

## THE DEVELOPMENT OF STEM EDUCATION ON MULTIMEDIA APPLICATIONS FOR PRESENTATIONS FOR VOCATIONAL CERTIFICATE

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**Abstract:** This paper reports on research that aimed (1) to plan a STEM class for *Multimedia Applications for Presentations*, a subject for vocational students in the Business and Computing Program of Chetupon Vocational School; (2) to compare students' achievements within the STEM class with those of a traditional class, and (3) to study the satisfaction of students with the STEM class. Thirty-eight first year vocational students were chosen to participate in this experiment using the cluster random sampling technique. The research tools used consisted of lesson plans, a STEM course quality evaluation form, a student satisfaction evaluation form, an assignment evaluation form, and a learning achievement evaluation form. This study found that: (1) the quality of the teaching plan in the STEM course was very good ( $M = 4.66$ , with an efficiency of 80.03/81.94; (2) the vocational students who participated in the STEM class achieved higher results than the students in traditional class with statistical significance at the 0.05 level; and, (3) the students' satisfaction with the learning activities in the STEM course was high ( $M = 4.46$ ).

**Keywords:** STEM Education, Multimedia Applications for Presentations, Creative Thinking.

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## **Introduction**

Education is considered the most important foundation for the development of the country, because it is an important tool in the development of human resources. For economic and social development, we must focus on developing new knowledge to enhance students' intellectual skills. By doing this, they can use the knowledge in the context of diversity and collaboration that innovation occurs in real life and create benefits to society (Doorley & Witthoft, 2011).

Grading in Multimedia Applications for Presentations in Semester 2/2017 showed that most students had scores of lower than 60 percent. This may have been because most students who had a basic knowledge of PowerPoint presentation software from their high school education lacked interest in learning this subject. They preferred to chat, watch unrelated videos, or play games in the class. Therefore, teachers need to use new learning and teaching strategies to motivate students. The adoption of new and innovative learning techniques by integrating instruction across subjects and mixing good points of each subject, such as "STEM education management", can be divided into 4 levels of content: (1) integrated within subjects, (2) integrated between two subjects, (3) integrated among many subjects, and (4) integrated across disciplines (Thailand Institute for the Promotion of Teaching Science and Technology, 2015). Students are able to apply this knowledge from the classroom into the real world. STEM education is a combination of science, math, technology, and engineering knowledge, and matched to real life. Students can apply the knowledge gained to solve real problems in community (Klomim, 2016). Then, students can create learning experiences by themselves. Teachers organize activities according to students' interests or students' problems. The teacher may define the framework of a broad issue or topic; then, students identify specific problems and solutions by themselves. However, teachers must consider the following factors to identify, and set the correct questions for, problems: 1) the issue or question that the students are interested in; 2) indicators in the relevant subjects; and, 3) students' prior knowledge.

Project-based learning is a similar learning approach to this integrated STEM approach (Thailand Institute for the Promotion of Teaching Science and Technology, 2015). In this subject, teachers assign students to create videos with Microsoft PowerPoint and present them. To create a piece of work, students can apply shapes to create stories about the concepts of science, math, and technology through the engineering design process. It should be noted, however, that to adapt this new learning approach teachers, educators, and directors should analyze and understand it thoroughly, so that it is applied properly.

Multimedia Applications for Presentations is one of the subjects in the Business and Computing Program in Vocational Certificates of 2013. This subject aims to increase knowledge about creating presentations with Microsoft PowerPoint 2013, which is well-known presentational software for both business and education. With Microsoft PowerPoint 2013, presentation slides can be created easily. Additionally, pictures sound, or videos can be inserted easily, making presentations even more interesting (Heinich and others, 1997).

In teaching, students need to gain knowledge with deep understanding. It is important to define real problems for students to solve in real situations by creating effective presentations that respond to the purpose of the subject.

### **Research Objectives**

There are three objectives for this study:

1. To develop the lesson plans for a STEM class in Multimedia Applications for Presentations, a subject in Chetupon Commercial College;
2. To compare students' achievement between the STEM class and a traditional class; and,
3. To study the satisfaction of students with the STEM class.

### **Research Hypothesis**

Students' learning achievement in a STEM class, Multimedia Applications for Presentations, a subject in the Business and Computing Program at Chetupon Commercial College are higher than in a traditional class.

### **Conceptual Framework**

#### *Conceptual Framework for Managing STEM Education*

There are 5 steps for the management of the STEM class in Multimedia Applications for Presentations that are applied (Institute for the Promotion of Teaching Science and Technology, 2015): 1) Identify a challenge; 2) Explore ideas; 3) Plan and develop; 4) Test and evaluate; and 5) Present the solution.

#### *Conceptual Framework for Learning and Teaching Process Quality Evaluation*

Learning lesson plans, designed by the Office of Vocational and Professional Standards (2018), is applied as follows: 1) Define the subject; 2) Define clear objectives; 3) Define the content 4) Define the activities (focus on the activities that students can think about and practice in; students can study from a variety of sources; students can synthesize knowledge, or create their own conclusions; the quality of students' work may be varied according to their abilities); 5) Determine how the evaluation is consistent with the objective (teachers must use the assessment results to develop students); and, 6) Define the materials and assessment tools.

#### *Conceptual Framework of STEM Class Evaluation*

To find out the effectiveness of the teaching plan in the STEM class, E1/E2 by Brahmawong, C. (2013) was applied which were: 1) The efficiency of the procedure (E1); and, 2) the efficiency of result (E2).

#### *Conceptual Framework of Learning Achievement*

Learning achievement in this study was designed based upon the following two methods;

Assignment assessment: Assignment assessment by means of rubric scoring was implemented in conceptualizing.

Project Assignment: Evaluation Form which comprises 2 parts: holistic scoring and analytic scoring (Sirasukhon, 2007).

In this study, analytic scoring was used in assessment of project - Learning Achievement Test: Learning achievement test with 4 multiple choice items was used to measure Bloom's cognitive domains as conceptualized from Anderson's Taxonomy which comprises 6 levels, but only 3 were selected for this study. Those are: 1) Remembering, 2) Understanding, and 3) Applying (Anderson & Krathwohl, 2001)

#### *Conceptual Framework of Satisfaction Level Study*

Likert's-5-rating-scale Questionnaire of satisfaction on STEM education was based on 6 domains: (1) Learning Activity Design (2) Learning Atmosphere (3) Learning Benefits (4) Instructor's Classroom management (5) Teaching Methods (6) Content (Jumpathai, 1982).

### **Scope of the Study**

#### *Population and Samples*

The population for this research was 230 first-year students in vocational certificate course, majoring in Business Computer studying in 6 classes in total, enrolling in the second semester of the academic year 2017 at Chetupon Commercial College.

Three classes of first-year students in vocational certificate course, majoring in Business Computer at Chetupon Commercial College were assigned as samples of the study, obtained by means of stratified sampling method.

### **Methodology**

#### *Variables of the Study*

1. Variables related to efficiency of learning management: Independent Variable is STEM education lesson plan; Dependent variable is Quality of STEM education lesson plan

2. Variables related to comparison of learning achievement: Independent Variable is STEM education and traditional education in Multimedia Program for Presentation. Dependent Variable is achievement of first-year students in vocational certificate course, majoring in Business Computer at Chetupon Commercial College

3. Variables related to Satisfaction level: Independent variable is STEM education; Dependent variable is satisfaction of first-year vocational certificate students majoring in Business Computer at Chetupon Commercial College on STEM education in Multimedia Program for Presentation.

#### *Scope of the Content*

Multimedia Program for Presentation is a subject in vocational certificate curriculum 2013, which is both theoretical and practical oriented, mainly operated with Microsoft PowerPoint 2013. The scope of the content is as follows:

- 1) Introduction to Multimedia and Presentation
- 2) Designing outline before creating presentation
- 3) Creating presentations and formatting slides

- 4) Text and Text Formatting
- 5) Slide decoration with pictures
- 6) Slide decoration with drawing and graphic design
- 7) Adding a multimedia presentation
- 8) Animation Slides
- 9) Slide shows
- 10) Slide Printing, Online Slideshows sharing and References

#### *Research Instruments*

1. 10 STEM education lesson plans and content of multimedia program for presentation, which were validated by 5 experts.
2. Evaluation form of quality of STEM Education lesson plans, which were validated by 3 experts.
3. Achievement Test of multimedia program for presentation that comprises 30 items with 4 multiple choices each and with IOC value between 0.67-1.00, Difficulty index 0.42-0.58, Discrimination 0.22-0.67 and Reliability at 0.83
4. Rubric scoring Evaluation Form of Assignments with reliability at 0.89.
5. Questionnaire of satisfaction on STEM education in multimedia program for presentation course of students, which were validated by 3 experts and with IOC value between 0.67-1.00 and reliability at 0.76.

#### *Research Procedure*

STEM education lesson plans were implemented in experimental class and accompanied with 10 module tests, served as the in-between progressive test, after each module. The scores obtained from these 10 module tests were analyzed for efficiency (E1) of STEM education lesson plans in multimedia program for presentation while the scores obtained from the achievement test that was administered in the experimental group as well as scores gained from the 19 assignments were used to analyzed for efficiency (E2) of the results.

In the case of traditional classroom, the scores obtained from the achievement test and scores from the assignments of using PowerPoint 2013 in creating projects were analyzed, and then used to compare achievements between a STEM education class and a traditional teaching method by means of t-test for independent sample.

#### **Results**

The process of data analysis was executed as follows:

1. The analysis for mean, standard deviation and efficiency level of STEM education lesson plans in multimedia program for presentation was shown in table 1.

**Table 1: Means, Standard Deviations and Efficiency Level of STEM Education Lesson Plans in Multimedia Program for Presentation**

No.	Module	Mean	S	Quality Level
1	Introduction to Multimedia and Presentation	4.53	0.54	Very good
2	Designing outline before creating presentation	4.82	0.30	Very good

**Table 1: Means, Standard Deviations and Efficiency Level of STEM Education Lesson Plans in Multimedia Program for Presentation**

No.	Module	Mean	S	Quality Level
3	Creating presentations and formatting slides	4.55	0.54	Very good
4	Text and Text Formatting	4.56	0.54	Very good
5	Slide decoration with pictures	4.75	0.39	Very good
6	Slide decoration with drawing and graphic design	4.77	0.38	Very good
7	Adding a multimedia presentation	4.63	0.51	Very good
8	Animation Slides	4.82	0.30	Very good
9	Slide shows	4.52	0.55	Very good
10	Slide Printing, Online Slideshows sharing and References	4.60	0.50	Very good
Total		4.66	0.46	Very good

As shown in Table 1, it was found that the overall quality of STEM education lesson plans in Multimedia Program for Presentation was at a very good level ( $M=4.66$ ,  $S=0.46$ ) with the highest mean at 4.82 in two modules which were module 2, designing outline before creating presentation, and module 8, Animation Slides, and the lowest mean at 4.52 in module 9, slideshow.

2. The analysis on the efficiency of STEM education and content of *Multimedia Application for Presentation*. The analysis results of learning education efficiency were shown in Table 2.

**Table 2: The Analysis on The Efficiency of Stem Learning Education and Content of Multimedia Application for Presentation Subject**

Results	No. of Students	Scores		Percentage
		Full Score	Average	
During learning	38	100	80.03	80.03 ( $E_1$ )
Learning achievement		50	40.97	81.94 ( $E_2$ )

From Table 2, it was found that the STEM education in *Multimedia Application for Presentation* was efficient ( $E_1/E_2$ ). Efficiency of procedure was 80.03 while efficiency of results was 81.94, which was consistent with criteria 80/80 and the identified criteria that the efficiency should not be lower than 80/80.

3. The comparison of learning achievement in Multimedia application for presentation subject for vocational certificate students who studying with Stem learning education and normal learning education. The comparison results is shown in Table 3.

**Table 3: Comparison of Learning Achievement in Multimedia Application for Presentation Subject for Vocational Certificate Students**

Learning Methods	n	Mean	S	t	Sig
Stem learning education	38	38.82	3.868	13.852	.000*
Normal learning education	36	28.17	2.580		

\* $p < 0.05$

Table 3 illustrates that the vocational certificate students studying with STEM education in *Multimedia Applications for Presentation* had higher achievement than those who studying with normal learning education with statistical significance 0.05.

4. The analysis on satisfaction of 38 vocational certificate students, Business Computer Program towards STEM education in *Multimedia Applications for Presentation* is shown in Table 4.

**Table 4: The Satisfaction of 38 Vocational Certificate Students, Business Computer Program towards STEM Education in Multimedia Applications for Presentation**

Items	Aspect	Mean	S	Level of Quality
1	Content of subject	4.19	0.06	Good
2	Learning activities	4.52	0.55	Very Good
3	Instructional style	4.46	0.57	Good
4	Teaching method	4.57	0.51	Very Good
5	Learning atmosphere	4.52	0.61	Very Good
6	Benefits	4.47	0.56	Good
Total		4.46	0.48	Good

From Table 4, the analysis on the satisfaction towards STEM education in *Multimedia Applications for Presentation* showed that the overall satisfaction was in good level ( $M = 4.46$ ,  $S = 0.48$ ). Considering by respect, the highest respect was teaching method, 4.57, while the lowest respect was content of subject, 4.19.

### Conclusion and Discussion

STEM education in *Multimedia Applications for Presentation* for vocational certificate students had the overall quality in the excellent range ( $M = 4.66$ ,  $S = 0.46$ ). The researcher followed the STEM education in Multimedia Applications for Presentation from studying the manual of Multimedia application for presentation subject, the Vocational Certificate Program, B.E.2556, Commerce, relevant documents and textbook to the method, principles, theories, and technique of writing STEM education, setting content of STEM education for Multimedia Applications for Presentation, changing slides for creating learning education, studying documents and textbook relating to the Multimedia Applications for Presentation, analyzing content, concept, and learning results of Multimedia Applications for Presentation. When considering by unit, it was found that there were two units with the highest average point at 4.82, which were Unit 2: Drafting before presentation, and Unit 8: Animation slides. This was because the content was consistent with the objectives, the content order was appropriate; the content was up-to-date and interesting. Moreover, the contents were consistent and connected which was verified by the advisor, co-advisor, and the expert who evaluated the STEM education plan. The expert in the test verified the questions on the test, questionnaire, and the assessment form, and revised. Regarding the questions in the questionnaire and assessment form, they were verified by the advisor, co-advisor, and the expert in STEM education.

Analysis result of efficiency of STEM education in Multimedia Applications for Presentation testing with the sample group, 38 vocational certificate students, Business Computer Program, Chetupon Commercial Collage showed that their

learning achievement, measuring from the end of class quiz and learning achievement test, from the score of STEM work creating using Microsoft Office PowerPoint 2013 had the efficiency of instructional set ( $E_1/E_2$ ) at 80.03/81.94, which was not lower than identified by the researcher. The researcher analyzed the content and learning activities to study the manual of STEM education and the Vocational Certificate Program, B.E.2556, set objective, sort the content, develop STEM education plan for Multimedia Applications for Presentation, in order to verify the accuracy of Stem learning education and modified by improving content, teaching and learning plan, and learning activities to draw students' attention. Further, the researcher created knowledge for students as suggested by the co-advisor. Then, the expert in STEM education and Multimedia Applications for Presentation subject evaluated the quality and gave suggestions to develop the STEM education. Regarding the learning achievement test, to ensure the quality and efficiency of questions, they were tested with the non-sample group and modified before using with the sample group. The STEM education plan created could be applied to the end lesson quiz to review the lesson. Students had higher score from the end lesson quiz and learning achievement test than the criteria. This was in line with Sangpromsri, Nuengchalerm and Janthiratikul (2015) who compared the leaning achievement, science process advance skill, and attitude towards learning Chemistry of the students in Mattayomsuksa 5 who studying Stem learning education and normal education. Sample group was 100 students from two classes in Mattayomsuksa 5, Semester 2, Academic year 2014, at Phayakkhaphum School, A. Phayakkhaphum Phisai, Mahasarakham obtaining by cluster sampling. Research tools was the seven plans of Stem learning education on chemical reaction rate. It was found that the students learning with STEM education had higher learning achievement of science process advance skill and attitude towards studying Chemistry than learning with normal learning education with statistical significance .05, which was consistent with the research hypothesis.

Comparison results of learning achievement between after learning with STEM education for Multimedia Applications for Presentation indicated that the achievement after learning with STEM education for Multimedia Applications for Presentation was higher than that of students learning with normal learning education with statistical significance 0.05, which was consistent with the research hypothesis. This was because the students learning with normal learning education adhered to rote learning but did not understand the application of Microsoft Office PowerPoint 2013. Consequently, they did not earn high average score. On the other hand, the students learning with STEM education had gone through STEM learning so they had higher average score than those who learnt with normal learning education. In STEM education, the instructor designed learning activities and STEM work creating from Microsoft Office PowerPoint 2013 while student designed work, had brainstorming, making draft before presentation. They created an object by themselves, set composition, and presented their work. As the students were able to draw an object with shape and figure, it reflected that the students had systematical thinking, analysis, and observation on the movement of object, applying animation to the moveable objects imitating actual object before making the work piece. On this step, the students processed the test followed the pair-work design, modified and developed the result further. After making the work piece, the teacher evaluated and suggested the improvement with explanation.

Regarding the learning achievement test, the questions were designed and analyzed, behavioral objectives were set to be consistent with learning and content objectives to create the four multiple choices test. The test measured three aspects of behavior, which were memory, understanding, and application. Learning achievement test was the four multiple choice which was proposed to the advisor and co-advisor for the verification and modification. Then, proposed to the expert to verify the content validity by analyzing IOC. Trial the modified test with the non-sample group and analyzed the obtained score for the difficulty (p), discrimination (r) and confidence. The difficulty, discrimination, and confidence of learning achievement test for Multimedia application for presentation subject was 0.42-0.58, 0.22-0.67, and 0.83 respectively. Then, measured the learning achievement of the qualified test. The STEM learning lesson plans had quality and efficiency for using with the learners as it helped them to understand the content easily, created the knowledge that the learners were able to apply to work. Regarding the results of STEM education, the students learning with STEM education had the good level of satisfaction towards STEM education for Multimedia Applications for Presentation (M= 4.46, S= 0.48). Considering by respect, it was found that the highest average score was on teaching method, M = 4.57. Moreover, the result was in line with Klomim, (2017) who found that students' learning achievements with Integrated Learning Management by using STEM for grade four students in elementary school were significantly higher than those studying in the normal setting, as well as Saengpromsri, Nuengchalem, and Janthiratikul (2015) which found that students learning with STEM class in Chemistry had significantly higher achievement scores and science process skills than those who studied with a traditional class.

### **Suggestions for Further Researches**

1. Content should be developed as the online teaching and learning media to facilitate the students to learn outside classroom.
2. Various situations should be created so the students can learn, apply, and respond to the individual requirement.
3. Gender classification for analyzing the learning difference using STEM education should be considered.

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