

# The Supervision Model to Promote Curriculum Administration Emphasizes Learner Competency of Schools under the Office of Primary Educational Service Area

Suriyon Chaiyamart<sup>1</sup>, Chuankid Masena<sup>1</sup>, Pongthorn Singpun<sup>1</sup>, Paiwan Kotta<sup>1</sup> & Taniya Morris<sup>1</sup>

<sup>1</sup> Faculty of Education, Ubon Ratchathani Rajabhat University, Thailand.

Correspondence: Suriyon Chaiyamart, Faculty of Education, Ubon Ratchathani Rajabhat University, Thailand.

Received: June 4, 2024

Accepted: August 1, 2024

Online Published: September 15, 2024

doi:10.5539/jel.v14n1p227

URL: <https://doi.org/10.5539/jel.v14n1p227>

## Abstract

This research aimed to develop a supervision model to promote curriculum administration that emphasized learner competency in schools under the Office of Primary Educational Service Area, using the Research and Development (R&D) methodology. The study consisted of two phases. The first phase investigated the current and desired status and the need for developing supervision to promote curriculum administration emphasizing learner competency. This involved document analysis, interviews with five educational supervision experts who were obtained through purposive sampling, and surveys of 370 school administrators and heads of academic teachers selected through stratified sampling determined using Taro Yamane's formula. The researchers developed and validated the supervision model with 11 experts selected through purposive sampling for the second phase. Research tools included document analysis verified by the advisor, questionnaires with IOC between .80 and 1.00 and Cronbach's alpha coefficient of .986, interviews, the supervision model, implementation manuals, and evaluation forms. Data analysis utilized percentage, mean, standard deviation,  $PNI_{modified}$ , and content analysis. The results indicated high levels of both current and desired statuses for supervision-promoting curriculum administration that emphasizes learner competency. The overall necessity for development, measured by the  $PNI_{modified}$  value, is .102, with evaluation, creation, reflection, information, and action ranked from highest to lowest. The supervision model included principles, objectives, and implementation methods with a five-step supervision process (information, creation, action, reflection, and evaluation) and outcomes promoting curriculum administration in four areas (curriculum preparation, curriculum use, curriculum supervision and monitoring, and curriculum evaluation and improvement), model evaluation, and conditions for use. The model's suitability and feasibility were rated as highly appropriate.

**Keywords:** supervision model, promoting curriculum administration, learner competency

## 1. Introduction

Thailand's need for modern and high-quality educational reform is mandated by the Constitution of the Kingdom of Thailand, particularly in curriculum and teaching reforms to develop learner competencies. Studies have shown declining learning outcomes, nationally (O-NET) and Programme for International Student Assessment (PISA), with learners lacking desired qualities due to the content-heavy curriculum that requires teachers to cover numerous indicators, leading to inefficient teaching and learning. Thus, there is a need to adjust the curriculum to improve learner quality as desired (Prommaboon et al., 2020).

Due to societal and global changes, there is a growing exploration of concepts and strategies for learner development. Research into competency-based curriculum and instruction in various educational settings has yielded recommendations for its adoption. This approach aims to shift teaching and learning towards emphasizing the essential skills and competencies learners need. Competency-based curriculum focuses on fostering skills, abilities, attitudes, and values that are relevant to learners' daily lives and future aspirations. It outlines specific competency criteria across different areas for each educational level and grade. Skills and abilities progress incrementally, building upon competencies achieved at each level to enhance proficiency in subsequent stages (Office of The Education Council, 2020).

Schools have a primary mission to manage curriculum to maximize learner potential. They play a crucial role in connecting curricula to the development of teachers and students, ensuring efficient learning management, which

impacts learner quality and educational development goals (Phutivanish, 2019). Current curriculum management requires a paradigm shift from traditional to new concepts, knowledge, management methods, and practices at national, local, and institutional levels (Khompetch, 2015).

Educational supervision involves guiding and developing teachers for effective performance, with the outcome being improved academic quality and learner competency (Office of the Basic Education Commission, 2013). Supervision processes need to adapt to drive policy implementation for 21<sup>st</sup> century educational reform, enhancing school management, teaching quality, and academic success by incorporating innovative supervision focused on teaching development, curriculum development, and personnel development. Effective educational supervision aims at directly improving teaching practices in response to school needs through diverse techniques and collaboration among school staff and administrators (Bowonsak, 2018).

There are issues in educational supervision, including personnel shortages, lack of knowledge, skills, and experience, inadequate tools and budget, and insufficient performance evaluation (Nillapun, 2011). The Office of the Education Council (2009) found that children's quality does not meet educational standards due to a lack of follow-up and evaluation by qualified supervisors, and a shortage of specialized supervisors.

Given these challenges, the researcher aims to study and develop a supervision model to promote curriculum administration emphasizing learner competency in schools under the Office of Primary Educational Service Area, providing guidelines for teachers, administrators, and supervisors to work together in enhancing curriculum and learning management focused on learner competency, addressing global advancements and changes, and improving educational quality effectively.

This research aimed to study the current status, desired status, and needs for developing supervision to promote curriculum administration that emphasizes learner competency in schools under the Office of Primary Educational Service Area. This study also aimed to develop a supervision model to promote curriculum administration emphasizing learner competency in schools under the Office of Primary Educational Service Area.

Research objectives included studying the current status, desired status, and necessary needs for the development of supervision to promote curriculum administration that emphasizes learner competency and developing a supervision model to promote curriculum administration that emphasizes learner competency in schools under the Office of Primary Educational Service Area.

The Research Framework included the components of the supervision model to promote curriculum administration that emphasized learner competency in schools under the Office of Primary Educational Service Area were synthesized by the researcher from relevant documents and research works related to the concept. Figure 1 demonstrates the research framework.

## 2. Method

This research employed a Research and Development (R&D) approach. The researchers divided this study into two phases. Phases 1 and 2.

Phase 1 involved studying the current status, desired status, and needs for developing supervision. In this phase, the researchers reviewed, analyzed, and synthesized relevant documents, theories, and research to frame interview and questionnaire development. The research tools included document analysis, which defined the concept framework for supervision promoting curriculum administration that emphasizes learner competency. Content analysis was used to summarize and define operational terms.

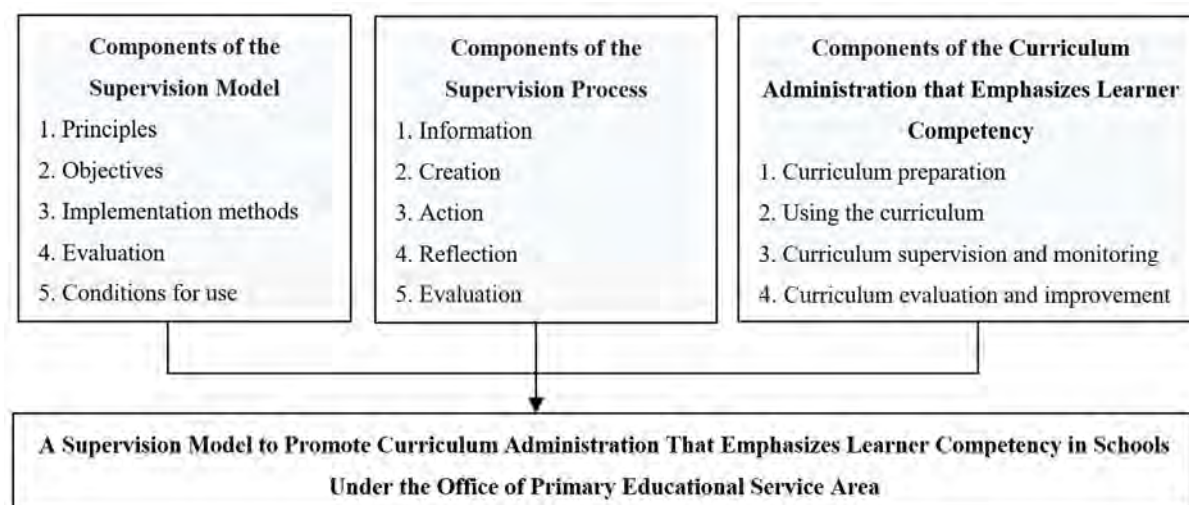


Figure 1. Research framework

*Note.* The figure demonstrates the research framework that includes components of the supervision model, the components of the supervision process, and the components of the curriculum administration that emphasize learner competency.

This research employed a Research and Development (R&D) approach. The researchers divided this study into two phases. Phases 1 and 2.

Phase 1 involved studying the current status, desired status, and needs for developing supervision. In this phase, the researchers reviewed, analyzed, and synthesized relevant documents, theories, and research to frame interview and questionnaire development. The research tools included document analysis, which defined the concept framework for supervision promoting curriculum administration that emphasizes learner competency. Content analysis was used to summarize and define operational terms.

In addition, the researchers interviewed experts to assess and provide feedback on the principles and concepts of supervision promoting curriculum administration that emphasizes learner competency. Using purposive sampling, five experts were selected based on their knowledge and experience in supervision or curriculum management, and holding at least a doctoral degree with at least five years of experience. The research tools included semi-structured interviews verified by the advisor. Data collection involved self-conducted interviews, and content analysis was used for data analysis.

Finally, the researchers used a survey for the current status, desired status, and needs for developing supervision promoting curriculum administration that emphasizes learner competency. The population included administrators and head academic teachers affiliated with the primary education service area offices in the 14th Inspection Region, comprising four provinces: Ubon Ratchathani, Si Sa Ket, Yasothon, and Amnat Charoen, totaling 12 Educational Service Areas, with a total of 5,074 people. The sample included 370 administrators and head academic teachers, determined using Taro Yamane's formula (1973, pp. 727–728), and stratified sampling. The research tools consisted of a questionnaire with three parts: general respondent information, current and desired supervision status, and open-ended questions on supervision guidelines. The questionnaire was reviewed by five experts for consistency the Item-Objective Congruence (IOC) found that IOC scores for individual items ranged between 0.80 and 1.00 and reliability (Cronbach's Alpha), with an overall reliability of .986. Data collection involved online questionnaires (Google Form), and data analysis used statistical software for quantitative data (mean, standard deviation,  $PNI_{modified}$ ) and content analysis for qualitative data.

Phase 2 consisted of developing the supervision model. In this phase, the researchers created a draft of the supervision model by integrating findings from Phase 1. The model components included: 1) Model principles 2) Model objectives 3) Implementation methods encompassing five supervision processes: information, creation, action, reflection, and evaluation, and outcomes promoting curriculum administration in four areas: curriculum preparation, using the curriculum, curriculum supervision and monitoring, and curriculum evaluation and improvement, 4) Model evaluation, and 5) Conditions for use. The model's suitability and feasibility were validated through an expert evaluation. The sample group consisted of 11 experts in academics, supervisors, school administrators, and educational administrators, selected using purposive sampling. The research tools included an

evaluation form for the model's suitability and feasibility, consisting of five levels: highest, high, moderate, low, and lowest. Data was collected by conducting focus group discussions, with experts evaluating the appropriateness and feasibility of the supervision model using an assessment form, and providing suggestions for improving and developing the draft model, with data analysis using mean and standard deviation. The researchers revised and improved the supervision model based on expert feedback, ensuring the model's suitability and feasibility for practical implementation.

### 3. Results

This part summarizes results obtained from Phase 1 (Current status, desired status, and needs for developing supervision) and Phase 2 (Development of the supervision model).

#### 3.1 Results from Phase 1 (Current Status, Desired Status, and Needs for Developing Supervision)

The study revealed that the current and desired statuses of supervision to promote curriculum administration emphasizing learner competency were at a high level. When considering each aspect, the average values are arranged from highest to lowest, namely: action, information, creation, reflection, and evaluation, respectively. The necessity for development, measured by the  $PNI_{\text{modified}}$  value, is .102, indicating the highest need for evaluation, followed by creation, reflection, information, and action. The researchers summarize the supervision guidelines in order of priority as follows:

##### 3.1.1 Evaluation ( $PNI_{\text{modified}} = .111$ )

Evaluation should aim for development, emphasizing participation from stakeholders using various methods. Digital technology should be applied, appropriate supervision tools should be used, and data should be systematically analyzed accurately, clearly, and comprehensively covering developmental issues. Evaluation reports should be prepared and disseminated through various channels.

##### 3.1.2 Creation ( $PNI_{\text{modified}} = .110$ )

This creation involves setting the objectives and goals of supervision, determining the content of supervision, designing techniques, methods, and formats that align with the content and needs of the supervisees, designing appropriate supervision tools, identifying relevant personnel, setting time frames and budgets, and designing appropriate supervision evaluation methods.

##### 3.1.3 Reflection ( $PNI_{\text{modified}} = .106$ )

The reflection should be done to review and analyze the results of supervision, to identify strengths and weaknesses, and to improve supervision plans for greater effectiveness. It should involve the participation of supervisors, supervisees, and stakeholders in a professional learning community process.

##### 3.1.4 Information ( $PNI_{\text{modified}} = .096$ )

The information involves collecting data through document studies, surveys on current conditions and supervision needs, and interviews with stakeholders to obtain accurate, complete, and reliable information. This data should then be analyzed, synthesized, and presented in an easily understandable format, using modern information technology tools for dissemination.

##### 3.1.5 Action ( $PNI_{\text{modified}} = .087$ )

The Supervision should be conducted by responsible personnel according to the techniques, methods, formats, and time frames outlined in the supervision plan. The use of tools, media, technology, and innovations should follow the designed plan.

#### 3.2 Results from Phase 2 (Development of the Supervision Model)

The development of the supervision model to promote curriculum administration that emphasizes learner competency consisted of principles of the model, objectives of the model, implementation methods, model evaluation, and conditions for use.

##### 3.2.1 Principles of the Model

The Principles of the Model consisted of 1) the Principle of Friendship; 2) the Principle of Cooperation; 3) the Principle of Continuous Development; 4) the Principle of Integrated Supervision; and 5) the Principle of Modernity. The principle of friendship referred to educational supervision that emphasized providing help, support, and encouragement to help those being supervised develop themselves. This principle involved giving encouragement and guidance without criticism.

The principle of cooperation meant supervision that emphasized participation. Supervisors and supervisees

participated in planning, set goals together, exchanged knowledge with each other, and worked as a team.

The principle of continuous development refers to educational supervision that focuses on improving and developing the supervision process to enhance its effectiveness and achieve goals. It involved analyzing data, methods, tools, and continuous monitoring and evaluation to make improvements for the next cycle.

The principle of integrated supervision refers to educational supervision that focused on linking and coordinating between agencies, individuals, processes, resources, goals, and activities. It involved connecting the content of supervision and using a variety of strategies, techniques, and methods.

The principle of modernity referred to educational supervision that focused on concepts and processes of societal change towards a modern way of life. It emphasized using modern technology to enhance the effectiveness of supervision, prioritizing individuality and equality, and incorporating contemporary educational systems.

### 3.2.2 Objectives of the Model

The Objectives of the Model included providing an effective supervision model for promoting curriculum administration that emphasizes learner competency in schools under the Office of Primary Educational Service Area and serving as a guideline for driving supervision to promote curriculum administration that emphasizes learner competency in schools under the Office of Primary Educational Service Area.

### 3.2.3 Implementation Methods

The Implementation Methods included a five-step supervision process and results of promoting curriculum administration that emphasizes learner competency.

The supervision process consisted of five steps. First, the information included collecting basic information; studying current conditions, problems, and needs; and synthesizing information on curriculum administration that emphasizes learner competency, involving five implementation strategies. Next, creation consisted of collaborative design and planning; setting shared goals; designing work methods; identifying personnel; allocating resources; setting supervision strategies, techniques, and activities; monitoring and evaluating; developing supervision media and tools; choosing digital technology; and creating a supervision plan with seven implementation strategies. Then the action included building relationships between supervisors and supervisees; coordinating cooperation; conducting supervision using tools to collect data; providing assistance and guidance, and using diverse supervision activities, techniques, and methods suited to the context and needs of the supervisees, with seven implementation strategies. Reflection consisted of exchanging views and participating in meetings to reflect on supervision results; analyzing data; providing feedback; creating a learning community; and organizing forums for sharing good practices in curriculum administration that emphasizes learner competency, with five implementation strategies. Finally, evaluation consisted of using appropriate evaluation methods and tools to assess and report on educational supervision; studying success conditions and obstacles; and summarizing evaluation results to improve future supervision, with three implementation strategies.

Outcomes for promoting curriculum administration that emphasizes learner competency consisted of curriculum preparation, using the curriculum, curriculum supervision and monitoring, and curriculum evaluation and improvement. The curriculum Preparation included preparing personnel, budget, materials, and managing curriculum focusing on learner competency, with ten sub elements. Using the Curriculum included integrating the competency-based curriculum into the school's learning process, with seven sub elements. The curriculum supervision and monitoring included systematically supervising, monitoring, assisting, and guiding the use of the competency-based curriculum, with seven sub elements. Finally, the curriculum evaluation and improvement consisted of evaluating and improving the competency-based curriculum to match the context and needs of students, schools, parents, communities, and localities, with eight sub elements.

### 3.2.4 Model Evaluation

The model evaluation consisted of evaluating the implementation process of the supervision model to promote curriculum administration that emphasizes learner competency; evaluating the outcomes of implementing the supervision model to promote curriculum administration that emphasizes learner competency; and assessing the satisfaction of stakeholders with the use of the supervision model to promote curriculum administration that emphasizes learner competency.

### 3.2.5 Conditions for Using the Model

The conditions for using the model included 1) developing a clear supervision plan that comprehensively covers content and supervision processes that promote curriculum administration that emphasizes learner competency, using appropriate techniques, methods, and activities; 2) regular monitoring and evaluation of the implementation,

using results to improve supervision; and 3) Creating a support system: The Office of Primary Educational Service Area provides budget, resources, media, innovation, and technology support, while schools establish internal supervision support systems to promote curriculum administration that emphasizes learner competency.

The expert evaluation results from Phase 2 (Development of the Supervision Model) showed that the supervision model's suitability and feasibility were rated as highly appropriate overall. In addition, the manual for using the supervision model was found to be highly appropriate overall.

#### 4. Discussion

The findings of this research indicated that the developed supervision model was effective in promoting curriculum administration that emphasizes learner competency. The model's systematic approach ensures comprehensive and sustainable curriculum management, addressing the needs of schools under the Office of Primary Educational Service Area. The high ratings for the model's suitability and feasibility suggest that it can be successfully implemented in practice, leading to improved curriculum administration and enhanced learner competency. The elements of the aforementioned supervision model were derived from a systematic study. There were clear process steps from the principle of style that should adhere to the principle of friendship, principles of cooperation, principles of continuous development principles of integrated supervision, and modern principles.

The objective was to develop an effective supervision model to promote curriculum management that emphasized student competency. A step-by-step supervision process was carried out, focusing on the results of promoting curriculum administration that emphasized student competency. An evaluation method was specified to appropriately cover the results, as well as conditions for its use to effectively benefit students, personnel, agencies, and organizations.

Saengthong et al. (2023) discussed the blended supervision model to promote active learning management for elementary school teachers, which includes the principles of the model, the objectives of the model, the implementation methods of the model, the evaluation of the model, and the conditions for success. According to Srina (2023), the results of creating a supervision model for developing teachers into professionals include objectives, principles, mechanisms, implementation methods, evaluation, and conditions for success. Following Nuammano (2019), it is stated that the supervision model consists of the model's principles, objectives, operational mechanisms, supervision content, supervision processes, model evaluation, and conditions for successful implementation. The supervision process comprises five steps: information management, supervision design, supervision implementation, supervision reflection, and supervision evaluation. This aligns with Chaiklaing (2019), who described a six-step integrated supervision process to promote secondary school teachers' research, including needs assessment, supervision planning, pre-supervision training, integrated supervision implementation, supervision evaluation, and reflection.

Similarly, Somsri (2020) discussed a supervision process that enhances the competence of elementary school teachers in managing English for communication, which includes analysis, preparation, knowledge provision, supervision implementation, and feedback. Furthermore, Sakulsuan (2022) described a new supervision process to improve the quality of educational management, which consists of six steps: analyzing supervision needs, designing technology-based supervision, implementing technology-based supervision, reporting supervision results using technology, providing motivation and support, and developing and refining the supervision process (pp. 208–209).

Additionally, Atchavichai (2022) research described a participatory supervision process to enhance the competence in learning assessment and evaluation for elementary school teachers, which includes four steps: collaborative supervision planning, collaborative supervision implementation, collaborative evaluation and summary of supervision, and collaborative meetings to create work understanding and provide feedback (pp. 295–298).

This research developed a supervision model to promote curriculum administration emphasizing learner competency in schools under the Office of Primary Educational Service Area. The model's systematic and comprehensive approach addresses the current needs and challenges in curriculum administration, providing a practical framework for schools to enhance learner competency through effective supervision processes. The high suitability and feasibility of the model indicate its potential for successful implementation and positive impact on educational quality and learner outcomes.

Based on the research findings, schools under the Office of Primary Educational Service Area should adopt the developed supervision model to enhance curriculum administration and learner competency. Then educational administrators and supervisors should provide training and support for teachers to effectively implement the

supervision model. In addition, further research should be conducted to evaluate the long-term impact of the supervision model on learner competency and educational quality. Finally, the model should be continuously reviewed and improved based on feedback and outcomes from its implementation in practice.

This research resulted in a supervision model for promoting curriculum management that emphasized student competency, which was highly appropriate and feasible. The developed model was implemented by following the supervision process consistently and continuously with an emphasis on participation. Additionally, there was monitoring, evaluation, and reporting of the results to further develop the quality of education. From the study on the need for developing supervision to promote curriculum management that emphasizes student competency, it was found that the evaluation of supervision had the highest index of development needs. Administrators, educational supervisors, teachers, and relevant parties were advised to prioritize the evaluation process. They should develop tools, establish clear and comprehensive evaluation criteria, and conduct evaluations regularly to use the results for continuous improvement and development.

Future research should focus on qualitative research and participatory action research related to supervision for promoting curriculum management that emphasizes student competency, to serve as a guide for improving the quality of education. Research should also be conducted to study the effects of supervision using different supervision processes or models, to understand their advantages and limitations, and to provide guidance for developing the supervision process to ensure effective educational management in the future.

### **Acknowledgments**

We greatly appreciate the valuable contributions of our community advisory committee members. We would also like to thank the Faculty of Education, Ubon Ratchathani Rajabhat University, Thailand and participants for their valuable contributions to this study.

### **Authors' contributions**

Suriyon Chaiyamart, Dr.Chuankid Masena and Dr.Pongthorn Singpun were responsible for study design and revising. Suriyon Chaiyamart was responsible for data collection. Dr.Paiwan Kotta and Dr.Taniya Morris drafted the manuscript and revised it. All authors read and approved the final manuscript.

### **Funding**

Not applicable.

### **Competing interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### **Informed consent**

Obtained.

### **Ethics approval**

The Publication Ethics Committee of the Canadian Center of Science and Education.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

### **Provenance and peer review**

Not commissioned; externally double-blind peer reviewed.

### **Data availability statement**

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

### **Data sharing statement**

No additional data are available.

### **References**

- Artwichai, W. (2022). *Development of a participatory supervision model to enhance learning measurement and evaluation competency of teachers in primary schools under the office of the basic education commission in the northeast*. Unpublished doctoral dissertation. Sakon Nakhon Rajabhat University, Sakon Nakhon, Thailand.
- Bowonsak, O. (2018). *Development of supervision model to enhance critical thinking for science teachers in*

- expansion schools*. Unpublished doctoral dissertation. Mahasarakham University, Mahasarakham, Thailand.
- Chaikliang, C. (2019). Blended supervision model for enhancement research of secondary school teachers. *Journal of MCU Nakhondhat*, 6(10), 5344–5361.
- Khompettee, R. (2015). *A Development of Effective Curriculum Administration Model for Large-sized Secondary Schools in the Upper Northeastern*. Unpublished doctoral dissertation. Sakon Nakhon Rajabhat University, Sakon Nakhon, Thailand.
- Nillapun, M. (2011). An evaluation project for leveling the teacher quality system: The new supervision development activity. *Silpakorn University e-Journal* (Social Sciences, Humanities, and Arts), 31(2), 149–166.
- Nuammano, C. (2019). *Development of internal supervisory model for teacher competency improvement on English learning management for secondary school in the northeastern part of Thailand*. Unpublished doctoral dissertation. Mahasarakham University, Mahasarakham, Thailand. <https://doi.org/10.2139/ssrn.3547093>
- Office of The Basic Education Commission. (2013). *Guidelines for full supervision*. Bangkok: Printing House of the Agricultural Cooperatives Association of Thailand.
- Office of The Education Council. (2009). *Second decade of educational reform B.E. 2552–2561* (2009–2018). Bangkok: Agricultural Cooperatives Association of Thailand Printing Company Limited.
- Office of The Education Council. (2020). *Competency-based learning management*. Nonthaburi: 21 century print Company Limited.
- Phutivanish, P. (2019). *A model development of the excellent music curriculum management of Patchara Music Academy Sriracha School under the Chonburi Primary Educational Area Office 3 by participatory action research*. Unpublished doctoral dissertation. Burapha University, Chonburi, Thailand.
- Prommaboon, T., Intakanok, P., Homjan, W., Boonthong, S., Imboonta, B., Yodsara, S., & Raungsit, W. (2021). *The development of testing system of core competency for learners at the primary school to enhance the quality of learner in the 21<sup>st</sup> century*. National Institute of Educational Testing Service (Public Organization), Bangkok, Thailand.
- Saengthong, W., Kuntharee, N., & Masena, C. (2023). Blended Supervision Model to Enhance Active Learning Management of Primary School Teachers. *Journal of MCU Nakhondhat*, 11(3), 1194–1205.
- Sagulsoo, K. (2022). *A new supervision model for educational management quality development of schools, Pathumthani Primary Educational Service Area Office 2*. Unpublished doctoral dissertation. North Bangkok University, Bangkok, Thailand.
- Somsri, M. (2020). *The development of supervision model to enhance communicative english learning management competency for primary teachers under the basic education commission in the northeast area*. Unpublished doctoral dissertation. Mahasarakham University, Mahasarakham, Thailand.
- Srina, T. (2023). *Teachers supervision model for development to professional teachers affiliated to the office commission*. Unpublished doctoral dissertation. Ubon Ratchathani Rajabhat University, Ubon Ratchathani, Thailand.
- Yamane, T. (1973). *Statistics: An Introductory Analysis* (3rd ed.). New York: Harper and Row.

## Copyrights

Copyright for this article is retained by the author, with first publication rights granted to the journal.

This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).