

# Factors Supporting the STEM Education Learning Management of Leader Teachers in the STEM Education Network of Thailand

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**Abstract** - The objective of the research study was to study the factors supporting the STEM education learning management of leader teachers in the STEM education network of Thailand. The sample consisted of 114 leader teachers in the STEM education network selected by purposive sampling. The research process was divided into three stages. The first stage was to analyze and synthesize documents and research studies related to factor supports, STEM education, and the STEM education network. The second stage was to design and develop the questionnaires with regard to the factors supporting the STEM education learning management of leader teachers in the STEM education network of Thailand, and to evaluate the consistency of the factors with the help of five experts. It was found that there were five main factors as follows: (1) the teachers, (2) the students, (3) the learning management, (4) the tools of learning management, and (5) the school management. The third stage was the data collection process using the questionnaires to determine the factors supporting the STEM education learning management of leader teachers in the STEM education network of Thailand. The instrument used was a questionnaire to determine the factors supporting the STEM education learning management of leader teachers in STEM education network of Thailand using a

Likert five level rating scale. The research results indicate that the factors supporting the STEM education learning management in summary was at a high level ( $\bar{x} = 2.87$ , S.D. = 0.03). The factor of the teachers in terms of knowledge of their own subjects was the factor supporting the STEM education learning management at the highest level ( $\bar{x} = 3.40$ , S.D. = 0.54). That was one of the factors that help the teachers to confidence in their own learning management and the need to integrate or share their knowledge with teachers in other subjects. The factor of the school management in terms of the support obtained from external agencies was a factor that supports the STEM education learning management, but at a low level ( $\bar{x} = 2.48$ , S.D. = 0.84) with most comments by teachers indicating that the cooperation of each of the parties within their school was an important factor in terms of supporting learning management and leading to success. In addition, if the teachers were assigned to STEM learning management in their own class it was found that learning management leads to success resulting from supporting factors such as cooperation from all parties, teachers' experience, knowledge, responsibility, intention, planning, materials and environment. The teachers were also concerned that in fact these factors were not

**always available.**

**Keywords - Factor Support, STEM Education, Leader Teachers in the STEM Education Network**

## **I. INTRODUCTION**

The basic education curriculum of Thailand has been improved continuously to keep pace with technological changes and modern science. Historically, there have been many problems associated with science and technology education in Thailand. These have impacted on the numbers of students in science and technology in that there has been a decrease at all grade levels. National and international assessments indicate the low quality of science and mathematics education. In addition, science and technology education cannot respond to the country's demands with regard to economic and social development in terms of both quantity and quality. These demands require people with the necessary knowledge and skills in science and technology to make Thailand competitive now and in the future [1].

The Institute for the Promotion of Teaching Science and Technology (IPST) was the organization set up by the Ministry of Education responsible for the development of Thailand's science, mathematics and technology education in terms of improving the learning process associated with science, mathematics and technology and also for developing the skills needed by students for the 21<sup>st</sup> Century. Its remit was to provide students with knowledge and skills equal to that of other countries. IPST initiated a learning process which integrates science, mathematics, technology and engineering processes for solving problems found in daily life through the STEM education learning management system. STEM education (Science, Technology, Engineering and Mathematics education) was an educational approach that integrates science, technology, engineering and mathematics by focusing on problem solving in everyday life and professional undertaking. STEM

education provides learning experiences through activities or projects which focus on solving real life problems, in order to develop the students' experience, life skills, analytical thinking, problem solving skills, and creativity for innovation. Learners with experience of STEM activities or projects will be better prepared to work in demanding positions which require knowledge and skills in science, mathematics and technology [1].

The STEM education network of Thailand founded by the IPST includes 13 regional STEM education centers in 12 provinces around the country. The leader teachers in the STEM education network within each center work as leaders in pedagogical development in terms of applying the STEM education approach in the classroom. They are expected to create STEM classrooms as examples for other schools in the region [1]. However, from observing the operation of some the STEM education network centers it has been found that they are unable to implement the center's objective, to develop patterns of activity on their own, in addition to other problems. From the above issues and concepts, the authors had the idea of studying the factors supporting the STEM education learning management of leader teachers in the STEM education network of Thailand.

## **II. OBJECTIVE OF THE RESEARCH STUDY**

The objective of the research study was to study the factors supporting the STEM education learning management of leader teachers in the STEM education network of Thailand.

## **III. METHODOLOGY OF THE RESEARCH**

### **A. Theory and Principles**

The theory and the important principle behind the research study are as follows:

1. **STEM Education:** STEM education (Science, Technology, Engineering and Mathematics education) is an educational approach that integrates Science, Technology,

Engineering and Mathematics by focusing on problem solving in everyday life and engaging in professional undertakings. STEM education integrates concepts that are usually taught as separate subjects in different classes, and emphasizes the application of knowledge to real-life situations. A lesson or unit in a STEM class is typically based on finding a solution to a real-world problem and tends to emphasize project-based learning. STEM education provides learning experiences through activities or projects, which focus on solving problems in real life, in order to develop experience, life skills and creativity for innovation. Learners with experience of STEM activities or projects will be better prepared to work in demanding positions which require knowledge and skill in science, mathematics and technology in various sectors, including agriculture, industry, energy, environmental management, health services and transportation. Therefore, the highlight of the STEM education approach is that it solves the problem of education in Thailand that focuses on the study of theoretical mathematics, science, engineering and technology separately, with an emphasis on memorizing for exams. At the same time, they do not focus on practical applications in everyday life [1, 2, 3]. Areas for consideration in the research study include the development of curriculum materials and instructional strategies for classroom teachers; effective professional development for classroom teachers; effective alternative preparation of new teachers; the use of engineering topics to achieve state and national content standards. Prior efforts to establish effective professional development for teachers of science and mathematics are discussed. We also consider successful programs that include specific examples and should serve as models for others [4].

**2. Leader Teachers in the STEM Education Network:** The IPST founded the STEM education network of Thailand in the form of 13 regional STEM education centers in 12 provinces around the country, and six school networks associated with each regional STEM education center. The leader

teachers in science, mathematics and technology in the STEM education network within each center were selected by regional STEM education center schools to work as leaders in pedagogical development in terms of applying the STEM education approach in the classroom. They were expected to create STEM classrooms as examples for other schools in the area. Each school has six to nine lead teachers: six teachers for each elementary and secondary school and nine teachers for each extended elementary school. Lead teachers were trained in STEM education by IPST at least once a year [1].

### ***B. Population and Sample***

1. The population of the study was leader teachers in the STEM education network.
2. The sample of the study was 114 leader teachers in the STEM education network selected by purposive sampling.

### ***C. Instrument of the Research***

The instrument of the study was a questionnaire aimed at determining the factors supporting the STEM education learning management of leader teachers in the STEM education network of Thailand using a five level Likert rating scale synthesized from the study of theories and concepts that relate to the research. Five experts were then used to evaluate the consistency of the factors. It was found that there were five main factors as follows: (1) teachers, (2) students, (3) learning management, (4) tools of learning management, and (5) school management.

### ***D. Data Collection***

The authors collected the data from 114 leader teachers in the STEM education network by using the questionnaire they had created. The data were then analyzed and the results of the research study were summarized through the use of average point ( $\bar{x}$ ) and standard deviation (SD). The criterion to determine the weight of evaluation is through the use of a four level Likert rating scale.

#### IV. RESULTS OF THE RESEARCH

the STEM education learning management of leader teachers in STEM education network of Thailand are as shown in Table I.

The results are as follows:

##### 1. The evaluation of the factors supporting

**TABLE I**  
**RESULTS OF THE EVALUATION OF THE FACTORS SUPPORTING THE STEM EDUCATION LEARNING MANAGEMENT OF LEADER TEACHERS IN THE STEM EDUCATION NETWORK OF THAILAND**

Factors supporting the STEM education learning management	Results		Level of Factor Supported
	$\bar{x}$	S.D.	
<b>1. Factor of the teachers</b>			
- The knowledge of their own subject	3.40	0.54	Highest
- The knowledge of other subject	2.80	0.68	High
- The collaborative of teacher in each learning subject	2.99	0.72	High
- The understanding of STEM education principle	3.23	0.64	High
- The understanding of the teacher's role for STEM education learning management	3.22	0.62	High
- The ability for create the new STEM education activity	2.96	0.71	High
- The ability to link between old knowledge and new knowledge	3.07	0.37	High
- The ability to link knowledge of each subjects	3.04	0.55	High
- The ability of teachers to consult to the students	3.17	0.53	High
<b>2. Factor of the students</b>			
- The status of student's parents	2.57	0.70	High
- The expectations of student's parents	2.88	0.71	High
- The understanding for activity pattern	2.77	0.70	High
- The collaboration to activity process	3.04	0.64	High
- The concentrate to do activity	3.09	0.66	High
- The knowledge of subject	2.92	0.63	High
- The ability to link knowledge	2.77	0.74	High
- The ability for problems solving	2.75	0.77	High
- The skill and knowledge relate to activity	2.80	0.72	High
<b>3. Factor of the learning management</b>			
- The clarity of pattern creation activities	3.04	0.60	High
- The objective of activities	3.10	0.61	High
- The stage of activity process	3.09	0.59	High
- The evaluation and measurement of activities	2.98	0.65	High
- The time line of activity process	2.81	0.77	High
- The additional learning resource of activities	2.90	0.73	High
- The training to new learning management from IPST	2.91	0.75	High
<b>4. Factor of the tools of learning management</b>			
- The relation between contents and material of activities	2.88	0.77	High
- The suitability of material number	2.67	0.86	High
- The easy to prepare the material	2.60	0.83	High
<b>5. Factor of the management</b>			
- The collaboration of teachers and other personnel in their school	2.84	0.78	High
- The concentrate to do activity of administrators in their school	2.96	0.80	High
- The role assignment of the administrators in their school	2.88	0.80	High
- The role assignment of the teachers in their school	2.92	0.78	High
- The honor of the teachers and other personnel in their school	2.53	0.82	High
- The management of activity timeline	2.54	0.89	High
- the support obtained from external agencies	2.48	0.84	Low
- The management of administrators	2.69	0.79	High
- The resource management for activity process	2.68	0.84	High
- The coordination with external personnel and agencies	2.58	0.75	High
- The knowledge management	2.78	0.74	High
- The perform exchange of experiences	2.68	0.78	High
<b>Summary</b>	<b>2.87</b>	<b>0.03</b>	<b>High</b>

In Table I, the results of the factors supporting the STEM education learning management of leader teachers indicates that it was at a high level ( $\bar{x} = 2.87$ , S.D.= 0.03).

When considering each sub-item, it was found that the factor of the teachers in terms of knowledge of their own subject was the factor that supports the STEM education learning management at the highest level ( $\bar{x} = 3.40$ , S.D.= 0.54) and the factor of school management in terms of the support from external agencies was the factor supporting the STEM education learning management at the lowest level ( $\bar{x} = 2.48$ , S.D.= 0.84).

2. In terms of the results of the other factors supporting the STEM education learning management when the leader teachers were assigned to STEM learning management in their own classrooms, it was found that they could learning management lead to success resulting from supporting factors at 96.5% such as cooperation from all parties, teachers' experience, knowledge, responsibility, intention, planning, materials and environment. However, the teachers were also concerned that in fact these factors were not always available.

## V. CONCLUSIONS AND DISCUSSION

From the study of the theories, concepts and research relating to factor support, we identified the factors supporting the STEM education learning management of leader teachers in the STEM education network of Thailand using a Likert five level rating scale. We then used five experts to evaluate the consistency of the factors. It was found that there were five main relevant factors as follows: (1) teachers, (2) students, (3) learning management, (4) tools of learning management, and (5) school management. The summarized results of the study was that the factors supporting the STEM education learning management of leader teachers in the STEM education network of Thailand indicates that it was at a high level. When considering each sub-item, it was found that the factor relating to the teachers in terms of

knowledge of their own subject was the factor supporting the STEM education learning management at the highest level. This was one of factors that helps the teachers be confident in their own learning management and in order to integrate or share knowledge with the teachers of other subjects. In contrast, the factor of management in terms of the support from external agencies was the factor that supports the STEM education learning management the least. Most comments in the questionnaires by the teachers indicated that the cooperation of each the parties within their school was an important factor in terms of supporting learning management in order to lead to success. In addition, if the teachers were assigned to STEM learning management in their own class, they found that learning management could be successful with the help of supporting factors such as cooperation from all parties, teachers' experience, knowledge, responsibility, intentions, planning, materials and environment. However, the teachers were also concerned that in fact these factors were not always available.

From this research it was found that teachers, students, tools, resources and resource management were the factors that supported and promoted the success of the students. These findings were in accord with the research of H. L. Patricia et al. [4], the concepts of Rockland et al. [5] and the approach of STEM education of the Institute for the Promotion of Teaching Science and Technology [1].

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**(Arranged in the order of citation in the same fashion as the case of Footnotes.)**

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