

The study of STEM Education management connecting the context of science teachers in the School of Extension for Educational Opportunities in the central region of Thailand

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Abstract

The purpose of the research is to study the STEM education learning management connecting the context of science teachers in the School of Extension for Educational Opportunities in central regions of Thailand. Samples used in this study contain 36 science teachers from the School of Extension for Educational Opportunities in the central region. Conditions for selecting the target groups are defined by considering in the quality in school zoning, school size, location and test results of basic national education (O-NET). The size of target samples is calculated using G * Power software, version 3.1.9.2. Variables used for the study include STEM Education learning management connecting the science teachers. Tools used to collect quantitative data are questionnaires regarding teaching practice. Data for analysis contains statistics, frequency statistics, and percentage. Tools used to collect qualitative data include interviewing forms. Analyzing of data for this study include content analysis and verification for the validity of the data by triangulation verification method.

From the quantitative data analysis, it is found that science teachers who participate in the research manage the STEM learning in various forms of connecting and in different proportions with the connection that uses a variety of data sources and link to the most real-life problems. Of 100 percent of teachers perform research from various sources for teaching planning accounted for more than 50 percent of the learning management hours. In addition, more than 90 percent of teachers have organized learning by linking context to solving problems in daily life of students, in proportion to more than 50 percent of learning management hours, while in linking the context of using community learning sources, inviting expert speakers and project-based learning management , these are in small proportion. 44 percent of teachers do not use learning resources in learning management and 80 percent of them invite external speakers to participate in learning management in the proportion of less than 50 percent of the study hours.

Qualitative data analysis represents the expectations of teachers in learning management which can be divided into 2 issues;

Issue 1: The expectation of science teachers to manage STEM learning in a full context consists of sub-issues, namely the use of teaching materials, comprehensive example raising, learning from actual conditions, the process in which students participate and summarize the lessons to connect the context.

Findings from this research will be empirical data that shows the real situation in the STEM learning management with linking the context in the School of Expansion for Educational Opportunities in the central

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region which will be a reference for the policy department to use in the planning of the professional development process for the School of Expansion to promote learning that focuses on linking and practical utilization to enable students in the School of Expansion to receive education at with equal quality. In addition, the results of the research also reflect obstacles in implementing the policy into practice in the classroom as well.

Keywords: Context linking process, science, the School of Extension for Opportunity

Background and importance of the problem

Development of learners' quality and promotion of educational management in order to create competitiveness (Office of the Basic Education Commission, 2018) is the strategy of the Office of the Basic Education Commission That is consistent with the national strategy for 20 years (2017 - 2036) with guidelines for promoting interdisciplinary integrated learning, such as Science Technology and Mathematics Education (STEM Education), to develop thinking processes and innovation to create additional value In line with Thailand 4.0 mission. STEM is an educational management framework that focuses on the integration of science or the four disciplines, namely science, technology, engineering, and mathematics. The purpose of learning management is to "encourage students to love and appreciate the value of learning science, technology, engineering, and mathematics and it is considered that those subjects are close to us that they can be used for every day "(STEM EDUCATION THAILAND, 2014)

Since the STEM education policy announcement, the organizing of Thai education system in the past 5 years has received cooperation from many sectors in the development of Thai education, both public and private agencies by funding more than a billion baht to develop science and mathematics education in many areas such as curriculum improvement, digital textbooks production, modification of the teaching process that emphasizes on practicality, teacher training for new courses and adjusting mea-

surement and evaluation procedures (Office of the Education Council, 2016)

Teachers are considered an important factor in the development of education that will result in the development of learners to become competitive citizens. The Office of Basic Education aims to create a sufficient number of teachers with training courses in various forms. Although many pieces of research suggest that teachers have developed understanding of new learning management methods from teacher development training (Ring et al., 2017), another side of the studies reveal that changing the teaching practices in actual classroom teachers is a challenge due to many involved factors involved both internal factors within the teachers such as beliefs, values, knowledge, and external factors such as the environment, policies and management support from the executives (Dong et al., 2019). These differences make understanding and various interpretations about STEM education especially in the integration and linking issues (Bybee, 2013; Chamrat, S., 2016; English, 2016; Ring et al., 2017; STEM EDUCATION THAILAND, 2014; Suthira Prasertsan, 2015) which results in different practices (Thibaut et al., 2018)

The School of Expansion for Education Opportunity is the school under the Office of Primary Education that aims to provide opportunities for youngsters who complete grade 6 in remote areas to have a higher education foundation. However, it is found that the School of Expansion for Opportunities often encounters either administrative prob-

lems, curriculum preparation, learning management and equipment shortages (Patcharin Kotsombat et al., 2015; Benjaporn Jitru, 2016), causing problems in learning management leading to the evaluation results among the School of Extension for opportunities group, the school usually falls in the lower group (Institute for the Promotion of Teaching Science and Technology Ministry of Education, 2018)

From the challenge of implementing the policy of STEM into practice at a limited environment like in the schools of expanding opportunities along with challenges in integrated learning management (Pang and Good, 2000) while there are none of any research made on this issue, therefore, the researcher is interested in studying the STEM learning management with the contextual linkage process of science teachers in the Schools of Extension for opportunities in the central region. The results of this research will help create an understanding of the implementation of the policy of STEM into the practice for teachers which will allow relevant people to support the teacher's practice that will affect learners' learning.

Objective of the study

To study STEM learning management connecting the context of science teachers in the Schools of Opportunity Extension in the central region.

Scope of the study

1. Target groups used in this study

Target groups used in this study are 36 science teachers from the Schools of Extension for Opportunities in the central region. The conditions are determined by considering the equality of the schools, school size, location, O-NET test results. Determination of target group size is implemented using G* Power software, version 3.1.9.2

2. Variables used in the study

Variables used in this study are contextual

learning management of teachers.

3. Duration of study; the 1st semester, academic year 2018

Literature Review

STEM education

STEM Education is a concept in education management that aims to create people with the potential to create innovation. It is a concept that has been used in many countries around the world. However, there are different interpretations and practices among educators (Bybee, 2013; Chamrat, S., 2016; English, 2016; STEM EDUCATION THAILAND, 2014; Suteera Prasertsan, 2015) and operating teachers (Thibaut et al., 2018;)

Thibaut et al., (2018) analyze the articles about STEM and summarize common elements in bringing STEM to be applied in the classroom which consists of integration using of problem-based concept, inquiry process, design process and teamwork in which each element has a different practice style.

In Thailand, the Institute for the Promotion of Teaching Science and Technology (IPST) defines the definition of STEM education as follows; STEM education is the educational management approach that integrates knowledge in 4 interdisciplinary areas including science, engineering, technology and mathematics by focusing on applying knowledge to solve real-life problems as well as the development of new processes or products that is useful for living and work, helping students build interdisciplinary links with real life and with work. STEM learning management is a learning management that focuses not only on memorizing theory or scientific and mathematics rules but also on creating understanding of those theories or rules through real practice along with the development of thinking skills, questioning, solving problems and finding information and analyzing new findings together with applying those findings

or integrating with everyday life (STEM EDUCATION THAILAND, 2014)

As for learning management according to STEM approach, there are five important characteristics namely;

(1) It is a teaching method that focuses on integration.

(2) It helps students to create linking between the content of all 4 subjects with daily life and career.

(3) It focuses on skills development in the 21st century

(4) It challenges students' ideas and

(5) It allows students to express their opinions and understanding that is consistent with all 4 subjects.

And it has the purpose of learning management that is to encourage learners to love and appreciate the value of learning science, technology, engineering and mathematics and see that those subjects are close to their life which can be used every day.

In managing learning according to the STEM approach, teacher is an important factor where the adjustment of learning management process is required including curriculum development. However, changes in the teaching practices of teachers depend on many factors either from internal factors of teachers such as beliefs, values, knowledge and external factors from the environment and executive policies. Integration or linkage is important nature of STEM learning management (Thibaut et al., 2018). In addition, linking is also considered the result of STEM (Barber, 2012). There are various interpretations of linkage in many patterns (Barber, 2012; Bybee, 2013). Based on the study of STEM teaching practices in the classroom, it is found that teachers have different forms of integration or linking (Thibaut et al., 2018) which can be divided as follows ;

Differences in the level of the linking between the integration of multiple disciplines in a Multidisciplinary approach or interdisciplinary integration.

Differences in the focus of linking between equal integration or the focus of integration

Differences in the issues of linking between integration between subjects (Content Integration) or content integration with context (Context Integration)

In this study, the objective of the study, contextual linking patterns are defined. Therefore, linking or integrating other aspects will not be in the extent of this research.

The international assessment of PISA has defined the level of scientific context into 4 levels as follows:

(1) Individual level

(2) Local or national level

(3) Global level

(OECD, 2017)

However, from the definitions, important characteristics and objectives of STEM learning management according to the STEM EDUCATION THAILAND (STEM EDUCATION THAILAND, 2014), this research determines the level of context into the following 3 levels:

(1) Linking to daily life

(2) Linking to locality and society

(3) Linking to careers

Problems in learning management in the Opportunity Expansion Schools

The Schools of Expansion for Opportunity are a school under the Office of Primary Education that aim to provide opportunities for youngsters who complete grade 6 in remote areas to have a higher education foundation. However, it is found that the Schools of Expansion for Opportunities often encounter either administrative problems, curriculum preparation, learning management and equipment shortages (Patcharin Kotsombat et al., 2015; Benja-

porn Jitru, 2016), causing problems in learning management leading to the evaluation results among the School of Extension for opportunities group, the school usually falls in the lower group (Institute for the Promotion of Teaching Science and Technology Ministry of Education, 2018)

From a literature review, from the policy of STEM learning management, teachers are developed about integrated learning, linking of knowledge and context which from the previous researches it is found that the development of teachers' learning management will enable students to change their concepts in learning management. However, learning in the classroom depends on many factors, both the teacher itself and the environment. The School of Expansion is a unique school that is a local school close to the community, the number of students is not high. However, most expansion schools will experience resources and personnel problems.

This research aims to study the science learning management of teachers in the Schools of Expansion for opportunities in contextual links in real classroom conditions by defining research variables as shown.

Research variables

Contextual learning management of science teachers in the School of opportunity expansion in the central region

- The expectation in learning management
- Teaching operation

Research Methodology

1. Research Model

This research is a survey research using Mixed Method Research. Tools used for collecting quantitative data include teaching practice questionnaires and the tools used to collect qualitative data such as interview forms. Data analysis results of both parts

will be used to find conclusions according to the educational objectives.

2. Study Tools

2.1 As for the questionnaire for teaching operation, the researcher studies related documents and research to be used to determine the question and answer so that to be in accordance with the objectives of the study.

2.1.1 Characteristics of the questionnaire are divided into 2 parts as follows: Part 1 Contains basic information of the respondents. Part 2 Contains questions asking about the contextual learning management of science teachers for 7 questions in the form of 4 levels of frequency.

2.1.2 Methods for developing questionnaires for teaching operation. The researcher drafts the questionnaires for teaching practice and provides to the experts to verify for accuracy (Validity) by finding the consistency index between the question and the purpose of the study (Item Objective Congruence Index: IOC)

Subsequently, the questionnaires are tested by experts to improve according to the proposal and find the confidence with Cronbach's alpha coefficient formula.

2.2 Interview Forms. The researcher studies the relevant documents and research works to determine the question in accordance with the objectives of the study.

2.2.1 Issues used in the interview are the reflection of learning management in the past hours and expectations in contextual learning management.

2.2.2 Development methods of interview form. The researcher uses the interview form developed for the experts to check for the accuracy (Validity) by finding the consistency index between the question and the purpose of the study (Item Objective Congruence Index: IOC) and by bringing the

interview data regarding to STEM learning management with linking process with science concepts of teachers to be considered by 3 researchers to find the reliability of the interviewers. (Inter-Observer Reliability or Point Agreement)

3. Data Collection

3.1 The researcher coordinates to target group used in the study and sends a letter of memorandum to the school director to request permission to collect data according to the date and time coordinated above.

3.2 The researcher explains how to perform video recording for the observation, interview, and distribution of questionnaires for the research assistant.

3.3 Research assistants prepare relevant documents, such as consent forms for participation for the target group which will be sent to recipients before the actual data collection for 1 week.

3.4 Research assistant go to the location to collect data according to the date and time that researcher coordinated with detailed explanations related to all 3 types of tools, complete the information process within 1 week and send the information to the researchers for further analysis.

4. Analysis of data and statistics used in the analysis

4.1 Quantitative data analysis. Analysis of data obtained from the teaching practice questionnaire, data for analysis contains frequency statistics, percentages. And data analysis results will be presented in the form of tables

4.2 Qualitative data analysis. Data analysis from the interview form will be conducted for analyzing the content (Content Analysis) and verification for the accuracy of the data by checking the triangle (Triangulation)

Research Results

The presentation of the data analysis is divided into 2 parts. Part 1; presentation of quantitative information and qualitative data on the link-based learning management of science teachers in the Schools of Opportunity Extension in the central region which data from the teaching practice questionnaires are obtained. Part 2 is the presentation of qualitative data obtained from the interview.

Part 1; presentation of quantitative information and qualitative data on the link-based learning management of science teachers in the Schools of Opportunity Extension in the central region.

Contextual learning management of 36 science teachers in the Opportunity Extension School in the central region, the results find tha ; Linkage to daily life is the most accounted for 50-79 percent of the time of teaching 53.00%. Followed by 80 percent or more, representing 36 percent and the last is no linkage is found and no teacher practices accounting for 0.00 percent. As for social linking, no most linking is found accounting for 44.00 percent, followed by 1-49 percent representing 25.00 percent and the last is 80 percent accounting for 8.00 percent. The most professional linkage is 50-79 percent of the time of teaching accounted for 50 percent, followed by 1-49 percent accounting for 31.00 percent and the last is it does not appear the linking, accounted for 8.00 percent. In terms of linking methods by external consultants, 50-79 percent of the time of teaching accounting for 39.00%, followed by 80% accounting for 36%, and the last that is it does not appear linking, accounting for 6.00 percent. As for linkage by inviting speakers; 1-49 percent of the time of teaching accounted for 53.00 percent, followed by it does not appear linking accounting for 28.00 percent and the last is 80 percent or more, representing 3.00 percent.

In term of data linking, it indicates 50-79 percent of the time of teaching accounted for 64.00 percent, followed by 80 percent or more, representing for 36 percent and the last is 1-49 percent. And it does not appear linking, and it does not appear that teachers practice in the percentage of 0.00. As for linking with the problem, the results contain 1-49 percent of the time of teaching accounting for 61.00 % , followed by 50-79 % accounting for 28 percent, and the last is it does not appear to link accounted for 3.00 percent. Results are presented in Table 1

From Table 1, the contextual linking model used most frequently by teachers in the sample group is they use a variety of data sources (item 6), followed by consideration of real-life problems

(item 1) and consultation and advice from experts (Item 4), respectively. However, the sample group of teachers uses the learning resources in the community in less proportion, 44 percent of them never use the learning resources in the community at all. In addition, for adjustment of learning (item 5 and 7) is still found in a low proportion.

In addition, the sample teachers reflect the linking of learning activities, the context of learning management in the past hours in the interviews in which examples of teacher answers that illustrate the concept of contextual links as follows ;

“The content of the course is integrated with teaching, such as in building a boat to match with the content regarding force, buoyancy, drowning,

Table 1. Linking learning management of science teachers in the School of Opportunity Extension in the Central region

N=36	Managing for learning with contextual links	Above 80 %	50-79 %	1-49 %	Not found
1	Consider real-life problems related to course content and plan to solve that problem	36.00	53.00	11.00	0
2	Use community learning resources, such as inviting speakers, educational resources, learning resources, local businesses or establishments etc..	8.00	22.00	25.00	44.00
3	Explore the possibilities of occupations related to STEM groups or education to develop professional skills.	11.00	50.00	31.00	8.00
4	Consult and seek advice from experts, professors or professionals in the science / mathematics field.	36.00	39.00	19.00	6.00
5	Invite external speakers to lecture or organize excursions in real places related to the content being studied.	3.00	17.00	53.00	28.00
6	Use various sources of information such as from newspapers, television, academic journals or publications on the inquiry for contemporary problems and inventions or new knowledge related to science, mathematics or technology	36.00	64.00	0	0
7	Project-based learning	8.00	28.00	61.00	3.00

drowning, children can apply this in everyday life by the invention of the wind arrow to allow students to understand the exact direction of the wind. This can be applied in daily life as parents of most students engage in fishing and they need to look for the wind direction”

“It can be applied about the use of the substance in the daily life of students, such as in occupation, in the kitchen, where logical thinking can be applied. For example; some families have an occupation in opening restaurants, they will understand the various mass that is added to cooking. “”

“It can be applied to explore the environment near their homes or school to see if the ecosystem in the school is complete? Or lack of life. There is any life that is too little or too much. For example, as for the plant, it is less, how does it affect the ecosystem?”

Based on these information from interviewing, it can be seen that there are teachers in the sample group that consider the links which correspond to the data in the questionnaire where the links contain both information and organizing the learning process that students solve real problems in which results from the questionnaire suggest that Contextual learning management by modifying learning management provide students to have a small proportion of roles

Part 2: Expectations of Contextual Learning Management. From the analysis of the content of the participants’ responses from the interview, findings can be divided into 2 issues

Issue 1: The expectation of contextual learning management is divided into 4 sub-issues.

1.1 Comprehensive use of media and examples

“Adding various substance to the experiment is required to have a variety to make children see the difference more clearly ”

“Use games to develop students’ potential to participate in all activities, such as represent each individual as different things in a cycle.”

1.2 Learning from real conditions

“Allowing students to experience the real ecosystem, students can learn in a way that they can touch and stay close to a concrete system”

“Actual food is needed for experimenting with carbohydrates for children to learn”

1.3 Process that students participate

“It is required children to prepare their own equipment better than the teacher preparing for them since they may be more successful in making”

“Changes on activity are needed by allowing students to design all activities of the experiment with having teacher gives advice”

1.4 Summary of lessons for linking

“Since the duration of presentation is not sufficient, in the final summary, adding concepts is needed so that students extend thinking for example “For this disease, what kind of fruit that contains vitamin should be eaten to cure”. And adding test after study is also needed..”

Issue 2: Problems and obstacles for contextual learning management

2.1 Equipment shortages

“Adding various substance to the experiment is required to have a variety to make children see the difference more clearly”

“It is required children to make their own slides, children to cut, seek and look the plants by their own by the problem is that there are no microscope and other equipment”

“Experimental materials are needed for students to experiment, for students to experience and practice for better understanding.”

2.2 Insufficient Time

“The last leaning session period, no concept was left. It has little summary since most of the con-

tent has not covered it must be continued to the next session”

“A final summary is needed for adding some content since the time for presentation and conclusion is limited. It requires Adding ideas for students to think like “For this disease, what vitamins in fruit should be eaten? and adding test is required after study.”

2.3 Diversity in the ability level of learners

“Increasing the number of teachers in the period is needed because children in the room have low learning skills, many people need to focus on this group of children”

Qualitative data reflects the expectations of teachers in contextual learning management in 4 issues, namely media use, accessibility to a wide range of information, learning from the real situation, participation in the learning process of students and the conclusion of the lesson to be linked. However, from the teacher's answering, it reflects the obstacles in contextual learning management in 3 issues: lack of equipment, insufficient time to manage learning and a variety of learners' abilities

Discussion and suggestions

This study reveals that research participants use different forms of linking learning management in different forms. These differences may be caused by different knowledge, experience, and beliefs (Pang and Good, 2000). If considering the pattern of linking of Barber (2012) from the contextual linking patterns found in this study based on the criteria of linking, it has different forms of application in different situations which can be divided into two levels: linking at the level of information, knowledge through the presentation of teachers and actual application through project activities. And the results from the research indicate that teachers rather have linking at the level of knowledge information through the presenta-

tion of teachers. This linking focuses on practical use in different contexts which can be seen that linking patterns that provide students the opportunity to use their knowledge in different contexts. This is a challenge for teachers. There are also obstacles for teachers in the schools of expansion like limitations of time and resources which shows that teachers need resources to support including techniques and strategies for effective learning management under limited time as well as skills in developing learning activities linking to the local context.

Future researches should, therefore, study the context of learning management in the real situation for what is the cause, factors that make these contextual operations not to be implemented. This information will reflect the policy level in order to be aware of the obstacles of contextual learning management caused by media, equipment, time for learning management and co-learning of children with different abilities including studying for the patterns of teacher development in the schools of opportunity expansion to be able to manage STEM learning that can be effectively linked to local resources.

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