THE RESULTS OF APPLYING STEM EDUCATION TO ENHANCE UNDERSTANDING OF LEARNING MANAGEMENT BASED ON THE STEM EDUCATION FOR THE STUDENTS IN THE FACULTY OF EDUCATION, UTTARADIT RAJABHAT UNIVERSITY

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Abstract

The objectives of this research were to 1) enhance knowledge and understanding of learning management based on STEM Education guidelines before and after learning 2) to study the satisfaction of the students towards this learning management. The data of this research were 30 students in Physics Department, Faculty of Education at Uttaradit Rajabhat University in the 2nd semester in 2017. The samples were chosen by a purposive sampling. The research instruments included a test examining student's knowledge and understanding of this learning management and the form evaluating students' satisfaction. The data were analyzed using mean, and the standard deviation, and t-test dependent. The results revealed that 1) the achievements on the students' knowledge and understanding of learning management based on STEM Education guidelines after learning were higher than those of before with statistical significance at .05 level and 2) the students' satisfaction was at a high level ($\bar{x}$ = 4.17).

Keywords

Stem Education, Learning Management, Knowledge and Learning

1. Introduction

Education is an element of living. The purposes of education are to develop people to grow physically, intelligently, emotionally, and socially so that they are able to live with other people in their society. Moreover, education can make society where people live prosper. Therefore, the Ministry of Education formulated the policy on education reform in the second decade (in 2009 – 2018) whose vision is "All Thai people are able to access high-quality lifelong learning by 2018." Education has to constantly pass on knowledge and always evolves. In addition, the implementations have to be adjusted to be in line with an era of curiosity. This is for effective educational development. Learning management development leading students to have knowledge, process skills, and scientific attitudes is important and it is possible by having students participate in the activities as much as they can and practive by themselves (Phongpluem & Chamnakit, 2014). Moreover, teaching Science should open opportunities so that students can fully develop themselves, their thoughts have been broadened and eventually the students have more good attitudes towards science and outer environment than absorbing knowledge from (Marzano et.al., 2001). The study of Trends in International Mathematics and Science Study [TIMSS], which The International Association for the Evaluation of Education Achievement [IEA] assessed the teachers' learning management and the students' learning achievement from 59 countries and eight states in 2007, was found that the Science teachers in Thailand still provided learning management by lecturing the scientific contents and this resulted in the students' learning achievement on Science which was lower than that of the international mean and this trend seemed to continue. Therefore, the teachers should have some educational guidelines to promote students' skills and competences which are required currently especially when demands are being changed in this 21st century. At present, "Stem Education" has been one of the learning management in line with the current demands and changes. Therefore, the institutions producing teachers should emphasize or prioritize on producing and developing teachers to be according to the standard framework of Science, Mathematics, and Technology teachers (The core of the standard of Science and Mathematics teachers). This can be implemented by focusing on developing skills and competences of teacher students so that they

are skillful on providing learning management and capable of integrating knowledge. Because the Faculty of Education at Uttaradit Rajabhat University is an institution producing and developing teachers, it has to produce and develop teachers who have competencies to work efficiently according to the demand in the society. Therefore, the researcher whose aim was to develop knowledge and understanding of learning management for the students in the Faculty of Education did this research in order to enhance the students in the Faculty of Education at Uttaradit Rajabhat University to have the knowledge and understanding of STEM Education learning management. This can develop the students' attributes to provide STEM Education learning management, be fun in learning, and be able to integrate with other areas well.

2. Research Objectives

   1) To compare the knowledge and understanding of the students' STEM Education learning management before and after studying
   2) To study the students' satisfaction towards STEM Education learning management

3. Research Limitations

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Content	The content used in this research is STEM Education learning management
Variables	An independent variable is providing learning activity package based on STEM Education.
	A dependent variable is the knowledge and understanding of the students on STEM Education and the students' satisfaction towards STEM Educaion learning management.
Duration	The 2nd semester in the academic year 2017 during January to March in 2017

4. Research Framework
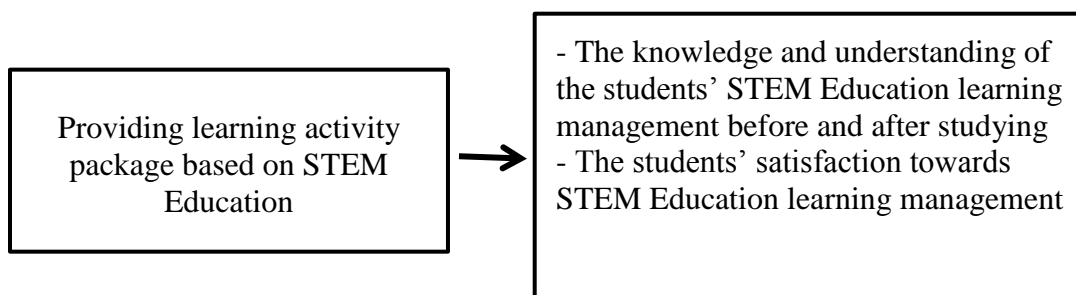
Figure 1: *Research Framework*

5. Research Methodology

This research is a quasi-experimental design whose experimental design is one group pretest-posttest design (Wongrattana, 2007). The information of this research was presented both quantitatively and qualitatively.

The research data

The second year students in the Faculty of Education at Uttaradit Rajabhat University. The information was gathered in the second semester in the academic year 2017 from a classroom in which the number of the students was 30. The samples were chosen by a purposive sampling.

The research instrument

1. The STEM learning activity package for high school level students of the Institute for the Promotion of Teaching Science and Technology (IPST) by using a problem-based learning management for as an activity. The steps were as follows:

Step 1 Giving the situation problem to the students and the students then made understanding of the situation in the problem so that they could make sure if they, in the group, were on the same page.

Step 2 Catching the main information or specifying the problem in the situation problem

Step 3 Brainstorming among the students to analyze the problem and discussing on solution and explaining each point of the problem based on their prior knowledge

Step 4 Working on making assumptions to find solutions for each point while simultaneously prioritizing of the possible assumptions reasonably

Step 5 Evaluating the new knowledge and the necessary knowledge needs proving the assumptions connecting to the situation problem. The learning issue or the learning objective was specified at this step for further research.

Step 6 Additionally researching from the learning resources such as books, texts, journals, other learning media, or specific area experts, etc. and continuing to evaluate correctness, and then planning for learning management and writing lesson plans

Step 7 Synthesizing the information or the knowledge gained, proving the assumptions, applying with the situation problem proper, and concluding a concept or a general principle.

2. A test with 10 items to measure the students' knowledge and understanding of STEM Education guidelines on Integration and the learning situation based on STEM Education before and after studying. It is a true-false test. The IOC values of the knowledge and understanding test used in the research were between 0.60-1.00 and the value of validity was 0.97.

3. A form to evaluate the students' satisfaction towards STEM Education learning management is a five rating scale (Likert Scale). The IOC values of this form were between 0.60-1.00 and the validity value was 0.98.

Data Collection

1. The pretest was completed first and the test measuring prior learning achievement was used, then learning objectives were explained to the samples, the STEM Education learning management plan was implemented for four weeks, one hour a week, in total four hours. After following the leaning management plan completely, the posttest was done by using the learning achievement test. The result scores were analyzed by t-test dependent.

2. The information on the satisfaction forms was analyzed by finding mean and a standard deviation value.

Data Analysis

1. The test measuring the students' knowledge and understanding of STEM Education guidelines was analyzed by giving scores for the knowledge and understanding both before and after studying. The regulation for scoring was 1 for a correct answer and 0 for an incorrect answer. Then the scores were compared between those of before and after studying by using STEM Education learning activity package and t-test dependent.

2. The form of the students' satisfaction towards STEM Education learning management was analyzed by finding mean and standard deviation with the five rating scale. The five rating scale was defined: "5" means the level of the students' satisfaction was at the highest level, "4" means the students' satisfaction was at a high level, "3" means the students' satisfaction was at a moderate level, "2" means the students' satisfaction was a low level, and "1" means the students' satisfaction was at the lowest level.

Criteria

4.51-5.00	means	the highest level
3.51-4.50	means	a high level
2.51-3.50	means	a moderate level
1.51-2.50	means	a low level
1.00-1.50	means	the lowest level

6. Results of Data Analysis

1. The results of data analysis to compare the students' knowledge and understanding on STEM Education before and after learning.

Table 1: *The results of data analysis comparing the students' knowledge and understanding on STEM Education before and after learning with STEM Education learning management plan*

Test	N	$\bar{X}$	S.D.	df	t		p
Pretest	30	7.7	0.35				
				9	3.24		.00
Posttest	30	9.1	0.20				

**p < .01

From the table, the results of data analysis comparing the students' knowledge and understanding on STEM Education before and after studying according to STEM Education learning management plan for the Physics major students at the Faculty of Education at Uttaradit Rajabhat Univesity were found that the mean after studying ($\bar{X}$ = 9.1) was higher than that of before studying ($\bar{X}$ = 7.7) statistical significance at .01 level. This reveals that implementing according to the STEM Education learning management plan is able to develop the students' learning and it can improve the students' learning achievement to be higher.

2. The results of the students' satisfaction towards STEM Education learning management (n=30)

Table 2: *The results of the students' satisfaction towards STEM Education learning management in general*

Items	Satisfaction level		
	$\bar{X}$	S.D	Interpretation
1. Service process			
1.1 The proper location	4.40	1.00	high
1.2 The proper duration	4.40	1.00	high
1.3 The proper content	4.40	1.00	high
Total	**4.40**	**1.00**	**high**
2. Service officer/Speaker/Coordinator			
2.1 Ability to pass the knowledge on	4.90	0.00	The highest
2.2 The speaker's preparation	4.00	0.00	high

2.3 The speaker used proper words.	4.00	0.00	high
2.4 The speaker's time management	4.00	1.00	high
2.5 The speaker's dressing	4.33	0.00	high
2.6 The speaker's answers	4.10	0.00	high
Total	**4.22**	**0.17**	**high**
3. Convenience			
3.1 The documents with full contents	4.00	0.00	high
3.2 Visual media	4.09	1.00	high
3.3 Food, beverage, and location	3.91	1.00	high
Total	**4.00**	**0.67**	**high**
4. Service quality of practical application			
4.1 Daily life practices	4.14	1.00	high
4.2 Sharing the knowledge to other people	4.00	1.00	high
4.3 Providing consultation to colleagues	3.86	0.00	high
Total	**4.00**	**0.67**	**high**
Total	**4.17**	**0.53**	**high**

From Table 2, it was found the results of the students' satisfaction towards STEM Education learning management in general were at a high level. ($\bar{x} = 4.17$).

When each aspect was considered, it was found that the first three items whose mean were the highest were the aspect of service process, at a high level ($\bar{x} = 4.40$), and the second one were the aspect of the service officer, the speaker, and the coordinator, at a high level ($\bar{x} = 4.22$), and the third one was the aspect of convenience which was equal to that of service quality of practical application, at a high level ($\bar{x} = 4.00$).

7. Research Conclusion

The results of this research entitled "the results of applying learning management based on STEM Education guidelines to enhance understanding of learning management based on the STEM Education for the students in the Faculty of Education, Uttaradit Rajabhat University can be concluded as follows.

1) The students' knowledge and understanding of learning management based on STEM Education guidelines after learning were higher than those of before with statistical significance at .05 level.

2) The students' satisfaction towards STEM Education learning management in general was at a high level ($\bar{x} = 4.17$).

8. Research Discussion

The results of this research entitled "the results of applying learning management based on STEM Education guidelines to enhance understanding of learning management based on the STEM Education for the students in the Faculty of Education, Uttaradit Rajabhat University can be discussed as follows.

1. The students' knowledge and understanding of learning management based on STEM Education guidelines after learning were higher than those of before with statistical significance at .05 level. The students have come to an understanding because they have applied their prior knowledge to their enjoyment on learning in class. This is in line with the theory of Social Constructivism which focuses on three different kinds of classroom contexts; that is, 1) classroom discussion which the students and the teacher together participated in an important issue creatively and reasonably, 2) the researcher studied how the students worked in small groups and participated in solving the academic problems because they arranged content-related interactions, and 3) learning concentrated on how students participated in physical activities such as a scientific experiment or using resources for example computers: how they facilitated or limited intelligence processing or constructed knowledge (Shujing Shen, 2014). The process of learning according to social constructivists requires learners to actively participate in creative activities and self-organization and teachers should allow their students to come up with their own questions, make their own theories, and test them. This is accordant to the study of Montha Buasawad (2004: 48) whose study entitled the Development of the Instructional Packages on Basic Science Process Skills of Prathomsuksa Three Students and it was found that the achievement on basic science process skills of the students after they learned by using the instructional package was higher than before learning at statistically significant .05 level. In addition, it is also in line with Michael J. Padilla, (2006:239) who studied the effects of integrated scientific process skill learning management towards skill learning achievement of grade six students. He found that the skill learning achievement of the students was higher and they were obviously capable of specifying variables and testing assumption.

2. The students' satisfaction towards STEM Education learning management in general was at a high level ($\bar{x} = 4.17$). This is in line with the research of Suwat Wattanawong (1995:130) who stated that what to realize when arranging activities for adults was understanding the nature of the targets, instructor roles, participant roles so that the activities would become an atmosphere of intimacy. The participants should be allowed to participate and share or exchange their experiences by having an instructor as a facilitator who encourage them to learn.

9. Suggestion

The suggestion for applying research results

1. An instructor should plan and allot proper duration for learning management to promote better learning activity management and better learning of students in the same amount of time as before or even less time.

2. Students should be allowed to practice teaching in classrooms and have an instructor evaluate after that. This can help the students to experience real practices.

The suggestion for further study

The guidelines of this STEM Education learning management should be implemented during students' teaching internship to enhance their knowledge and understanding of learning management and to promote learning of Matthayom level students in Science Department and other departments.

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