CHAPTER 1

Introduction

Teachers were those whose duties were to teach students subjects, knowledge, concepts, reading, practices, and operational guidelines. Teachers were those who determined population quality in a society which could predict success in economic, social, politic, administrative, educational, cultural, scientific, technological, and environmental development. Basic education curricular stipulated that mathematics was required to study in educational institutions at all levels. That the teaching and learning management of mathematics was able to achieve an objective or not depended on teachers who were required to have sufficient teaching competency in order to produce mathematics teachers. Nowadays, a teacher profession organization and educational institutions whose duties were to produce mathematics teachers did not yet contain any specific indicator on mathematics teacher competency, tools, and obvious guidelines on evaluating competency so as to determine goals on mathematics teacher competency evaluation to be a process of judging, valuing, and identifying quality, knowledge, skills, attitudes, and personality of those expressing practical behavior. This could be used as data to be compared with criteria or determined standards so as to identify guidelines on developing mathematics teachers to be in accordance with needs and organizational goals. Therefore, the chapter content presented historical background, research questions, research objectives, scopes, terminology, and research benefits gained as detailed below.

1.1 Historical Background

Mathematics was considered extremely important and influential to human lifestyle (Gouba: 2008). It was accepted that mathematics was one of the important factors in developing human beings as it helped improve thoughts systematically, reasonably, and organizationally. It also could analyze and solve problems of situations thoroughly,

carefully, and efficiently. It enhanced concentration and created reasonable people who characterized careful, precise, prudent, observant, and sharp aspects (Ministry of Education: 2008, Boontan Yoochomboon: 1996). Moreover, it could be applied as learning devices in other subjects and living with others happily. (Department of Curriculum and Instruction Development: 2002, Ministry of Education: 2009, Chomnard Cheuasuwantawee: 1999). People had to be sensible in making wise decisions in order to be in accordance with rapidly changing societies in terms of economy, living conditions, and technological and academic advancement. This could be seen from a major mathematic application in building and developing electronics and computers that advanced thoroughly. Mathematics would create and develop thinking skills as well. In other words, almost all professions involved with mathematic knowledge (Chaweewan Sawettaman: 2011, Yupin Pipitkul: 2002). The thoughts regarding reasons, orders, wisdom, adroitness, discussion and evaluation ability, and mathematics were in a form of a model and structure used to explain a natural phenomenon (Brow and Porter: 1995). Mathematics was also the main foundation of every type of research (the Institute for the Promotion of Teaching Science and Technology: 2010).

In addition, the purpose of mathematics was to give students wide experience so that they could apply knowledge into various situations properly and practice with new problems in the future (Raweewan Thumchai: 2002). It could be said that mathematics was considered an important subject in developing individual quality as it could train individuals to be reasonable and creative. This was an essential foundation for their living and preparation to be good community members. Mathematics also enhanced self-development, problem solving (Siriporn Thipkong: 2001), profession decision based on their skills, interest, and abilities. If students learned mathematics comprehensively and pleasantly, they could solve mathematic problems and apply that knowledge into their daily lives. This resulted in good attitude toward mathematics leading to other studies in science and others based on their mathematic knowledge. This could support invention so that new technologies and sciences could emerge in the world. In terms of basic education, the learning content of mathematics emphasized on applying knowledge, skills, and mathematic processes into solving problems in their lifestyle, further education, sensibility, and good attitude toward mathematics

(Department of Curriculum and Instruction Development: 2008). Moreover, mathematics aimed at students so that they could think, solve problems critically, and work systematically with emphasis on generating thinking processes and searching knowledge skills without content-based aspects. This could allow students to develop based on their potential and follow new sciences and advancement (Thawon Phabsimma: 2006).

In the past, teaching and learning in mathematics content could not achieve the curriculum outcome. There were problems in this area continuously, especially in the secondary level. Students thought that it was too difficult. They did not prefer to think and to do exercises. Teachers could not teach comprehensively with fun. More students were not interested in learning mathematics as they did not prefer to solve problems. They lacked practices and self-revision. This was in accordance with Niyom Youngsakul (1997) and the Institute for the Promotion of Teaching Science and Technology (IPST: 2010). In higher education level, it was found that those who got gold medals from the International Mathematical Olympiad were not interested in studying mathematics. Instead, they transferred to study in other fields (Sumlee Manmai: 2003). In addition, according to a report of the Program for International Student Assessment in 2006 (PISA 2006) which evaluated reading skills, science, and mathematics with a group of students in Grade 9 at an age of 15, it was found that Thai students possessed an average of 417 scores in mathematics. This average was lower than that of an international level (Office of the Education Council: 2009). In 2009, the Institute for the Promotion of Teaching Science and Technology reported that Thai students possessed mathematic skill at an average of 419 scores while the international average of TIMSS and PISA was 500. Additionally, according to the O-Net testing result in mathematics of Grade 9 students in the academic years 2009-2011, it was found that the average scores in mathematics were 28.56, 28.14, and 30.49 out of 100, respectively (NIETS: 2012, online). It expressed that mathematics was always at a low level when compared with other subjects.

According to a survey on problems in teaching and learning mathematics in Thailand, it was found that there were problems in teachers. The teacher development did not cover on all teachers, for example. Teachers did not prepare their teaching well; they lacked

techniques in delivering lessons and confidence in teaching. Mathematics teachers hold degrees in other fields (Somwong Plangprasomchok, et.al: 2006) leading to the lack of concepts of all inclusive thoughts in mathematics (Somneuk Phattiyathanee: 1999). And, according to the research articles of Somwong Plangprasopchok, Somdet Boonprajak, and Janya Phu-udom (2008) entitled on "The Survey on the Reasons Why Thai Students Were Poor at Mathematics and Solution Guidelines." Based on that result, both teachers and students agreed that the causes making Thai students poor at mathematics were teachers allowing students to read, summarize by themselves, and test, and poor knowledge self-confidence of teachers. This was in accordance with Chaweewan Kiratikorn (2004) who summarized problems of teaching and learning mathematics in that teachers did not understand curriculum and teacher manuals. They did not use correct teaching methodology. They could not explain for the sake of ultimate knowledge. And, they did not have knowledge on teaching methods. They were not supervised and they did not open to independent answers of students (Kwanjai Srithapak: 2012). This was in accordance with Naruebet Larpyingyong and Kitipong Luenam (1999) in that teachers did not understand the content in some chapters. They could not identify appropriate teaching methods for the content. Most teachers needed to develop themselves, especially in techniques and teaching methods. Additionally, students thought that their teaching methods were not interested as they were lecture-based without any consideration on the differences among students. Teachers taught with no emphasis on problem-solving and real life application resulting in slow learning among students. Students could not keep up with the lectures. They did not understand the content and finally they were bored. They did not want to study. When they had to study new lessons, this problem would accumulate more due to the fact that they lacked knowledge and understanding on previous chapters. Mathematics teachers also thought that new mathematic teaching emphasized on inclusive ideas in mathematics so it was not necessary to let students practice and do exercises or much homework (Somjit Chiwapreecha, cited in Noppawan Mongkolnoppakao: 1999). The achievement of studying mathematics was at a lower level; students had a bad attitude toward mathematics. The reason of this low achievement might result from an influence of various factors. However, the most important role relied on teachers. According to the research and several scholars, it was found that in order to solve the problem teachers

had to be developed so that students would have knowledge and ability in mathematics resulting in high achievement (Polsan Phositong: 2010). This was in accordance with the research of Prayoon Asanam (2003) who found that the knowledge in mathematics content of students was lower than 50 percent. Teaching potential was also low because there was a lack in mathematics teaching concepts. Students also possessed poor attitude toward mathematics. This was in accordance with the study of Ueuajit Pattanajak (2003).

The Bureau of Teacher Education Personnel Development (2010) evaluated competency of mathematics teachers in the lower secondary school on knowledgeable content they taught and in the higher secondary school on mathematics reasoning and the application of mathematics language in writing by testing on mathematics test. It was found that the higher group of 58 percent in mathematics of the higher secondary level possessed this aspect only of 0.06 percent. According to the research of Phreuk Siribanpitak et.al. (2006) on the teacher qualification and work quality, it was found that mathematics teachers in the secondary level could teach in accordance with their majors at 73.80 percent. Due to the fact that teachers were those who developed students in various aspects, especially in learning achievement, teachers were required to have competency in their working on duties so that they could operate learning procedure to achieve goals. This aspect was important in that it could develop knowledge, ability, and skills in teaching and learning. Teachers were supposed to have personality facilitating students' perception. This was in accordance with the policy in managing mathematics education so that it could keep up with other countries as set in international standards (IPST: 2002). This could be considered tools in the studies of students resulting in higher learning and achievement so as to meet the goals as set in educational management reform guidelines. According to these reasons, teachers had to be supported so that they possessed competency in their teaching resulting in the operational quality and effectiveness. Evaluating teacher competency was another important mechanism reflecting teacher quality in terms of their knowledge, ability, skills, competency, attitude, and motivation in teaching and learning (Chanatip Tuipae: 2008). This enabled teachers to manage their teaching and learning effectively leading the students to possess knowledge and ability as stated in the objectives and goals of educational management.

Additionally, teacher competency was also an important variable in predicting students' quality. Teachers had to have ability and competency in teaching students academically and mentally. Teachers needed to admire their profession. Therefore, the educational reform gave precedence toward teacher reform with an emphasis on developing teachers continuously. Teachers were the main factor in managing teaching and learning. They were supposed to be leaders in applying, generating, and developing curriculum. In designing and developing learning activities, teachers had to possess mathematic knowledge profoundly in (1) knowledge aspect that consisted of subject matter knowledge and pedagogical content knowledge, (2) teaching skill aspect, and (3) mentor characteristic in developing students (Kilpatrick Swafford and Findell: 2001 cited in Umpond Makhanong: 2014). This was in accordance with the new criteria on evaluating teachers for their academic standing of the Office of the Basic Education (2014) that evaluated the academic theoretical competency and pedagogical competency based on student achievement. Teachers were required to possess sufficient teaching competency so that students could have learning outcomes as identified in the goals.

In 2009, the Office of Basic Education Commission held a project in order to upgrade teacher quality in an entire system. Teacher and educational personnel competency was evaluated on two parts. The former was the learning content the teachers taught; the latter was key competency. In evaluating the aforementioned teacher competency, teachers in the secondary level were developed in two groups which were the lower secondary level and the higher secondary level. Each group that its evaluation results were at moderate and low levels was developed in a form of a workshop. The measurement of knowledge only on content enabled the teachers to revise their knowledge in order to prepare for their exams. However, this was still not an empirical evaluation. There was still no clear evaluation model of mathematics teacher competency but an element evaluation in an overall aspect. The needs of mathematics teachers were varied and distinct, such as teaching methods and techniques, media preparation, technology application, and teaching and learning innovation (IPST: 2010). In terms of mathematics teacher standards provided by IPST, they were constructed as central ones the teachers used as guidelines in developing themselves. Educational institutions also could use as guidelines in developing and giving knowledge. However, steps and details were still not apparent with little application. In terms of evaluating

teachers in order to maintain their academic standing, the Bureau of Teacher Education Personnel Development determined guidelines of developing similar teacher evaluation from the central without decentralizing of those duties. The guidelines of operating them were not determined apparently.

According to the study on relevant documents and research, current institutions providing mathematics teaching in higher education and an organization in charge of overseeing teacher profession standards were not possess clear guidelines in evaluating teacher competency, especially in each subject including mathematics teacher competency evaluation. It was found that mathematics teachers, especially those who taught mathematics, did not hold degrees matching with their majors. They had teaching problems. According to the research of educators and a research report on developing internal quality assurance within educational institutions, it was found that an evaluation model of teacher competency was not standardized with qualified evaluation tools resulting in various problems. Teachers lacked key competency in being teachers (Yaowadee Rangchaikul: 2009). According to the synthesis of relevant research on teacher competency, it was found that the characteristics of the research found were the development of an evaluation model of teacher competency. The concepts, principles, and evaluation criteria were acknowledged. There was also the research focusing on analyzing elements and indicators of teacher competency and constructing tools in evaluating teacher competency. Another research was conducted on problem conditions and guidelines on developing and enhancing teacher competency which were used to develop teachers in an overall aspect based on an interval level without any specification on a subject content group. In terms of teacher competency evaluation, the similar evaluation model was applied to all subject content groups without adopting any evaluation results to develop and enhance teacher competency clearly. There was no evaluation system of teacher competency on specific subjects covering natural structure in each subject. At the basic education level, the developed evaluation form used to evaluate teachers did not cover certain aspects and contain specification. The self-evaluation methods of teachers were considered an activity for evaluating progress aiming at information to adjusting themselves (Mccoiskey and Egelson: 1993). They were not an evaluation for making a decision. According to the study on relevant documents and research of an evaluation model of mathematics

teacher competency, it was found that the key outstanding aspects which were supposed to be were (1) elements and indicators of mathematics teacher competency gained from literature review, theories, documents, concepts, and relevant research of specific experts separated in significant aspects, namely academic content on mathematics, mathematics teaching methods skills, and mathematics teacher personality. (2) Evaluation methods of mathematics teacher competency gained from, for example, element analysis of mathematics teachers, mathematics teacher standardized criteria, tool classification of evaluating mathematics teacher competency. These were key guidelines that acknowledged importance levels of elements and indicators used as guidelines in constructing an evaluation model of mathematics teacher competency covering key elements of mathematics teacher competency. (3) Elements and indicators of evaluating mathematics teacher competency were gained from various methods. A factor analysis was one of those methods used in studying elements and grouping indicators in each element of mathematics teacher competency relating in the same group. This was convenient resulting in acquiring necessary elements and indicators used in an evaluation model of mathematics teacher competency. (4) In terms of an evaluation of mathematics teacher competency, the identified elements and indicators were guidelines used to develop and enhance mathematics teacher competency so that they were ready in managing teaching and learning activities and developing students so as to serve the mathematics curriculum goals. The necessary elements were acknowledged for mathematics teachers who did not graduate from mathematics field so that their teacher competency were developed to meet goals and student achievement in mathematics.

As for the weaknesses of an evaluation model of mathematics teacher competency, it was found that there were key aspects as follows. (1) An evaluation model of mathematics teacher competency that covered elements of the mathematics teacher competency was not yet constructed. Mostly, it evaluated mathematics teacher competency only in certain aspects, such as teaching and learning management efficiency, teaching material construction, measurement and evaluation, and evaluation guidelines as stated in the mathematics teacher standard guidelines of the Institute for the Promotion of Teaching Science and Technology (IPST). This was not employed seriously as there were only details and steps teachers and administrators acknowledged

while lacking clear application. (2) Evaluation methods of the mathematics teacher competency were similar to those of other subjects that were naturally different. The mathematics content was mostly performed by inquiry methods and work inspection without any standardized evaluation criteria. The tool evaluation also lacked objectivity depending only on feelings and expectation of the assessors. (3) In terms of the problems of assessors evaluating mathematics teacher competency, it was found that the main problems were derived from, for example, the assessors lacked clear knowledge and understanding toward evaluation methods and tools. Moreover, the competency evaluation was performed only on mathematics content. The assessors were biased while evaluating due to their thought obstacles, such as their unease and anxiety whether the evaluation results might not be satisfying among those relevant. (4) Problems of elements and indicators in evaluating mathematics teacher competency were derived from some groups of higher administrators within educational units, not from evaluating scholars. The acquirement of evaluation methods, elements, and indicators were not derived from the research findings on developing evaluation models. There was no study of the model application results conducted by those relevant who evaluated on a basis of evaluation model standards. (5) The results of the mathematics teacher competency gained were not accepted among assessors as they were unreliable and biased with no feedback to those assessed who never had a chance to adjust, correct, and used in the consideration for developing and enhancing the mathematics teacher competency. The evaluation procedure was not performed continuously so as to monitor personnel development after the end of the evaluation. (6) The former mathematics teacher competency mathematics teacher competency methods could not provide answers, importance, and necessity completely in all ten questions needed (Stufflebeam: 2001), namely evaluation definition, evaluation functions, evaluated items, gained evaluation data, evaluation criteria, evaluation target groups, evaluation procedure, evaluation methods, evaluating assessors, and evaluation standards in judging the evaluation.

In addition, the competency evaluation lacked efficient communication and mutual understanding among those relevant so that they could comprehend authentic intention of the evaluation which would be conducted on a basis of each individual's belief and propriety of each situation. The guidelines and methods of evaluating mathematics

teacher competency were supposed to be determined as follows. (1) The objectives and elements of evaluating mathematics teacher competency were supposed to be established absolutely in order to be the guidelines of developing and adjusting the evaluation model in any relevant aspects. The elements and indicators of mathematics teacher competency that was essential were to be given precedence orderly. (2) The evaluation model of mathematics teacher competency was to be a continuous and constant procedure successively so that the operational progress could be monitored. The evaluation model was to be gained from synthesizing concepts and theories from experts. The methods gained were supposed to be studied and developed. (3) The application of the evaluation model on mathematics teacher competency was to be clarified among those relevant in the evaluation. The evaluation steps and details were to be apparent and practically convenient. The application steps, operational methods, and result summary were to be used as guidelines in developing. (4) The evaluation model of mathematics teacher competency was supposed to consider the elements of knowledge, skills, proper personality, and other relevant and proper elements in accordance with the mathematics teacher competency. (5) The evaluation model of competency in each element had to retain to objectives and goals of each competency. Teaching and learning mathematics elements, for example, aimed at encouraging students to possess the knowledge, comprehension, mathematic procedure skills, and desirable attributes. They had to be the elements and indicators identifying that teachers could allow students to have knowledge, skills, and those aforementioned characteristics absolutely. According to the General System Theory of Von Bertalanffy (1968) that was used as a guideline to construct the evaluation model, it consisted of four elements which were inputs, process, outputs, and feedback. And, according to the concept regarding the model adjusting system development of Smith (1978) and Debenham (1989), it stated that the system development in order to construct a model could be synthesized in six steps which were system analysis, system synthesis, system design, system verification, system improvement, and system implementation. This was a system used as a guideline frame to construct and develop the evaluation model of mathematics teacher competency. As for recently developing and enhancing mathematics teacher competency in the basic education, the results of educational reform and the announcement on the basic education curriculum application in 2008

made the secondary and elementary service areas and encounter problems in teaching and learning and mathematics teacher competency development. Due to the fact that the researcher used to be a teacher leading in teaching mathematics of the Institute for the Promotion of Teaching Science and Technology (IPST), the researcher participated in developing teacher competency by holding workshops and developing teaching and learning activities management in mathematics in the lower secondary school continuously. It was found that there was a lack of mathematics teachers while most of them did not graduate from mathematics field. They also lacked learning management competency; therefore, they could not manage to learn in mathematics learning content group to achieve curriculum goals, especially the teachers in the mathematics learning content group in the lower secondary school in educational opportunity expansion schools. There were few teachers graduating from mathematics field. The researcher did a survey on mathematics teacher competency in the Academic Year 2010 in a mathematics learning content group in Chiang Mai Province. And, it was found that many teachers still lacked necessary competency in managing teaching and learning in mathematics. Importantly, they did not possess knowledge and understanding in learning standards and new learning content added in the curriculum, especially in teaching methods of mathematics learning content, student-centered learning activities, authentic measuring and evaluating learning achievement, and research for solving problems in classes. Mathematics teachers needed to develop and building this aforementioned competency which was in accordance with the research of Onsee Kaewpakdee (2010). According to these conditions and problems, there was no guideline of developing and enhancing mathematics teacher competency in the lower secondary school which covered teacher competency. There was also no evaluation model of mathematics teacher competency. The researcher who was a teacher in a secondary level was then interested in conducting research and developing an evaluation model by selecting a developing method of indicators based on empirical evidence and data. Therefore, indicators that were efficient, accurate, and precise were developed as an evaluation model of mathematics teacher competency in the lower secondary school. This could be performed on a basis of research and developing procedure of Nevo's concept and theory (1983) which determined five key elements of an evaluation model which were (1) evaluation goals, (2) evaluation scopes, (3)

evaluation consisting of assessor qualification and evaluation methods, (4) evaluation result judgment, and (5) result reporting and application. The competency evaluation procedure was cooperated among those relevant to mathematics teachers in order to synthesize a model and guidelines in applying and evaluating mathematics teacher competency in the lower secondary school. This could be done to identify guidelines in developing and enhancing mathematics teacher competency properly, systematically, and continuously both individual and overall. This was also in accordance with needs and necessities based on quality, effectiveness, and operational efficiency. It would help encourage mathematics teacher morale so that they put their effort in developing competency, increasing experience, and operating efficiently in managing education to be in accordance with the goals of the basic education curriculum in 2008 onward.

1.2 Research Questions

1.2.1 What were the elements and indicators on mathematics teacher competency in the lower secondary school?

1.2.2. What was the appropriate evaluation model of mathematics teacher competency in the lower secondary school like?

1.2.3 Was the evaluation model of mathematics teacher competency in the lower secondary school practical? What level of efficiency was it at?

1.2.4 What were the guidelines of developing and enhancing mathematics teacher competency in the lower secondary school like?

1.3 Research Objectives

1.3.1 To analyze the elements and indicators in evaluating mathematics teacher competency in the lower secondary school.

1.3.2 To construct a model and a manual on evaluating mathematics teacher competency in the lower secondary school.

1.3.3 To study the application results of the evaluation model of mathematics teacher competency in the lower secondary school.

1.3.4 To identify guidelines of developing and enhancing mathematics teacher competency in the lower secondary school.

1.4 Scope of the Study

1.4.1 Content Scope

The content of the study was as follows:

Content Scope 1: Indicators and elements of the mathematics teacher competency in the lower secondary school covering three aspects as follows.

(1) Competency in mathematics content knowledge consisted of four elements which were (1) a knowledge element in mathematics learning content in the lower secondary school, (2) a knowledge element regarding methods in teaching mathematics learning content in the lower secondary school, (3) a knowledge element regarding mathematics curriculum goals, relevant fundamental knowledge, and mathematics learning content in the lower secondary school, and (4) a knowledge element regarding curriculum preparation and mathematics curriculum application.

(2) Competency in mathematics learning management consisted of three elements which were (1) a skill element on managing mathematics learning in the lower secondary school, (2) an element of problem-solving and self-development of students, and (3) a skill element on developing students.

(3) An element on psychological factors in developing students, virtue, morality, and professional ethics

Element and indicator quality of the mathematics teacher competency in the lower secondary school covered content validity, construct validity, concurrent validity, and tool quality in evaluating the evaluation model of mathematics teacher competency.

Content Scope 2: Constructing and developing the evaluation model of the mathematics teacher competency in the lower secondary school used in schools under the Office of the Basic Education Commission. This covered the mathematics teacher competency in the lower secondary school in four aspects which were factors or operational resources, operational procedures, output or operational results, and feedback data.

Content Scope 3: The evaluation model of the mathematics teacher competency in the lower secondary school. This was a guideline in applying indicators in evaluating the

mathematics teacher competency in the lower secondary school. It covered five elements which were (1) evaluation goals, (2) evaluation scopes, (3) evaluation operation consisting of assessors, assessing tools, assessing methods, and assessing time frame, (4) evaluation result judgment consisting of result evaluation criteria, processing programs, and (5) competency evaluation results and their application consisting of evaluation result reporting, result judgment, and developing and enhancing competency guidelines. The quality of the evaluation model of mathematics teacher competency in the lower secondary school consisted of four standards adopted from the Joint Committee on Standards for Education Evaluation (1988) which were (1) utility standards, (2) feasibility standards, (3) propriety standards, and (4) accuracy standards.

Content Scope 4: Guidelines for developing and enhancing mathematics teacher competency in the lower secondary school. These were the guidelines gained from synthesis, advices, comments, and recommendations of experts relevant to mathematics teachers in the lower secondary school. They covered guidelines for developing and enhancing competency, knowledge body, knowledge content in teaching mathematics, knowledge on applying a curriculum to provide mathematics learning activities, and psychological factors in developing students, virtue, morality, and professional ethics.

1.4.2 Population scope

As for the study of evaluating mathematics teacher competency in the lower secondary school, the population was 14,361 mathematics teachers in 7,329 lower secondary schools under the Office of the Basic Education Commission (the Bureau of Policy: 2013)

1.4.3 Timing scope

This study was conducted from 2012 to 2014.

1.4.4 Variables

The variables in this study were as follows.

(1) Elements and indicators of the mathematics teacher competency in the lower secondary school

(2) The evaluation model of the mathematics teacher competency in the lower secondary school

(3) The efficiency of the evaluation model application which was classified into utility standards, feasibility standards, propriety standards, and accuracy standards.

(4) Guidelines of developing and enhancing mathematics teacher competency in the lower secondary school

1.5 Definitions of Terms

Indicators referred to information, quantitative observation, or qualitative information that indicated quality in the operation of mathematics teachers in the lower secondary school reflecting the knowledge, skills, and individual qualification that was appropriate to mathematics teacher competency.

Elements referred to a group of indicators or observation identifying status or reflecting the knowledge, skills, and individual qualification that was appropriate to mathematics teacher competency. They consisted of 8 aspects which were (1) knowledge aspect in terms of learning content in mathematics of the lower secondary school, (2) knowledge aspect in terms of teaching methods of mathematics learning content of the lower secondary school, (3) knowledge aspect in terms of mathematics curriculum goals and learning fundamental knowledge regarding mathematics learning content in the lower secondary school, (4) knowledge aspect regarding curriculum preparation and application, (5) an aspect on mathematics learning management skills of the lower secondary school, (6) an aspect on problem solving and self-developing of students, (7) an aspect of developing students in learning mathematics, and (8) an aspect on psychological factors in developing students, virtue, morality, and professional ethics.

Mathematics teacher competency referred to personal characteristics which were resulted from knowledge, skills, and psychological factors in developing students, virtue, and morality making mathematics teachers create their work successfully resulting in learning goal achievement in operating mathematics teaching.

An evaluation model of mathematics teacher competency referred to an overall structure of systematic relationship in evaluating mathematics teacher competency in

the lower secondary school that covered all four systems of the elements of mathematics teacher competency in the lower secondary school. These were factors or operational resources, operational procedures, output or operational results, and feedback data. There were competency evaluation guidelines as well consisting of (1) evaluation goals, (2) evaluation scopes, (3) evaluation operation consisting of assessors, assessing tools, assessing methods, and assessing period, (4) evaluation result judgment consisting of evaluation criteria and processing programs, and (5) competency evaluation results and result application consisting of evaluation result report, result judgment, and development and competency enhancement guidelines.

Element and indicator quality referred to the judgment results of element and indicator quality determined. This could be considered from content validity, construct validity, concurrent validity, and Rater Agreement Index (RAI).

Development and enhancement guidelines on mathematics teacher competency in the lower secondary school referred to planning guidelines gained from a synthesis, advice, comments, and recommendations of experts relevant to mathematics teachers in the lower secondary school. These covered development and enhancement guidelines on knowledge competency in mathematics content, skill competency in managing mathematics learning, and psychological factor competency in developing students, virtue, morality, and professional ethics.

Model efficiency referred to the quality level of the evaluation model of mathematics teacher competency in the lower secondary school in standards consisting of the followings.

(1) Utility standard referred to a quality level of the evaluation model of mathematics teacher competency in the lower secondary school constructed by the researcher. It could be used to evaluate the mathematics teacher competency in the lower secondary school so as to respond to the needs of users and stakeholders, user qualification, scope identification, value judgment, obvious result reports, and dissemination in determined time frame.

(2) Feasibility standard referred to a quality level of the evaluation model of mathematics teacher competency in the lower secondary school constructed by the researcher. It could be used to evaluate the mathematics teacher competency in the

lower secondary school in real situations carefully, relatively, economically, inclusively in terms of operational methods and policy, and cost-effectively.

(3) Propriety standard referred to referred to a quality level of the evaluation model of mathematics teacher competency in the lower secondary school constructed by the researcher. It was in accordance with concepts, principles, objectives, structures, and teacher profession practices without any conflict with laws, policies, and morality contributing to completeness, justice, and benefits to those relevant.

(4) Accuracy standard referred to a quality level of the evaluation model of mathematics teacher competency in the lower secondary school constructed by the researcher. It could be used to evaluate the mathematics teacher competency in the lower secondary school apparently. It consisted of accurate reports and documents explaining obvious procedures that were in accordance with real situations, inclusive, complete, valid, and reliable.

1.6 Expected Benefits of the Study

The benefits of this research were as follows.

1.6.1 The concepts of model construction and evaluation were gained.

1.6.2 The elements of mathematics teacher competency were gained so that mathematics teachers acknowledged their own ability level and in which aspect they needed to develop.

1.6.3 The indicators and evaluation guidelines on mathematics teacher competency were gained. Those relevant could use these data to develop, enhance, and support mathematics teacher competency directly. This could develop teachers' weaknesses and enhance strengths of teacher competency.

1.6.4 The model of evaluating mathematics teacher competency was gained so as to be used as guidelines to develop mathematics teachers so that they possessed competency as needed by an organization. This could develop teachers effectively with goal achievement much better.

1.6.5 The effectiveness of the evaluation model on mathematics teachers' competency in the lower secondary level was acknowledged.

1.6.6 Educational offices, such as educational service areas, secondary service areas, and basic education offices, could apply this as guidelines to develop, evaluate, and monitor teacher competency.

1.6.7 The evaluation guidelines in order to promote academic standing, activity provision to develop and enhance the competency of teachers, educational personnel, and other teachers in other learning content groups.