



THE MODEL OF THE DEVELOPMENT COMPETENCY FOR THE
ADMINISTRATORS OF SCIENCE, MATHEMATICS AND TECHNOLOGY
QUALITY OF THE SECONDARY SCHOOLS UNDER THE OFFICE
OF THE BASIC EDUCATION COMMISSION*

การพัฒนารูปแบบสมรรถนะผู้บริหารโรงเรียนคุณภาพวิทยาศาสตร์ คณิตศาสตร์และ
เทคโนโลยี ระดับมัธยมศึกษา สังกัดสำนักงานคณะกรรมการการศึกษาขั้นพื้นฐาน



Sirikwun Kwunmuang, Sinchai Suwanmanee, Rungchatchadaporn Vehachart

ศิริขวัญ ชวนมูล, ศิน彩 สุวนามนี, รุ่งชัชดาพร เวหชาติ

Thaksin University

มหาวิทยาลัยทักษิณ

Corresponding Author E-mail: Sirikwun9140@gmail.com

Abstract

Objectives of this research article were: 1. To develop a competency model for the administrators of science, mathematics, and technology quality secondary schools 2. To evaluate the developed model and propose the guidelines for model application. The data were collected in two rounds using in-depth interviews and a questionnaire. In the first round, seven experts were semi-structured interviewed, and in the second round, there were twenty experts examined by a questionnaire. The Delphi technique was used for data collection. All data were used for evaluating appropriateness and possibility, including guidelines for the model application using a focus group discussion using nine specific experts. The statistics used for data analysis were percentage, median, interquartile range, mean, and standard deviation.

The research findings revealed that: 1. The competency model consists of 6 main components, 22 sub-components, and 118 indicators, which were result-based leadership, academic leadership, strategic management, using digital technology for communication, and teacher and student development, and

*Received April 25, 2023; Revised May 19, 2023; Accepted May 20, 2023



2. Appropriateness evaluation and probability that were at the high level. There were two ways to develop the administrators' competency, which were the administrators of Science, Mathematics, and Technology Quality Secondary Schools would develop the competency with 118 indicators whilst the administrators of Princess Chulabhorn Science School would develop the competency with 66 indicators.

Keywords: Competency; Competency Model of Administrators; Science, Mathematics, and Technology Quality of the Schools

บทคัดย่อ

บทความวิจัยนี้มีวัตถุประสงค์ 1. พัฒนารูปแบบสมรรถนะผู้บริหารโรงเรียนคุณภาพวิทยาศาสตร์ คณิตศาสตร์และเทคโนโลยี 2. ประเมินรูปแบบพร้อมทั้งเสนอแนวทางการนำรูปแบบไปใช้ เก็บข้อมูลด้วยการสัมภาษณ์เชิงลึกจากผู้ทรงคุณวุฒิแบบเฉพาะเจาะจง จำนวน 2 รอบ โดยรอบที่ 1 ใช้แบบสัมภาษณ์กึ่งโครงสร้าง มีผู้ทรงคุณวุฒิ จำนวน 7 คน และรอบที่ 2 ใช้แบบสอบถามชนิดเลือกตอบ มีผู้ทรงคุณวุฒิ จำนวน 20 คน รวบรวมความคิดเห็นจากผู้ทรงคุณวุฒิ โดยใช้เทคนิคเดลไฟย์ จำนวน 20 คน ประเมินความเหมาะสมและความเป็นไปได้ รวมทั้งเสนอแนวทางการนำรูปแบบไปใช้ โดยใช้เทคนิคการสนทนากลุ่ม จากผู้เชี่ยวชาญแบบเฉพาะเจาะจง จำนวน 9 คน วิเคราะห์ข้อมูลโดยการหาค่าร้อยละ ค่ามัธยฐาน ค่าพิสัยควรอ้างอิง ค่าเฉลี่ยและส่วนเบี่ยงเบนมาตรฐาน

ผลการวิจัยพบว่า 1. รูปแบบสมรรถนะประกอบด้วย 6 องค์ประกอบหลัก 22 องค์ประกอบย่อย 118 ตัวบ่งชี้ ได้แก่ การเป็นผู้นำองค์กรที่มุ่งเน้นผลสัมฤทธิ์, การมีภาวะผู้นำทางวิชาการ, การบริหารเชิงกลยุทธ์, การใช้เทคโนโลยีดิจิทัลและการสื่อสาร, การพัฒนาครุและ การพัฒนาผู้เรียน 2. ผลการประเมินรูปแบบมีความเหมาะสมและมีความเป็นไปได้ โดยรวมอยู่ในระดับมาก มีแนวทางการนำรูปแบบไปใช้เพื่อพัฒนาสมรรถนะผู้บริหารใน 2 แนวทาง คือ ผู้บริหารโรงเรียนคุณภาพวิทยาศาสตร์ คณิตศาสตร์และเทคโนโลยีโดยทั่วไป จะพัฒนาสมรรถนะโดยใช้ 118 ตัวบ่งชี้ และผู้บริหารโรงเรียนวิทยาศาสตร์จุฬาภรณราชวิทยาลัย จะพัฒนาสมรรถนะโดยใช้ 66 ตัวบ่งชี้

คำสำคัญ: สมรรถนะ; รูปแบบสมรรถนะของผู้บริหารโรงเรียน; โรงเรียนคุณภาพวิทยาศาสตร์ คณิตศาสตร์และเทคโนโลยี

Introduction

In the 21st century, a rapidly technological, innovative, and world economic changing era, there have increasingly been effects of the changes; therefore, human



has to adjust themselves to be in changing trends for survival. The Ministry of Education developed 3RX8Cs learning skills that are necessary for students in the 21st century focusing on the development of students' potential in creative and critical thinking applied in solving scientific, mathematical, and technological problems in daily life and for careers (Ministry of Education, 2018).

The Ministry of Education also arranged a lot of activities such as the Neighboring School Project, Sub-district Quality School Project, Science School Project such as Princess Chulabhorn Science School, Science-class Establishment under the University's Supervision Project, and the Project of Quality Science, Mathematics, and Technology School based on the standard of the Institute for the Promotion of Teaching Science and Technology (The Institute for the Promotion of Teaching Science and Technology, 2017).

However, it was not much success for students' quality in terms of science, mathematics, and technology, especially for secondary students. The score of PISA 2018 in mathematics and science Thai students were lower than the mean scores of the country members (The Institute for the Promotion of Teaching Science and Technology, 2020) and the results of the National Test showed that the scores general secondary gained were lower than the gained score of secondary students in science schools.

As a result, the researchers were interested in investigating the competency of administrators of Kamnoetvidya Science Academy, Mahidol Wittayanusorn School, Princess Chulabhorn Science School, science schools under the Science-class Establishment under the University's Supervision Project and schools under Quality Science, Mathematics, Technology Project based on the standard of the Institute for the Promotion of Teaching Science and Technology, including a documentary study on the development of competency of school administrators from both national and international research applied to competency model development for administrators of quality science, mathematics, and technology schools affecting the high level of learning achievement with expected characteristics and important scientific, mathematical, and technical competencies.

Research Objectives

1. To develop a competency model for administrators of science, mathematics, and technology quality secondary schools under the Office of the Basic Education Commission
2. To evaluate the developed model and propose guidelines for the application of the developed model

Methodology

1. Research Design

This is mixed-method research consisting of qualitative study using in-depth interview and focus group, and a quantitative study.

2. Population Samples and Key Informants

There were fifty-six informants in this research study divided into three groups: 1. two rounds of in-depth interviews proceeded by seven specific selected experts using semi-structure interview form in the first round consisting of one regional administrator on STEM of Southeast Asia Ministers of Education Organization, one administrator of The Institute for the Promotion of Teaching Science and Technology, three administrators of science schools that are Kamnoetvidya Science Academy, Mahidol Wittayanusorn School, and PSU Wittayanusorn School, one administrator of Princess Chulabhorn Science School, and one administrator of science schools under the Science-class Establishment under the University's Supervision Project, and in the second round, a questionnaire was used with twenty experts consisting of three top executives of the Ministry of Education playing important roles in terms of policy and four administrators of organizations or institutions developing administrators' competency, four administrators of Secondary Educational Service Offices, three educational staff, two administrators of Chulabhorn science schools, two administrators of schools getting the support of establishing science class under the supervision of university, and two administrators of science, mathematics, and technology quality secondary schools based on the standard of the Institute for the Promotion of Teaching Science and Technology, 2. collecting data from twenty specific experts using Delphi technique consisting of eight experts in educational administration experts, four experts in educational policy, two experts in



educational administrators' competency development, and six experts in school management, and 3. focus group was used with nine experts consisting of four experts in educational administration, two experts in educational policy, one expert in educational administrators' competency development, and two experts in educational administration.

3. Research Instruments

3.1 Qualitative Research: in-depth interview and focus group

3.2 Quantitative Research: a questionnaire in the form of checklist and Likert scale

4. Data Collection

4.1 Firstly, collecting the data using a semi-structured interview to get components and indicators of competency

4.2 Secondly, collecting the data using a questionnaire designed by analyzed components and indicators gained in 4.1, which is a checklist of agree, disagree, and open-ended questions to get the ideas from experts

4.3 Thirdly, using another set of questionnaire in Likert scale designed by the gained data from 4.2

4.4 Fourthly, using the third set of questionnaire designed by the gained data from 4.3 that is in the form of Likert Scale collecting the data one month after the data collection process in 4.3

4.5 Fifthly, collecting data via focus group to evaluate the developed model and propose the guidelines for model application

5. Data Analysis

The researchers analyzed the qualitative data gained from semi-structured interview and focus group using content analysis techniques and the quantitative data using program detailed as follows: 1. gained data of questionnaire set 1 using 80/80 of Bloom (Bloom, 1968) and percentage 2. gained data of questionnaire set 2 and 3 using median and interquartile at the median 3.50 and above and interquartile 1.50 and below and meaning translation criteria of Srisa-ard (2004) and 3. analyzed appropriateness and possibility of the model using mean, standard deviation, and meaning translation criteria (Srisa-ard, 2004)

Results

1. the development of competency model for the administrators of science, mathematics, and technology quality secondary schools under the Office of the Basic Education Commission revealed that two rounds of in-depth interview found that the first round using semi-structured interview getting a draft of competency model consisting of seven core components, twenty-four sub-components, and 215 indicators, and the second round using multiple choice questionnaire which experts agree with more than 80 percent, leaving 156 indicators remaining, and passed the judging criteria at the level of expert consensus, which is having a median (Md.) of 3.50 or higher and an interquartile range (I.R.) of 1.50 or lower, resulting in 155 indicators. And from the evaluation of the competency model using group discussion techniques, there will be 118 indicators remaining. Therefore, it can be concluded that the performance model consists of 6 core components, 22 sub-components, and 118 indicators as follows.

2. Evaluation of the model and proposing guidelines for the implementation of the competency model for the administrators of science, mathematics, and technology quality secondary schools under the Office of the Basic Education Commission to use.

Table 1 shows the mean and standard deviation of the suitability and likelihood of the competency of school administrators of science, mathematics, and Technology quality.

Capability	Appropriateness			Probability		
	(\bar{X})	(S.D.)	Level	(\bar{X})	(S.D.)	Level
1. Result-Based Leader	4.35	0.34	high	4.21	0.46	high
2. Academic Leadership	4.37	0.49	high	4.24	0.50	high
3. Strategic Management	4.44	0.57	high	4.40	0.37	high
4. Digital Technology and Communication	4.31	0.56	high	4.16	0.51	high
5. Teacher Development	4.34	0.34	high	4.30	0.37	high
6. Student Development	4.40	0.27	high	4.35	0.41	high
Total	4.37	0.43	high	4.28	0.44	high

From table 1 can be concluded that the assessment of appropriateness ($\bar{X}=4.37$, S.D.=0.43), and probability ($\bar{X}=4.28$, S.D.=0.44) in overall were at the high level, and there are guidelines for applying the competency model to develop the school administrator's competency in 2 ways which are used for developing the competency of administrators of science, mathematics, and technology



quality secondary schools in general, and used for Princess Chulabhorn Science School.

Discussion

The results of research have the important issues to discuss the result of the research as follows:

1. Result-Based Leader, from the research found that the competency of school administrators consistent with Bunmee (2018) states that an organization with morality, knowledge, and ability of the executives will be able to compete with others and be successful according to the set goals, and Azar & Adnan (2020) say that school administrators with leadership will help create effective education and plays a key role in determining the direction of education that can meet the needs of society and challenges. Nathamphloi (2019) explains that to manage achievement-oriented of the organization to be successful, senior management must establish a performance appraisal system, incentivization includes the delegation of decision-making authority in exchange for performance responsibility, and there must be systematic data preparation in order to have information to make better decisions.

2. Academic Leadership, from the research found that the competency of school administrators consistent with Saengsarnpan (2019) studies the Development of Academic Leadership Competency Indicators of Secondary School Administrators under the Office of Basic Education Commission has found that the indicators included academic leadership competency are creating a learning atmosphere and learning culture, and management of curriculum and teaching. According to Rukwong (2019), the Development of an Administration Model for the Quality of Secondary Science Schools in Thailand found that factors that affect the quality of secondary science schools in the country are academic leadership of the executive, classroom environment and atmosphere that promotes science learning, and learning management process that focuses on the quality of science students. Moreover, it is correspond to Sarikaya & Erdogan (2016) study that the Relationship Between the Instructional Leadership Behaviors of Secondary School Principals and Teacher's Organizational Commitment found that academic leadership that affects teacher commitment includes curriculum

management and academic processes, and creating a learning atmosphere and environment conducive to learning.

3. Strategic Management, from the research found that the competency of school administrators consistent with Choomwong (2020) study that Model of the Strategic Management for Private Schools under Office of the Private Education Commission in Nonthaburi Province found that strategic management in the direction of management will include a picture of the future of the organization that will lead to increasing the chances of success in future-oriented management. Administrators must systematically create or set a vision, mission, and objectives of the organization to bring it to adjust the direction of work to achieve clear goals and be accepted by society. According to Amoli & Aghashahi (2016) study in an Investigation on Strategic Management Success Factors in an Educational Complex, they found that strategic management creates added value for the school. The success factor in strategic management must consist of strategic planning that has a clear aim, and appropriate to the context of the cooperation of those involved, and implement the strategy, including monitoring systematic operations. Boonananwong et al. (2017) explores the Model of Strategic Management in Secondary School under the Office of Basic Education Commission. It is found that the strategy implementation is directly critical to the success of the strategy.

4. Digital Technology and Communication, from the research, it was found that the competency of school administrators consistent with Herdiana & Khairuddin (2021) which state that the communication of school administrators is necessary so that teachers can convey information from communication to students. Sheninger (2014) finds that school administrators in the digital age need to keep up with the changes in technology because administrators are the key to change in both practice and culture of the school. Educational administrators who are leading the way in digital technology therefore representing new concepts and practices. According to Komolwanich et al. (2020), the study of Digital Leadership of School Administrator under the Secondary Educational Service Area Office 23 found that the digital leadership of school administrators has three main components: 1. digital communication, 2. digital vision, and 3. digital literacy which administrator must be able to anticipate the changes in education by using digital



technology in making decision, and apply digital technology to improve the quality of education.

5. Teacher Development, from the study found that the competency of school administrators consistent with Mahaphromwan et al. (2018) studies in the Model of Competency for Private School Leaders Towards the International Standard, which found that the key competency used in school management to meet international standards include: formulating a clear human resource development strategy to motivate personnel to achieve the vision and mission set by the school. Tufai & Mahmood (2020) states the methods for teaching science that teachers must create in the classroom is that Science teachers must be trained in the use of innovative technologies. So that teachers can use such technology to manage their teaching and learning and must be able to connect teaching to real situations through project-based learning.

6. Student Development, from the study found that the competency of school administrators consistent with Aiamsiri (2019), School administrators can develop students' scientific knowledge and develop their scientific mind by using the five modules learning package including: 1. Interaction with science teachers, 2. Interaction with fellow science students, 3. Interaction with seniors who are successful in science, 4. Interaction with entrepreneurs involved in science and 5. interaction with scientists. It is correspond to Vosniadou (2019) that has studied The Development of Students' Understanding of Science found that the development of scientific knowledge is a time-consuming and gradual process. Therefore, school administrators must collaborate with teachers in organizing the learning process to create creative learning mechanisms for students and develop scientific reasoning skills to helps students to come up with new ideas or scientific innovations. Patrawiwat et al. (2016) identify the study Guideline Development of Quality Gifted Education in Science, Mathematics, and Technology by Using the Application of Futures Research found that Curriculum or extra-curricular activities must consider the special needs of each individual and develop teaching and learning excellence.

Body of Knowledge

The Model of the Development Competency for the Administrators of Science, Mathematics, and Technology Quality Secondary School under the Office of the Basic Education Commission is made in order to be effective in applying to develop school administrators' competencies, therefore, it should be applied in two ways that are the competency model consisting of 6 core components, 22 sub-components, and 118 indicators applying to develop the competency of administrators of science, mathematics, and technology quality secondary schools in general as educational management aimed to high level of learning achievement with expected characteristics and significant competencies in science, mathematics, and technology. The model has crucial indicators identifying important behaviors in developing competencies in organizational leaders, academic leaders, strategic administration of application of information technology and communication, teacher development, and student development as shown in Figure 1.

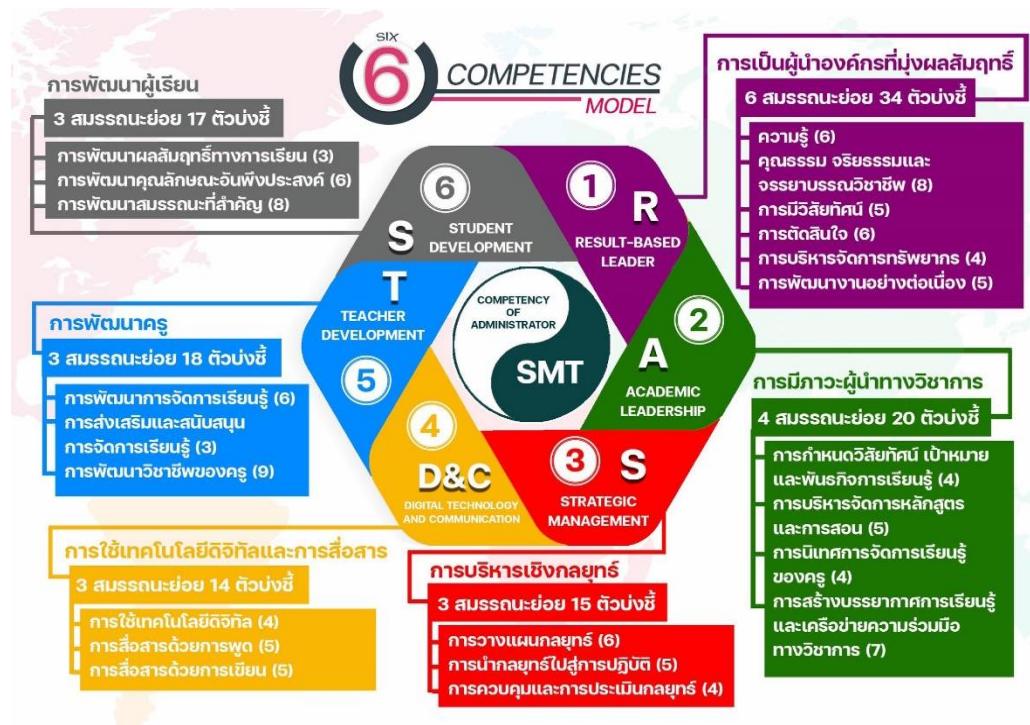


Figure 1 The Model of the Development Competency for the Administrators of Science, Mathematics, and Technology Quality School



However, Princess Chulabhorn Science School that is a science school should utilize the competency model consisting 6 core components, 22 sub-components, and 66 indicators (top 3 highest average indicators of sub-components) to further the success in quality development in science, mathematics, and technology to international level, especially academic leadership such as school management to be consistent with customized curriculum, creation of learning atmosphere and national and international academic networks, development of result-based leadership that requires knowledge, understanding in creating academic excellence for the students with potential and trust the ideology on development of science, mathematics, and technology. In addition, the development of students' and teachers' quality development competency to encourage development of high-ordered thinking of students so that it can create knowledge and lead to high qualified research team having high-level capability at the similar level with leading international researchers as shown in Figure 2.

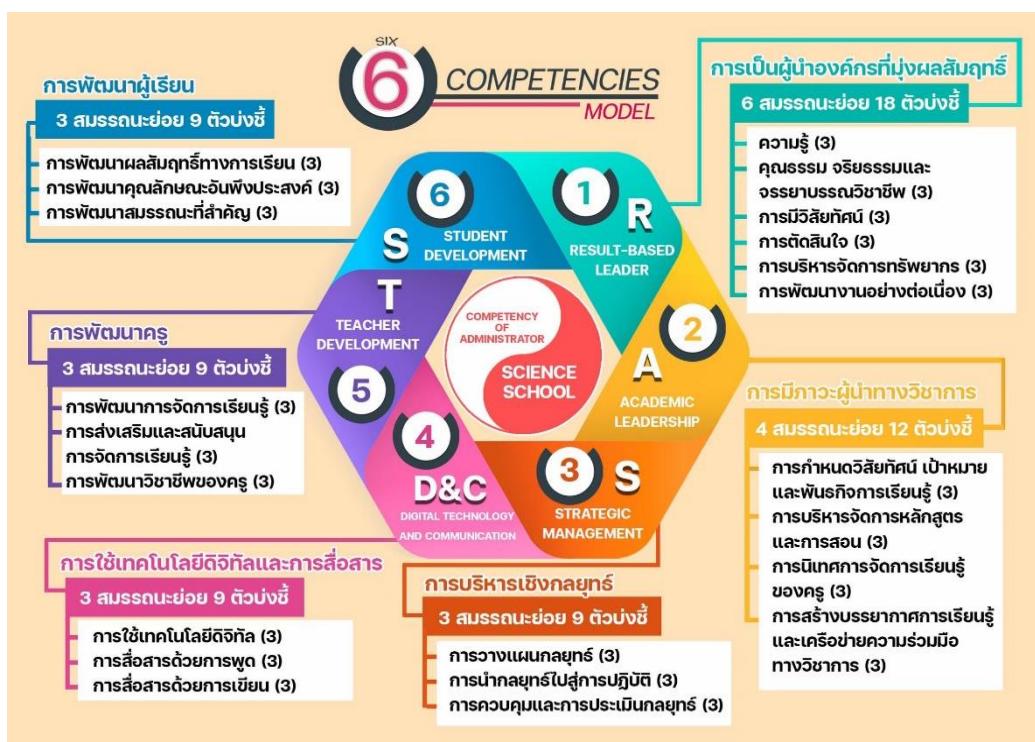


Figure 2 The model of competency administrators at Princess Chulabhorn Science School

Recommendations

It should also be a quantitative study using Confirm Factor Analysis to be a model to develop competency of the quality science schools having statistically confirmed data that are useful in terms of educational Administration development.

References

Aiamsiri, Y. (2019). The participatory administrative model for gifted students' scientifically psychological characteristics development at Princess Chulabhorn College, Loei. *Journal of Educational Administration and Leadership*, 8(32), 242–252.

Amoli, S. J. & Aghashahi, F. (2016). An investigation on strategic management success factors in an educational complex. *ScienceDirect*, 9(3), 447–454.

Azar, A. S. & Adnan, E. J. (2020). The impact of effective educational leadership on school students' performance in Malaysia. *Education Quarterly Reviews*, 3(2), 146–155.

Bloom, B. S. (1968). *Learning for mastery evaluation comment, centre for the study of instruction program*. Los Angeles: University of California at Los Angeles.

Boonananwong, Ch. et al. (2017). The Analysis of the Components of Strategic Management Model in Secondary Under the Office of the Basic Education Commission, Bangkok Metropolis. *Dusit Thani College Journal*, 11(2), 318-333.

Bunmee, U. (2018). Morality and ethics for administrators in accordance with organization governance. *Veridian E-Journal, Silpakorn University*, 11(3), 1399-1408.

Choomwong, N. (2020). Model of the strategic management for private schools under Office of the Private Education Commission in Nonthaburi Province. *Journal of Humanities and Social Sciences, Rajapruk University*, 6(3), 91-108.

Herdiana, Y. & Khairuddin. (2021). Principal communication management to improve teacher performance. *Al- Ishlah: Jurnal Pendidikan*, 13(1), 78–87.



Institute for the Promotion of Teaching Science and Technology. (2020). *PISA evaluation result 2018: What do 15-year Thai students know and do?*. Retrieved January 7, 2020, from <https://shorturl.asia/zSXsR>

Komolwanich, S. et al. (2020). Digital leadership of school administrator under the Secondary Educational Service Area Office 23. *21st National Postgraduate Research Conference*, 1(1), 1–8.

Mahaphromwan, N. et al. (2018). The model of competency for private school leaders towards the international standard. *Journal of Humanities and Social Sciences Thonburi University*, 13(2), 138-150.

Ministry of Education. (2018). *Entrepreneurship Education*. Bangkok: Prikwan Graphic.

Nathamphloei, Ch. (2019). Achievement management in current social society. *Journal of Educational Innovation and Research*, 3(3), 171–178.

Pattrawiwat, K. et al. (2016). Guideline development of quality gifted education in science, mathematics, and technology by using the application of futures research. *Journal of Behavioral Science for Development*, 8(2), 151–168.

Rukwong, K. (2019). *The development of an administration model for the quality of secondary science schools in Thailand* (Ph.D. dissertation in Educational Administration). Chonburi: Burapha University.

Saengsarnpan, K. (2019). *The development of academic leadership competency indicators of secondary school administrators under the Office of Basic Education Commission* (Ph.D. Dissertation in Educational Administration). Chonburi: Burapha University.

Sarikaya, N. & Erdogan, C. (2016). Relationship between the instructional leadership behaviors of secondary school principals and teacher's organizational commitment. *Journal of Education and Practice*, 7(3), 7-18.

Sheninger, E. C. (2014). *Digital leadership: Changing paradigms for changing times*. California: Corwin.

Srisa-ard, B. (2004). *Statistical methodology for research* (4th ed.). Bangkok: Suweeriyas.

Tufai, I. & Mahmood, M. K. (2020). Teaching methods preferred by school science teachers and students in their classrooms. *International Journal of Teaching, Education, and Learning*, 4(3), 332–347.



Vosniadou, S. (2019). The Development of Students' Understanding of Science. *Frontiers in Education*, 4(32), 1–6.

