

CHAPTER 5

Conclusion, Discussion and Suggestions

The aims of the research study entitled “A Model of Developing Mentor Teachers’ Competencies to Enhance Mathematics Learning Provision in the 21st Century” were 1) to explore the conditions of mathematics learning and current mentor teachers’ supervision, and the needs for competencies development in promoting mathematics learning provision in the 21st century, 2) to develop the model of developing mentor teachers’ competencies corresponding to mathematics learning provision in the 21st century, and 3) to examine the results of the use of the model of developing mentor teachers’ competencies corresponding to mathematics learning provision in the 21st century.

5.1 Conclusion

The findings were;

1) The conditions of mathematics learning provision in the 21st century and the overall image of mentor teachers’ supervision regarding to knowledge, process, and attitude was at a high level. When considering each subject from the lowest to the highest respectively, the first three subjects were consecutively the understanding of different cultures and various visions, knowledge of professional learning community coordination, and learning facilitator ability. The analysis results in terms of the need for mentor teachers’ competencies development in promoting mathematics learning provision in the 21st century was thoroughly comprised of the need for self-improvement in those three competencies at a high level. When considering each subject, the most valued on average was the need for modern teaching aid innovation. Technology employed in mathematics provision and development of creative thinking skill, innovation, and mathematics problem-solving.

2) The results of the use of the model of developing mentor teachers’ competencies corresponding to mathematics learning provision in the 21st century were:

2.1) The model of developing mentor teachers' competencies corresponding to mathematics learning provision in the 21st century was called 3 New & CAR which is comprised of the principles/concepts, purposes, developing processes, results and supporting factors according to the manual of development. The model of developing mentor teachers' competencies could be divided into 2 phases: phase 1, Preparing with these three small steps 1) New Motivation, 2) New Knowledge and 3) New Skill) ; phase 2, mentoring with the other 3 steps: 4) Collaboration (C), 5) Action (A), and 6) Reflection (R). Therefore, results of the effectiveness of the model were as follows:

2.2) Results of the effectiveness of the model according to 12 experts in the effectiveness of the model assessment in 4 standards were the standard of Feasibility, the standard of Appropriateness, the standard of Adequacy, and the standard of Utility which were at the highest level.

3) The results of the use of the model of developing mentor teachers' competencies corresponding to mathematics learning provision in the 21st century were provided after the trial of the assessment of the effectiveness of the model by mentor teachers. It found out that the model for mentor teachers' competencies development in promoting mathematics learning provision in the 21st century was entirely considered at the highest level, which was the standard of Feasibility, Appropriateness, Adequacy and Utility, respectively.

4) Results of the use of the model of developing mentor teachers' competencies corresponding to mathematics learning provision in the 21st century were:

4.1) Mentor teachers could increase their competency knowledge as shown when comparing the pre-test average score of 16.20 and the post-test one of 25.40. When comparing the pre-test and post-test scores of the mentor teachers' competencies, the post-test scores were higher than the pre-test scores. The overall score of the development was 67 percent and all mentor teachers had a development score of 60 percent.

4.2) Before joining the competency development, mentor teachers' overall had a competency of learning provision and supervision skills to promote mathematics learning provision in the 21st century at a moderate level, and the average score after the development was at the highest level. When considering each item arranged from highest to lowest, they were the students' participation in writing mathematics learning provision plans in the 21st century, followed by the collaboration between the supervising adviser

from the university and student-teachers in terms of mathematics learning provision in the 21st century.

4.3) As a whole, mentor teachers had the attribute competency in learning provision and the mentor teachers' supervision in promoting mathematics learning provision in the 21st century with an average pre-test score at a high level and a post-test one at the highest level. When considering the difference of each item from the highest score to the lowest one, the first three items were the belief that learners can develop their math skills for the 21st century learning, the belief that 21st century learning skills are essential to learning math, and the patience to wait and let the students figure out ways and find answers by themselves.

4.4) Results of the mentor teachers' attitude reveal that all mentor teachers participating in the competency development agreed that the collaboration between mentor teachers and supervising teachers was good for developing student-teachers to gain knowledge and abilities in teaching in order to practice students' problem-solving skills. Also, student-teachers need to prepare the instruction with the supervising teacher because it is new and helps students understand mathematics on their own. Supervising teachers need to give some advice to student-teachers as part of their cooperation. The student-teachers are brave enough to ask for advice from the mentor teachers regarding the learning provision in lesson plan preparation, and they feel more confident to teach as mentor teachers have tried to support the student-teachers throughout the whole class. This should be compared to a normal mentor teacher who lets student-teachers teach by themselves. Also, mentor teachers and student-teachers are able to write lesson plans that emphasize problem-solving skills, manage the class, and give feedback about students' learning provisions.

4.5) Student teachers were satisfied with mentor teachers' support in terms of giving any advice, helping to write lesson plans and class observation, and giving feedback. Normally, there has been teaching feedback. Students noted that mentor teachers understand the method of supervision of students and are able to give advice because of the cooperation. The student-teachers are brave enough to ask the mentor teachers for advice about the learning provision in lesson plan preparation, and they feel more confident to have mentor teachers support them during the class. Students were satisfied with getting advice from and being taken care of by their mentor teachers with regard to promoting the lesson

plan preparation, learning provision, and giving feedback. Previously, mentor teachers focused more on lesson plan evaluation and teaching evaluation through scoring, yet the collaboration in this performance helps evaluation for students by supporting learning activity improvement appropriately.

5.2 Discussion of the Research Results

1) Based on the study of learning management in mathematics, it was found that mentor teachers had a medium level in knowledge and skills competency. 1.1) Knowledge about the principles and guidelines of learning lessons that promote learners in the 21st century in terms of the understanding of culture and paradigm differences 1.2) Ability to be a facilitator of learning that focuses on teaching in a less formal way. 1.3) Creative thinking and innovation skills are what mentors need to develop. They had the old traditional mathematics learning way of teaching that did not promote learning in the 21st century, which is in accordance with Maitree Intraprasit (2014), Vijarn Panich (2012), Pimpan Techagupt and Payao Yindeesuk (2014).

According to what the mentor teachers showed, the teaching methods of teachers were focused on conveying the content with teacher-centered teaching techniques. The nature of teachers in the past was to explain the way or solution to the problem. This research showed that the top three demands of mentors in their competency development areas were: (1) Need for creative thinking and innovation skills, (2) Math problem-solving skills, and (3) Learning management as teachers facilitating the learner's learning (Teach Less, Learn More) to be consistent with the context of school education, particularly in mathematics. There are great mathematicians of the world; for example, Felix Klein, George Pollack, or Hans Freuden studied solving problems and accessing the learning processes of learners. They attempted to create theories and models to promote problem-solving by students. Prasit (2014) showed the same concept of problem-solving as Polya (1945). They focused on the role of teachers focused on helping students with goals. Polya (1945) thought that problem-solving needed to be focused on the learner with the teacher's dedication, but the results of the research showed that teachers had competency in enhancing 21st century mathematics learning, creative thinking, and mathematics problem-solving skills at a moderate level, while the needs of mentor teachers in the development area of these aspects mentioned were at high level. Therefore, there is a need for teacher-

facilitated learning management that emphasizes the learner's ability to think and find solutions. Therefore, the teacher should be trained to have knowledge and ability to develop their teaching technique that focuses on the learner thinking and solving problems on their own. Maitree InPrasit (2014), Panich (2012) Pravat Maharachakul (2004) also stated that the trend of human resource development should be shifted from training to learner-centered and the role of the teacher as facilitator.

As for the present condition of the mentors' competencies, the results showed that the mentors were knowledgeable about collaborative learning as a professional learning community (PLC) in collaboration with student-teachers who had been practicing their profession by creating or producing instructional media of the modern 21st century mathematics at a moderate level. The network associates for 21st century skills 21 (Partnership for 21st Century Skill, 2009), which is an organization in the United States, clearly stated that the most appropriate environment for teaching 21st century skills was in a professional learning community. PLCs allows educators, mentor teachers, and student-teachers to work together and share good ideas to integrate 21st century skills into the classroom (Partnership for 21st Century Skill, 2009). Richard DuFour & Rebecca DuFour, M.Ed, 2011, cited in Bellanca. J. & Brandt, R. (2010) presented the three main ideas of the professional learning community demanded by the parties, including (1) the commitment to the advancement of learning for all students (2) the importance of cooperation and working together to achieve that mission and (3) striving for results that enable schools to provide education that meets the needs of each student. The teacher's guideline shown in Rungwanawan Chandratana (2015) on the study about the factors influencing students' out-of-the box thinking of Yala Rajabhat University suggested that the relationships with the professors have an impact on student' thinking-outside-the-box ability. There was need for developing mentor teachers and student-teachers with the use of a Professional Learning Community in the 21st century. Also Jarin Ngamman (2012) said that the effectiveness of supervision required the cooperation between the supervisor and the teacher who was supervised by all the stakeholders in education management. In addition, Richard DuFour & Rebecca DuFour (2011) cited in Bellanca. J. & Brandt, R (2010). The role of the professional learning community in enhancing 21st century skills was that all teachers would work together on more than one project and they also would have to be involved in identifying issues critical to student learning. They need to solve those problems and answer

the questions by having discussions and sharing knowledge. They should also continuously keep track of student learning and gather information to improve professional practice. These things should be practiced both inside and outside the school or educational district. This will improve student learning competency and gather information to continuously improve professional practice.

2) The development of the model of teacher development enhancement that promotes the learning of mathematics in the 21st century has been developed through the study of the present condition and needs of learning management and supervision of teachers. The idea and theory consists of principle, concept, purpose, development process, role of responsibility, measurement and evaluation and results are a development model derived from the analysis and synthesis of data. The model of teacher development enhances teachers' understanding of mathematics in the 21st century, which includes the first phase of preparation: (1) New Motivation (2) New Knowledge (3) New Skills and phase 2 (4) Collaboration (5) Action and (6) Reflection.

The major characteristic of the model of teacher development enhancement for promoting the management of mathematics learning in the 21st century is the collaborative development of teacher professional development through the use of a Professional Learning Community (PLC), which is the cooperation between mentor teachers, student-teachers, and supervisors. Mentor teachers can learn how to encourage their students to learn math in the 21st century effectively, focusing on learners as thinkers or problem solvers, with teachers as facilitators. This is in response to the factors that promote successful teacher development, namely, the teacher's self-improvement needs, the administrators' support, the professors' expertise capability, the teacher development activities ability, as well as teacher collaboration. (Sirinapa Ikagagool, 2010: 45-59) Similarly, the human resource development model of learning organization to move to the ASEAN community of secondary schools in Chachoengsao Province found four factors to support the development of the learning organization which were; the Ministry's policy, ASEAN preparedness policy, teamwork, and the participation of the community (WichitSangsawang and NawawanWongprasit (2016). The model for developing mentor teachers' competencies that promote the learning of mathematics in the 21st century has developed from theoretical concepts to the study of condition and need for the development of mentor teachers' competencies. There were two phases, phases (1) Preparation and

(2) Practice. From the Theory of Adult Learning, the development of a teacher will be successful if their true needs were taken into account. It must be by their own will not by force, only then will the voluntary be in charge. Adults can bring their past experiences or prior knowledge into new learning. The readiness of adults to learn was influenced by the need to solve their real-life problems. Adults learn from real practice. In the same way, they will try out what they know immediately, which is the reason why this research was divided into two phases as follows:

Stage1: Get Ready

1) *New Motivation* is the first stage of mentor teacher development which corresponds with the Theory of Adult Learning which requires internal motivation to create the interest in one aspect. It can be seen that motivation to follow-up in support is necessary in learning development. In the theory, Wachara Laoriandee (2009:71) stated the importance of the motivation theory in supporting that motivation with any materials such as money, things, or physical conditions which may have no meaning for some people but meaning for others. Besides, opportunity for every individual cannot be equally obtained; in other words, being honored or obtaining a desired physical condition such as pride, the satisfaction of working, appreciation of having a priority in a workplace, and feeling honorable are ways of increasing motivation with regard to performance. This also related to Suduenpen Kongkajunand et al. (2007:7) who identified the benefit of creating motivation for officers working well with high proficiency was that they stay with organization and it encourages them to create more works and get ready for working hard and overcoming challenges. Also, Herzberg 1988, (qtd. Glickman and others 2001:83-84) stated that the importance of motivation can influence monitoring which is a key point of adjusting working for achievement. This includes Motivation Factors with Possibility of Growth, Advancement, Recognition, Responsibility, and Achievement. This theory relates to the Theory of Motivation which includes the concept of monitoring. In this study, the researcher emphasized the motivation of mentor teachers by giving praises in order to be accepted and to be a role model for the student-teachers.

2) *New Knowledge* is the activity of sharing knowledge regarding mathematics learning provision in the 21st century and creating a PLC. In this step, teaching profession standards were regarded in these three aspects: standard of knowledge, standard of working performance, and standard of self-performance in gaining more knowledge. The

knowledge in this model was the knowledge from the performance involving the concept of Empiricism group and the group of progressives which believe that the knowledge inquiry process comes from experiences or performances. New philosophy by John Dewey also gives importance to learning principles from experiences; he states that real experiences are the experiences of problem-solving and informed by problem-solving lessons. Dewey also gave a definition of education as what creates new experiences or adjusts an increase in the value of those experiences and raises abilities to point to the direction of future experiences. This means mentor teachers need to participate in the trials of class activities and writing lesson plans for the improvement of mathematics learning provision in the 21st century.

3) *New skills* is an activity for mentor teachers. In this step, mentor teachers will bring lesson plans to class that were created together with the student-teachers to teach in the mentor teachers' class in order to experience and to give advice for student-teachers in the case of giving feedback for those learning activities. Also, it can enhance mentor teachers skills in writing lesson plans, learning provision, and giving feedback. Steinaker and Bell, (1979) explained that the concept of providing experiences focuses on the involvement of all aspects of an individual who is engaged in different activities. Hence, to attain the learning goals, some steps for detecting gradual improvement in the learner are proposed as follows: (1) Learners encounter real situations; that is, they perceive them consciously, (2) Learners are actively engaged in existing experiences, particularly physical experiences, (3) Learners search for knowledge on their own; in other words, the learners are part of the learning management that decides "what to learn," so their intelligence and emotions are needed to attain the learning goals, (4) Reinforcement: learning activities which can be applied in real life are organized, and (5) Dissemination: the experiences are spread out, both within and outside of the learner in a controllable way.

Stage 2 Take Action

This stage includes steps (4) Collaboration, (5) Action, and (6) Reflection. In this stage, mentor teachers work in collaboration with student teachers in lesson planning, learning and teaching management and reflection on students' learning. The Social Learning Theory refers to the social learning behaviors of social adults (Suwat Wathanawong, 2001) as social activities involving adults that immensely influence learning, adjustment, and personality development consistent with social conditions in which they are members. At work, when encountering doubts or problems, there is no

single best way or approach to resolve them. Learning by doing needs experiences and points of view of a group or an individual to develop inquiries and share opinions that lead to new and different solutions. Organizations, individuals, or teams develop only when their learning rate is equal to or faster than the change rate, that is, $L \geq C$. Revans believes that learning to keep up with what is going on in the world is not enough. We also need to reflect on and share what we have learned in order to benefit ourselves, our teams, our organization, and society. According to social learning concepts, an individual develops one's own behavior by observing and gathering information from the one he sees as his model. The behavior of whoever one chooses to observe and imitate depends on his own perception both of behavioral expressions and their results. The learning process and behaviors incorporate the concepts of the behaviorist theory (Wanchai Meechat, 2008). For this reason, during fieldwork experience at school, student-teachers can learn socially from school administrators, mentor teachers, their fellow student teachers, and students. The school environment has a huge amount of influence over student-teachers' learning and behavioral adjustment. If schools where there are mentor teachers who could be good role models for student-teachers could be selected, the student-teachers would be able to learn things on their own from first-hand experience.

In order to provide learning activities promoting mathematics learning and teaching management in the 21st century based on the constructivist theory (Wantipa Rodrangka, 1998: qtd. in Biddulph and Osborne, 1984: 109), assistance and advice about the interaction between learners and teachers based on this learning theory for student-teachers are needed.

Constructivist theory believes that a teacher should play the role of a learning facilitator who helps students learn and solve problems on their own. Besides, a teacher needs to create a learning environment that stimulates students to construct their knowledge meaningfully and develop understanding of content of different school subjects in a holistic way based on a learner-centered teaching approach. Likewise, Marwardt (2002: 171-186) proposes a 5-step approach to success in Action Learning (AL) which includes (1) to get approval and support from executive administrators by submitting a project describing the process, the advantages, and the resources needed for running the project, (2) to organize a preliminary workshop to introduce the concepts of AL possibly by inviting some experienced personalities to do that and to select 5-6 volunteers to join the

workshop to practice solving some problems and reflect on their learning experiences, (3) to specify activities in the project, action plan and/or proposed problems, and select participants, (4) to determine the process, dates and times, places for continuous meetings, as well as objectives and expected outcomes, and (5) to provide cascade training actively in the organization and follow-up regularly with assessments.

2.1) Results of the study of the effectiveness of the model of developing mentor teachers' competencies to enhance mathematics learning provision in the 21st century revealed that the effectiveness of the model competencies development in the four standards was at the highest level; the mentor teachers' competency with regard to skills and characteristics were at the highest level; the mentor teachers and student-teachers' satisfaction with the use of the model competency development was in a positive way. This may be because the model competency development was conducted using the research and development based process starting from synthesizing related literature and research studies, investigating the conditions and needs for development from mentor teachers, drafting and scrutinizing the model competency development through a focus group discussion among experts who could have proposed practical suggestions, as well as attempting a trial with a group of mentor teachers who could reflect on the problems and obstacles of using the model competency development and the evaluation of the effectiveness of the model development, in all four aspects, from the experts who are knowledgeable and have expertise in educational supervision, educational personnel development, and mathematics learning and teaching management. The results were consistent with those found in the study of Yuwatida Srichana (2015: 153-162) who investigated a model development for participatory non-formal education management in secondary schools under the Office of Basic Education Commission and found that the suitability, feasibility, and usability of the model development as a whole and in all individual aspects were at the highest level. Also, the results were similar to those Wasan Parntong (2013: 193-205) found in the study of a model development for teachers of students in schools under the Primary Education Service Area Offices which revealed that the feasibility of the model development was at a high level and the usability was at the highest level.

2.2) Results of the trial of the model competency development promoting the mathematics learning and teaching management in the 21st century revealed that after

the trial, the effectiveness of the model development was appraised and it was found to be at the highest level and higher than evaluated by the experts in all four aspects. This may be due to the fact that the researcher developed and improved of the model development and had the experts evaluate its effectiveness before the trial, which resulted in the mentor teachers rating it at a very high level.

2.3) Results of the implementation of the model competency development promoting the mathematics learning and teaching management in the 21st century showed the following (1) the average score of the effectiveness with regard to knowledge before joining the competency development program was 16.20 and after was 25.40. When comparing the scores before and after the program, it was found that all mentor teachers earned a higher score after the program than they did before. On average, their developmental score was 56.79 percent, and all mentor teachers earned developmental score of more than 50 percent. (2) As a whole, the mentor teachers' competency with regard to skills indicated that the average score of learning management and teachers' supervising skills before joining the program was at an average level and at the highest level after the program. When considering all items from the highest to the lowest scores, the highest were collaboration with student-teachers in lesson planning based on mathematics learning and teaching management in the 21st century, collaboration with university teachers in supervising the student-teachers, and collaboration with student-teachers in mathematics learning and teaching management in the 21st century respectively. (3) As a whole, the mentor teachers' competency with regard to attributes revealed that the average score of learning management and teachers' supervision skills before joining the program was at a high level and at the highest level after the program. When considering the three items listed from the highest to the lowest scores, the highest scoring items were that it was believed that learners are able to develop their mathematics learning skills of the 21st century, it was believed that learning skills of the 21st century are essential for mathematics learning, and that the learning skills develop learners' patience and make them able to find their own strategies and answers. (4) Most of the mentor teachers' answers tend to be consistent in that the program provided a variety of hands-on activities for mentor teachers, including examples from a model school and model mentor teachers, opportunities to learn things they had no idea about before, and collaboration with university supervisors. Previously, the mentor teachers never met with university supervisors. The student-teachers were more

energetic than their predecessors. They were able to prepare lesson plans that focus on the learners' ability to think and search for different solutions, where teachers act as facilitators. Unlike a traditional teaching class where teachers were the ones who explained, demonstrated and assigned exercises to the students, the new learning activities made them more excited and interested in the lessons because they had never experienced such a learning style before. They also had the opportunity to experience trials and errors, to work on their own, and to help each other in their groups which made the students proud of their groups' ideas and they were able to present their own ideas, as well as their new knowledge and approach. This created a learning atmosphere in the classroom where teachers learn from students, while students are able to learn from their peers and teachers. The mentor teachers were satisfied with their participation in the mentor teachers' competency development program, and they learned more about mathematics learning and teaching management in the 21st century. (5) The student-teachers were also happy with the mentor teachers in that they received assistance and advice about everything, including lesson planning and class observation, as well as reflection on the student-teachers' teaching performance which had never been done before. The student-teachers noted that the mentor teachers understood mentoring strategies and were able to give advice effectively because they worked together with the student-teachers, therefore the student-teachers felt comfortable when consulting the mentor teachers about learning and teaching management and lesson planning. Also, they were more confident in teaching students due to their mentor teacher's regular presence in class. Normally, mentor teachers let student-teachers teach alone. Mentor teachers and student-teachers were able to write problem-based lesson plans and manage and reflect on the learning activities. Apart from that, the student-teachers were pleased with the advice and care from their mentor teachers, particularly in lesson planning, learning management, and reflection on the learning activities. In the past, mentor teachers emphasized lesson plan evaluation and teaching appraisal for grading student-teacher ability, whereas in the new approach, the evaluation was done in a collaborative way in order to help student-teachers develop the learning activities to be more effective.

5.3 Suggestions

5.3.1 Suggestions in application

1.) Suggestions for mentor teachers

1.1) Mentor teachers should study documents relating to the model before employing it to develop their supervision and mathematics learning provision in the 21st century.

1.2) Mentor teachers need to be open-minded and listen to different opinions and share experiences with others.

2) Suggestions for school administrators, teacher trainers, and other interested persons

2.1) School administrators/the center of teacher training can include the model of developing mentor teachers' competencies to enhance mathematics learning provision in the 21st century into the school development plan and annual school plan in order to continuously improve teachers.

2.2) School administrators, or other persons who are interested in teacher development at school should examine the manual of the model uses and other related documents with precision and clarity in order to be better in competency development, especially with follow-up on the evaluation development. For this reason, the assessors need to study and understanding the assessment of the mentor teachers' competencies clearly.

Thus, the developers should give priority to the collaboration between mentor teachers and student-teachers and study the model of developing mentor teachers' competencies to enhance the 21st century provision for the student-teachers.

5.3.2 Suggestions for further studies

1) This study represents the research and the development of a model of developing mentor teachers' competencies to enhance mathematics learning provision in the 21st century provided for mathematics student-teachers. Hence, it should fulfill its purpose by being integrated with other subjects by creating professional learning communities in every school or serve as a connection between schools.

2) From the result of study, mentor teachers had competencies with regard to the character of being a mentor teacher at levels from high to highest. To gain the result effectively, mentor teachers' competencies should be studied prior to joining the

development program or doing research. This is to compare the development of mentor teachers who have an attitude scoring at a low level with those scoring at a high level. In the study, this model can be employed not only to volunteer groups but to every group. This is for both internal and external accuracy.

3) Deep study of mathematics problems should be examined with an in-depth interview in order to obtain the complete details of that time so it can be considered in the future in order to effectively improve the teachers and student-teachers.



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