

STREAM Education Curriculum for Primary Thai Language Teachers and School Implementation

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Abstract

This research employed mixed method for development curriculum for primary Thai language teachers according to STREAM education. The participants were 17 volunteering primary Thai language teachers for curriculum development and 110 primary students from 6 primary schools for curriculum implementation. The findings revealed that teachers were well-versed in the STREAM education curriculum, and that instructional management was at a high level. Thai teachers were capable of developing a STREAM-based integrated curriculum and learning management system. Students can improve their reading, writing, and analytical thinking skills as a result of the implementation. The result is fruitful for teachers and students in self-development, learning skill, and learning competency by employing integrated approach. Indeed, STREAM education should be more continuously improved and invite to school curriculum and instructional practices based on different contexts.

Keywords: Learning achievement, Self-development, STREAM education, Teacher competency

1. Introduction

The education of future generations is a primary issue for the world's educational authorities. Because of advancements in educational technology, knowledge building and development, and the nature of young learners, the uncertainty situations and underestimating environment in the world of learning are changing. Tomorrow our classroom needs talents that students can design learning process to have proactively and creatively solve in socio-cultural problems. We cannot determine solution in problems that it will be of a complexity with diverse aspects. The previous solution cannot be solved with rapidly changed in knowledge, it will function and challenge our society with convergent knowledge and creative problem-solving abilities will play a core role in the future (Chen, 2010; Kim & Kim, 2016). STEM education is an integrated approach to worldwide education, it needs to invite to curriculum and school activities (Siribunnam et al., 2019; Nuangchalerm et al., 2020a). That is, teachers and educators should be try the alternative choice by integrating in what they should know based on creatively practices about science, technology, engineering, and mathematics.

The new approach needs to expand concept of STEM to STEAM education (Shin & Han, 2011; Kim et al., 2012; Yakman & Lee, 2012; Lee et al., 2013; Guyotte et al., 2014; Kim et al., 2014; Lim et al., 2014; Sim et al., 2015; Liao, 2016). STEAM education is emerged and expanded through STEM education. The ultimate goal of STEAM education is fostering convergence talents in new era, the concepts of improving students' interest as well as nature of learning, connecting the scientific principles with their real life activities, and enhancing creative-problem solving (Park et al., 2012; Park et al., 2016; Kim & Kim, 2018). Yakman (2008) claims that STEAM education is an integrating concept, makes students learn how to do in holistic education. Students can think and do in the possible ways. As its accordance with educational plan throughout the goal of raising creative and convergent talents who enjoy learning and also practiced various supporting policies to strengthen science, technology, engineering, arts, and mathematics education in primary and secondary schools (English, 2017).

STEAM education consists of multi-disciplinary which students can learn from their learning potential, learning experiences are designed based on theory-laden daily life. It helps students realize how to learn and focus by emphasizing higher-ordered thinking while increasing students' learning motivation in suitable situations, arousing their curiosity about mathematic and scientific learning in connection with their real life activities (Bybee, 2010). STEAM education aims to increase students' science-learning efficacy, confidence, and interest in science in order to motivate them to study science better rather teaching them from concepts in the field of science technology (Ching et al., 2019). This is an alternative education that students can improve self-directed learning, solve various problems in a creative and integrative ways, promoting their abilities to hit the highest potential in 21st century skills, increasing their understanding in convergent knowledge (Kim, 2011; Kim & Keyhani, 2019).

Since STEAM education, the paradigm shift is fluctuating in the new learning environments. Instructional practices based on real-life is now in reforming era that calling for

students-centered approach, is well-designed classroom. The concept of integration view seems to be best for contemporary education (Kang, 2019). In real-life science, art, and other related disciplines can be embedded to integrated approach to different classroom contexts (Pavlou, 2020). At this moment, term of integration approach, is well-defined by different purposes. We cannot reject concept of holistic education due to anything are connected. The learning outcomes are networking which results in various kinds of methods and processes. The world is now uncertainty due to technology and science are developed, it influences to our society by forms i.e. political, economic, social, and technological factors. The key success of students had the source of learning competency, quality of students come from quality of teachers. That is, teacher should adapt and adopt teaching strategies to fit with the era of social change (Tondeur et al., 2019; Kinloch et al., 2020). The real-life situation of students cannot be separated from the truth of integration, but educational system and existentialists make students far from the purposes of changing world.

This study employed STREAM education which consisted of science, technology, reading, engineering, arts, and mathematics as curriculum and instructional areas. It is developed as Thai contexts, employed to improve both teachers and students in self-development, learning achievement, and affective dimension. STREAM education curriculum needs students to have effectively learning, necessary learning skills for tomorrow is prepared. Students should know necessary contents and tools of learning to face with future. Education should provide suitable contents and ways of improving thinking, teachers can employ different methods of teaching and strategies in relation to school contexts. But teachers tended to focus concept is distributed to various kinds of school management and teachers' practice. Thailand needs to improve curriculum management and learning management through alternative and effective education practices for students' learning quality in 21st century (Prasertsang & Nuangchalerm, 2018; Nuangchalerm, 2018; Listiana et al., 2019; Nuangchalerm et al., 2020). The study is initiated curriculum for primary Thai language teachers to design and manipulate their classroom based on integration approach. They are key success of students' achievement and lead national future through concept of holistic education for all.

Teachers are critical role in classroom to change students 'learning and their abilities through various kinds of methods, instructional practices, authentic assessment. Teachers have to understand curriculum design and planning, integrated learning, professional learning community, and enhancing 21st century learning skills. It also can be said that teachers and holistic approach in lesson design is a necessary pedagogy. Teachers can tailor their classroom within knowledge, skill, and attitude that are required for classroom successful (Tigelaar et al., 2004). Teaching competency is classified into two areas: theoretical competency and practical competency. It is defined as the theoretical basis for teachers to successfully perform subject matter education in the changing world, teachers' effectively performing subject-matter education in actual classes as contextual appearance (Hahn et al., 2016). Theoretical and practical competency are both further classified into lecture and general competency (Kim et al., 2014). Teachers are key important factor to shape quality of education, teachers act as change agent to students' effective learning (Prachagool et al., 2016; Mitchell et al., 2017).

The research adopted STREAM education by aiming Thai language primary teachers who joined development competency program, the program for enhancing teachers' competency of curriculum management and learning management of Thai language primary teachers. The program purposes to help primary students in reading, analytical thinking, and writing (Chomphara et al., 2021; Srisawat, 2021). STREAM education, teachers have competencies to develop creative young citizens for the real-life in the future global. Reliable knowledge and process of science can promote student do and scientific thinking (Baran et al., 2016; Scaradozzi et al., 2019), and based on the concepts of improving students' interest, connecting the principles studied with their real life, and enhancing convergent thinking (Park et al., 2016).

Therefore, there is a need for a way to promote effective learning experiences for children. So that they can solve problems overcome obstacles and grow to be a quality citizen with a career path, helping to develop a livable and happy society in an uncertain world society. STREAM education and competencies as key words in this research for building in-service teachers to initiate their curriculum and instruction based on integrated learning. The research examines competency STREAM education of primary Thai language teachers from development model.

2. Materials and Methods

2.1 Participants

As a method to develop STREAM education curriculum for primary Thai teachers, the participants were 17 volunteering primary Thai language teachers who joined development program, the program for enhancing teachers' competency of curriculum and instruction management. The program purposes to help teachers had understanding about STREAM education in terms of design and implement through integrated approach. Teachers have to design their course and conducting lesson plan which appropriate their classroom.

Especially, the concept of STREAM education for Thai teachers and their role in helping primary students in reading and reading, and analytical thinking that are basis of development in young learners. Seventeen Thai language teachers who have been teaching in primary school level from Surin province, Thailand. Thai language teachers are mostly female, young teachers 20-30 yrs, and having teaching experiences between 0 and 5 years. They are the most of new generation of primary teachers, ready to learn new things, concerning integration practices as well as educational policy.

Students from 6 primary schools were participated in the process of curriculum implementation. One hundred and ten primary students to enhance learning achievement by STREAM education curriculum is target group of study. They are purposive sampling through the program of teacher development by STREAM education school project. Six schools are located in Surin province, Thailand. These school are ready to develop students as integrated approach designed during the program of study.

2.2 Research Instrument

The research instruments on the development model of curriculum management and learning management competency of Thai language teachers according to STREAM education to enhance reading achievement analytical thinking and writing for primary school students consisted; Questionnaire about the problems and needs of learning management for STREAM education, Semi-structured interview form, assessment form model of developing competency 4 element 5-rating scale 18 items, True or False test 36 items reliability 0.85, design curriculum management and learning management evaluation 5-rating scale 17 items reliability 0.86 that translate and improve from the origin was Korea Foundation for the Advancement of Science and Creativity (2016), teacher competency evaluation 5-rating scale 7 elements 41 items reliability 0.89 that translate and improve from the origin was B. Kim and J. Kim (2016), satisfaction 5-rating scale 24 items reliability 0.87, reading achievement test, analytical thinking test and writing test reliability 0.81, and overall index of item of objective congruence 0.60-1.00. That is suitable for data collection in the experiment.

2.3 Data Collection

This research was a mixed research. For quality data collection by inquiry and in-depth interviews with 8 primary Thai language teachers, and quantitative data collection by five professional assessment the model of curriculum management and learning management competency of Thai language primary teachers on STREAM education, pre-test and post-test before and after the workshop on STREAM education for 17 Thai language primary teachers in Surin province, held on 2-day period in February 2020, and three month for implementation model development with coaching and monitoring.

An evaluation of Thai language primary teachers' competency, competency of design curriculum management and learning management, satisfaction on model of curriculum management and learning management competency of Thai language primary teachers according to STREAM Education. Then, implementation curriculum is conducted between February and April 2021. Students are manipulated in testing reading achievement, analytical thinking and writing skills. Data were analyzed in terms of percentage, mean, standard deviation, and dependent t-test.

2.4 Data Analysis

Satisfaction towards STREAM education curriculum can be calculated and interpreted by indicating into assessment the model of developing competency 4 element 5-rating scale, 5-rating scale levels of mean for interpreting: highest (4.51-5.00), high (3.51-4.50), moderate (2.51-3.50), low (1.51-2.50), and lowest (1.00-1.50). Data were analyzed by descriptive statistics, percentage, mean, standard deviation, and dependent t-test.

3. Results

3.1 STREAM Education Curriculum and Instructional Management

STREAM education curriculum and instructional management for primary Thai language teachers can be drawn in Figure 1. The curriculum allows teachers understand integrated

approach and how holistic education in terms of STREAM education is effective in their different classes. The curriculum helps teachers design their process and content which relevant to learning activities. STREAM education enhances reading achievement, analytical thinking, and writing skills for primary school students.

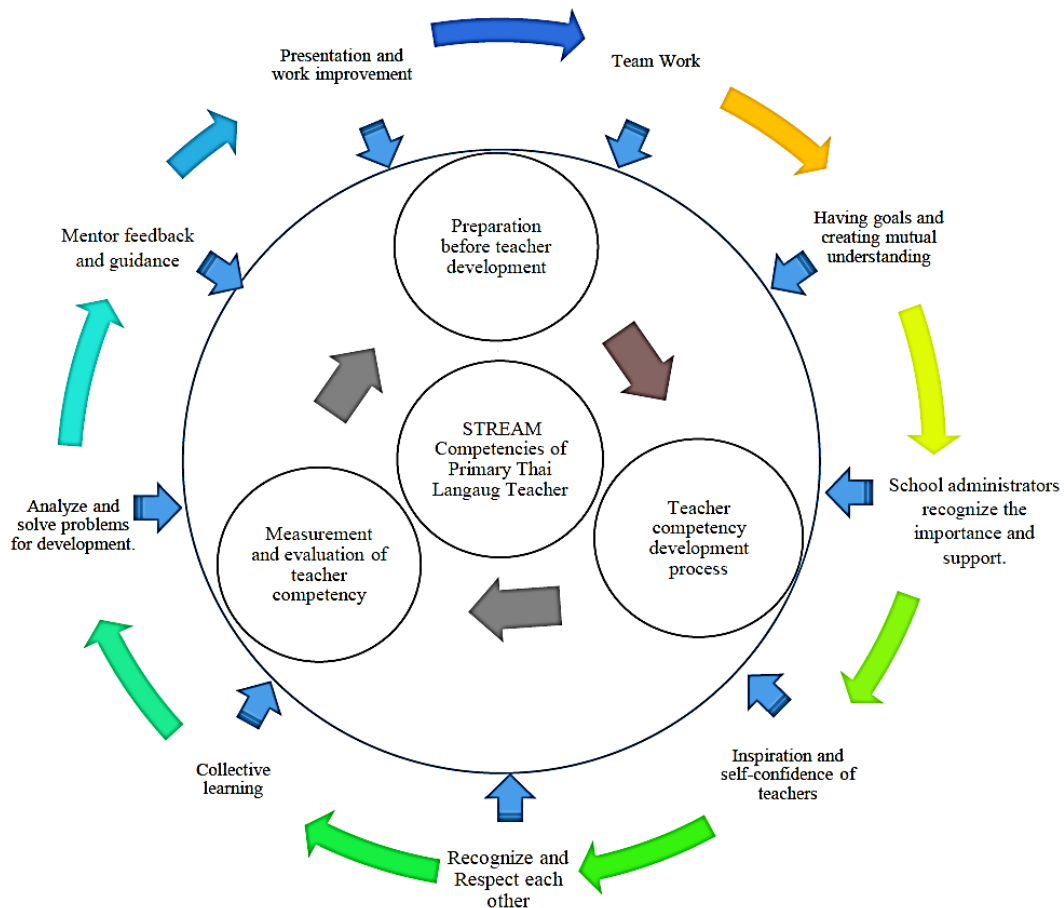


Figure 1. STREAM education curriculum and instructional management for primary school

The STREAM education curriculum consisted of 4 components: (1) preparation components before teacher development, (2) components of teacher competency development process, (3) Components of mechanism for teacher competency development, and (4) the measurement and evaluation components of teacher competency. Teachers have to understand and employed this concept into instructional practices. The curriculum is verified by experts in 4 issues: utilities, feasibility, suitability, and accuracy. It can be concluded that the overall quality of curriculum is at the highest level and ready for teachers use in their classroom.

Teacher had understanding about STREAM education curriculum and instructional management, then they were examined post-test after participate program of teacher development in STREAM education for Thai primary teacher project. They had post-test higher than pre-test scores with statistical significance at the level of .05 (Table 1).

Table 1. Teachers' understanding of STREAM education curriculum instructional management

Test	\bar{X}	Mean Difference	S.D.	t	df	Sig. (2-tailed)
Post	29.17	8.23	4.38	7.751	16	0.000
Pre	20.94					

Primary teachers had understanding STREAM education concept after development by self-assessed that they can gain more knowledge and concept in holistic approach through the program of study. Even though they are Thai language teachers, but STREAM education can be designed for different classroom and school contexts. They change their opinion and concept to integrate other disciplines into their class with modern curriculum (Table 2). They had perception in moderate level before program of development, then the process can improve their perception was at high level in after program of development.

Table 2. Teachers' perception in ability to design curriculum and learning management about STREAM education between before and after program of study

Perception	Before			After		
	\bar{X}	S.D.	Interpret	\bar{X}	S.D.	Interpret
1. Understanding of subjects	3.76	0.37	High	4.75	0.35	Highest
2. Teaching-learning methods	3.36	0.41	Moderate	4.42	0.38	High
3. Inducing learners to participation	3.36	0.57	Moderate	4.30	0.56	High
4. Understanding of learners	3.64	0.35	High	4.69	0.40	Highest
5. Learning environments and circumstances	3.70	0.45	High	4.58	0.34	Highest
6. Evaluation of learners	3.19	0.60	Moderate	4.01	0.50	High
7. Individual qualification	3.16	0.55	Moderate	4.21	0.57	High
Overall	3.44	0.37	Moderate	4.41	0.34	High

The level of perception was developed between pre- and post-development program. The overall view can be indicated that they had high level, each item in which showed highest level consisted of understanding of subjects, understanding of learners, and learning environments and circumstances as in the following. Also, teachers had perception in ability to design curriculum and learning management according to the concept of STREAM education with the high quality (Table 3).

Table 3. Teachers' ability to design curriculum management and learning management

Item	\bar{X}	S.D.	Interpret
1. Is the class appropriate for the purpose of nurturing talents for integration?	4.56	0.65	Highest
2. Is the class designed to increase the students' interest in scientific technology?	4.43	0.65	High
3. In the theme related to scientific technology in the real world?	4.21	0.55	High
4. Is the program designed to cultivate the integrated thinking abilities of students?	4.29	0.62	High
5. Does the class present problematic situations for student to solve in the real world?	4.27	0.59	High
6. Is it a specific situation that can arouse the interest of students and appropriate for their level?	4.14	0.57	High
7. Is the process of creative design clearly revealed for the students to think about how they will solve the problem?	4.15	0.62	High
8. Is the class made up of activities focusing on play and experiences, and is there a process for the students to personally devise and think about the issues at hand?	4.26	0.57	High
9. Is the class made up of activities for search to read for understanding and comprehension, can analyze and write solutions at hand?	4.25	0.61	High
10. Is the class designed for various results (or ideas) to be presented by each students (or group) as a result of creative design?	4.07	0.60	High
11. Is the class designed for students to solve problems using devices from the real world?	4.27	0.63	High
12. Are the contents presented in the context presentation step for students to feel the joys of success in solving a problem?	4.23	0.67	High
13. Is the class designed for students to solve problems through cooperation in coming up with their results?	4.39	0.65	High
14. Is the class guided for students to challenge new tasks through the process of solving problems?	4.09	0.74	High
15. Is it made to evaluate the experience of success for students having solved the problem?	4.23	0.68	High
16. Are various results (ideas) analyzed in the evaluation of students?	3.99	0.53	High
17. Is the aim to conduct not a results-focused evaluation but rather an evaluation focusing on the process and its steps?	4.34	0.66	High
Overall	4.24	0.64	High

Teachers also express their satisfaction towards the program of development. They had level of satisfaction towards STREAM education curriculum and instructional management for primary Thai language teacher project was at the highest level (Table 4).

Table 4. Teachers' satisfaction towards the program of development

Item	\bar{X}	S.D.	Interpret
1. Preparation components before teacher development	4.65	0.42	Highest
2. Teacher competency development process	4.53	0.33	Highest
3. Mechanism for teacher competency development	4.48	0.40	High
4. Measurement and evaluation components of teacher competency	4.71	0.39	Highest
Overall	4.55	0.33	Highest

Teachers were very happy with the STREAM curriculum, and the instructional management program was excellent. The following diagram depicts the components of teacher competency measurement and evaluation, preparation components prior to teacher development, teacher competency development process, and method for teacher competency development. Teachers were then trained in the understanding and affective dimensions of STREAM education and prepared to put it into practice through instructional techniques.

3.2 Curriculum Implementation and Students' Achievements

Teachers designed their lesson plans based on the concept of STREAM education during the experimental phase of curriculum implementation. The reading, writing, and analytical thinking pre-tests were examined. The post-test was administered after teachers' educational activities. The statistical analysis was utilized to compare before and after instructional management scores (Table 5).

Table 5. Comparison of reading, writing, and analytical thinking of primary students (n = 110) through STREAM education instructional practices

Achievement	Test	\bar{X}	Mean Difference	S.D.	t	df	Sig. (2-tailed)
Analytical thinking	Before	5.27	1.03	1.09	9.58*	109	0.000
	After	4.23					
Reading	Before	4.12	1.16	0.65	18.57*	109	0.000
	After	2.96					
Writing	Before	6.54	1.96	1.63	12.58*	109	0.000
	After	4.58					

Note. *p-value < .05.

The scores showed mean differences between before and after STREAM education was implemented in schools. After learning at, students' reading, writing, and critical thinking scores were higher than before. Statistical significance is set at a level of .05.

4. Discussion

STREAM education curriculum and instructional management for primary Thai language teachers emerged from a process to explore the problem state and needs of teacher competency development. Curriculum needs teachers understand what and how integrated approach works in the school. It is not difficult to design and manipulate classroom for increasing students' learning abilities in and out schools (Altan et al., 2019). Teachers have to stay at their curriculum and reflect in what students should be learned and should be developed in the suitable education. Teachers are key success in all dimension of teaching and learning due to they know in what students' needs and how to pay attention in classroom activities (Herro et al., 2019; Yuenyong, 2019). Thus, teachers obtain positive information through students-centered approach. Students can construct their way of learnings and reflect of what and how to learn.

Findings revealed that curriculum for teacher development in STREAM education can be used and validated in terms of feasibility, usability, suitability, and accuracy standards that meet the concept of Pugach et al. (2020), a pattern validation by a qualified person by analyzing in-depth criticism from experts who have specialization in particular of program in teacher development. The curriculum is appropriate to primary teachers due to concept of integration and it can gain necessary learning skills (Nuangchalerm, 2017; Chu et al., 2019). They can think and do towards how teachers and students learn by the modern learning environment. The concept of integration is not new to education, but it seems to be forgotten by content-based education. Some teachers may be not understandable national standards curriculum which written only standards and learning indicators. Teachers have to analyzed its and generate to other disciplines, meet the requirements of students' needs, and construct the necessary learning skills to them.

Teachers, primary Thai language or other subjects can employ STREAM education to their classroom practices. The empirical data showed that teachers can designed curriculum, lesson plans, instructional, practices, and learning assessment as well. According to Abd Razak et al. (2009) states that the development of program for teacher or curriculum is a systematic setting, related and interrelated concept to clearly point out what a pattern offers. The development of patterns may have different stages of work. The details of each step depend on the research framework. It represents concepts, objectives, goals and methods that will lead to change for the better (Brown & Bogiages, 2019; Thaibut et al., 2018).

Teachers had understanding about curriculum and instructional management, then practical setting can help teachers more understanding of how STREAM education can gain students' learning abilities. However, teachers have to have self-development in the initial process before leads students learn in effectively. They design curriculum, lesson plans, and manipulate integrated instructional practices by their best. The implementation phase showed how teachers employed suitable concept into their classroom. The limitation and barrier of instruction in each school and classroom may be different, but teachers can imply the process and methods which suitable for them into practices (Ring et al., 2017; Srikoorn et al., 2017). Teachers have knowledge and understanding through the program of development, the empirical instruction will be productive depend on action learning.

The implementation, STREAM education can gain students' learning abilities to hit goal of education by integrated learning. Students have reading, writing, and analytical thinking in higher scores than those before implementation (Intasena & Nuangchalerm, 2022). The previous studies reported that analytical thinking and language skills are correlated (Baharin et al., 2018; Petek & Bedir, 2018; Prawita & Prayitno, 2019). Also, STREAM education can be conducted in any level of study in both primary and secondary schools. It is not only used for science and mathematics subjects, but also any subjects can be done through the concept of integration. The unit plan is the significant thing for lesson designed in relation to STREAM education. Students can make a link from one subject to other subjects by connection of contents or processes (National Academies of Sciences, Engineering, and Medicine, 2018).

It can be discussed that STREAM education is a point of integrated approach for teachers in lesson plan, instructional practices, and monitor how students learn. Teachers have to understand the linkage between contents and process which relevant to nature of students' learning. The most effective curriculum and instruction starts with teacher development, conditions of trainees before training who are prepared and motivated to receive training learn better than those who are not ready and without motivation (Ugras, 2018; Julià & Antolí, 2019; Suebsing & Nuangchalerm, 2021). The motivation is the expectation of the results obtained from the training to lead to better performance. Teachers can improve their curriculum and instructional practices based on knowledge and understanding, thinking creatively, and doing continuously that is appropriately training activities and courses can develop such skills (Darling-Hammond & Hyler, 2020; Darling-Hammond et al., 2020). Effective teachers make students to have learning inspiration and find their highly potential of learning.

5. Conclusion

Teachers play an important role in the development of curricula and the implementation of successful instructional practices. The essential content that motivates instructors to enhance curriculum is STREAM education. The integrated method is a hidden goal for primary Thai language teachers' self-development, allowing them to demonstrate their strengths in lesson design, effective instruction, and honest evaluation. Students can improve their reading, writing, and analytical thinking skills as a result of the implementation. The outcome is beneficial for both teachers and students in terms of implying comprehensive education in order to improve learning experiences. STREAM education should be more consistently utilized in school curricula and instructional approaches in the future studies.

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