groups. In the same respect, many students did not do their homework by themselves but copied from their friends who gain higher mathematical learning achievement. As the result, the students were unable to do the exam and gained a high score. Furthermore, the students avoided to practice seriously improving their mathematical calculation skill. Nevertheless, the learning activity plan was arranged substance and learning activities from an easy to more complicated level, related to students' lives, provided opportunity of group and individual work, as well as, a clear learning activity which was easy for the students to solve. Besides, in an attempt to develop mathematical problem solving skills, the learning activity provided extra learning situations, and post-learning practices in each learning unit. [1] stated that knowledge building method is more effective than lecturing, demonstrating mathematic theories.
- C. The level of students' attitude toward the learning activity for constructivism was at a medium level. In considering each question in the attitude test, it was found that the learning activity to stimulate students' knowledge building encouraged the students to participate in the learning activity more often. In this respect, it can be said that the learning activity provided a clear process of mathematic learning and the practice from an easy to a complicated level. Therefore, the student felt more confident in solving mathematical problems. According to Tiphauakong [10], a mathematical unit should provide hard, medium, and easy problem-solving level as the way to encourage the students to participate in the activity.

## VII. SUGGESTIONS

### Recommendations for Mathematical Teaching

Mathematical Analysis teaching should demonstrate a four-step problem solving that comprises understanding the problem, devising a plan, carrying out the plan, and reviewing results.

- A. The instructor should encourage the students to work in groups for assisting one another to solve difficult Mathematical Analysis problems.
- B. Mathematical Analysis learning activities should focus on practices to enhance students' Mathematical Analysis problem solving skills.
- C. Before the Mathematical Analysis teaching, the instructor should examine the background knowledge of the students.

#### Recommendation for Future Research

The future research should be study the learning activities for constructivism with connection skill, reasoning skill and analytical thinking.

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#### REFERENCES

- [1] Bloom, Benjamin s. (1976). Human Characteristics and School Learning. New York: McGraw-Hill.
- [2] Bruner, Jerome Seymour. (1966). The Process of Education. Cambridge: Harvard University Press.
- [3] Commission of National Education. (1997). Plans National Education Act No.8 1997-2001. Bangkok: Office of the Prime Minister.
- [4] Department of Education Ministry. (2000). Law of the Nation Education 1999. Bangkok: Kuruspha Press.
- [5] Institute for the Promotion of Teaching Science and Technology. (2008). Standards of learning in Science and Technology. Bangkok: Printed in Learning Science and Technology Institution.
- [6] Thatong, Knuth (2011). Teaching Thinking. Bangkok: Pechakasem Press.
- [7] Noypitaksa, S. (2008). The Study of the Relationship Between Learning and Self-consciousness in the Ability in Learning Mathematics and Problem Solving of Mathayomsuksa 3 Student. Master of Education. Srinakarinwirot University.
- [8] Prachumkayormat, S. (2009). The Comparison of the Ability in Mathematic Problem Solving and IQ of Matthayom Suksa 1 Students by using Problem Solving Learning Cell, Master of Education, Srinakarinwirot University.
- [9] Somvong Plangprasochoke. (2003). Problems of Teaching Mathematics. Bangkok: Pra Nakhon Rajabhat University Press.
- [10] Tiphphauakong, S. (2001). Mathematic Problem Solving. Bangkok: The Teacher's Council of Thailand Ladprow Publishing
- [11] Yong, Carolyn. (1972). "Team Learning," The Arithmetics Teacher. December.