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The Supervision Of Stem Educational Learning Activities Of Primary Level In Private Schools

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Abstract

The purpose of this research was to develop the supervision model of Stem Education learning activities of primary level in private schools and to evaluate the use of the model through research and development. The findings were found that the supervision model of Stem Education learning activities of primary level in private schools gained suitability, feasibility and usefulness at the highest level, which consists of principle of the model, the procedure called "PIE Supervision Model" that comprises Preparation (P); Implementation (I); Evaluation (E), evaluation of the use, and success condition. The results of the supervision model of Stem Education learning activity of the primary level in private schools revealed that the teachers gained higher score than before using the model. The teachers' performance on Stem Education learning activity and the supervision were at the highest level. In addition, the result affecting the students after providing the Stem Education learning activities was at the highest level. And the satisfaction of the teachers towards the supervision model of Stem Education learning activity of the primary level in private schools was the highest level as well.

Keywords: *Supervision Model of Learning Activity, Stem Education*

Background of the Study

Thailand focuses on human resources (Kerdpitak & Jermsittiparsert, 2019), stem with skills, and productivity of the nation and promote the management of stem education by requiring improvement and development of the public individuals to be creative and innovate in order to perform official duties and government administration with efficiency (Jermsittiparsert, Sriyakul, Pamornmast, Rodboonsong, Boonprong, Sangperm, Pakvichai, Vipaporn, & Maneechote, 2016a, 2016b). The National Education Plan 2017-2036 has defined a target for learners (Learner as privations) that aims to develop all learners to have characteristics and learning skills in the 21st century, with the goal of providing the basic educational institutions to arrange the education based on curriculum that aims to develop learners with characteristics and learning skills in the 21st century (Secretariat of the Council of Education, 2017). One concept used in educational management that is important to learners is STEM Education: Science, Technology, Engineering and Mathematics Education. It encourages the students to have the skills of critical thinking and creating innovations that use knowledge in sciences, mathematics, technology and engineering design process of learning activity management to develop for quality human resources with thinking skill, learning, capability of applying knowledge for problem solving, and innovation creativity to develop the country for progression (The Secretariat of the Council of Education, 2016).

Educational quality, along with science and technology skills affects the human resource development and the country's economy in which Thailand is experiencing problem regarding educational quality of Sciences and Mathematics. According to the evaluation of PISA and TIMSS, the results are lower than the national average of Organization for Economic Co-operation and Development (OECD). This is probably because the students do not really understand the lessons which they are taught with memorizing. It causes them to unable to connect knowledge to overall image and unable to apply those lessons in real life. Therefore, this must be accelerated for the development of competency, critical thinking and application, in particular, the areas which are defined as the main subject for international assessment, namely Mathematics and Sciences. Educational quality, along with science and technology skills affects the human resource development and the country's economy in which Thailand is experiencing problem regarding educational quality of Sciences and Mathematics. According to the evaluation of PISA and TIMSS, the results are lower than the national average of Organization for Economic Co-operation and Development (OECD).

This is probably due to the students do not really understand the lessons which they are taught with memorizing. It causes them to unable to connect knowledge to overall image and unable to apply those lessons in real life. Therefore, this must be accelerated for the development of competency, critical thinking and application, in particular, the areas which are defined as the main subject for international assessment, namely Mathematics and Sciences. As mentioned above, Stem Education would help the students in educational system gain stem skill and well enhance technology and innovation competency of the people in working age (Chulawatanathon, 2013; Chiangkun, 2016; Siriphatrachai, 2013; The Secretariat of the Education Council, 2017; Rachdawong CEO, TMA, 2015). Thailand pays attention to the development of human resources on stem and helps for productivity of the country and promote the management of Stem Education. In the past, integrated learning management that is consistent with the concept of STEM Education is still unclear in practice resulting in being unable to proceed efficiently. It is necessary to make an understanding of Stem Education by focusing on the learners to think as if they have necessary skills and competencies to life, careers and country development. One of practices is to develop teachers to have knowledge and understanding in Stem education so that STEM teachers have the ability to develop the students, including to create understanding among school administrators and educational personnel in order to create the capacity for supervision in the development of stem skills effectively. In addition, it is to provide the educational management which is in line with learning in the 21st century (Phonsima, 2011; Chanprasert, 2013) by setting a goal for the basic educational institutions to provide education in accordance with the curriculum aimed at developing the learners to have more characteristics and learning skills in the 21st century (Office of the Education Council, 2017).

Private education is involved in the development of education to improve the students into potential human beings, to be power of the country development, to be responsible for providing the basic education to up to 2.2 million learners who are still experiencing a problem of learners' quality. Average scores of learning achievement based on O-NET and PISA are generally lower than the criteria (50 percent, because teaching and learning process is still more focused on memorization than learning from practice. It is not consistent with learning in the 21st century and does not serve a purpose for the development of human potential to achieve the goals of the country development. Also, it is related to the supervision of the Stem Education learning activity management of primary level teachers in private schools of Ranong Provincial Education Office , found that the teachers still lack knowledge and understanding of the integrated curriculum for Stem Education, Stem Education learning activity, evaluation and assessment. Moreover, most teachers are not able to organize Stem Education activities that are related to the 21st century learning as effective as expected. Internal supervision for promoting Stem Education learning activities was at a low level due to lack of supervisors. The supervisors also lack knowledge and understanding in educational supervision and lack of internal supervision system (Ranong Provincial Education Office, 2017). Office of the Private Education Commission therefore establishes guidelines for the development of learning management process in order to improve the quality of education for the students to meet standards and strengthen them with skills of the 21st century by developing the curriculum of the basic education institutions and learning management styles, improve the learning process that encourages them to learn from real practice. Consistent with brain development in each age range that focuses on developing basic skills in science, technology, engineering, mathematics, arts, and foreign languages, as well as promotes integrated learning process to develop critical thinking (Office of the Private Education Commission, 2016) so that the students obtain quality education with standards in accordance with the learning skills of the 21st century, which develop the students according to STEM Education. This helps enhance the students for critical thinking and create innovation using knowledge in science, mathematics, technology, and a process of engineering design in learning activity management.

Educational supervision is a collaborative process between supervisors and teachers emphasizing on the quality of learners and education in helping, promoting and supporting each other. It is a way to help build relationships between fellow teachers and administrators. The supervision is the development of teacher's learning management that affects learning quality of the learners to achieve the specified objectives (Laoriandee, 2013). It is an important process assisting to improve teaching quality of the teachers affecting the quality of learners (Glickman, Gordon & Ross-Gordon, 2007). It is the model of teacher development that is prepared for changes, namely: individually guided; observation and assessment; feedback; involvement in a development process; training;

transforming; inquiry; action-based research; quality circles; and total quality management (Sparks and Loucks Horsley, 2001). The supervision to promote Stem Educational learning activities need to be implemented in order to prepare the teachers for improving quality of learning activities. it also helps the teachers to have up-to-date knowledge, and receive suggestion or supervision from an expert that would help to successfully solve problems.

From the problems of organizing Stem Education learning activities at the primary level in private schools, together with the need of promoting Stem Education learning activity management of the primary level in private schools to be related to the target of human potential development and be consistent with the national development direction of the Office of the Private Education Commission and the purpose of educational management in the 21st century. Therefore, the researcher would like to study and develop the supervision model of Stem Education learning activity management of the primary level in private schools so as to develop the supervision model and to evaluate use of the model as a guideline to promote Stem Education learning activity management of the primary level in private schools and be able to provide the supervision for developing the quality of Stem Education learning activity management with effectiveness.

Literature Review

The supervision model of Stem Education learning activities of primary level in private schools has been conducted with concepts, theories and related studies, namely: the concept of development of professional learning community of Wichan Panich (2012); Watchara Laoriandee (2013); Rungratchadaphorn Wehachart (2014); Charinee Triwarunyu (2014); Glickman and others (2007); Hargrove (2000); Beach and Reinhartz (2000); Corria, M.P. McHenry, J.M. (2002); Blanchard and Thacker (2004); Knight (2004); Wiles and Bondi (2004); Dunne K. and Villani S. (2007); DuFour and others (2010); Avalos (2011); and Toby (2011), consisting of Preparation (P); Analysis (A); Media Prparation (M); Implementation (I); Awareness (A); Classroom Observation (C); Developing (D); and Learning Good Practices.

The concept of Stem Education learning activity management of Wichan Panich (2012); the Secretariat of the Council of Education (2016); Institute for the Promotion of Teaching Science and Technology (2014); Suphanee Chanprasert (2015); Dusadee Yolao, et. al (2014); Naphasiri Kritsanan (2017); Pinyo Wongthong (2017); Pornsawat Songkwae (2017); Chamrat Inthalaphaphon (2015); Lantz (2009); Fioriello (2011); Herschbach (2011); Chen (2012); Pucha and Utschig (2012); Wayne (2012); Bybee (2013); Center for Mathematics Science and Technology of Illinois State University (2013); and DeLuca and Lari (2013). The procedure can be concluded as the design of integrated Stem Education learning unit, innovation and learning sources, Stem Education learning activity management, learning atmosphere management, and evaluation and assessment.

The concept of model development using research and development process of Thitsana Khammanee and Soison Sakonrak (1997); Thanet Khamkerd (1997); Uthai Bunprasert (2000); Viroj Sarattana (2007); Nonglak Wiratchai and Suwimon Wongwanit (2001); Pharit Siribanpitak (2007); Sirichai Kanchanawasi (2016); Guskey (2000). The procedure can be summarized as Analysis, Design, Development, and Evaluation.

Methodology

This study was conducted with research and development by implementing in 3 phases, which are studying the current and desirable conditions of the supervision model of Stem Education learning activity management for primary level in private schools, the development of the supervision model for enhancing Stem Education learning activity management, and the evaluation of applying the supervision model of Stem Education learning activity management for primary level in private schools. Population and a target group were: Group 1 consists of 320 school administrators and primary level teachers of the private schools affiliated with the Southern Regional Education Office of Andaman Coast, with 6 provinces, namely: Ranong; Phuket; Phang Nga; Krabi; Trang; and Satun using questionnaire. Group 2 consists of 7 university professors, school administrators, supervisors, and teachers with experience of learning activity management in a field related to Stem Education using interview. Group 3 consists of 3 school administrators and volunteer teachers for the model application; 7 experts of the supervision, academic administration, teaching supervision and

supporting private education for verifying the model draft; and 9 experts for assuring the model by focus group discussion.

Data Collection

There was data collection of the current and desirable conditions regarding the supervision model of Stem Education learning activity management in the primary level in private schools by providing the questionnaire in order to ask for opinions from the school administrator, mathematics teachers, science teachers, and computer teachers. After that, the data was brought to analyze and prioritize the needs. The data was collected by interview of university professors, school administrators, supervisors and teachers with experience of learning activity management in a field related to Stem Education by the structured interview. The evaluation and confirmation of the supervision model of Stem Education learning activity management of the primary level in private schools was from the experts by focus group discussion. The data was collected from application of the supervision model by cognition test, the evaluation form of learning activity management and teaching supervision competencies, and the satisfaction evaluation of participants towards the supervision model of Stem Education learning activity management of the primary level in private schools.

Data Analysis

The data was analyzed and synthesized on the current and desirable conditions of the supervision model of Stem Education learning activity management of the primary level in private schools by questionnaire asking for opinions from the school administrators and teachers using SPSS for Window to analyze Mean and Standard Deviation. Qualitative analysis and synthesis was conducted with open-ended questions and interview by content analysis. The evaluation of application of the supervision model for enhancing Stem Education learning activity was conducted by SPSS for Window for Mean and Standard Deviation.

Conclusion

Private schools had the supervision on Stem Education learning activity management at a moderate level and the desirable condition of the supervision on Stem Education learning activity management at a high level with the need for Stem Education learning activity development at the 1st place as shown in Table 1 and 2.

Table 1 The results of the current and desirable conditions of the supervision of Stem Education learning activity management of the primary level in private schools

Elements	Current Condition			Desirable Condition		
	$\overline{X}$	S.D.	Interpret	$\overline{X}$	S.D.	Interpret
1. Building awareness of the need for the supervision of Stem Education learning activities.	2.92	0.43	Moderate	4.49	0.32	High
2. Jointly planning for the supervision of Stem Education learning activities.	2.91	0.51	Moderate	4.46	0.33	High
3. Implementing the supervision and learning practice method regarding the supervision of Stem Education learning activities.	2.91	0.44	Moderate	4.46	0.34	High
4. Development of the supervision of Stem Education learning activities.	2.87	0.32	Moderate	4.47	0.29	High
5. Evaluation of the supervision of Stem Education learning activities.	2.90	0.42	Moderate	4.48	0.34	High
Total	2.91	0.27	Moderate	4.47	0.22	High

Table 2 The result of prioritization of needs assessment in the development of supervision model of Stem Education learning activity management at primary level in private schools

Elements	I	D	$PNI_{Modified}$	No.
1. Building awareness of the need for the supervision of Stem Education learning activities.	4.49	2.92	0.35	2
2. Jointly planning for the supervision of Stem Education learning activities.	4.46	2.91	0.35	2
3. Implementing the supervision and learning practice method regarding the supervision of Stem Education learning activities.	4.46	2.91	0.35	2
4. Development of the supervision of Stem Education learning activities.	4.47	2.87	0.36	1
5. Evaluation of the supervision of Stem Education learning activities.	4.48	2.90	0.35	2
Total	4.47	2.91	0.35	

The supervision model of Stem Education learning activity management in the primary level in private schools had suitability, feasibility and usefulness at the highest level as shown in Table 3.

Table 3 The evaluation of suitability, feasibility and usefulness of the supervision model of Stem Education learning activity management in the primary level in private schools

Particulars	Suitability			Feasibility			Usefulness		
	$\overline{X}$	S.D.	Interpret	$\overline{X}$	S.D.	Interpret	$\overline{X}$	S.D.	Interpret
1. Principle	4.94	0.17	Highest	4.71	0.45	Highest	5.00	0.00	Highest
2. Objective	5.00	0.00	Highest	4.72	0.44	Highest	5.00	0.00	Highest
3. Procedure	4.89	0.33	Highest	4.74	0.43	Highest	5.00	0.00	Highest
4. Evaluation	5.00	0.00	Highest	4.78	0.44	Highest	5.00	0.00	Highest
5. Achievement Condition	5.00	0.00	Highest	4.72	0.44	Highest	5.00	0.00	Highest
Total	4.94	1.67	Highest	4.73	0.44	Highest	5.00	0.00	Highest

By which the model consists of:

The principle of the model is the development of supervisors and teachers by suggesting and being academic mentor with goodwill for the teachers to create a professional learning community in schools so as to develop Stem Education lessons together and provide the supervision of Stem Education learning activities for each other with the goal of continuous development for the student.

Objective of the model is to develop the supervisors to be able to provide the supervision of Stem Education learning activities of the primary level and to develop the teachers to be able to arrange Stem Education learning activities of the primary level. The procedure of the model consists of 3 main phases, with 8 sub-steps called "PIE Supervision Model", namely: Phase 1 Preparation (P), consisting of 2 sub-steps which are basic data analysis and media preparation, it is a training course in which the activities of the curriculum are systematically operated together from the beginning of the training process, real practice in schools and in the classroom, as well as the summary for presentation at the end of the training by interacting in the format of a community of practitioners in the professional learning community of a group of Stem Education teachers. Phase 2 Implementation (I), consisting of building awareness of the need for supervision to promote Stem Education learning activities, jointly planning the supervision to promote Stem Education learning activities, classroom observation, the development of Stem Education learning activities, and learning practice method of the supervision for enhancing Stem Education learning activities. Phase 3 Evaluation (E), the evaluation of using the model by assessing knowledge and understanding, the teachers' ability regarding Stem Education learning activities and teaching techniques and the satisfaction towards the use of the supervision of Stem Education learning activities of the primary level in private schools and success condition, that

is, the supervisors, supervisor teacher and teachers, and school administrator understand the model. The group of Stem Education teachers who perform as supervisor teachers and teachers has communication for continuously learning implementation method according to the model. The school administrators and agencies that accompany the private schools, support and encourage for continuous moving according to the model, as well as the educational institutions to continuously move based on the model, as shown in Figure 1.

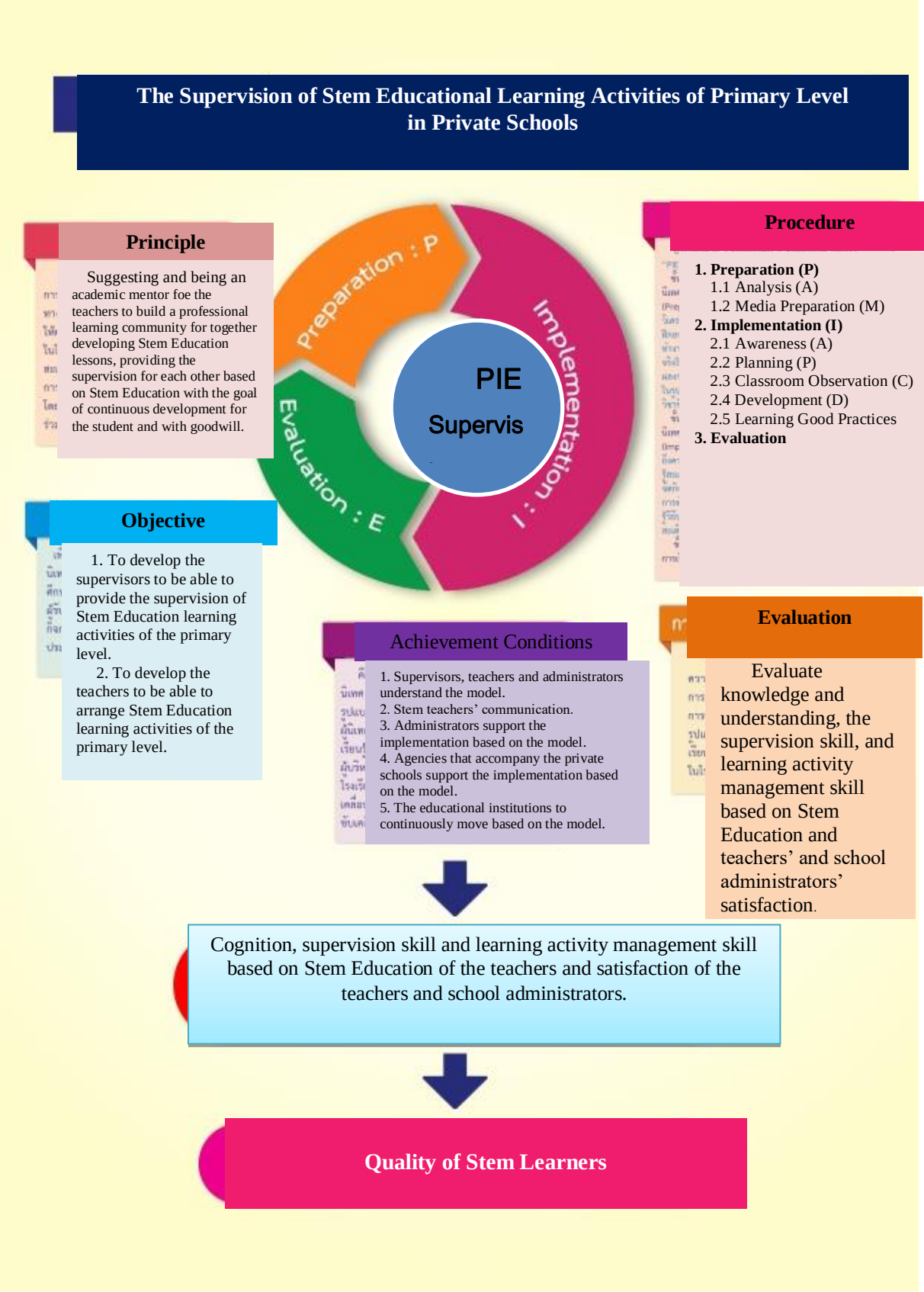


Figure 1 The supervision model of Stem Education learning activity management in the primary level in private schools

The teachers in private schools had higher knowledge and understanding of the supervision model of Stem Education learning activities than before the use of the model. Performance of Stem Education learning activities and teaching supervision was at the highest level and the result affecting the students from arranging the learning activities was generally at the highest level as shown in Table 4-6.

Table 4 The evaluation of the teachers' cognition before and after applying the supervision model of Stem Education learning activity management in the primary level in private schools

Target Group	Before Training		After Training		Difference	
	Score	Percentage	Score	Percentage		
Group 1	12	60.00	17	85.00	5	25.00
Group 2	13	65.00	17	85.00	4	20.00
Group 3	12	60.00	16	80.00	4	20.00
Average Score	12.33	61.67	16.67	83.33	4.33	21.67

Table 5 The evaluating the performance levels of the supervisor teachers and teachers in arranging Stem Education learning activities and supervision

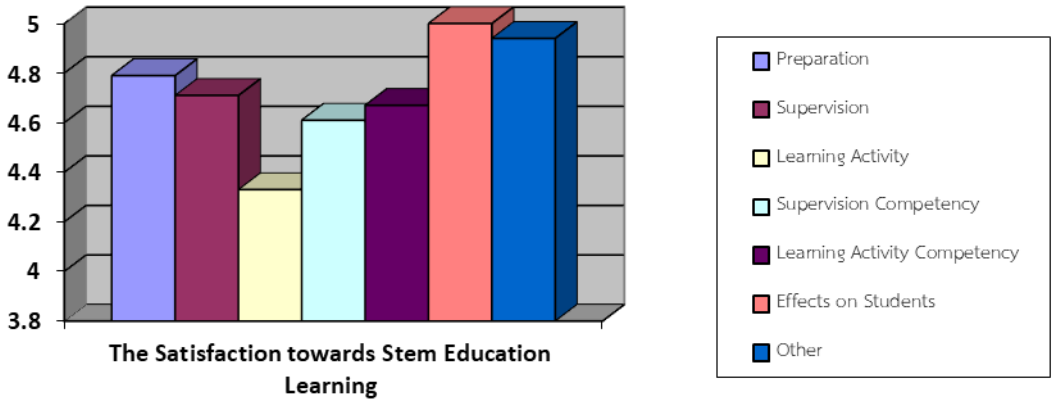
Aspects	Performance Level		
	$\overline{X}$	S.D.	Interpret
1. Management of Stem Education learning activities 1.1 Design of integrated Stem Education learning units with the group of Stem Education teachers.	5.00	0.00	Highest
1.2 Preparation of Sciences, Mathematics, or Technology lesson plans.	5.00	0.00	Highest
1.3 Creating and providing learning media for Sciences, Mathematics, or Technology.	5.00	0.00	Highest
1.4 Creating and providing learning materials that focus on engineering design process.	5.00	0.00	Highest
1.5 Sciences, Mathematics, or Technology learning activities management.	5.00	0.00	Highest
1.6 Organizing learning activities that focus on engineering design process.	4.33	0.58	High
1.7 Evaluation of Science, Mathematics or Technology learning activities.	4.00	0.00	High
1.8 Evaluation of learning activities that emphasize engineering design process.	4.00	0.00	High
1.9 Development of learning activities using various aspects that are suggested by the supervisors.	5.00	0.00	Highest
1.10 Applying various issues from self-reflection to the development of learning activities.	5.00	0.00	Highest
Total	4.73	0.06	Highest
2. Teaching Supervision			
2.1 Jointly planning the supervision.	5.00	0.00	Highest
2.2 Providing suggestions on educational methods and curriculum analysis for designing collaborative learning activities.	5.00	0.00	Highest
2.3 Providing suggestions on how to create integrated Stem Education learning units and lesson plans.	5.00	0.00	Highest
2.4 Recording various aspects obtained from classroom observation.	4.67	0.58	Highest

2.5 Applying various issues from fellow teachers to the development of learning activities.	4.00	0.00	High
Total	4.73	0.12	Highest

Table 6 The evaluation affecting the students in the classroom of the teachers according to Stem Education learning activities

Evaluation Aspects	Opinion Levels		
	$\overline{X}$	S.D.	Interpret
1. Students are aware of problems related to the environment.	4.67	0.58	Highest
2. Students more understand the subject content and process of science and mathematics.	5.00	0.00	Highest
3. Students have skills in critical thinking and creating new innovations using science, mathematics, technology, and engineering design process as the basis.	5.00	0.00	Highest
4. Students have the ability on group work.	4.67	0.58	Highest
5. Students have the ability on effective communication.	5.00	0.00	Highest
6. Students have the ability of being a pioneer and accept criticisms.	5.00	0.00	Highest
7. Students develop learning skills in the 21st century.	5.00	0.00	Highest
8. Students learn from actions and group work.	5.00	0.00	Highest
9. Students do the self-assessment and peer assessment related to actual conditions.	4.33	0.58	High
10. Students can apply knowledge to solve problems in real life.	4.33	0.58	High
Total	4.80	0.17	Highest

The teachers were satisfied with the use of the supervision model of Stem Education learning activities at the primary level in private schools at the highest level, as in Chart 1.



Discussion

The supervision model of Stem Education learning activities at the primary level in private schools consists of Principle, objective called "PIE Supervision Model", Preparation (P), Implementation (I), Evaluation (E), Model Assessment and Achievement Condition with suitability, feasibility and usefulness through the process of studying, analyzing, developing with continuity and systematic steps by studying the principles, concepts, theories, questioning, interview those who involved to obtain data as basic information in designing, drafting,, and improving. It includes consideration for giving suggestions to improve with accuracy and appropriateness according to the concept of knowledge management in supervision, monitoring and evaluation of educational management of the Primary Educational Service Area Office to be able to improve the quality of

education with effectiveness until obtaining the model with accuracy, appropriateness and can be applied for real and passed the inspection for the efficiency. The handbook has been inspected by the experts in terms of utilization, feasibility, appropriateness, accuracy standards (Stufflebeam and Shinkfield, 2007) at the highest level. In addition, there is promotion of Stem Education learning activity management of the teachers so as to gain performance learning activities and teaching supervision at the highest level. The students are aware of problems related to the environment; more understand the subject contents and science and mathematics processes have skill of critical thinking and new innovation creating with science, mathematics, technology and engineering design process as the basis. Moreover, the students have the competency of group work, be able to effectively communicate, the ability to be a pioneer and accept criticisms, learning skills in the 21st century and learning from actions and teamwork at the highest level. The supervisors and teachers' satisfaction towards the supervision model of Stem Education learning activities at the primary level in private schools is generally at the highest level by suggesting and being an academic trainer with a friendly attitude for the teachers to create a professional learning community in the schools to together develop lessons (Yankomut, 2015). It is an integrated professional development with work by sharing and learning with each other, reflect, think, practice which is an important tool in professional development causing the teachers to more develop profession than teachers, or the teaching supervision stimulates the exchange of knowledge with fellow teachers while working including professional development for new teachers or those who have started into the teaching profession. Furthermore, an important factor for success in professional development is the administrator's support (Evans and Jolly, 2005 (Cited in Zepeda J.S., 2003)). Caring and counseling helps professional and personal development and support teachers who provide advice and guidance, including the process of in-school counseling (Hudson, P., and Hudson, S., 2010). which is the creation of a professional learning community that affects school operation. In addition, good communication and cooperation, a good collaborative network and used to exchange knowledge causes the teachers to receive good advice in performance and helps them have better performance and affects the students to receive effective learning activities and better learning achievement (Dan, 2012).

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