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THE DEVELOPMENT OF TEACHING METHOD BY ONLINE LESSONS BASED ON CONSTRUCTIVISM THEORY IN PRINCIPLES OF MATHEMATICS FOR TEACHERS

Abstract:

This research on Development of Teaching method by Online Lessons Based on Constructivism Theory in Principles of Mathematics for Teachers aims to compare the learning achievement of students who studied through online lessons based on constructivism theory against students who studied through normal method as well as to study on the satisfaction towards online lessons based on Constructivism Theory in Principles of Mathematics for Teachers. Target group was 62 first year students of Academic Year 2014 who studied in Bachelor of Education Program in Mathematics, Faculty of Education, SuanSunandha Rajabhat University and registered to study Principles of Mathematics for Teacher. Simple Random Sampling was conducted in order to divide samples into two groups, Experimental Group and Control Group, with 24 samples per each group. Tools used in this research were Test and Satisfaction Questionnaire. Statistics used in this research were mean, Standard Deviation, and t-test. The results showed that learning achievement of students who studied through online lessons based on Constructivism Theory was higher than that of students who studied through normal methods with statistical significance of 0.05 and the level of satisfaction towards online lessons based on Constructivism Theory was also in high level.

Keywords:

Teaching method; Mathematics; Online Lessons; Development

Introduction

Although Mathematics is a kind of abstract that is difficult to understand requiring review and proof of related theories, and regular practice to gain explicit understanding and implementation, it was found that most students studied Mathematics through memorization in the past academic year without making understanding on the importance of its content. Consequently, they were unable to achieve Mathematics learning like their friends leading to boredom on Mathematics. As a result, it was necessary for teachers to design and develop various learning management or teaching method or new teaching process in order to enable students to gain more understanding on provided contents. This was consistent with research conducted by Pacharee Watchawalkul (2012) on Development of Computer Multimedia regarding the Relationship between 2 D Geometry and 3D Geometry of Lower Secondary School (Level 1) and found that the post-test score of students after learning through Computer Multimedia regarding the Relationship between 2 D Geometry and 3D Geometry of Lower Secondary School *Level 1)was higher than pre-test score with statistical significance. Similarly, Panida Buamanee (2006) who developed Computer Assisted Instruction (CAI) Lessons of Mathematics Learning Area on Ratio and Percentage for Level 2 Students in Lower Secondary School (Level 3) founded that the level of post-learning achievement of students who learned through Computer Assisted Instruction (CAI) Lessons of Mathematics Learning Area on Ratio and Percentage for Students in Lower Secondary School (Level 2 and 3) was higher than that of pre-learning achievement. Development of teaching method based on various techniques and methods improved the learning achievement leading to plenty of new and beneficial teaching methods

Teaching method by Online Lessons Based on Constructivism Theory is a teaching method creating online lessons for learning of students while students are being facilitated by teachers in order to process such learning properly. Consequently, students will be motivated to perform all activities by themselves leading to higher level of learning achievement. This was consistent with the research conducted by Chuleemart Banjong (2010) who presented Online Lessons Based on Constructivism Theoryon Probability of Upper Secondary School (Level 5) and found that the level of post-learning achievement of students learned through Online Lessons Based on Constructivism Theory was higher than that of students learned through normal method with statistical significance. This was very important for individual learning. From various data, the researcher, as a teacher teaching Principles of Mathematics for Teachers (EMA3302) that was one of courses contained in curriculum of Mathematics Program of Faculty of Education,Suan Sunandha Rajabhat University, realized the importance of development of teaching method in order to enable students to have more knowledge and understanding on Principles of Mathematics for Teachers leading to higher level of learning achievement and satisfaction towards learning. As a result, the researcher was interested in studying on Development of Teaching method by Online Lessons Based on Constructivism Theory in Principles of Mathematics for Teachers for utilizing as information for administrators, teachers, and educators for developing teaching method to suit with learners leading to further benefits of teaching and learning.

Literature Review and Hypotheses

1. Concept on Online Lessons

Several educators provided the definition of online lesson as follows: Chuleemart Banjong (2010:7) defined the meaning of online lessons based on Constructivism Theory as learning on content of Probability of Mathematics of Upper Secondary School (Level 5) through electronic equipment, computer network, internet or intranet. This kind of learning is considered as self-directed learning enabling learners to learn upon their abilities and readiness on content of lessons based on Web Browser. Learners, teachers, and peers were able to contact, consult, and exchange opinions to one another as same as normal classroom learning. This type of learning is based on modern communication tools including e-mail , Webboard , Chat, therefore, this kind of learning is suitable for all learners that can be studied at any time and any place. In addition, the behavior of learners is also able to be evaluated and followed-up like classroom learning and student's behavior will be developed upon method of online lessons. Its learning activities are consisted of problem base, learning resources, base of support, and coach based on Constructivism Theory emphasizing on learners. Students will build their learning by their own through process of independent working and knowledge exchanging while teachers play the role of planning how to support students, promoting and motivating learners, as well as giving suggestions to enable students to build knowledge by their own.

2. Concept on Constructivism Theory

Concept on Constructivism Theory is consisted of the following details:

2.1 Background and Constructivism Theory

Vygotsky was a Russian psychologist who studied on cognitive development in the same period with Piaget. His work was accepted in Russia and started to be published to U.S.A. and other countries in Europe such research was translated into English in 1962. Subsequently, in 1986, Kozulin retranslated and rearranged papers of Vygotsky. Consequently, this theory has been applied to teaching and learning extensively (Surang Kwotrakul, 2005:61).

Piaget's Cognitive Development Theory is the important foundation of Constructivism Theory and cognitive development of each person is adjusted through assimilation and accommodation. Development will be occurred when such person perceives information or new experiences for linking with existing knowledge or cognitive structure. In the event that such person is unable to link such information or new experiences with his/her existing knowledge or cognitive structure, disequilibrium will be occurred. Consequently, such person will strive to adjust himself/herself to be in equilibrium through accommodation. Piaget believed that all people had successive cognitive development commenced from interaction to experiences on natural environment, logico-mathematical experience, social transmission, maturity, and equilibration of such person. On the other hand, Vygotsky greatly emphasized on culture and society and he explained that humans had been influenced by environment since they were born. Besides natural environment, there was the social environment or culture created by each society. As a result, social institutions, started from family institution, had influence on individual cognitive development. Moreover, language was also the important cognitive tool of children started from separated development.

However, when the children were grown older, both dimensions of development combined together. Piaget and Vygotsky are considered as the learning theoreticians classified in Cognitivism who paid attention on "cognition". The important thinker of this group is Ulrich Neisser who defined "cognition" as "the cognition process of brain to adjust, change, reduce, shorten, expand, store, and utilize information obtained by senses that may be caused by or not caused by motivation of external stimulus therefore feeling, perceiving, imagination, recall, memory, existence, problem solving, thinking, and others to name a few, are considered as an integral part of this cognition process" (Surang Kwotrakul. 2005:208-209 ; Sumalee Chaichareon. 2008:102-104).

2.2 Conceptual Framework of Constructivism Theory

Conceptual Framework of Constructivism Theory based on basic concept, important elements of learning, methods of teaching, roles of teacher are consisted of the following details:

1) Basic Concept: According to conceptual framework, students have to build their own knowledge with important concept, i.e., learners are able to build knowledge by their own rather than being enabled by teaching. Learning is considered as the internal process of each person and learners are able to develop their knowledge and understanding on problems and situations based on their existing experiences. In conclusion, important basic concept on knowledge and learning based on this conceptual framework is self-directed learning of learners.

2) Important elements of learning: When considering on basic concept on learning based on self-directed learning of learners, it was found that there are three important elements of learning including learning goals, learning conditions, and methods of teaching.

3) Methods of teaching: Methods of learning are important for learning, for example, utilization of instructional media (e.g., computer programs and media design, programs motivating children to survey and discover by themselves). These methods support learning by emphasizing children as the center of learning. In addition, provision of environment enabling children to take action, learning from mutual working with computer as a tool by enabling learners to make conversation via characters in computer leading to efficient expression, also help to develop children's learning. Computer programs serve to edit, reflect, and support children to develop their language skills.

4) Roles of Teacher: According to Teaching Based on Constructivism Theory, teachers should facilitate students to learn and have some opportunities to build their own understanding on content as well as give students moral support and accept independence and imitative of students. Teachers should provide students natural information and actual data sources as well as uses some words enabling students to build their concept, for example, to classify, to analyze, to predict, and to create. Students should utilize problematic activities as the support of their understanding before exchanging their experiences. Teachers should motivate students to participate in conversation made with teachers and other people and reflect their existing understanding. Moreover, teachers should provide students some sufficient time for building relationship and creating comparison. In addition, teachers should pay attention on curiosity of students by providing them some opportunities enabling them to have interaction and select learning content.

In this stage, it is designed to enable learners to address their problems. Teachers should prepare new relationship and vocabularies with the same structure as experienced by students. Teachers should set new situations and problems in order to enable students to reflect their own potential based on what they formerly learned. Teachers should emphasize on learning management in the meaningful context by utilizing technologies, especially, Multi-Media, to respond to those learning activities. Those technologies are consisted of Web-base, CD-ROM, etc. Teachers must set the learning environment helping to expand basic concept and experiences of students (Sumalee Chaichareon. 2008:235-239).

3. Principles of Knowledge Building in the Form of Mathematics Teaching Based on Constructivism Theory

Paijit Saduakkarn (1995): Mathematics learning in the form that facts and calculation have to be identified by students is forcing students to make understanding with what taught by teachers but students may not be able to link what taught by teachers with their understanding. Teaching with emphasis on calculation without providing reasons obstructs students from understanding. When students don't understand, they may have negative feeling with Mathematics. Consequently, many students are stressful with Mathematics learning and deny to learn Mathematics. For Teaching Based on Constructivism Theory, students will be able to create their knowledge enabling them to have more understanding on Mathematics. The first important thing that should be emphasized by teachers is existing knowledge of students. As a result, teachers will be able to planning teaching method based on existing knowledge and learning method of students.

Podjana Supsamarn (2007: 14-15) mentioned Principles of Learning Building Based on Constructivism Theory as follows:

1) Learners would interact with everything around them and would strive to find some friends to explain those things while they build the model or symbol of everything in such environment. The role of teachers was supporting learners to build and assemble their conceptual model to be more complete.

2) All learners would create or mutually create meaningful things by themselves.

3) Learners must be responsible or their own learning while teachers must support and facilitate such learning.

4) Learners would create their own meaningful things for exchanging by interacting with one another.

5) Learners must have some opportunities to plan their own learning plan with flexibility on learning.

6) Learners were able to build knowledge and understanding based on action through physical world and social world with interaction with environment and opinion exchange with other persons.

7) Mistake would lead to new knowledge and cognitive development.

8) Learning of learners are involved and relative to one another in all dimensions and the procedures of instructional activities preparation should be consisted of:

- Clear objectives of content

- Design and preparation or problems that were actual situations

- Teachers should design various presentation methods of problems or abstract concepts in order to enable learners to perceive and consider problems in various dimensions.

- Learners should play some roles and participate in activities preparation and should have direct interaction with lessons as well as direct interaction with other learners in the form of group activities.

- Learners should be evaluated on their knowledge and understanding and continuality between their existing knowledge and new knowledge.

As above mentioned, it could be concluded that Development of Mathematics Teaching Based on Constructivism Theory was a Mathematics Teaching Method enabling learners to build or learn Mathematics by their own under suggestions of teachers.

Methodology

This research aims to compare the learning achievement of students who learned through online lessons based on constructivism theory against students who studied through normal method as well as to study on the satisfaction towards online lessons based on Constructivism Theory in Principles of Mathematics for Teachers.

Sample and Data Collection

The sample group in this study,was selected by purposive sampling, is 62 mathematic students. They are from 2 sections of students who enrolled inPrinciples of Mathematics for Teachersat the first semester of the 2014 academic year in the faculty of education, SuanSunandha Rajabhat University. Simple random sampling was used to divide students into 2 groups; the 24 students of treatment group who learned from Online Lessons Based on Constructivism Theory and 24 students of the control group who learned by conventional method. The instruments used in this study were a teaching method in Principles of Mathematics for Teachers by Online Lessons Based on Constructivism Theory, test of fundamental knowledge; achievement test is worthmorethan 0.5IOC and questionnaire of satisfaction with 0.89 reliability coefficients (alpha). mean, standard deviation and t-test were employed to analyse data

Analyses and Results

Data analysis of this research was divided into 3 procedures including Test on Basic Knowledge of Mathematics, Test on Knowledge of Principles of Mathematics for Teachers between students learned through normal teaching method (Control Group) and students who learned through Online Lessons Based on Constructivism Theory (Experimental Group), and Satisfaction Questionnaire towards Teaching Method by Online Lessons Based on Constructivism Theory, with the following details:

First procedure: Analysis on Basic Knowledge of Mathematics between Control Group and Experimental Group

Table 1 Analysis on Basic Knowledge of Mathematics between Control Group and Experimental Group

Group	Mean	Std.Deviation	t	Sig.
Control Group	27.83	5.96	1.51	0.14
Experimental Group	24.04	10.79		

From Table 1, it was found that there was no difference onbasic knowledge of Mathematics between Control Group and Experimental Group with the statistical significance of 0.05. As a result, it showed that students in both groups had no different on Mathematical abilities. Therefore, the second procedure should be conducted.

Second procedure: Analysis on Mathematical knowledge on Principles of Mathematics for Teachers after Teaching by Normal Teaching Method (Control Group) and Online Lessons Based on Constructivism Theory (Experimental Group). It was found that:

Table 2 Analysis on Knowledge on Principles of Mathematics for Teachers between Control Group and Experimental Group

Group	Mean	Std.Deviation	t	Sig.
Control Group	26.25	3.21	7.18	0.00
Experimental Group	35.21	5.21		

From Table 2 , it was found that there was no difference on Mathematical knowledge on Principles of Mathematics for Teachers after Teaching by Normal Teaching Method (Control Group) and Online Lessons Based on Constructivism Theory (Experimental Group) with statistical significance of 0.05. As a result, it showed that students in both groups had no different on Mathematical abilities but the mean score of Control group was higher.

Third Procedure: Analysis on Satisfaction towards Learning through Online Lessons Based on Constructivism Theory

Table 3 Analysis of student's satisfaction

Details	Mean	Std.Deviation
1.Presentation Format	3.90	0.71
2.Introduction	3.67	0.72
3.Interesting	3.63	0.85
4.Learning Procedures	4.33	0.71
5.Activities	3.90	0.80
6.Conclusion	4.03	0.67
7.Instructional Media	4.10	0.76
8.Overall Picture of Learning by Online Lessons Based on Constructivism Theory	4.10	0.63

From Table 3, it was found that students who learned through Online Lessons Based on Constructivism Theory had high level of satisfaction towards learning and the first three highest levels were learning procedures, overall picture, and instructional media.

Conclusion

The learning achievement of students in Experimental Group who learned through Online Lessons Based on Constructivism Theory was higher than that of students who learned through normal teaching method and they also had high level of satisfaction towards learning in all dimensions because students who learned through Online Lessons Based on Constructivism Theory was practiced through self-directed learning in each activity leading to higher level of learning achievement than that of students who learned through normal teaching method. In addition, learning outside classroom motivated students to be more enthusiastic in learning that was consistent with research conducted by Ladarat Songwanna (2010) on Results of Learning Management Based on Web-Quest lessons on Basic graph Theory Influencing on Learning Achievement and Abilities of Critical Thinking of Students in Upper Secondary Education (Level 5) and found that pre-learning achievement of Mathematics learning on Basic graph Theory of students after studying through Web-Quest lessons was higher than post-learning achievement with statistical significance of .01. Similarly, Chulimart Banjong (2010) also found that learning achievement of Utilization of Online Lessons Based on Constructivism Theory on Probability was also higher than normal teaching method with statistical significance of 0.5. In addition, the satisfaction of students in Upper Secondary Education (Level 5) taught byOnline Lessons Based on Constructivism Theory was also higher. Teaching method by Online Lessons Based on Constructivism Theory was an interesting teaching method enabling to develop learning achievement and improve satisfaction towards Mathematics learning.

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