

# Development of Supervision Model to Enhance Critical Thinking for Science Teachers in Expansion Schools in Thailand

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## Abstract

This research aimed to (1) investigate the supervision models which enhance critical thinking, (2) develop a supervision model to enhance critical thinking for science teachers in expansion schools by adopting the process of Research and Development (R&D). The target audiences included 9 qualified experts, science teachers teaching grade 7 students from 3 Best Practice schools, and 9 experts in group discussions. Tools adopted for data collection were comprised of questionnaires, evaluation forms, and recording forms. Statistics tools used for data analysis included frequency, mean, standard deviation, content analysis, and data validation by triangulation method. The results were listed below.

The supervision model to enhance critical thinking consisted of two key elements: (1.1) 5 elements and 59 indicators for supervision, (1.2) elements and indicators for science teachers who have critical thinking skills comprised (1.2.1) 5 elements and 26 indicators for learning management capability to enhance critical thinking and (1.2.2) 7 elements and 25 indicators for characteristics of people who have critical

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thinking skills. 2) The supervision model to enhance critical thinking was referred to as ARPED model; it consisted of 5 key elements namely (1) Assessment: A, (2) Relationship Building: R, (3) Practice: P, (4) Evaluation: E, and (5) Development: D. For the third element (Practice: P) in particular, it involved the supervision process referred to as ATOMS which comprised (3.1) Assessment of Context: A, (3.2) Teaching and Learning Methods: T, (3.3) Observations: O, (3.4) Mentoring and Coaching: M, and (3.5) Summative Evaluation and Improvement: S.

**Keywords:** model, supervision, critical thinking, coaching, mentoring

## Introduction

Today, the world has been driven into changing very rapidly in all aspects, particularly a quantum leap progress in information technology, by the power of globalization. The nation that may survive and gain the most benefits within this particular scenario is the one with the power of knowledge. The only possible way to deal with all challenges in the 21<sup>st</sup> century is that every society works hand in hand to build up a life-long learning and borderless society. Development in educational system, therefore, has become a vital key factor. To catch up on the changing circumstances, elements in education management must also be changed to fit with the new conditions. Policy makers must be well-aware and determined to build up a sustainable learning society and support human resources to be capable in self-learning; with these equipped learning skills, teachers and schools should be supported and developed altogether (Somprach, 2017).

Indicator can be found in PISA 2015 research. The study analyzed assessments in Reading, Mathematics, and Science of students under 15 years old, and results showed that average scores for science were 421, lower than the mean and significantly lower than PISA 2012-2015 scores (The Institute for the Promotion of Teaching Science and Technology, 2013). Findings on science learning in different school types have shown that students from scientific schools and demonstration schools have been able to score higher than students from other school types, whose scores were lower than the mean. The schools with significantly lower scores were those under the Office of the Basic Education Commission 1 (expansion schools). These schools are often small and located in rural areas, the students are from poor families, and there are inadequate teachers (Lattipipat, 2017). Improvements in science teaching should be a main focus in weak schools so that they are not left behind. It is the right time to provide these schools with special care, as students from these schools will be the majority of the population in the future (Klainil, 2012). This is consistent with Inchukul (2016: 95-97) whose study was on Strategy for Opportunity Expansion School

Development under Kanchanaburi Primary Educational Service Area Office 4. The results showed that the academic staff should be supported accordingly to their needs and scarce major subjects. Teachers should be in classrooms teaching students with their full capabilities. Teachers should be positioned in relation to the 8 subject areas and focusing on learner-centered activities. Moreover, there should be a variety of supervising and following up processes, as well as developing the teaching and learning management which helps learners with their future careers. The emphasis should be on raising all levels of education.

Those who have higher order thinking skills must be primarily trained to acquire some essential basic skills, for examples: creativity, critical thinking, thinking by adopting science process skills, futuristic thinking, and synthesis-type thinking. According to the order of thinking skills, it is seen that higher thinking skills are crucial and very necessary for life living. It is so because a huge amount of circulating information is connected and because of the advancement of technology and communication, learners need to be able to recognize, classify, and evaluate the reliability of information received.

In a similar vein, Elizabeth A. Gordon's study on integrating higher-order thinking skills in the classroom (2016) suggests that more than a half of leading universities agree on the point that collective thinking, critical thinking, problem-solving, and free association are essential skills for students and they are in need to be developed. According to the Basic Education Core Curriculum 2551 (A.D. 2008), it states that science is assimilated into everybody's daily life and professions. All technological gadgets that enable people to live conveniently are products of scientific knowledge in combination with creativity and other forms of science. Science capacitates people to develop logical and critical thinking. In addition, scientific process demands students' participation to construct the knowledge by searching for information and solving diverse problems; therefore, it is essential that students must be encouraged to develop their scientific knowledge.

Although Thailand's educational management policy has been focusing on developing learners' thinking, reasoning, and having good attitude skills, teaching and learning management has not yet been successful. According to the research result of the Secretariat of the House of Representatives (2007), it was found that factors influencing Thailand's education quality were 1) human i.e. teachers, administrators, learners, and supporters; 2) system and process, namely, learning and teaching system and administrative system; 3) environment and society, including supports in developing learning activities, media, and textbooks; and 4) supporting resources, that is, budget. Additionally, it was also found that current teaching and learning management has not been able to create thinking skill foundation for learners to be able to

encounter rapid changes of social and economic problems. Boonjang (2017: 3-8) asserts that teaching science is very important in the sense that it provides opportunity for students to develop their critical thinking skills along with logical knowledge in the lessons so that the students learn to understand possible causes of a problem which leads them to be able to find solutions for the problem. Lao-reandee (2013) suggests that the way to help teachers to improve and develop themselves sustainably and professionally which will eventually result in the greatest benefits to learners is supervision of instruction. Glickman (2010) proposes the concept of differentiated coaching which aims to improve teaching behaviors. Teachers are also supported to make proper decision for the best benefit of students. Mentoring is another type of supervision. It is based on one-to-one relationship or a small group, supervised by experienced teachers which are referred to as mentors. Role of mentors is to provide supports to the less experienced new-comers for their professional growth and development in order to achieve the best teaching and learning qualities (Panlert, 2015). Results confirm the study by Cheunklin (2010) conducted a research to develop a coaching model to enhance nursing instructors' instructional competency that promotes critical thinking skills of nursing students. The results show that there are 4 steps in coaching process: 1) Preparing Phase: P; 2) Planning Phase: P; 3) Coaching Phase: C; and 4) Evaluation Phase: E.

From the reasons abovementioned, the researcher is interested in developing supervision model which enhances critical thinking for science teachers in expansion schools. This research sets hope to help the teachers to be able to strengthen and develop their professional capability, towards teaching profession, and to cultivate critical thinking skills within themselves. With all these skills and knowledge, the teachers will be able to adopt the knowledge and techniques gained from the supervision model to design their own teachings and pass on the critical thinking skills to their students.

## **Objectives**

1. To investigate the supervision models which enhance critical thinking for science teachers in expansion schools
2. To develop supervision model to enhance critical thinking for science teachers in expansion schools

## Framework

1. For the supervision models to enhance critical thinking in expansion schools, concepts and theories are based on Cogan (1973) ; Goldhammer (1980) ; Harris (1985) ; Glickmam and others (2510) ; Zepeda (2513) ; Sullivan and Glanz (2013) ; Uttaranon (1987) ; Boonsawat (1995) ; Nilpan (2011) ; Lao-reandee (2013). It can be synthesized into 4 elements, namely, 1) principle, 2) objective, 3) supervision process, and 4) factors supporting the application of the models

2. For the elements enhancing competence and characteristics of persons who have critical thinking skills, concepts and theories are based on the following lists:

2.1 In competence of learning management that enhances critical thinking skills, concepts and theories are based on Decaroli (1973) , Ennis (1985) . This can be synthesized into 5 main elements including 1) defining problems, 2) considering the information, 3) identifying the hypothesis, 4) interpreting the information, and 5) assessing the work

2.2 For characteristics of persons who have critical thinking skills, concepts and theories are based on (1) Ennis (1985), (2) CCDI (2008) (California Critical Thinking Dispositions Inventory), and (3) Susaoraj (2011), which can be synthesized into 7 characteristics namely, 1) generosity, 2) intellectual maturity, 3) self-confidence, 4) being analytical, 5) systematic thought, 6) truth finder, and 7) logicity.

## Methodology

The research was designed to be conducted in two sessions:

**First session:** the study of supervision models which enhance critical thinking skills for science teachers in expansion schools comprised two steps as follows:

First step – study and analyze concepts and theories from textbooks and previous research papers.

Second step – interview 9 experts to confirm the elements

**Second session:** the development of supervision model which enhances critical thinking skills in expansion schools resulted from the outcomes from the first session; this session consisted of 3 steps.

First step – the study of best practice supervision models from 3 schools by using a purposive sampling technique with the following criteria: 1) having science teachers who obtain excellent science learning management awards in the region level or higher; 2) having students who have received awards in science competitions in the region level or higher; 3) having notion of managing alternative education for students; and 4) having passed the quality assessment in terms of thinking skills and ranked on Good level or higher by the Office for National Education Standards and Quality Assessment.

Second step – the drafting of the supervision model

Third steps – draft-verifying by a focus group discussion attended by 8 qualified experts. The focus group discussion comprised 2 experts in educational supervision, 1 school administrator, 1 educational administration instructor, 2 curriculum and teaching instructors, and 2 educational supervision instructors. All of the participants were selected by the use of purposive sampling technique.

### **Instrumentation**

1) Tools adopted in data collection are listed below: 1) Structured in-depth interview.

2) Evaluation form for the feasibility of supervision elements, 3) Interviews of science teachers with Best Practice award, and 4) Group discussion records. The tools were quality tested by assessing the content validity from the experts.

### **Data analysis**

1. Descriptive Statistic analysis – mean and standard deviation were extracted from evaluation forms for the feasibility of supervision elements.

2. Content analysis – data checking by adopting triangulation from the focus group discussion and the study of best practices supervised by 8 qualified experts.

### **Results**

1. The results of the study of supervision models which enhance critical thinking skills for science teachers in expansion schools are shown below:

1.1 The study and analysis of concepts and theories from textbooks and research papers

1.1.1 Supervision elements consists of 4 key elements namely 1) Principles, 2) Objectives, 3) Supervision process, 4) Application factors.

1.1.2 Elements of learning management to enhance critical thinking skills of science teachers consist of 5 steps and activities as listed below.

Step 1: Identifying the problems: this is the step that aims to build up students' motivation in learning. Step 2: Studying by adopting various methods: in this step, after students having identified the unknown areas that they want to learn, they then have to apply different methods in order to gain the knowledge they are seeking. Step 3: Knowledge synthesizing: in this step, students are encouraged to share their thoughts and opinions with other group members. Step 4: Conclusion and evaluation, and Step 5: Presentation and result evaluation.

1.2 The interviews with 7 qualified experts and evaluation results to confirm the elements are shown below:

1.2.1 The conclusion can be drawn from the in-depth interviews of 7 qualified experts that the second element (learning management to enhance critical thinking skills for science teachers) should be crossed out as it could consume too much time to conduct the research; moreover, this study would appear to gear to curriculum design and class management rather than critical thinking skills enhancement. The experts also recommended that the research should stick to the topic of supervision; however, the researcher may add the elements related to capability of teachers in learning management to enhance critical thinking skills and characteristics of people who has critical thinking skills.

1.2.2 For elements evaluation, the experts viewed that the overall supervision elements to enhance critical thinking skills for science teachers in expansion schools was in medium level ( $\bar{x} = 2.58$ ). However, the level of suitability for supervision that enhances critical thinking skills was at high level ( $\bar{x} = 3.78$ ) and the level of suitability for learning management that enhances critical thinking skills was at the lowest level ( $\bar{x} = 1.38$ ).

2. The results of supervision model that enhance critical thinking skills for science teachers in expansion schools can be delineated below:

2.1 There were 3 best practice schools participating in the research study.

The conclusion from the interviews can be delineated as follows. 1) There was only one curriculum management without any other specially designed curriculum for smart and slow students and it is adjusted to fit the local context. 2) For the teaching and learning management, it is found that teachers focused on skills-construction process rather than content in order to enforce higher order thinking skills among students. 3) The evaluation is assessed based on real

circumstances during the teaching and learning process. The special focus is placed on students' thinking skills, reflections and feedbacks. 4) Schools provide incentives (remunerations) for teachers whose works are recognized in the regional and national levels. 5) Schools allow community participation in learning using local community as a resource of scientific learning; the learning is also conducted via project base. 6) Schools actively participate both in internal and external networks. For internal network, the teachers co-work with other colleague teachers both within their own subject area and with other subject areas to develop leaning management via different types of activities and projects. For external network, schools share information and co-work with other schools in terms of academic competitions and research funding. 7) Schools provide learning resources both inside and outside the schools for students. 8) Supervision through Mentoring and Coaching system is arranged by the schools and put into the administration structure. 9) Some small sized schools which are district schools do not have the policy to provide incentives for the teachers. They, however, constantly give moral supports to their colleagues, build up team spirits, and hold firmly to the seniority system.

2.2 For the process of drafting the supervision model, 8 qualified experts participated in a focus group discussion to check and then approved the draft which is referred to as ARPED Model. The model is illustrated in the figure below.

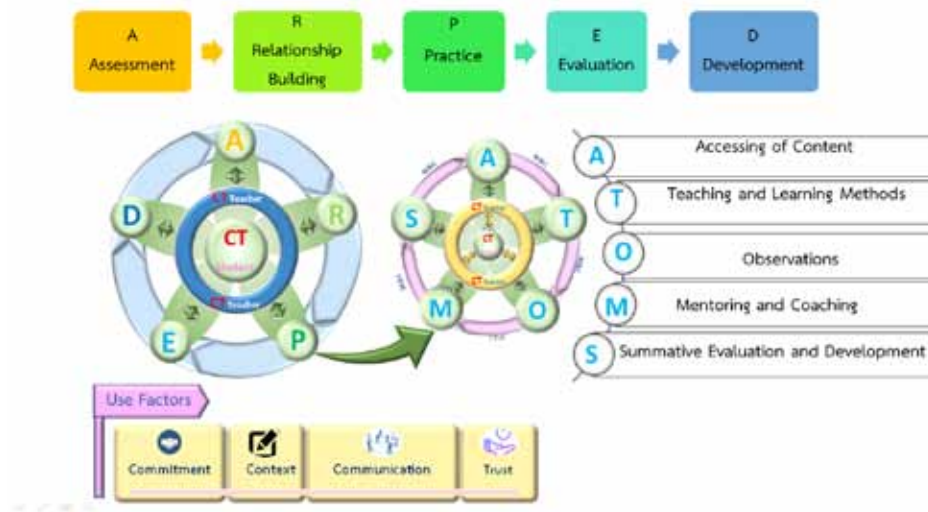


Figure 1 ARPED Model



The illustration demonstrates the supervision model to enhance critical thinking skills for science teachers in expansion schools.

1. The ARPED Model comprises the following elements.

**Principles:** systematic supervisory process which takes into accounts the differences of individual teachers in terms of capability and knowledge. It emphasizes on finding diverse methods in promoting critical thinking skills of science teachers.

**Objectives:** to enhance the capability in mentoring and coaching of supervisory teachers. The main objectives are to consistently and systematically provide assistance to supervisory teachers in learning management, student development, changing patterned classroom behavior of teachers, and teaching profession development.

1. Assessment: A – is the study of general circumstances in order to identify the problematic issues which are needed to be developed or solved, and set priority of order for serious issues.

2. Relationship Building: R – is the ability to make understanding, set goals and mutual values, and promote compassion.

3. Practice: P – can be divided as seen below. Supervision process According to ATOMS model, the process of supervision includes 5 steps as follows.

3.1) Assessing of Context: A -It is analysis of curriculum.This step allows the teachers to select proper teaching techniques and methods that will enhance thinking skills. It also provides selections of teaching-assisting information technology and resources which are most suitable for classroom activities.

3.2) Teaching and Learning Methods: T- This step aims to build up teachers' awareness for developing critical thinking skills. The vital activities are to provide knowledge and information about supervision in terms of learning management techniques, classroom management techniques, and knowledge sharing opportunity among teachers in order to create a community of practice (CoP).

3.3) Observations: O- This process includes pre-observation meeting to view the overall plan, identify objectives and method of supervision, and pinpoint assessment and reflecting evaluation. In addition, this step involves arrangement of tools, classroom observations, data analysis, and group reflects on improvement and solutions in order that the teachers learn about classroom behaviors that can be maintained and ones that should be changed or improved.

3.4) Mentoring and Coaching: M-This method encourages the supervisor and supervisee to share moral supports and compliments. Additionally, it provides space to share academic information, principles, and new techniques along with suggesting the solutions for any weaknesses found. This process emphasizes also on promoting teachers' thinking skills and encouraging teachers to maximize their capability.

3.5) Summative Evaluation and Development-S This process is to evaluate students' accomplishment in terms of knowledge and understanding in academic lessons, and critical thinking skills. Planning for future development and improving the learning management are essential in order to upgrade the supervision process.

4. Evaluation: E – is the evaluation of supervision model which enhances critical thinking skills for science teachers in expansion schools and the After Action Review.

5. Development: D – is the review of the whole process to develop and improve the supervision model.

2. Capabilities and characteristics of science teachers who have critical thinking skills are listed as follows.

2.1) Capability in learning management that enhances critical thinking skills can be categorized into 5 elements:

1) Identifying problems – it is to make sure that the teachers completely understand the contents and principles in teaching science. In addition, they must have clear comprehension about critical thinking process.

2) Selecting of information – the teachers are expected to understand teaching methods and learning innovations. They must be able to design the lesson plans and assessment by applying diverse evaluation techniques based on real circumstances. Apart from that the teachers should seek information technology to assist the teaching, arrange the learning process in order so that the students can follow.

3) Identifying hypothesis – this is to design learning activities based on case study or problematic situations. The students should be given logical suggestions for how many different ways to tackle the problems. The learning situations must provide students the opportunity to make clear understanding of the problem in mentioning; questions must be prepared to arouse students' reflections. Students must be urged to classify the components of the situation to see the relationship of different related sections. The activities must encourage students to guess the feasible final answer and enable them to select the suitable solution for the problem.

4) Interpretation – this is the learning activity that allows students to work both individually and in group to find the answer. The teachers must prepare different questions to ask students and provide platform for the students to share and present their opinions to the group in order to reach the sensible solutions at the final stage.

5) Evaluation – this is to give students opportunity to review their knowledge gained from opinion sharing and presentation. Students are requested to reflect and record the thoughts so that they can see better how significant the critical thinking can lead them to the solutions. The reflection can also be applied in students' evaluation as it shows the outcome of the thought and thinking process.

## 2.2 Characteristics of persons who have critical thinking skills

The characteristics of people who have critical thinking skills are demonstrated through 7 traits as listed in the following. 1) Generosity – they must be open for different opinions, have no bias, can accept the changes, and be flexible. 2) Intellectual maturity – they are smart, calm, attentive and capable of overcoming obstacles based on critical thinking. They also prefer prevention of the problem rather than solving the problem. 3) Self-confidence – they are sensitive to other people's feelings and appreciate the value the knowledge. They are also emotionally secure and believe in sensible reasons. With their intellect, they are courageous in encountering obstacles. 4) Be analytical – they can classify information they have gathered and screen for vital points. They can apply the knowledge for particular situation and are capable of predicting the outcomes. 5) Systematic thought – they are capable of screening for only the key points and neglecting unnecessary details. They can solve complex problems and work systematically. 6) Truth finder – they are enthusiastic in finding knowledge and information from different trustable sources to which can be properly referred and 7) Logicity – they can provide logic and feasible reasons supported by concepts and principles which can be proved. They can also provide trustworthy summary and conclusion about the subjects.

Additional suggestion is for the use of supervision instruction manual and handouts; two written materials can be put together for more convenient use and future reference. The qualified experts and the researcher also agree on the factors of accomplishment as listed in the following. 1) Trust – the trust between the supervisor and the supervisee on their experiences and previous knowledge would allow them to adjust themselves for better mutual understanding. 2) Commitment – the mutual agreement between the supervisor and the supervisee to co-work from the beginning to the ending of the supervision process. 3) Communication – the communication through verbal and non-verbal languages

which would help smooth the progress of the cooperation. 4) Context – it means surroundings and working atmosphere which may involve policy designated by the administrators to support profession development, materials and other gadgets related to the work.

## Discussion

1. According to the synthesis of the elements of supervision models to enhance critical thinking, it can be stated that the supervision model consisted of two key elements: (1.1) 5 elements and 59 indicators for supervision, (1.2) elements and indicators for science teachers who have critical thinking skill consisted of (1.2.1) 5 elements and 26 indicators for learning management capability to enhance critical thinking and (1.2.2) 7 elements and 25 indicators for characteristics of persons who have critical thinking skills. Results confirm the study by Kruekam-eye (2009) who conducted a study on creating supervision model for student teachers field experiences to improve instructional competency that enhances thinking skills of elementary students. The results reveal that the student teachers field experiences supervision model called “PPIE” consists of 4 sequent steps as follows (1) Preparing = P is the preparing of knowledge and Techniques in instruction and supervision; (2) Planning = P is the planning for supervision; (3) Implementing = I is the implementing or managing instruction together with supervision; and (4) Evaluating = E is the evaluating of the results of supervision model implementation. The evaluation of supervision process includes elements namely operational methods, tools, effectiveness inspection, all of which depending on goals primarily set in the plan.

2. The results of supervision model to enhance critical thinking skills for science teachers in expansion schools contain 5 key elements as follows. 1) A=Assessment & Edis – it includes 2 sub-elements: planning and assigning. 2) R=Building relationship – behaviors of sciences teachers who acted as the supervisors and the supervisees consist of some sub-elements namely ability to show understanding, building objectives and shared values, sharing compassion and gaining mutual confidence. 3) P=Practice – it contains some sub-elements which are 3.1) Assessing of Context; 3.2) Teaching and Learning Methods – belonging to this element is 3.3) Observations which involve 1) Pre observation Conference, 2) Observation, 3) Reflecting; 3.4.) Mentoring and Coaching; Timnak (2553) focused on developing of instructional supervision model based on Glickman’s principles to improve reading instructional competency of Thai language teachers. His study results propose supervision model called “AIPDE Model” which consists of 5 stages: first stage – assessing (A); second stage - informing (I); third stage - planning (P); fourth stage – Doing (D) which

composes of 3 supervision steps: 1) before teaching and supervising 2) observing classes 3) giving feedback after class-observing and fifth stage - evaluating (E). Sumonta 3.5) Summative Evaluation and Improvement. 4) E=Evaluation. 5) D=Development. The results confirm the study by Chulajata's study (2012) on the development of collaborative teacher-centered professional development model to enhance instructional competency promoting analytical thinking skills of elementary school teachers reveals that 1) the Collaborative Professional Development Model called "ASTPPCE Model" comprises principle, objective, supporting factors, and 7 phases of professional development; Phase 1, A= Analyzing problem; Phase 2, S = Setting objectives for the improvement; Phase 3, T = Training and selecting professional development; Phase 4, P = Planning the action plan; Phase5, P = Practice for professional development including collaborative action for professional development with 1. Review of action plan, 2. Observation, 3. Analysis of data, and 4. Reflection and feedback; Phase 6, R = Collaborating reflective discussion; and Phase 7, E = Evaluating the professional development results. Chanaupakara's study (2014) on the professional development model for the enhancement of coaching competency of subject area master teachers proposes a model called "NPPC Model". The model consists of 4 components: 1) principles: the systematic procedures for continuous professional development that allowed teachers to share opinions and work cooperatively; 2) objectives: to enhance coaching competency of coaches to support teaching and learning management of trained professionals for learning achievements of learners; 3) process of professional development includes 4 stages: stage 1 - Needs Analyzing (N), stage 2 - Preparing for professional development (P), stage 3 - Proceeding (P) 3.1) planning 3.2) collaborating 3.3) reflecting conversation 3.4) action learning 3.5) assessing for improving, and stage 4- Collaborating Continuous Professional Development (C); and 4) supporting factors to successfully implement the model which consisted of: 4.1) organization policy, 4.2) administrators supported, 4.3) willingness of both coaches and trained professionals, 4.4) good relationship among coaches and trained professionals, and 4.5) enhancing coaching competency, mentoring is necessary especially in curriculum, instructional design, and assessment.

## Recommendations

### 1. Recommendations for the applications of the research results.

1.1 Educational Service Area Offices and expansion schools should provide continuous supports and promote the development of critical thinking skills among the teachers so that the skills can be effectively passed on to the students.

1.2 Supervisors should adopt the concepts and processes and apply them under the context of their local spaces and learning areas.

1.3 School administrators should adopt the concepts and processes of supervision and develop it systematically to use as a model in their schools.

## 2. Recommendations for future studies

Therefore, there would be qualified and validated models to promote the development of capability and characteristics of teachers who have critical thinking skills in the future.

## References

- Boonsawat, W. (1993). *Principles of educational supervision*. Bangkok: Faculty of Education, Chulalongkorn University. (in Thai).
- Chanupakara P. (2014). *The professional development model for the enhancement of coaching competency of subject area master teachers*. Doctoral Dissertation, Silapakorn University, Nakhon Pathom. (in Thai).
- Decaroli, J. (1973). What research say to the classroom teacher: Critical thinking. *Social Education*, 37(1), 67–68.
- Ennis, R.H. (1985). A concept of critical thinking: A proposed basic for research in teaching and evaluation of critical thinking ability. *Herv Edue Rev*, 32(1): 81-111.
- Elizabeth A. Gordon. (2016). Integrating higher-order thinking skills in the classroom. *Pennsylvania CPA Journal*. [Online]. Available from ProQuest Dissertations & Theses Global. (Order No 56258). [Accessed 15 September 2016].
- Glickman (2010). *Supervision and instructional leadership: A developmental approach*. 6<sup>th</sup> ed. Boston: Allyn and Bacon, Inc.
- Harris, Ben M. (1985). *Supervisory behavior in education*. 3<sup>rd</sup> ed. Englewood Cliffs, New Jersey: Prentice-Hall, Inc.
- Inchukul, C. (2016). *Strategy for opportunity expansion school development under kanchanaburi primary educational service area office 4*. Master of Education Dissertation, Silapakorn University, Nakhon Pathom. (in Thai).
- John Craven, Bruce S. Cooper. (2016). The supervision and mentoring of science teachers: Building capacity in the absence of expertise in classroom science supervisors. *CLEARvoz Journal*, 3(2): 9-14.

- Kruekam-ai W. (2009). *The development of supervision model for field experience student teachers to instructional competency that enhances thinking skills of elementary school students*. Doctoral Dissertation, Silapakorn University, Nakhon Pathom. (in Thai).
- Laowreandee, W. (2013). *Supervision for teaching*. Nakhon Pathom: Silpakorn University. (in Thai).
- Nillapun, M. (2011). An evaluation project to enhance the teacher quality system: the new supervision development activity. *Silpakorn University Journal*. 31(2). (in Thai).
- Panleat C. (2015). *Mentorin system*. Social Academic Ministry of Education. (in Thai).
- Somprach, K. (2017). *Leadership and learning leadership for school principals*. 2<sup>th</sup> ed. Khon Kaen: Khlang nana witthaya.
- Sullivan, S. and Glanz, J. (2013). *Supervision that improves teaching: Strategies and teaching*. 2<sup>nd</sup> ed. Thousand Oaks: Corwin.
- Uttranon S. (1987). *Principal and theories in educational supervision*. (2<sup>th</sup> ed.). Bangkok: Mitsaim. (in Thai).
- Yuenyong y. (2010). *The development of differentiaed supervision model for the enhancment on classroom action research competency of teachers in bangkok archdiocese, educational region 5*. Doctoral Dissertation, Silapakorn University, Nakhon Pathom. (in Thai).
- Zepeda. (2513). *Professional development*. What work. Larchmont, N.Y.: Eye on Education, Inc.