CHAPTER 2

Literature Review

The research study entitled "A Model of Developing Mentor Teacher's Competencies to Enhance Mathematics Learning Provision in the 21st Century" aimed to (1) examine the conditions of mathematics learning, teaching management, and supervision of instruction by mentor teachers at the present time and also the needs for the learning development, teaching management competency, and the mentor teachers' supervision in consistency with learning and teaching management in the 21st century; (2) develop a mentor teachers' competency development model in consistency with the learning and teaching management in the 21st century; and (3) investigate the results of implementing the mentor teacher's competency development model in consistency with the learning and teaching management in the 21st century.

Literature and research studies related to human resource development, mathematics learning and teaching management, 21st century learning and teaching management, and model development were thoroughly reviewed as guidelines for developing mentor teachers which can be presented as follows:

1. Teachers production and development
    1. Concepts of teacher development
    2. Current state and conditions of teacher production and development
    3. Pre-service student-teaching practicum experience
    4. Roles of mentor teachers
    5. Teacher professional development
2. Concepts and theories in relevance to human resource development
    1. Concepts of educational philosophy
        (1) Experimentalism
        (2) Progressivism

2. Theories of human resource development

1) Motivation theories

2) Learning theories

2.1) Adult learning theories

2.2) Social learning theories

-Socialization

2.3) Action learning theories

3) Theories of Counseling

3. Concepts of learning and teaching mathematics

4. Concepts of learning in the 21st century

5. Concepts of teacher competency and development

6. Concepts of model development

3. Research related to human resource development, teacher development, mathematics teacher development, learning and teaching mathematics based on students' learning process

2.1 Teachers production and development

2.1.1 Concepts of Teachers Development

Teacher development is an attempt to enhance teachers' knowledge and skills in their teaching profession, as well as encourage positive attitudes toward their jobs and the desired personality and morality of good teachers (Yont Chumjit, 2007:30).

Teacher development is a continuous process that needs to be practiced for the rest of a teacher's life on the grounds that teacher development helps to improve the quality of teacher performance, save time, and minimize educational wasteland. In addition, teacher development makes teachers learn how to work faster and decreases the workload of school administrators or department heads. It also offers teachers excellent promotion prospects and prepares them for future possible changes.

Generally, teacher development begins with selecting students to study in teacher training institutions. When they start their jobs as in-service teachers, a novice teacher training course is a requirement for them to learn about their responsibilities. Also, in-service teachers need to be developed professionally on a regular basis throughout their career until retirement (Yont Chumjit, 1992:9).

Teacher performance assessment is part of teacher development for the reason that teacher performance manifests teachers' ability to fulfill tasks. Hence, a systematic examination of teachers in learning and teaching environments or in classrooms helps to determine reliable indicators that represent the needs and abilities of teachers while working with students.

What is more about this, organized observation of a teacher's performance in the classroom is important because much more information about the teacher's behavior, as well as the students', can be collected and acknowledged, enabling the teacher to compare similarities and differences between their own behavior and the students'.

Furthermore, the information is beneficial for deciding what kind of changes need to be made.

Bishop (Bishop, 1979, pp.4-8) proposes a system approach for university faculty development as presented below.

1) Needs for Development. Needs are the most important factor in teacher professional development. Teachers are the ones who have to realize the importance of the development and be prepared for any possible changes that may occur. In doing so, they need to learn from textbooks and research studies on their own. Apart from that, there are also needs from administrators who want their subordinates to be eager to develop themselves due to the fact that in all educational institutions there are faculties, staff, or teachers who lack interest in improving themselves or want to adhere to the same approach. Thus, administrators need to develop those people in order to change their attitudes.

2) Diagnosis and Analysis. This procedure has been done to examine physical shortcomings and situations that need correction. In doing this, however, clear objectives need to be considered. At this stage, opinion polls may be conducted to survey teachers' needs. Apart from that, questionnaires can also be used to explore teachers' opinions as to whether or not a seminar should be held in order to exchange ideas about how students have reacted to the teachers' teaching. Teacher representatives should be appointed to deliberate over the teachers' needs.

3) Professional Development. This stage is a search for strategies to improve areas of problems proposed by teachers. One possible method is to provide some professional training directly for the teachers, giving guidance that is needed by the

teacher for their teaching or for their workplace. Such trainings may include workshops, group discussions, professional counseling, information dissemination, production of teaching materials, or teaching evaluation, all of which would probably be used as to determine teachers' merits for their pay raise. The other method involves potential activities that indirectly help enhance the effectiveness of teaching. For example, administrators who are keen on academic affairs, particularly teaching and learning, could have an influence over the teachers who, accordingly, are more academic-oriented. Apart from that, making the school environment more scholarly and providing necessary materials for teachers and reducing teachers' workload will also give them more time to improve their teaching.

4) Validation. Feasibility of the development project needs to be examined. In so doing, a pilot study has to be conducted. If any disadvantages are found, find ways to fix them so that the initiative can proceed.

5) Implementation. To implement the development project, experts or experienced trainers will be invited to undergo the training in particular areas where the project manager lacks expertise or experience.

6) Evaluation. Evaluation of the development project needs to be carried out to determine if the project achieved the goal by measuring various sources of information against the criteria. Evaluation needs to be done at every phase of the project so as to fix the problems.

2.1.2 Current conditions of teacher training and development

As far as today's teacher training and development is concerned, teachers are encouraged to learn how to promote student learning with an emphasis on a learner-centered approach. In other words, teaching needs to benefit students the most in order to allow them to develop. Teachers are supposed to find every possible way to reach such an ultimate goal. Student learning can be seen from the alteration of behaviors as follows:

1) A behavioral change occurs when a learner experiences something for the first time and it makes him think, curious to know more, and eager to do something own his own, whether or not what he has done is trial and error. However, if he can respond correctly to the same experience again, that means he has learned a lesson.

2) Transfer of learning

2.1) A transfer of learning has occurred when a learner has experienced a variety of situations similar to the previous one.

2.2) Teachers should give students practice on how to recognize the similarities from those situations so that the students can come to their own conclusion about the lesson learned.

2.3) A learner is able to compare a previously learned lesson with the new one.

2.4) A learner should learn successfully from one lesson to another owing to the fact that if the learner has achieved success in learning one thing, it can be transferred to something else. Hence, the teacher needs to allow students to construct their own knowledge. Such understanding will be a long-lasting memory, and students are able to apply it to other situations.

2.5) How much the transfer of learning is fulfilled depends on the teacher's teaching methods. Thus, the teacher has to bear in mind what and how to teach the students. However, to enable students to learn, the following principles need to be followed:

2.5.1) Allow students to formulate a concept and come to a conclusion by themselves so that they can make use of it.

2.5.2) The teacher needs to focus on teaching students to analyze the components of what they are learning.

2.5.3) The teacher needs to provide students with practices on how to use the knowledge they have learned in situations with similar but more complicated conditions.

2.5.4) The teacher is supposed to use different teaching strategies.

3) As far as the nature of learning is concerned, there are essential skills students need to possess before learning a lesson.

3.1) Students need to know what each lesson's objectives are, what they need to learn or do or what behavioral change is expected.

3.2) Students need to know how to analyze similar situations or how to compare them to previous ones to make a new discovery.

3.3) Students need to know how to connect ideas. In order to do that, the teacher is supposed to teach them how to relate an idea with others. When teaching a lesson, the teacher should refer to other related ones. For example, to teach students about the decimal system, the teacher needs to review percentages as well as other related knowledge the students may have. However, this needs to be done in a suitable period of time.

3.4) Students need to learn with understanding and be able to implement their knowledge. Some students have memorized certain mathematic formulas but fail to solve the given problems. As such, the teacher should respond to this challenge by providing the students with more and different examples for them to practice with until they have an insight into the lesson.

3.5) The teacher needs to be sharp-witted enough to know how to wrap up a lesson so that the students can reach a conclusion of the lesson.

3.6) Students need to learn how to learn, particularly during mathematics lessons. Importantly, rote-learning is not effective in learning mathematics.

3.7) The teacher should not punish students as that will most likely make them bored with learning. Instead, the teacher should give them encouragement, referring to teaching psychology as well as psychology of drilling.

4) Psychology of drilling

Drilling is essential for students; however, having students repeatedly practice the same thing sometimes makes them uninterested. Giving students too many similar math problems can bore students. Thus, the there are some considerations the teacher needs to make as presented here.

4.1) Drilling, if it is done individually, is most effective because students' individual differences are met.

4.2) Drilling should be done after each lesson, and a summative drill is also needed after a set of lessons.

4.3) Each student's practice needs to be checked and corrected in order to evaluate their learning and also to evaluate the teacher's teaching performance. When students are not able to solve a problem, the teacher is supposed to ask himself or herself why. More likely than not, teaching methods do not work themselves out. For this reason, the students are not solely to blame.

4.4) Exercises should be selected to suit the lessons and in appropriate in quantities.

4.5) Exercises provided should also respond to individual differences.

4.6) Exercises provided should cover different aspects of learning with regards to their difficulty and some particular points that need more emphasis. Enough exercised should be given in order for the students to grasp the concept and retain it.

4.7) Teachers should be aware that before giving students math problems, they need to make sure that the students have understood thoroughly how to solve the problems. However, they should not be allowed to do that by copying what the teacher has previously taught them to do in the sample problems without their own initiatives.

In summary, teacher training institutions should stress the importance of current problems and find ways to develop student-teachers in line with the curricula, and place more focus on pre-service student-teaching practicum experience, a key process that will enhance desirable teachers' characteristics in student-teachers, all of which can be learned through mentor teachers and educational personnel at schools.

2.1.3 Pre-service student-teaching practicum experience

It is stated in the handbook of pre-service student-teaching practicum experience, Faculty of Education, Lampang Rajabhat University, that the process of pre-service student-teaching practicum experience is a course in teaching professional courses/specific required courses, and it is considered the most essential course for studying in the Faculty of Education studies program. It generates a precious experience for every student who has an opportunity to practice working as a teacher in the real workplace, a field work experience that will enhance the teachers training quality to the extent that the student-teachers are able to work effectively as teachers (Faculty of Education, Lampang Rajabhat University, 2007). Pre-service student-teaching practicum experience in a regular school is part of the curriculum designed to develop teaching professional competency of the student-teachers and to encourage them to bring the theories they have learned into practice in the school for one year before they leave the college.

Pre-service student-teaching practicum experience is initiated in order to prepare student-teachers to work as teaching professionals, so they can have first-hand

experiences in real situations, a chance to work with different people, and time to develop their leadership. Student-teachers can improve themselves by bringing theories into practice. A good student-teaching experience does not mean being in a well-equipped, comfortable classroom with all the teaching materials and technology him or her needs or even being taken good care of. All student-teachers need are opportunities to practice working extensively, to learn from good role models, to face challenging problems, and to learn more about themselves so that they can proudly develop desirable teaching characteristics.

1) Meaning of pre-service student-teaching practicum experience

Pre-service student-teaching practicum experience refers to the provision of a first-hand experience with students in order to learn in real situations, that is, to practice working as in-service teachers. The students are able to practice and examine problems related to teaching and learning, as well as the problems' solutions under the supervision of university supervisors with the assistance and advice from mentor teachers provided by the schools. To educate students through a student-teaching experience is to have them learn in a practical way so that they can work effectively as teachers and develop their skills and competency, building their confidence and faith in the teaching profession with passion to be a good teacher.

2) Significance of pre-service student-teaching practicum experience

Student-teaching experience is the heart of the Bachelor of Education curriculum. It provides valuable experiences for student-teachers, giving them opportunities to bring their knowledge into practice in real situations, making them extensively well-prepared to graduate with confidence in order to work as quality professional teachers, meeting the teaching profession standards prescribed in Teachers and Educational Personnel Council Act B.E.2546, Section 49, which includes 3 areas: 1) professional knowledge and experience standards, 2) working competency standards, and 3) teacher conduct standards.

The educational profession has been regarded as a high-level profession, on the same level with other professions, including medical doctors, engineers, architects, lawyers, nurses, veterinarians, etc. Thus, a practitioner bears high responsibility due to the fact that their work directly affects their clients and the public, and their professional

practice needs to be strictly overseen in order to create confidence among their clients and the public (Educational profession standards, 2005).

When it comes to professional experience standards, the above-mentioned Teachers and Educational Personnel Council Act stipulates that an applicant for a professional teacher's license must hold a bachelor's degree in education with at least 1-year of teaching practicum experience in a school and have passed the evaluation according to the assessment criteria, methods, and conditions prescribed by the Teachers' Council: 1) the teaching experience is curricula-based, and 2) the teaching experience is for the applicant's specific area of study.

3) The 1-year teaching practicum experience in a school, a major part of the Bachelor's Degree in Education studies program, has the following objectives:

3.1) To allow student-teachers to integrate their knowledge of theories they have learned into real situations.

3.2) To allow student-teachers to practice teaching in their specific subject areas, along with other teaching responsibilities.

3.3) To allow student-teachers to develop their teaching and research skills.

3.4) To allow student-teachers to develop their personality and behaviors to meet professional standards.

3.5) To strengthen student-teachers' positive attitudes toward and faith and pride in the teaching profession.

3.6) To enhance student-teachers' professional virtues and ethics.

3.7) To allow student-teachers to carry out their academic or development projects.

To conclude, teaching practicum experience in a school is an important part of the teacher training process. Rajabhat universities are primary teacher training institutions. On the assumption that student-teachers are encouraged to learn from their mentor teachers at the school through the 1-year teaching practicum experience, a problem-based mentor teachers' competency development model in consistency with mathematics learning and teaching management is needed. This model will help develop mentor teachers to learn more about the problem-based teaching and learning management, and enable them to give advice and oversee and evaluate student-teachers'

performances by encouraging them to use the problem-based learning technique in their mathematics classes.

2.1.4 Roles of mentor teachers

Mentor teachers are responsible for providing advice to student-teachers in all areas in order to develop their teaching competency, including knowledge, techniques, and desirable attributes as a teacher. Presented below are the roles of mentor teachers (Handbook of Teaching Practicum Experience, 2012)

4.1) Instruct student-teachers about what teachers' responsibilities are.

4.2) Allow student-teachers to observe teaching and learning activities in the classrooms one week prior to their teaching practice.

4.3) Act as a good role model for student-teachers in all aspects.

4.4) Assign student-teachers to teachers' jobs and help them edit and correct their lesson plans, and give them advice about how to make post-teaching notes before letting them practice teaching in class.

4.5) Inform them about other things such as school regulations and traditions of living, working, and dressing at school.

4.6) Visit student-teachers' classrooms to observe their teaching activities at least once a month and give them suggestions on a required form for the teaching practicum experience.

4.7) Co-evaluate student-teachers' performances in the teaching practicum experience according to the required assessment form and period of time.

4.8) Discuss with university supervisors about student-teachers' teaching, the evaluation, and possible issues that may occur.

4.9) Give advice to student-teachers regarding relevant activities like exhibiting bulletin boards, holding academic exhibitions, carrying out other special projects, etc.

4.10) In case there are some problems with student-teachers, mentor teachers need to report to supervising teachers at school or university supervisors so as to promptly solve the problems. In addition, mentor teachers are assigned to assess student-teachers' desired attributes, completion of routine jobs of teachers, and their teaching competency. They must also gather the final evaluations of student-teachers completed by supervising teachers and mentor teachers and submit the evaluation with all assessment and

evaluation forms to the school administrator for final approval, and also report to the universities within the designated time.

4.11) Qualifications of mentor teachers as prescribed by the Teachers' Council are as follows:

1) Hold a Bachelor's Degree or above (for those who mentor 3rd year or 4th year students, they need to have graduated in the same subject area as the student-teachers).

2) Have at least 3 years of teaching experience.

3) Possess the desirable attributes of a good teacher.

2.1.5 Teaching profession development

1) Current conditions and problems of teaching professions in Thailand

Educational professions (Teachers and Educational Personnel Council Act B.E.2546) carry the main duties of teaching and learning management and promoting students' learning through different teaching methods, including other responsibilities, in both public and private educational institutions providing early childhood, basic, and higher education below a bachelor's degree. Other responsibilities included are non-school based educational management within educational service areas, as well as promoting education, offering service, or working in the matter of teaching and learning management and educational supervision and management in other government educational agencies.

A teacher (Teachers and Educational Personnel Council Act B.E.2546) is defined as an individual whose primary duties include teaching and learning management and promoting students' learning through different teaching methods, but whose duties also include other responsibilities, both in public and private educational institutions providing early childhood, basic, and higher education below a bachelor's degree.

2) Significance of teaching professional standards

The prescription of teaching professional standards is to determine the quality criteria of teaching profession licensees who need to develop themselves professionally in a continuous and regular basis with regard to related laws. The Teachers' Council is authorized to take the leading role in updating the professional standards. The governing body of teaching professionals establishes three teaching professional standards as described below:

(1) Standards of professional knowledge and experience: requirements of knowledge and experience in teaching and learning or educational management needed by a teaching professional for his professional practice.

(2) Standards of working competency: requirements of attributes or behaviors related to working performance and development that a teaching professional needs to follow and pursue continuously in order to advance his skills and expertise. These standards include knowledge of languages and technology for teachers, curriculum development, teaching and learning management, teaching psychology, educational assessment and evaluation, classroom management, educational research and innovation, and educational information technology. A teaching license applicant needs to hold a bachelor's degree in education from institutions accredited by the Teachers' Council or a bachelor's degree in another field of study and also have earned a minimum of 24 credits in educational courses or professional teaching training, along with a teaching practicum experience in a school using the assessment criteria and results required by the governing body of teaching professionals.

(3) Standards of teachers' conduct: a code of conduct prescribed as the ethics for teaching professionals by the Teachers' Council.

Due to the fact that teachers decide the quality of population in societies, and such quality is an indicator of success in economic, social, political, educational, cultural, scientific and technological, and environmental development, teaching professionals are supposed to be a group of knowledgeable and good personalities who are role models leading moral and ethical lives, guiding society in the right direction. However, at the present time, the teaching profession is not in a favorable situation as people in general still look down on it as a low-paid occupation. Many educated and well-off people do not fancy their children studying to be teachers. Worse, young people who have finished Grade 12 do not intend to further their studies in a bachelor of education program. As a consequence, the students with poor learning achievement who fail to get seats in the programs they aspire to eventually end up in the education studies program.

3) Significance and elements of teaching profession standards

Teaching professionals play a major role in developing the education of a nation, so the following teaching profession standards are needed:

3.1) To oversee the teaching professionals' performance and maintain the integrity, honor, and dignity of the profession.

3.2) To lead the people of the nation with regard to keeping up with globalized development in a sustainable and secured manner by raising awareness of duties and responsibilities as teaching professionals and carrying out research, both domestically and internationally in order to strengthen professional teaching development that benefits the following areas:

3.2.1) the development of learners' quality and their success in life

3.2.2) the assurance of a school's educational quality

3.2.3) the improvement of policies and curriculum of the teacher's training institutions to produce graduates in education that meet the teaching professional standards so that teacher quality can be systematically audited to ensure genuine learner development.

2.2 Concepts and theories in relevance to human resource development

2.2.1. Concepts of educational psychology

1) Experimentalism

Experimentalism is a modern education concept which was first introduced in the 19th century. The theory accentuates the "experience" of a person most and asserts that experience is everything, a state of reality. John Dewey, an experimentalist theorist, states that experience is what all people can talk about. Experience holds our first and last answers. Experience determines our problems and tests our solutions; hence, people need not think beyond their experience. This school of theorists refuses Plato's idealist concept that views reality, as we can know it, as fundamentally mental, mentally constructed, or otherwise immaterial. The experimentalists do not determine the final goal of human beings or a society. Instead, it emphasizes problem-solving procedures and actions. Human intelligence develops as a result of the experiences of solving one's own problems and problems of society. Based on this theory, a leading experimentalist, John Dewey, followed these "learning-by-doing" and "learning through problem-solving" concepts, and he later introduced an educational theory called "progressivism".

2) Progressivism

As previously mentioned, the experimentalist theory was a new concept introduced late in the 19th century, and the core thinkers of this group were C. Pierce, William James, and John Dewey. The theory was also referred to as "pragmatism," or "instrumentalism," as John Dewey called it. This contemporary concept focuses on experience as an access to knowledge.

Progressivism originated when Francis Parker proposed a revolution in the school system around 1870. However, the key person who made the theory well-known was John Dewey. Apart from writing numerous books to spread his ideas, he also established the Progressive Education Association in 1919. Prior to this, however, he had experimented with the theory since he was a professor in philosophy, psychology, and education at the University of Chicago in the early 19th century. He founded a primary school in the university in 1896, which was later called a "laboratory school." Later, in 1902, results of his educational experiment at this "laboratory school" were presented in the books "The School and Society," in 1900, and "The Child and the Curriculum," in 1902, respectively.

In short, John Dewey postulates that human beings are curious by nature. He adds that the nature of a child involves four types of interest: communication, discovery, creation, and artistic expression. The theory which puts an emphasis on the love of actions derives from the concepts of Rousseau, Pestalozzi, and Froebel, and it is complemented by the ideas of experimentalism which believes in the process of gaining knowledge through experience or practice. In this fashion, John Dewey places importance on learning-by-doing, or what is termed "experience." He mentions that real experience comes from solving problems and reviewing the lessons learned from the problems. He also defines education as "the way to create new experiences or improve them so as to make them more meaningful, as well as to enhance our ability to determine the direction of future experiences."

Based on the theory, education needs to focus more on practical activities at school such as a geographical (environment) study project based on the students' own environment, in which all four types of interest: communication, discovery, creation, and artistic expression are covered.

John Dewey names the new concept "Progressive Education," which, unlike essentialism, is not based on "essence" for "essence," nor does it give first priority to content. Essence comes after practical experience. It also differs from perennials in that focuses are not on disciplining minds or assumptions of developing minds and wisdom in order to attain absolute truth. On the contrary, the main aim is on spiritual or mental growth gained from experiences related to present life or those the students are facing or are of interest to them. According to progressive theory, learners themselves and their interests are the priority, not other people or their interests. Thus, knowledge is not the definite "essence" which has been previously decided in the same manner for all learners. Knowledge is an individual experience that is changing from one period of time to another, or that originates from certain new experiences from hands-on practice. What's more, experimentalist philosophy, in which John Dewey was an eminent thinker, maintains that the survival of all living things, including human beings, depends on their ability to adapt. Such belief originated from a principle of Charles Darwin's Theory of Evolution that champions the idea of the survival of the fittest, in which the weaker ones will eventually die. Based on this, John Dewey adopted the concept of "adaptation" to the surroundings as the core principle of education. In addition, Dewey sees that human beings regularly have problems, all of which are encounters with changes that surround us endlessly. As human beings have to face challenges all their lives, teaching them problem-solving skills is necessary because that will help cast obstacles aside and allow them to leading their lives and live safely. From Dewey's perspective, experience breaks into two types: primary experience and secondary experience (Prathum Angkoonrohit, 2000). Primary experience refers to one that has not yet become knowledge or one without reflective thinking. It is in the middle of an action and confronts changes between human organs and the environment. Meanwhile, a secondary experience is a body of knowledge, for it has passed the reflective process. A primary experience is an element of the secondary experience to further one's thinking. For example, A little child is playing and accidentally steps on a hot coal, which results in a physical change: a burn on his foot. This is considered the child's primary experience, from which he has learned his secondary experience: that stepping on a hot coal will cause him much pain, and so, he will stay away from a place with hot coals or will be cautious about playing with fire. An experience with reflective thought is also known as a cognitive experience. John Dewey

states that the right education is not only based on a traditional or conservative system, or the progressive system alone. Dewey's educational philosophy evidently appreciates all essential experiences for the learner, focusing on learning in real situations. Furthermore, education, according to Dewey, means the physical, mental, and moral growth of a learner. Hence, the process of having new experiences in connection with old ones on a regular basis is required and encouraged as a springboard for present and future knowledge and understanding. Learning process management established on practical experience in real situations encompasses the set of learning activities through a problem-based approach. The learners learn by doing, thinking, and practicing different skills and processes, such as solving problems on their own and searching for knowledge in a collaborative manner, as well as learning both in theories and in practice in a democratic setting. A problem-based learning approach emphasizes that learners learn by themselves, developing their thinking and problem-solving skills. In so doing, a scientific process is usually used in this teaching approach. For this reson, it is also called a scientific teaching method. At present, the learning process management based on practical experiences is a learning-by-doing style. It is a learner-centered approach. This teaching strategy will use project-based learning in order to provide direct experiences for the learners, so they can experiment, search for and organize information, come to conclusions, discover methods and procedures by themselves or with other learners in groups. The learners independently search for knowledge in a democratic manner. The learners learn how to work with others and search for information and knowledge from different learning resources, aside from the classroom, helping them develop self-regulated learning skills. Advantages of the experimentalist or progressive theory of John Dewey are described as follows:

(1) Learners are happy with the learning activity that is they learn happily through a variety of activities and interest-arousing learning materials.

(2) Learners learn through activities of their interests, ability, and potential. Learners are able to search for knowledge and practice the skills and learn by themselves, making them confident and motivated to learn more.

(3) Learning activities strengthen learners' desirable attributes needed for the working process, such as planning ability, responsibility, generosity, self-discipline, democratic characteristics, knowledge of when to lead and when to follow, and

listening to others' opinions. The weaker learners learn happily because they have encouragement and assistance from their peers to the extent that it generates their confidence to exhibit their ability and generosity, and sharing is encouraged among learners.

(4) Learners develop process thinking skills while being engaged in learning activities, enabling them to find answers to the teacher's peers' questions individually as well as to express themselves with evidently rational explanations.

(5) Moral principles are embedding in learning activities so that learners can absorb such virtues at all times.

(6) Individual differences in learning and working ability of the learners are respected. All learners are able to learn with their full potential. However, competition with themselves, not ambition for too much excellence nor comparison between the learners' work, is encouraged.

(7) Learners learn happily, develop in all aspects and pick up their learning styles independently to suit themselves, and are able to apply the knowledge they gain to their daily life in an appropriate manner.

Whether or not learning experiences are knowledge-generating can be categorized by some principles as presented below (John Dewey, 1963).

(1) Continuity of experience: every experience is influenced by previous ones and needs adjustment in order to enhance the quality for continuous improvement of the experience, that is, continuous growth.

(2) Interaction: all experiences occur when individuals interact collectively with something within a period of time in an environment. All experiences are organized with objectives. Thus, educational experiences have meaning, and whether they generate knowledge and skills depends on how effective the management is, i.e. how a lesson is planned.

Steinaker and Bell (1979) define the concepts of providing experiences that focus 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 the gradual improvement of 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 by themselves. 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.

(5) Dissemination: the experiences are spread out, both within and outside of the learner in a controllable way.

2.2.2 Theories of human resource development

1) Theory of motivation

Some academics define motivation in different ways as described below:

Stephen P. Robbins refers to motivation as behaviors exhibited by motivated people who exert themselves more greatly to do something than the less-motivated. Motivation is the willingness to do something in order to create one's own satisfaction. The process of motivation can be illustrated in figure 2.1 below.

Figure 2.1 Process of Motivation

Wanchai Meechart (2008) summarizes that motivation is a state of willingness a person needs to work to attain the goals of his organization in response to his own satisfaction. Actually, it is a responsibility of an executive to motivate his subordinates, and the ability to do that job is also needed by those who are motivated.

It can be seen that using motivation to help learners is necessary for teaching and learning management. Watchara Laoriandee (2009:71) notes about the significance of motivation to help learners, that it is the use of motivation in the form of materials or objects, like money and gifts, or some physical conditions that may not mean anything to some people. In some cases, admiration tends to be more meaningful. People

do not have the same opportunities to have honor or to be in a position of power with desirable physical conditions such as pride, job satisfaction, feeling of how important they are in their organization, and feeling of honor, all of which can enhance the motivation to work.

In summary, if mentor teachers are motivated to develop themselves, believe and faith in working as mentor teachers to promote student-teachers' determination to learn how to manage learning activities effectively, both mentor teachers and student-teachers will work together more happily.

2) Theory of Learning

Meanings of learning discussed below are derived from the research of many psychologists who have examined the attributes and nature of learning which can help those who study about learning to have a more insightful and accurate understanding. In addition, concepts and ideas of other educational psychologists are also investigated and presented as follows:

Suwat Watthanawongse (2001) defines learning as a behavioral change caused by certain stimuli, and such a change is more likely to be permanent. In other words, it is what is termed as an experience.

Crow and Crow (1969: 1) posit that learning involves the change and development of behaviors, knowledge, and attitudes, so that one needs to adapt both personally and socially. The concept of such changes is directly related to learning. As change is in a learning process, whenever there is a change, learning occurs.

Cronbach (1963: 7) notes that learning can be exhibited appropriately as behavioral changes.

2.1) Adult learning theory

Malcolm Knowles was the first who attempted to do research on and introduce a new theory of adult learning. He named the new theory "andragogy," which he believed was different from what has been used in childhood education or, as it is referred to in educational terminology, "pedagogy" (andra = adult; ped = child).

According to his theory, Knowles notices that adults direct their own learning and are responsible for their own decisions about learning. Hence, education programs for adults need to be adjusted to embrace this theory's principles (Wanlee Sattayasai, 2004: 10).

As for the crucial assumptions of adult learning he developed, along with other subsequent research studies conducted by some others, Malcolm S. Knowles (1978) came to some conclusions about modern adult learning theory as presented below (Suwat Watthanawongse, 2001: 225-226).

(1) Needs and interests: adults are motivated to learn something if it suits their needs and interests developed from past experiences; it satisfies them. As such, learning activities should be started in a suitable manner so that they are able to learn.

(2) Life situations of adults: learning for adults is most effective if the adult's life is involved. Thus, suitable learning units' management for adults needs to emphasize situations relevant to the adult's life, rather than subject content.

(3) Analysis of experience: due to the fact that experience is the most valuable source of learning for adults, the principal methodology of adult education is the thorough analysis of the adult's experiences in order to consider what aspects of experience can be used in the learning activities.

(4) Adults need to be self-directed: adults have the inner-need to direct themselves. Hence, a teacher should be active during the mutual inquiry process, rather than just passing or mediating the knowledge and assessing the learners' responses.

(5) Individual difference: individual difference increases when people get older. As such, in order to teach adults, one needs to be accordingly well-prepared in terms of teaching and learning styles and teaching duration and place. Most importantly, the adults' ability to learn in each step is supposed to suit the adults' pace of learning.

The science of adult learning, andragogy, indicates that in designing the adult learning programs, the following assumptions need to be looked into:

(1) Adults want to know why they need to learn.

(2) Adults want to learn from experiences.

(3) Adults learn through problem-solving activities.

(4) Adults learn best when subjects of learning are of benefit and relevance to their lives.

In summary, to motivate adults to learn, learning experiences should be relevant to significant changes in their life. The more important their learning experiences are to them, the more they try to learn. They will learn things that help them know more and develop new skills in order to encounter such significant changes. Simply put, adults appreciate such learning. Aside from that, self-esteem and satisfaction are also factors that motivate adults to learn. Incidentally, principles of adult education can be described below.

(1) Adult education programs management should refer to adults' experiences.

(2) Adults prefer problem-based learning.

(3) Age should be considered in adult education program management.

(4) Teachers need to provide learning activities that challenge adults' ability to enhance their development in different dimensions.

(5) Learners should be given opportunities to be part of the educational management plan. It can be seen that adults' learning is based on challenges experiences of change. Due to these facts, in order to motivate mentor teachers to learn to develop student-teachers at their schools, they should be provided with the opportunity to participate in student-teacher development planning. As a result of this, mentor teachers can use their previous experiences to apply to and develop their teaching and learning management. This will also enable them to care for and give advice to student-teachers, monitor and evaluate, as well as promote the student-teachers' ability to manage mathematics teaching and learning activities using the problem-based approach. If theories of learning and motivation are used as mentioned, mentor teachers will be confident, equipped with principles and methods to give advice to student-teachers.

2.2) Social learning theory

Social learning behaviors (Suwat Watthanawongse, 2001) involve the social world of adults. Social adults refer to individuals who take part in adult social activities, which have a strong influence on their learning; that is, the adaptation and development of their personalities are suited to the social situations. Social conditions greatly influence adults' social behavior almost all their adulthood due to the fact that they have to interact with people in different social activities constantly. The first social

interaction starts with their parents, siblings, and others in the family. When they enter adulthood, people will be more experienced and develop more social skills. Nevertheless, human social behaviors are specific and complicated, particularly when in new social circumstances, people's social behaviors are affected differently. In a similar manner, an individual's reactions to social situations may also have some social effects on others because mutual interactions among people in a society tend to occur regularly.

In addition to observing and imitating others' behaviors or applying the behaviors to themselves, according to the theory of social learning, people are believed to exhibit their behaviors based on their direct experiences. In other words, when an individual displays a behavior and responds to it, the behavior is stored or memorized and it will direct subsequent behaviors in similar situations or situations based on previous experiences. For example, when a person enters a food court and buys some food without knowing the coupon system used, he will learn a lesson from his direct experience. As a result of this, when he goes into another food court, later, he checks whether a coupon system is used or if he needs to pay cash. Such experience is stored in the person's memory and also used to guide his later behaviors.

As stated in social learning concepts, an individual is believed to determine his own behaviors by observing, collecting information from and mimicking someone else's behaviors. However, whose and which behaviors are selected to imitate depend on a person's perceptions of behavioral expressions and their effects, learning process, and behaviorist concepts of human behaviors (Wanchai Meechart, 2008: 48-49). For these reasons, in order to provide students with a teaching practicum experience, teachers should endow them with social skills in a school setting. Consequently, school administrators, mentor teachers, student peers, school children, and the school environment all have a crucial influence on students' learning and their adjustment. If the schools where mentor teachers are able to serve as good role models for students can be selected, that will be a great social learning experience for students. In this case, classroom activities at the college are no longer needed for students as they can learn from those role models on their own.

2.3) Action learning theory

Action learning as stated by Wanthip Sinsoongsus (2006) is referred to as learning that is based on experiences in the work place where a small group of 5-8

people cooperatively solve problems and share experiences and perspectives. As a team, they need to know what and how to learn about something and apply what they have learned in solving their problems and enhancing their opportunity for work improvement. The learning takes place owing to the willingness of the team, and it is driven by all team members.

Such learning needs approval from the executive members of the team or organization, and all team members need collaborative learning skills to generate new knowledge by meeting and exchanging ideas regularly to come up with opportunities to improve their work. To do that, the team members require consistent reflection-in-action to better their performance. Action learning differs from experiential learning in that the latter is done by oneself, and it is different from problem-based learning in that action learning is more future-oriented involving initiatives or new projects, whereas learning-by-doing covers experiences of all kinds.

(1) Background of action learning

Reginald Revans, an Englishman, introduced the idea in an article in 1937 before the world war, during which time he saw nursing students often abandoning the training sessions at Revans Hospital. Seeing this, he regarded the traditional method of teaching management knowledge as fruitless and ineffective. He believed that there is no learning without action and no action without learning. In 1991, he wrote a book entitled "Developing Effective Managers," which triggered the idea of action learning. In his book, Revans proposes a learning equation as L (Learning) = P (Programming) + Q (Questioning), from which Marwuardt (2002) subsequently revised the equation to L = P+Q+R+I+R where

P = Previous knowledge and suggestions as guidance

Q = Viewpoints from questioning and reflections

I = Implementations, and

R = Reflection conducted regularly before and after an action

When coming up with questions or facing problems while working, there are so many answers or solutions. However, there is no single best way or approach. Action learning requires experiences, knowledge, and opinions that the individuals already have, and it also requires inquiry and idea-sharing that will lead to some new and different solutions. Organizations, individuals or groups of people develop

when their learning pace is faster than or as fast as the change; that is, $L \geq C$. It is certain that Revans believes that learning to keep up with the world; learning to know what, why, and how are not enough. The learners need to reflect on what they have learned and then transfer the knowledge to benefit themselves, the work teams, their organization, and society.

Recently, there have been many private companies and multi-national corporations from many countries like Belgium, South Africa, and the United Kingdom that apply action learning concepts to their business management and leader development, particularly under the Department of Management Learning, Lancaster University, Revans Centre for Action Learning and Research at Salford University, and the Institution of Leadership in International Management (LIM) in Lund, Sweden, all of which have a focus on business-driven action learning.

(2) Advantages of action learning

(2.1) It enables employees to learn how to cope with real situations in their working life and narrow the gap between learning and real practice.

(2.2) It promotes learning, thinking, opinion-sharing, and communication within the team so as to generate more confidence and self-understanding.

(2.3) It creates collaborative learning from which skills and experiences are transferred to benefit the real practice.

(2.4) It is advantageous for all parties concerned, including employees and work teams, to gain knowledge in order to fulfill their work with more expertise and to achieve the goals of the organization. As a result, the cost in hiring business consultants to manage the training will be reduced so that the organization can save in both budget and time. For these reasons, action learning is a tool for developing individuals and work teams, eventually creating changes in the organization.

(2.5) It contributes change to management and adjustment of the organization's culture, particularly the teamwork-based culture from which the team members can learn together and innovate; as a result of that, teach members form attachment to their work and the organization and also earn recognition and trust from their colleagues.

(3) Characteristics of action learning

(3.1) Learning about the work one does, not about theories; learning about real problems in the workplace or about performance-based business opportunities

(3.2) Learning that requires work teams, learning through actions that generate learning skills for both "how to learn" and "what to learn"

(3.3) Learning supported by senior executives in the organization whose active encouragement is needed

(3.4) Learning that creates a continuous learning culture in the organization, focusing on asking questions that need to be asked, rather than giving the answers

(3.5) Learning with eagerness, not one in which learners just listen passively; a classroom is the workplace, not a training room

(3.6) Learning that embraces experiments, risks, and errors; simple questions may lead to seeing some problems or opportunities in the work

(3.7) Learning that develops the reflection-in-action ability and concept-ideas organizing skills

(3.8) Learning that drives the development mechanism of behaviors and learning skills that contribute to the creation of learning organizations

(3.9) Learning that creates a network of exchanging and giving feedback information and challenging present ideas and practices

(3.10) Learning that is a model for learning-while-working, which is cost-effective and economical

(3.11) Learning that does away with obstacles in the work that need experts from other agencies to help; those who work in the organization are capable of being the experts

(3.12) Learning that drives a training-based organization to be learning-based

(4) Key principles of action learning

(4.1) Learning increases in an environment where members in an organization reflect on what they have learned and create a working environment.

(4.1.1) Employees enjoy freedom in their work with a flexible work guideline.

(4.1.2) Employees are given feedback information about their individual working performance.

(4.1.3) Employees interacts with each other, connect and stimulate ideas and perspectives among themselves.

(4.1.4) Employees are given privacy away from the workplace to reflect and come up with new concepts.

(4.2) Learning gives freedom to and authorizes employees to discover their own problems in the ways that they find suitable. As such, no experts are needed.

(4.3) Employees practice their essential working and thinking skills when they are given freedom to ask about beliefs and reasons behind actions.

(4.4) Employees learn greatly if they listen to feedback information from others.

(4.5) Results of experiments or problem solutions lead to employees gaining creative and valuable perspectives, most notably with the problems and situations they have not experienced before.

(4.6) New learning occurs in great measure when work team members are from different departments, but their age and positions are not much different.

(4.7) Action learning is more effective if the learner responds to and understands the overall system of the organization in advance.

(5) Elements of action learning

(5.1) Problems involving issues, concerns, work, or projects that prompt the start of action learning during the work of respective responsibilities, in which work teams or organizations appreciate the importance because it gives opportunities for them to experiment with the ideas and knowledge that they have learned and reflected on in their work. Rothwell (1999: 36-40) proposes some criteria for selecting topics of problems or issues for action learning. First, the problems or issues should be under the work teams' duties and be beneficial to the organization, and they should be worth spending time, money, and intelligence on. Additionally, the issues should be in consistency with the organizational strategic plans, supported by the executive members and some experts. Also,

in working on problems, the team members are given time to think and propose creative measures that enhancing the members' competency.

(5.2) Action learning involves groups of 5-8 people who are interested and love the challenge of problems even though they are not easy to solve. The group members should come from different departments or stake-holders in the work and policies of the organization, such as customers, suppliers, and sales representatives, and they should be people with direct experiences who are equipped with, if possible, reciprocal supplementing working skills. In this case, Pedler (1996) suggests that members "who know," "who care," and "who can" are needed in an interested group.

(5.3) The inquiry and reflection process take place both before and after each action. The work team needs to take "a step away" to look at their goal and see what is really happening, so they can analyze the reasonableness of the solutions, know how to ask open-ended questions (why and how), which lead to information circulation, and switch to close-ended questions (which one, how many times, true or false) in order to shed more light on the issues for the team members.

(5.4) Problem solutions and reflections are fruitless if no encouragement and feedback are received to check whether or not they are correct, economical, cost-effective, faster, or better. It can be assumed that action together with reflection is able to add more value. Hence, people involved in action learning need authority to reinforce the learning based on a reflection-in-action process.

(5.5) Continuous learning is secure if that reflection is done before every action; that is, the deliberation on how to achieve the goals of the work, learning, and the reflection itself. The think-aloud strategy benefits not only the individuals themselves, but also the workplace and the organization. Such a reflection needs to be practiced consistently and seriously on every possible occasion. Because of this, a suitable period of time that is needed is at least 4-9 months; the more time that is taken, the better the results will be.

(5.6) A work team needs a group manager who functions as a "learning coach," a person who motivates the group to talk, share perspectives, and come up with the group's problems to be discussed in the group. This person sets the framework of discussion for a final conclusion, gives feedback, organizes and uses the common beliefs of the group in pushing ahead with the actions, such as health-consciousness or success-

oriented learning. The group manager facilitates the team members in order to understand problems and place trust in each other, resolves conflicts and misunderstandings, and also encourages the group to come to a conclusion about the way out of a problem. Rothwell (1999: 65-75) points out that a group manager needs crucial competency in order to support the group to arrive at a conclusion (speaking, listening, gesture observing, and questioning) as well as competency of instructional design that includes examining needs, assessing the practice, and analyzing work and manpower (Nonglak Wiratchai, 2002).

(6) Stages of action learning

(6.1) Summarize what learning is about from previous working performances or experiences.

(6.2) State the problems and critical situations, how the problems are solved, and the results of the solutions.

(6.3) Name those who have experiences and who have improved learning and working performance.

(6.4) Create a support system for learning which contributes to the search for new ways and opportunities.

(6.5) Give opportunities to team members to work closely and share their perspectives.

(6.6) State the conflicts, behaviors, and results of the resolutions in each stage of the group working together.

Marquardt (2002: 171-186) introduces five stages for the success of action learning as presented below.

(1) Ask for approval and support from executive members by making it a project that illustrates the activities, processes, and ending benefits, as well as resources in the organization that are needed.

(2) Hold a preliminary workshop to introduce the core principles of action learning, probably by inviting some experts to throw light upon it, creating more understanding and giving the participants opportunities to practice and learn about the action learning process by selecting problems relevant to their work and asking 5-6 volunteers to solve the problems, reflect on their actions, and share their perspectives.

(3) State the activities, projects, action plans, or problem topics, and select team members and a team manager.

(4) Determine the process, date and times, places for regular meetings, objectives, and expected results.

(5) Implement action learning vigorously throughout the organization with close follow-up and monitoring measures to achieve the expected results.

To conclude, the adult learning theory and action learning theory can be used as basic concepts in creating a development model for mentor teachers to promote student-teachers to manage mathematics teaching and learning activities in the 21st century so as to develop school children's mathematics studies.

2.3) Theories of Counseling

Counseling is an art of helping fellow human beings discover, know of, understand, accept, and develop themselves. It is also an expression of concern, generosity, care, and compassion, as well as sincere support. To counsel someone means to empathize with him, share his suffering, and facilitate him to help himself. A counselor needs good human relation skills, including self-reliance, whom other people can rely on, both professionally and mentally. All of the aforementioned attributes are described as counseling.

Counseling is the heart of guidance work, so before the scope and techniques of counseling are presented, definitions of counseling will be described so that they will help people in the counseling circle to understand their work correctly and do their work with more obvious goals. In most cases, the work of a counselor is not limited to, as some define it, giving advice, but it depends on each counselor's mentality and attitudes as to how much he appreciates the value of humanity. As such, these factors, more or less, influence a counselor when spotting targets of counseling and finding more suitable techniques. Granted, counselors should hold a firm belief in target-counseling and different strategies of counseling, from which definitions of counseling from a variety of dimensions are derived. Unsurprisingly, there is not a single definition of counseling that is unanimously acceptable due to the fact that each definition is given by different counselors who have, from their own counseling experiences, different perspectives.

2.3.1) Definitions of counseling

Some psychologists give counseling different meanings, and the differences come not only from different viewpoints and philosophies of counseling experts, but they also originated in different times as presented below.

In 1945, Good, who established an educational dictionary, defined counseling as "an assistance for individuals who have personal, educational, and professional problems, from which all essential facts need to be investigated and analyzed to find ways to solve such problems, which is supported by experts and resources in the school and society. More importantly, a private interview is needed to instruct the client to make his own decision."

In addition to the above-mentioned definitions, Pepin sky also refers to counseling as

a. a diagnosis and treatment for maladjustment, and

b. in terms of a relationship, a face-to-face talk between a person who provides and another who receives counseling service.

Recently recognized definitions of counseling usually focus on the facilitation of individuals to make choices and to answer for themselves what they are supposed to do.

The definition consistently used as reference is that of Wrenn who states that "counseling is a relationship with dynamic and purpose between two people, in which the process used may differ depending on the needs of a person who receives the counsel"; i.e. it is a cooperation between a counselor and a counselee who receives counsel to enable the counselee to know himself and make his own decisions (self clarification and self determination).

In a similar manner, a definition of counseling from Tyler is another one that has regularly been cited. Tyler notes that "counseling means a process of facilitating a counselee to exploit his potential and existing personal qualities to manage his own life; for example, to be able to make decisions and address his emotional conflicts on his own."

Additionally, Shostrom and Brammer argue that "counseling refers to a process of facilitating a counselee to exploit his potential and existing personal qualities

to manage his own life; for example, to be able to make decisions and address his emotional conflicts on his own."

Traube also notes that "the work of a counselor is to help students learn how to examine and analyze their problems, and seek possible solutions, as well as to learn how to choose and try out what they think are most effective."

Wolberg says that "counseling is a form of interviewing people who need counsel to have more understanding about themselves to improve their environment or to resolve their problems."

Furthermore, some more definitions of counseling are given as presented below (Kaewta Phuphattanaphong, 2000).

Gilbert C. Wrenn presents the meaning of counseling as a process in which a counselor provides help to a counselee by meeting privately to enable him to direct himself and make his own decisions effectively.

B.G. Williamsons claims that counseling means offering help to individuals personally and privately in order to train them how to capably understand and direct themselves.

Counseling is a process of facilitating people who run into some difficulties and require assistance to resolve the difficulties to succeed in doing so. However, such help should be from those who are knowledgeable, experienced, and well-trained in providing counsel.

Counseling is also defined as a process related to a personal relationship between a counseling provider who has received special training and a client who needs counseling services, a relationship in which help, cooperation, understanding, and mutual respect are encouraged so as to facilitate the clients to know more about themselves and perceive the world in a correct way to the extent that they can make a choice and decision wisely and develop themselves entirely.

Despite so many different definitions, the process of counseling actually involves at least 3 important elements.

(1) An individual with emotional or mental difficulties; a client or counselee

(2) A person who gives counsel to the individual with such difficulties; a counselor

(3) An interaction between a counselor and a counselee which produces some change in the counselee

Nonetheless, the reason that describing an interaction between a counselor and a counselee causes different definitions of counseling is that some counselors emphasize the close relationship between a counselor and his counselee, whereas others focus on the process in which a counselee starts to change. For example, Carl R. Rogers, a well-known American counselor, suggests that to make counseling based on a relationship between a counselor and a counselee most effective, a structure of such a relationship needs to be definitely determined so that the counselee gains enough insight about himself to the point that he leads himself into a more suitable direction using new experiences he has received. Similarly, Steffler, another counselor whose emphasis is on personal relationship, asserts that "counseling is a symbol signifying a relationship in a profession between a counselor and a counselee, a relationship that occurs between an individual and another, to which some more people are possibly connected. In this case, a counselor has to enlighten a counselee on the present situations of his life so as to seek effective solutions to the problems with available opportunities."

Arguing in the same manner, some counselors accentuate the meaning of counseling as the process of relationship. Gustad proposes a clear definition of counseling as "counseling is a learning-oriented process, carried out in a simple, one-to-one social environment, in which a counselor, professionally competent in relevant psychological skills and knowledge, seeks to assist the counselee, by methods appropriate to the latter's needs and within the context of the personnel program, to learn more about and accept himself, to learn how to put such understanding into effect in relation to more clearly perceived and realistically defined goals to the extent that the client may become a happier and more productive member in his society."

It can be concluded that the main aims of counseling involve cooperation between a counselor and a counselee, a condition in which a counselee seek counsel with specific needs, and a counselor expects that his counseling will help the client to meet his needs at a satisfactory level.

To develop his counseling, a counselor needs to know the ability, attitudes, values and motivation, as well as other factors of the counselees, such as their household environment, workplace, spouse, and family, which vary from one counselee to

another. A counselor should focus his attention on how to promote individuals' self-integrity in order to succeed in life. To attain the goals of counseling, counselors should admit that the following are their responsibilities that need to be undertaken.

(1) Counselors should try to help individuals to understand and accept their own potential, which is needed to lead life in society.

(2) Counselors should play an active part in planning counselees' lives in terms of education, choosing study programs and occupations, and solving personal problems.

(3) Counselors should keep a record of counseling results and evaluate the progress of each counseling session.

2.3.2) Basic factors of counseling

One important thing that needs to be considered during counseling is rapport between counselors and counselees. Such connection between the two parties is viewed as a primary nature of interpersonal relationship-oriented counseling. Accordingly, some basic factors of counseling that counselors need to be aware of include the following:

(1) Motivational factor

Counselors need to realize that the readiness of the counselee is the main factor. They should examine how much the counselee is happy to accept counsel, and whether the appointment for counseling is made by the counselor or the counselee. Counselors have to be cognizant of such readiness in order to generate motivation during the counseling.

(2) The counselee-counselor relationship

The most coveted atmosphere for counseling is one where a counselee feels as equally accepted and respected as other people. In this sense, the counselor is the one who creates such an atmosphere.

(3) The counselor's decision-making responsibility

A counselor needs to stimulate and promote the counselee to seek and order the steps of making a choice, and to give opportunities to the counselee to do what they decide as their way of life, to the full extent that the counselor is capable of doing so. Despite this, the counselee has the right to make final decisions.

(4) The counselor's respect for privacy of communication

A counselor needs to respect the personal rights of the counselees, except for the matters about their true potential or things that will inflict damage on the general public. Thus, to what extent matters are considered a counselee's private matters needs to be accepted by the counselor and all parties concerned before the counseling process has started.

2.3.3) Scope of counseling

Due to the fact that counseling is a process of cooperation between counselors and counselees in order to seek effective channels to abate or eliminate suffering. However, counseling has to be based on the condition that such suffering is not caused by the counselee's behavioral disorders or mental illnesses. The counseling should be given to normal individuals whose sufferings or problems are those regularly found in general people, and their suffering encompasses the following problems:

(1) Educational problems: counselors need to have knowledge and understanding of the education system and how to plan a student's education in a way that would lead to the occupation they want to take up in the future, as well as how to select studies programs that will meet the student's abilities, aptitudes, and interests.

2) Occupational problems: counselors are able to help counselees with occupational problems, to give them a better understanding of world occupations and an opportunity to choose their jobs and to help them know how to choose the jobs that fit their qualifications and make them happy.

3) Social problems: counselors are able to help a counselee adjust his or herself to life in their family, at the workplace, or at school, as well as in their personal life. As a result, they are able to improve their mental health, self-understanding, self-acceptance, and acceptance of others. This will help them work with other people more effectively to contribute to both his and her own self and to society.

2.3.4) Qualifications for effective counselors

How much guidance and counseling are effective depends on an important factor, that is, the counselors themselves. What type of personality and attitude a counselor has determines how successful the work of guidance and counseling will be. Analyses of effective counselors, based on their basic behaviors, has been carried out by many famous psychologists and counseling experts, such as Fieldler and Heine in 1950, and

Combs and Super in 1959. The results of their studies can be summarized as that a good counselor does not need to possess any particular type of personality. Instead, what is more important is that a counselor's personality must reflect what he really is by nature, be it in the aspect of attitude or that of self-acceptance. Additionally, Rogers argues that if a counselor is determined and sincere about helping, no matter what kind of personality he has, it will be of great benefit. Success depends not on theories or techniques only, but it mainly depends on counselors believe it is most important to work to help fellow human beings. This concept is in consistency with that of Super who introduces the term "Self As Instrument".

2.3.5) General characteristics of effective counselors can be summarized as follows:

(1) In terms of perceiving the overall conditions, a good counselor examines these aspects when meeting a counselee for the first time:

(1.1) True personality and mentality of a person, rather than the physical appearance, is focused on. A counselor has to accept that a person actually consists of his body and mind, not his appearance or his clothing. Effective counselors should consider a person a human being and understand the theory of personality.

(1.2) The humanity of a person is appreciated, rather than considering him as an object. Counselors should understand that different problems of human beings are, more or less, involved with emotions in addition to reasons, so not only reasons are needed to solve their problems. Hence, counselors are required to scrutinize emotions and feelings, too.

(2) In terms of accepting others, counselors should have the following attributes:

(2.1) Be confident that every person has the ability to correct and develop himself

(2.2) Have trust in others, in themselves, and in the counselees

(2.3) Express cordiality and be friendly to people, that is, accept that general people are more friendly than antagonistic

(2.4) Acknowledge the value and virtues of human beings

(3) In terms of the counselors themselves, counselors should develop the following qualities:

(3.1) Ability to empathize with others' feelings and share in the suffering with their counselee throughout counseling

(3.2) A sense of sufficiency, that is, accepting that they have enough, and do not need to find ways to take advantage of their counselees or prey on them

(3.3) Impartiality, openness, and self-disclosure

(3.4) An attempt to encourage the counselees to stand on their own two feet and be themselves, rather than manipulate them

(3.5) Determination to bring benefits to the counselees

(3.6) Generosity and a comprehensive world view, seeing the importance of the main issues of counseling

(3.7) Sharp-wittedness

(3.8) A sense of humor

(3.9) Ability to keep the counselees' secrets

(4) Differences between counseling and psychotherapy

Some scholars in the counseling circle and psychology use the terms counseling and psychotherapy to mean the same thing. However, confusion of these two terminologies still prevails. As a matter of fact, processes of the two activities are differentiated with some distinct characteristics, not understood by some people.

These differences can be noted by reviewing the definition given by Lawrence Brammer and Everett Shostrom which says, "Professional expertise of counseling overlaps with that of psychotherapy. Counseling involves educating, giving support, solving problems that focus on normal issues faced by conscious minds, and that does not take too much time; whereas psychotherapy is associated with a type of support in a more specific sense that emphasizes a deeper psychoanalysis of the unconscious mind of those who suffer from psychosis and neurosis or abnormal emotional symptoms, which takes a long time.

Eysenck argues that psychotherapy is comprised of the following elements:

(1) A long-standing and close relationship between individuals

(2) A party in the relationship is a well-trained psychologist or psychotherapist

(3) A client or counselee has problems of emotional or personal relationship adjustment

(4) Psychological methods are implemented

(5) Activities based on theories of mental disorders are used

(6) The relationship aims to correct low self-esteem

In conclusion, the goal of counseling is to help normal people with suffering at a normal level feel more comfortable, see themselves more clearly, perceive and understand their roles, and adjust themselves to the environment. On the other hand, psychotherapy is for helping those with psychosis and neurosis, or those with abnormal emotional symptoms. The process of psychotherapy has emphasis on the unconscious state of mind of the counselees. If the difference in severity of degree of the emotional conditions and behaviors is not seen, it is most likely understood, in this sense, that counseling and psychotherapy is the same thing.

(5) Counseling skills

In giving counseling, counselors need different related skills of different advantages which they have to choose to suit the situations and times when necessary. Thus, to give effective counseling, such different skills are needed. Additionally, QA NEWS suggests some important counseling skills as presented below (Department of Academic Affairs, Ministry of Education, 2002):

(5.1) Listening

Listening is a very important counseling skill. It is active listening when a listener is attentive to both verbal and non-verbal languages and responds to them at the same level. It helps a counselor to understand his counselee, and the counselee realizes that the listener appreciates the importance of what he saying, and so wants to disclose more about him. All the listener may need to do is simply nod his head or answer with short utterances like “hmm” or “yes,” or use questions to resume the talk, like “So what?” or “Then what?” The most common drawback of listening is that the listener talks too much. However, this disadvantage should be noted by the counselor who needs to alert himself during the talk.

(5.2) Questioning

Questions start a talk and give opportunities for counselees to express themselves on the issues they need counseling for. Hence, close-ended or open-ended questions should be chosen properly. Open-ended questions are those without the extent of response; thus, the counselees are encouraged to exhibit more about their opinions.

Try to use the words “what” or “how,” and be cautious of beginning questions with “why,” because the counselee’s answers may not be relevant, and they may think that they are being reprimanded or making some mistakes, which will probably lead them to seek reasons to defend themselves rather than to tell the truth. On the other hand, close-ended questions need specific answers, or must aim to clarify some points. The questions for short and simple replies usually begin with “who,” “when,” and “Yes or No” questions.

(5.3) Being silent

Silence is a crucial skill that comes with listening. It is a period when a counselor and a counselee take a pause during the talk in order to give time for the counselee to reflect on his own thoughts and feelings until he is ready to resume the discussion. Silence is usually needed when the counselor notices that the counselee encounters certain feelings and cannot respond to some questions at the moment. The counselee may hesitate and decide whether or not to answer questions, or he may be deeply moved after recounting something, or he may concentrate on or spend time organizing his ideas in order to respond or resume talking. During the silence, the counselor has to show his attention and patience and also give time for the counselee, about 2-3 minutes, react to his feelings appropriately, or ask him new questions to make him feel comfortable enough to talk more.

(5.4) Paraphrasing

Paraphrasing means repeating what a counselee has said or what he is expected to express, focusing on important points, using less words while keeping the same meaning. This helps the counselee review his thoughts by listening to what he has said which will make him more convinced of what type of counseling he needs. Also, it will help the counselor to examine if what he understands is exactly what the counselee wants to tell, and it is a way to show his attention to the counselee. However, one thing the counselor needs to be careful of is the timeliness and repetitiveness of the paraphrasing technique.

(5.5) Suggesting

In some cases, counselors may find that counselees are confused with their own problems and are not able to respond during the counseling session, so the counselors need to give some suggestions to guide them as to what they are supposed to do. As such, counselors have to be knowledgeable and well-informed.

Nonetheless, the suggestions may adversely affect the objective of counseling because, with too many suggestions, children may fail to direct themselves.

(5.6) Clarifying

After talking for some time, it may be found that the problems of counselees are not properly or clearly addressed. This may be because the counselees themselves do not understand their own problems, making them talk in a roundabout way. Sometimes, the counselees try to reject problems that are occurring, resulting in a self-defense mechanism. Thus, as far as effective counseling is concerned, issues of the problems need to be clarified in order to arrive at a conclusion and find ways to solve such problems. Counselors have to be careful about the conclusion of the aforementioned content as it is greatly essential for them when using this technique.

(5.7) Reflecting on feelings

Reflecting on feelings is a time when counselors follow and sense the feeling counselees have expressed by listening and observing their gestures, then interpreting what they have listened to and observed into words, most of which are related to the feelings and factors that caused it. This will help the counselees see themselves more clearly and the counselors examine their understanding if it is exactly what the counselees feel.

(5.8) Interpreting

During counseling, verbal communication is used, so counselors and counselees need to share the same understanding. At times, counselors are not able to understand or are doubtful about the wording of the counselees. However, counselors should not use their guesswork on them because that may be misleading and damage the counseling. What counselors are supposed to do in this case is interpret that wording and share the interpretation with the counselee to check if it is true or not. If not, explanations on the points of doubt are required to reach the same conclusion.

(5.9) Making Observations

Observation is a skill needed to perceive different behaviors expressed in forms of both verbal and non-verbal language, as well as present conflict, both in terms of language spoken and behaviors exhibited. In observation, things that need to be considered are:

(1) Observation should be made in a natural and unobtrusive manner.

(2) Gestures, words, expressions, and feelings should be observed.

(3) Reactions of the counselees after receiving feedback should be observed.

(5.10) Giving Assurance

Giving assurance is a skill for promoting or supporting counselees to attain their self-understanding and self-clarification to ease their anxiety, and have self-esteem. To give assurance, sincerity is needed by using accurate information in consistency with what the counselees have, and to give hope based on reality.

(5.11) Summarization

Summarizing is the gathering of essential contents, including emotions that are expressed in the form of words and giving feedback information to the counselees. It is not repeating every sentence but choosing only the main points to help the counselees understand thoroughly the contents of the counseling. In summarizing, counselors can use the phrase, "After listening to you, it can be concluded that……."

2.3 Concepts of learning and teaching mathematics

1) Mathematics is one of the most important subjects to learn, and it does not only refer to figures but it also has a very broad meaning which can be summarized as follows (Watcharee Karnkeerati, 2011).

(1) Mathematics is a subject that involves the thinking process; we use mathematics to reasonably prove what we think is valid or not. Mathematics helps people to be reasonable, to yearn for knowledge, and to invent something new. So, mathematics is the base of the growth of technology because we have to always find answers to various problems. For example, how many students are in this class? how many birds are in the cage? how many people have died? etc. and these questions are solved by counting: if the number of people is increased, then addition is used, and if the number of people decreases, then subtraction is used.

(2) Mathematics is a subject that is related to humans' thoughts. Humans created symbols to refer to those thoughts and they invented rules to use so that everyone could understand the same meanings. Therefore, mathematics has its own

language; it consists of pictures indicated by compact symbols which convey meaning. It is the language that consists of numbers and symbols, and everyone in the world who learns mathematics will have this mutual understanding.

(3) Mathematics is a subject that has patterns; mathematical thinking requires patterns for every step, and there is an answer for every question.

(4) Mathematics is a subject that has structures; mathematical reasoning begins with simple problems, such as addition, subtraction, multiplication, and division. These simple problems are the fundamentals that will lead to more complex problems, such as fractions, decimals, percentages, etc.

(5) Mathematics is an art just like other areas of art. The beauty of mathematics is its formality and its harmonization. Mathematicians express their creative thoughts and imagination in order to create new mathematical structures. Mathematics is very important for our lives because it is a subject that is used in various occupations. It allows us to think and find reasons to solve problems systematically. Mathematics creates understanding. As it is very important, Thai students still struggle with problems and learning mathematics.

Watcharee Karnkeerati (2011) mentions factors that affect lower level math achievement for Thai students when compared to other countries. It can be summarized as follows.

(1) Learning and teaching procedures were unfavorable for encouraging students to enjoy studying math. For example, teachers started with difficult lessons and provided little research and improper practice problems. Some teachers used advanced language to explain the lessons or did not have enough time to check students' work. Therefore, students did not know what they needed to improve, so this problem continued.

(2) Teaching materials and media were limited. Some formulas and facts will be easier to understand if teaching media is used. Many teachers used suitable teaching media to encourage students to think and find mathematical facts, but many teachers did not see the value of using teaching media or did not have time to prepare it.

(3) A part of the assessment was completed using multiple choice questions, which do not allow students to write what they know because multiple choice tests frame both questions and answers. Some teachers provided good multiple choice

exams that encouraged students to analyze and answer the questions. However, many teachers used multiple choice exams often. One reason for this is that it is easy to check and process the scores. Presently, many evaluators have pointed out that taking scores from various aspects, such as a student's ability to describe, complete, and present reports, perform research and experiments, and create media and projects, as well as group participation behavior, are difficult to be measured by multiple choice examinations. Still, the obtained scores can be calculated into a comprehensive achievement score that will provide a better assessment result.

(4) There is a lack of integration. Teachers must have the ability to integrate knowledge and experience. Many teachers can blend knowledge between science and art successfully, allowing students to link different fields of knowledge. Also, many teachers are able to integrate mathematics into everyday life, making students feel that mathematics is not difficult, which will lead them to like other fields of learning, too, especially science.

(5) There are not enough experienced mathematic teachers or teachers who actually have a degree in mathematics. There are many reasons for the lack of mathematics teachers, including having a small number of graduates, graduates choosing to work in a field other than teaching, and the number of retired teachers. Schools hire fewer people than the number of people they lost each year, which affects the quality of learning and teaching.

The Trends in International Mathematics and Science Study 2007 or TIMSS-2007 evaluated projects of 8th grade students in high school in science and mathematics in 2004 – 2008. 59 countries all over the world, including the United States of America, England, France, Russia, Italy, Norway, the Republic of China, Singapore, South Korea, and Thailand, participated in this project. The study found that the Republic of China, Taipei, South Korea, Hong Kong, and Japan ha thde highest scores in mathematics. Thailand was ranked twenty-ninth with 441 points, which is below the study average of 500 points. Singapore, Taipei, Japan, South Korea, and England had the highest scores in science. Thailand was ranked twenty-first with 471 points, which is below the study average of 500 points. Comparing these scores with the scores of 1999, Thailand dropped in mathematics from 467 points to 441 points and in science from 482 points to 471 points. This problem has been affecting Thai education for a long time because Thai teachers test

students with multiple-choice examinations. Multiple-choice examinations are generally used to evaluate students' knowledge, which not only prohibits students' drive to develop analyzing or critical thinking skills, but also causes students to select answers without reading the questions. Dr. Narong stated that the multiple-choice examination has been used in Thai education since 1973, for 35 years. Teachers always teach students how to do this kind of exam using test-taking techniques rather than teaching them to apply their knowledge to do the examination. Nowadays, Thai students go to tutoring school because there are lots of techniques to guess correct answers. When they have those techniques, sometimes, it helps them get into university. However, even though they can enter university, they still have to go to tutoring school because they are not used to doing subjective tests. This is cause and effect. The countries that have high scores in mathematics and science—Singapore, Japan, South Korea, Taiwan, Hong Kong, and Malaysia—never use multiple choices examinations to evaluate students. Somwong Plengprasobchock, Dech Bunprajuk, and Janya Puudom's (2007) poll on 474 mathematics teachers and 971 students from 169 schools, based on pilot projects implemented by the curriculum in 1999 (B.E 2542), found that Thai students are not good at mathematics for the following reasons.

(1) Students do not like to think or to analyze and lack training and regular review. The survey result from teachers was high. The survey result from students was medium.

(2) Parents have less education. The survey result from teachers was high. The survey result from students was medium. Parents do not support children's studies. The survey result from teachers was high. The survey result from students was low.

(3) Students are not good at mathematics because teaching materials and teaching facilities are not adequate. The survey result from teachers was high. The survey result from secondary students was medium. The survey result from primary students was low.

(4) The survey result from teachers and secondary students was high with regard to the following points: teachers let students study lessons and tests, teachers do not have enough knowledge and are not well prepared, teachers do not graduate with a degree in mathematics, and teachers are not open-minded enough to let students answer freely. The survey result from teachers as well as primary students was medium with regard

to the following points: teachers do not explain well, teachers are temperamental, teachers are not strict with homework, teachers have no humor, teachers are not patient enough to explain, teachers do not use resources, teachers have boring teaching methods, teachers are not motivated, teachers do not teach students how to apply their knowledge in real situations, and teachers have a lot of other responsibilities in school.

Somwong Plengprasobchock conducted seminars for 118 teachers, heads of mathematics department, educators, and experts from academia, utilizing research from 6 university lecturers; it generalizes the problems and solutions of teaching mathematics as follows:

(1) Problem of resources and materials – the teaching tools are limited; they are not applied to students. Sometimes, directors determine resource purchases for everyone, and those purchases do not always match teachers' needs, and they are not interesting. In addition, purchasing materials or resources consists of many elements, and there is not always enough of a budget for them. So, all resources must be created by teachers, which is not standard. One solution for some lessons is to divide students into groups, which will allow them to build resources for themselves.

(2) Problem of teachers – teachers do not have time to review students' homework because there are a lot of lessons and few office hours. Another obstacle is mathematics class time, around noon, which is not interesting to students. Teacher development is not widely settled. Teachers are not well-prepared. Some schools have one teacher teaching every subject. Teachers do not have a mathematics degree. Teachers have no teaching techniques. Teachers are not motivated to learn new things. Teachers are over-confident. Some teachers do not have ethics. Teachers take things too seriously. Teachers' emotions are not stable. Teachers evaluate students without giving knowledge in their lessons. Teachers are often absent from school. The examinations are to difficult. There is no supervision among teachers. Teachers have many subjects to teach, so they do not have time to prepare resources and materials. Solutions include making sure that teachers have the proper psychology to teach students and that teachers know how to influence students to use thinking skills and that teachers are patient enough to make things happen. Teachers should emphasize the importance of mathematics in their lives. Teachers should be patient to solve problems regarding teaching. Teachers' teaching skills should be developed in many ways. There should be various trainings about teaching and using

resources. More importantly, teachers must have exact knowledge and understand various techniques.

(3) Student indolence – students keep their attention on amusement. Students do not concentrate on studying. Students do not like to study. Students do not think, and simply copy their homework from others. Students have Attention Deficit Hyperactivity Disorder due to problems within their families. Students have a lot of housework. Students do not like mathematics because their basis of calculation is not good. Students do not pay attention to lessons because the learning schedule is not productive. Students are unenthusiastic because they have many remedial exams. Students lack ethics. Solutions include teachers providing many interesting activities, motivating and encouraging students to learn. Teachers should provide "Friends helping Friends" activities to build a good attitude among students. Teachers should also introduce mathematics lessons by using interesting methods in order to express how important mathematics is in daily life. Teachers should teach systematically and treat students equally.

(4) Problems of skills and intelligence - Students, as usual, differ in ability if teachers use only one method of teaching. The curriculum does not conform to practice. Teachers have many tasks apart from teaching, which leads to students being neglected. More importantly, students do not like mathematics. The solution is that teachers should conduct research projects in order to find causes of the problem, starting in kindergarten, in order to avoid the expansion of the problem.

(5) Students have basic-math impairments caused teachers did not have good knowledge and did not have a degree in mathematics. Teachers either have no techniques or teachers who have a degree in mathematics did not have techniques. All of these factors caused low student achievement. Confusing resources and materials resulted in incorrect use. The solutions are that teachers should be trained to be experts; additional teaching and resources should be offered for students who did not understand the lesson or be provided for different students. These resources should help a variety of difficulties. Teachers should have good techniques to convey knowledge to students and attract their attention. Teachers should be able to persuade students to believe in and love mathematics. Teachers should apply resources and materials appropriately to lessons.

(6) Students are not able to apply knowledge in their daily life because they only study theories. Solutions include teachers studying methods, for example,

instructing students to do a project integrating mathematics into real situations. Each class asks students to propose ways to apply mathematics to real situations and provide simulations for students to solve the problems.

(7) Thai students are not instilled with logical thinking. They did not dare to share their opinions because they were afraid of failure. Teachers only instructed them on how to perform without allowing them to analyze their thoughts. In other words, teachers used closed-ended questions and had all students in class answer together, resulting in little thinking on the part of students. Multiple-choice exams lead students not to consider methods to answer correctly, but to guess the answer from the given choices. The solution is to practice the thinking process in groups and to encourage students to come up with various simulations to support the development of their thinking process.

(8) Lack of ethics - Students share and copy their homework. They think that plagiarism is normal. The solutions are that teachers should check and evaluate all homework and parents should also monitor their children and check homework, encouraging them to do homework honestly and motivating them to realize that their bright future is based on what they are doing in the present. Teachers should not focus on the importance of scores because students will not think for themselves, but will instead rely on a straight-A student to help.

(9) Students do not like mathematics because teachers are not able to show practical examples. The complex questions trouble them and lead to boring lessons. The solutions are to make math fun by using games, technology, and computers as a tool of teaching. Calculators might be a way to help students in case there are many numbers to calculate, but they must know how to do the problem without a calculator first. Use current situations that pull from their interests. The environment is also important and might be a way to motivate them to yearn for learning. Sometimes we should use a reward technique.

All of the above problems and limitations can be solved by teachers. The people who can directly develop students are teachers, so teachers should develop themselves first in order to be able to provide a learning process that focuses on students. Mathematics management using Problem-Based Learning is a form of learning that encourages learners to integrate what they have learned into their daily life.

So, teachers have to develop themselves with regard to learning management and understand mathematics management deeply, using Problem-Based Learning, in which

learning is about changing behaviors. Teachers should understand some theories of psychology for effective teaching. (Watcharee Karnkirati, 2011).

(1) Individual differences – students have different behaviors, minds, and intelligences. In general, schools group students without considering the individual students' potentials, which causes teaching to be ineffective, so teachers should be concerned about those things in the classroom.

(1.1) Within one group, students may have differences because students have different abilities, thus teachers are unable to teach them all the same way. Teachers should study each student's background.

(1.2) Differences in group - Teachers should group students using ability grouping and teach them according to each group's ability. Straight-A students might be excellent in finding the answers, while some students are discouraged. Teachers should cheer them up.

(1.3) Study students' backgrounds and diagnose problems based on each individual.

(1.4) Plan a lesson that conforms to those differences. Teachers are able to support straight-A students by using more difficult mathematical problems. The other students can be supported by offering special classes or give them a lot of mathematical problems to practice.

(1.5) Teachers should think about fun stories to help as a tool in order to avoid boring lessons. Examples include songs, cartoons, or puzzle clues.

(1.6) Teachers are conscious of providing proper worksheets. Straight-A students might have very difficult ones, and the others might start at an easy level and progress to a difficult one.

(1.7) One crucial factor when teaching different students, is the teachers should be patient, curious, and willing to sacrifice themselves in order to teach different students effectively.

(2) Principles and guidelines of teaching and learning mathematics.

Regarding mathematics learning, teachers should understand a teacher's role without any doubts (Wannee Someprayune, 1997). The curriculum should be comprehensive, indicating the main idea, principle of content, objective, new terms, technical symbols, and instructional media. Teachers should simply clarify teaching steps

and student activities. Crucial principles and guidelines of teaching are as follows (Wacharee Karnsiri, 2011).

(2.1) Teach students to gain concepts or knowledge of mathematics by thinking through participation-based activities that use questions and answers in order to establish the discussion, leading to various ideas and conclusions.

(2.2) Teach students to see relative structures of mathematics and continuity of mathematic contents.

(2.3) Teach student to consider what to learn and how to learn; required to understand both content and learning processes.

(2.4) Teach students by using concrete examples to clarify abstract issues or explain issues that are very complicated in abstract terms so they are easier to understand, allowing students to picture their understanding, as some mathematical ideas cannot be explained through media.

(2.5) Provide activities based on experiences and students' backgrounds.

(2.6) Teach students to apply their own experiences when solving complex mathematics problems, individually or in small groups.

(2.7) Teach students to analyze problems in order to find solutions, explain reasonable relationships, think creatively, and continue to think more.

(2.8) Teach students to see the relationship of mathematics between the classroom and daily life.

(2.9) Study the nature and potential of students for additional activities.

(2.10) Lighten students up by having fun activities and make them feel that mathematics is not difficult.

(2.11) Observe and assess students' learning and understand students via conversation or general questions.

(3) In addition, Yupin Pipitkul (2002) mentions the principles of teaching mathematics as follows.

(3.1) Start from easier levels and move to difficult levels.

(3.2) Change from abstract to concrete for topics that concrete instructional media can be used.

(3.3) Relative ideas – when teachers need to review lessons, they should categorize content into different groups.

(3.4) New teaching methods – teachers should change the way they teach to be more interesting by using songs, cartoons, or puzzles.

(3.5) Motivation – teachers should use students' interests to help them concentrate on the lesson.

(3.6) Teachers should consider new activities that align with their students' potential and existing skills.

(3.7) Related topics should be taught together in the same lesson.

(3.8) Teachers should help students to understand structure, not only content.

(3.9) Difficulty – teachers should realize that content should not be too complex or difficult for students because this may lead to discouragement. However, if difficulty draws the attention of some students, it should be considered individually.

(3.10) Teachers should teach students to summarize the information by themselves by referring to various examples. Do not summarize for them all at once.

(3.11) Teachers should let students practice and evaluate the practice results.

(3.12) Teachers should have a sense of humor in order to maintain a relaxed environment in the classroom because mathematics is one of the most difficult subjects.

(3.13) Teachers should always be enthusiastic and stay alert.

(3.14) Teachers should always seek and learn new things in order to gain new knowledge to teach students. Furthermore, teachers should respect their own role so that they can teach well.

A successful way of teaching mathematics is to make students understand that mathematics can be defined according to three experiential learning theories as follows.

(1) Concrete learning experience – or "action" is when students experience acting with objects associated with symbols which will help them to understand that symbols represent meanings.

(2) Semi-concrete learning experience – or "imagination" is the experience of students having visual stimuli associated with symbols which will help them to understand that symbols represent meanings, and students do not need to act with an object, only observe or look at the image of such object.

(3) Abstract learning experience – the experience of students to act with an object or have visual stimuli.

According to principles and guidelines of mathematics teaching and learning mentioned above, it can be found that the objective is to advocate learning provisions focused on students having skills, analyzing problems in order to find solutions, explaining reasonable relationships, thinking creatively, and seeking out ideas in order to think more. So, students will gain concepts or knowledge of mathematics by thinking, joining activities, using questions and answers to establish discussions for various ideas, leading to conclusions. Learning provisions should always consider the experiences of students so that they can put their experiences into practice, considering what and how they will learn, which means there should be both content and processes for solving mathematics problems.

Teaching mathematics in the 21st century should emphasize both understanding and concepts (Wicharn Panich, 2012: 311 – 313) using questioning, linking, and using steps as follows.

1) Questioning – In this step, teachers will ask students questions in order to let them begin practicing, starting with concrete media and moving to symbols as follows.

Concrete – In this stage, students will learn through the five senses (sensory) including sight, hearing, taste, smell, and touch. For example media, teachers may use rocks, sticks, Soma cubes, etc.

Semi concrete – After using actual media, in this stage, students will learn problem-solving skills via drawing pictures to allow their brains to practice visualizing skills, which are important for the next stage.

Symbolic – In this stage, students transfer pictures into symbols in order to solve problems using mathematical logic and rules.

2) Linking – This refers to individual students exchanging problem-solving methods in order to solve mathematics problems. It is not necessary for teachers to say who is right or wrong because when the methods are finally shared, everyone will see different aspects, defects that appear in some methods, or will be able to check some methods. In addition, students will eventually find answers and be able to select a solution that he/she understands the most to use. This is the skill of knowing about knowing, also known as meta-cognition, which is the skill that leads us to further development. During this step, teachers can simply ask questions such as, who can answer? What is one method? Or who has another method? A good teacher will not hastily give the answer; instead, they will let students find answers. Student will improve their skills of problem solving, patterning, creative thinking, reasoning, and communication, resulting in participation and answer-findings (meta-cognition).

3) Using – In this step, teachers give similar mathematical problems or more difficult ones than in the previous step so that students can practice together and shape their understanding. Furthermore, teachers can check how much students understand again. Problems in learning mathematics – Wacharee Karnkirati (2011) summarize the factors that cause Thailand to be unable to compete against other countries as follows.

(1) The teaching process commonly used is not conducive for children to love mathematics, often involving difficult exercises right at the beginning of the class, not enough experiments or research, inappropriate practice, teachers use difficult words or teachers do not check homework, which affects students as they will not know what they need to improve on. This will continue, so students do not like mathematics.

(2) There is a lack of constructional media. Media is the key tool that leads students to understand formulas or facts. Some teachers use proper resources that apply to real situations; some teachers never use resources or do not see the value of using them, or some think they are good but don't have time to create them.

(3) Assessments are often multiple-choice examinations, which allow students to guess what they don't know. Some teachers are really good at making multiple-choice tests and encourage students to analyze and write answers, but the main reason why multiple-choice is a root cause of Thailand's problem is because this type

of examination doesn't test students' ability to analyze and think, but rather, it is an easy way to evaluate, so teachers like to use it. Conversely, to evaluate students by using students' explanation projects, the students' reports, or students' behavior and teamwork, is a more effective way of evaluating because it is real and practical.

(4) there is a lack of integration. In everyday life, we are facing a lot of situations that can be integrated into teaching mathematics as teachers from many schools in Thailand know how to integrate mathematics lessons and current situations harmoniously by incorporating social studies, sciences, and arts. This will help students have fun when studying mathematics and it is a ladder to other subjects in the sciences.

(5) there are not sufficient numbers of experienced math teachers, including those who have a degree in mathematics. One reason for this might be because there are small numbers of degree-holding teachers; some are early-retired, or some just quit going do something else. The proportion of hiring and quitting is not balanced, leading to the lack of teachers and significantly affecting the development of teaching and learning quality.

In the original frame of teaching mathematics (Wicharn Panich, 2012: 310 – 311), teachers always teach children to memorize formulas without understanding them. Hence, we do not understand why, in long division, you need to start by dividing the dividend in the first place of the dividend, or we do not understand why, for fraction division, you need to invert the fraction of the divisor and multiply by the dividend. We also do not understand why, when solving a circular area problem, we do not multiply side by side as we do in a quadrilateral problem. Teachers usually teach students to work on difficult numbers because they believe that by calculating a lot of numbers they will be good at mathematics. In reality, teachers just need to teach students to understand the concepts starting from small numbers and eventually students will understand and be able to calculate large numbers by themselves. Teachers waste students' time by having them memorize formulas even though they barely use them because formulas can be found in a calculator or mobile phone.

The original frame starts from instructing methods in which hardly gives students a chance to find new methods by themselves. Students will study independently. It is believed that consulting is a type of copying. There are fewer opportunities for students to gain various methods through sharing or discussing. Teachers

expect that if students solve lots of mathematics problems, they will understand. But the dullness is all we gained from studying; all mathematics is only based on calculations. Nonetheless, Lamplaimat Pattana School is a private school which has a new frame of teaching. Mathematics in this school aims to achieve key skills, such as problem solving, patterning, creative thinking and reasoning, communication, and meta-cognition.

Therefore, teaching emphasizes concepts and seeking for various methods. The result is the way of answering is more important than the answer.

According to the problems, principles, and guidelines of teaching and learning mathematics, teachers should mainly focus on students and meta-cognition in order to let students think by themselves. It is important for teachers to develop themselves for students, to become a teacher for students. Teaching by solving problems is an appropriate method to support students. Furthermore, it is suitable when teaching contextual concepts because students can improve themselves and integrate knowledge into current situations.

Teachers, therefore, have to change themselves with learning provisions and understand how to apply learning mathematics using problem-solving. To change behavior is to change from experience and that experience changes behaviors in which teachers should have some theories of psychologies in order to teach effectively. Some psychologies that teachers should know are as follows (Wacharee Karnkirati, 2011).

2.4 Concept of learning in the 21st Century

Leaning in the 21st century requires teachers to be teachers for students; teachers should improve themselves in order to prepare students to be ready to be knowledgeable workers and learning people. In the 21st century, everyone should be a person who is ready to learn and work using knowledge, even a farmer. So, the most important skill of the 21st century is learning (Wicharn Panich, 2012).

The skills of 21st century people, that they have to learn from kindergarten through university and their entire life, is 3R x 7C which can be explained: 3R is Reading, (W)Riting, and (A) Rithmetic; 7C is critical thinking & problem solving, creativity & innovation, cross-cultural understanding, collaboration, teamwork & leadership, communication, information & media literacy, computing & ICT literacy, and career & learning skills. Teachers for students should improve themselves to be coaches.

Furthermore, problem-based learning is associated with learning provisions that follow Constructionism. Constructionism is generally referred to as Constructivism (Piaget) developed by Seymour Papert, Professor of Massachusetts Institute of Technology. The core of this theory is that students benefit from knowledge through the power of their own work, not from teachers. The theory emphasized building knowledge that allows students to have thinking skills and be enthusiastic and responsible. Knowledge built by learners is meaningful for themselves and it lasts forever. Students will remember it by heart and are able to pass it on to others effectively (Chaiwat Suttirat, 2010). Moreover, people these days have to work under the new economic system, that is, we need to drive students to have knowledge based on the economy according to 21st century skills. We need to find out what skills students should have in order to survive in the present because the "world changes rapidly and so does society, everything always changes, same as living skills." Thus, everyone should keep up with those changes and be ready to practice skills that are important for living. We need to adapt, change, and learn new things every day. Being a teacher in the new age of the 21st century requires three main roles including facilitator, guide/coach, and co-learner/co-investigator, not just being a "teacher."

2.5 Concepts of Competency and Teacher Development

1) For the meaning of competency, various researchers have given ideas as follows.

David C. McClelland (1970) defines competency as the characteristic hidden in individuals that leads to effective and excellent results in their jobs.

Boyatzis (1982) mentions that competency is the underlying characteristic of individuals including motives, traits, skills, self-image, social roles, and the body of knowledge which people need to use so that that they will gain effective and excellent results that are higher or beyond the determined goal.

Boam and Sparrow (1992) states that competency refers to behavioral features of individuals that they need to have in order to perform work and gain effective and excellent results in jobs.

David D. Dubois, William J. Rothwell (2004) points out that competency refers to characteristics that everyone has to use properly in order achieve their goals. These characteristics include knowledge, skills, personal appearances, and thinking patterns and methods.

Desha Deshawattanapisan (2000) refers to competency as skills, knowledge, ability, and characteristics of individuals that are necessary to perform leading effectiveness and success within an organization, called superior performers.

Ukkrit Karnjanaked (2000) states that competency means the ability and professionalism in different aspects which are important components allowing individuals to perform work successfully or with failure depending on their experiences and practices.

Narong Sangtong, (2002) defines competency as knowledge, ability, skills, and motivation related to and affecting goals, in which each function is equally important.

Office of the Civil Service Commission gives the definition of competency as a behavioral characteristic as a result of skills and capacities allowing a person to create outstanding work that is better than others within their organization. It is said that a person who is able to show potential usually has elements of knowledge, skills, and capacity. For example, a service mind which can be explained as "able to provide a required service to the service user." If a person lacks some elements, such as knowledge about the work or relevant skills, they might need to search for information from the internet. The characteristics of service people should be those who are patient and like to help others.

2) Concept of competency

The concept of competency begins in the early 1970s with David McClelland. He explored research found to consistently distinguish outstanding from typical performance in a given job or role. He divided it into 2 groups and studied why there were discrepancies in the results. In conclusion, he summarized the variable causing the results to come out unequally as "competency" (Jirapapha Akkraboa (2006: 58). Three years later, McClelland published the research "Testing for Competence rather than Intelligence," which is origin of the concept of competency explained through the characteristics of an iceberg.

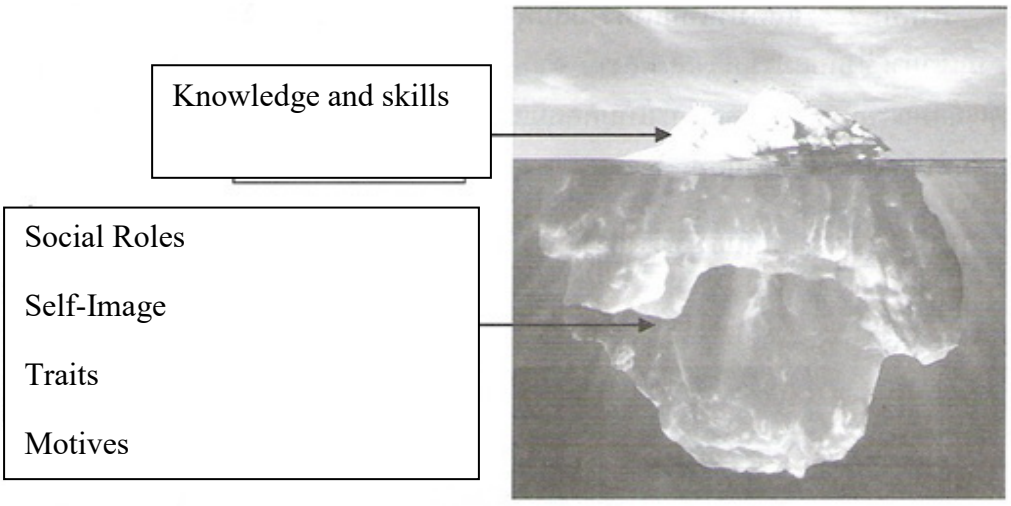


Figure 2.2 The Iceberg Model

Sources: Chuchai Smithikai (2007: 29)

From figure 2.2, it can be explained that a person's characteristics are like an iceberg floating in water, which only has a part of it floating above water, able to be observed and measured. This part includes skills and knowledge. On the other hand, the submerged part of the iceberg, which is much greater than what can be seen, may not be noticeable or measurable. Those parts are influenced by behaviors including social roles, self-image, traits, and motives. The part that is above water is the relationship with the intelligence of a person. They can learn knowledge and practice skills; it is, however, not enough to make outstanding performance. To be outstanding, there must be impulsion.

Competency can be categorized according to purposes, including the British approach and the American approach. The purpose of the British approach is for accreditation or certification of personnel by setting acceptable standards of performance. Competency according to this approach therefore depends on work and profession. The purpose of the American approach is for human-resource development, determined by the behavior of those who have good performance, that set the requirements and the guidelines that need to be followed for the needs of the organization. This competency, accordingly, cannot be imitated because the requirement of characteristics for each organization is quite different.

There are many definitions of competency according to the concept of the American approach as shown below.

Boyatzis (1982: 58) – defines competency as underlying characteristics of a person, which determines a person's behavior, resulting in the achievement of the needs of the work in the organization's environment.

Mitrani, Dalziel and Fitt (1992: 11) states that competency means an identity of a person linked to effectiveness and performance. It is associated with Spencer and Spencer, (1993: 9) defining competency as the identity of a person who has causality for effectiveness of the criterion reference. On the contrary, Spencer and Spencer (1993: 9) expand the definition of competency as the underlying characteristic that has causality in the effectiveness of the criterion reference or superior performance. It is explained more in details in the following figure.

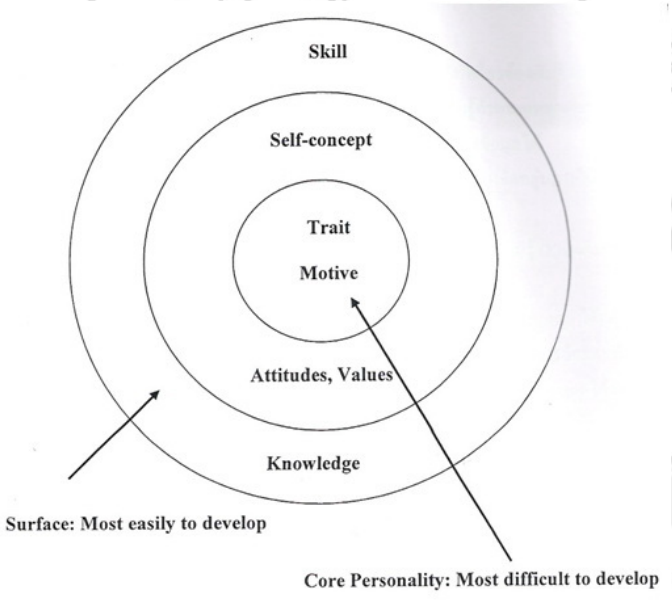


Figure 2.3 The relationship between competency and required performance

Sources: Spencer and Spencer (1993: 11)

1) Motives are what a person really thinks of and needs, which drives the determination of direction of a person's selection, representing behavior or correspondence to goals or retreating from such goals.

2) Traits are physical characteristics and consistent responses to situations or information. Emotional self-control is an example.

3) Self-concept refers to a person's attitudes, values, or self-image, which serves as motivation for the occurrence of behaviors, and such behaviors in a short-term situation can be predicted.

4) Knowledge refers to the scope of specific information or content a person has.

5) Skill is the ability to perform work, both relating to physical aspects, such as thinking and mental aspects, such as analyzing using knowledge or planning, while recognizing the complexity of the information.

The 5 characteristics of competency can be categorized under the criteria of expressive and noticeable behavior into 2 parts as follows.

1) Visible competency, such as knowledge and skills, which is the competency that can be improved easily.

2) Hidden competency, such as motives and traits, which are difficult to measure or develop.

Furthermore, there is a competency called self-concept, including attitude and value, in which there are competencies that can be changed but require a long period of time and can be done by training using psychological principles or the collection of experiences.

Dales and Hes (1995: 80) mentioned that competency is what causes excellent performance or superior performance. Moreover, it is defined as occupational competency, which means the ability to perform activities to reach targeted standards. The standard means the elements of ability with regard to performance criteria and job description.

Wattana Pattanapong (2004: 33) mentions competency means the level of adjustment and paradigm, attitudes, behaviors, knowledge and skills for the highest quality, efficiency, and effectiveness. Personnel should have an equal standard and improve themselves to have useful and beneficial skills based on an emotional quotient (EQ) and intelligence quotient (IQ).

As mentioned above, it can be summarized that competency refers to knowledge, skills, and attributes expressed through ways of thinking and behavior. It affects the performance and self-improvement of each individual which leads to the success of the organization or exceeding expectations.

Academics classify competency in various ways depending on different aspects, which Narong Sangtong (2004: 10-11) divided based on 3 criteria as follows.

1) Core competency means individuality reflecting knowledge, skills, attitudes, beliefs, and habits of a person within an organization that will help the organization, contributing to its success according to its vision.

2) Job competency means individuality reflecting knowledge, skills, attitudes, beliefs, and habits of a person that will help that person be able to create good work that is higher than the standard.

3) Personal competency refers to individuality reflecting knowledge, skills, attitudes, beliefs, and habits of a person that will make that person able to do something better than others. For example, someone who can live with scorpions or poisonous snakes can be said to have personal competency.

Jiprapha Akkrabao (2006: 68) stated that competency for each position can be divided into 3 criteria as follow.

1) Core competency, which means good behavior that everyone within an organization should have in order to show the organization's culture and values.

2) Professional competency, which means the ability of management that everyone in an organization should have in order to work successfully and be relevant to the organization's strategy and vision.

3) Technical competency, which means professional skills needed in order to execute tasks to accomplish expectations, which may be different according to job descriptions. This can be classified into two sub-sections, including core-technical competency and specific-technical competency.

In conclusion, competency can be divided into two main categories including core competency, which refers to the required characteristics of personnel in an organization in order to achieve the goals, including organizational knowledge, honesty, curiosity, responsibility, etc. Another point is functional competency, which refer to the required characteristics of personnel who work in various positions in order to complete their jobs and gain results as needed.

This research maintains the core competencies including knowledge competency, skill competency, and characteristic competency.

2.5 Concept of teacher competency and development

Prarachaworamunee (1985) defines "development" as growth or making something grow, which corresponds to the word "pray," which refers to growth or to making something happen. To clarify, something that has not happened yet will be created. This definition of the word "development" is similar to the westerner, Burke (1987:232), who gave the definition that "development is growth and maturation." Personal growth is related to the increase of personal knowledge and qualities while maturation is about using individual capacity to integrate knowledge in order to achieve goals. Academics interpret the meaning of personal development in similar ways.

Personal development refers to any effort that will make creative competency of each individual relevant to that person's responsibility (Megginson.1967).

Personal development can also refer to activities concerning promotion that help people gain abilities and skills as well as a good attitude with regard to working effectively. In other words, personal development also means the process of behavior changes depending on the area of knowledge, potential, behaviors, attitudes, and operational approach (Saman Rangsiyokrit 1997:80).

A personal development training course builds knowledge of employee proficiency in order to change behaviors and attitudes permanently, which has an impact on the efficiency of employees' career paths and growth opportunities (Supranee Srichattrapimuk. 1981:1)

Teachers are important personnel in many levels of education. As a consequence, it can be said that developing teachers is the attempted process of increasing and building teachers to have extreme teaching capabilities and good moral principles, ethics, and personality traits that are appropriate for being a good teacher. Based on the documentation and research of teacher development, teacher development patterns can be summarized as follows.

1) Education, The purpose of teacher development is to help educational personnel by developing and improving knowledge in Thailand continuously, especially in quantitative subjects in order to support all populations to be able to access to education, for example, increasing students in bachelor degree programs. According to research, students in degree programs has rapidly increased from 68,078 in 1974 to 239,444 in 2002, (Pasin Tangjoung, 2005) which conforms to Wichai Tonsiri's (2007) thought that

in university levels, there will be a lot of expansion by changing 41 Rajabhat Institutions to Rajabhat Universities in 2004. There are about 390 educational institutions in Thailand, including Rajamangala Institute of Technology, Vocational College, College of Dramatic Arts, and College of Fine Arts, and there are 29 private educational institutions that have levels below a bachelor degree in all of Thailand. Considering all students in bachelor degree programs, in 2001, 27.3% of students were 18-21 years old, approximately 1,286,212 students. In contrast, the students in a program below than or higher than a bachelor degree came out to 1,868,642. It is stated that the extension of education in Thailand is growing satisfactorily. To draw comparisons of students in 1981 and 2001, the proportion was 27.3% but the quality and management of education (Pasin Tangjoung, 2005) is not relative to globalization because it is unable to develop student potential, increase value, or allow them to consume technology, which is the expressway to appropriately access the beneficial information needed for productivity. In promoting teachers to study in a master's degree and philosophy degree program is to develop organizations as well, which can be the standard of education and build social values for teachers. Preceding this, the study summarizes that education in Thailand is not encouraged to question (Petcharee Rupawichet, 2002), it is only a recitation and commands. Education in Thailand lacks analysis, practical usage, and problem-solving skills, and it is not connected to the economy, society, politics, or global-warming. In 1999, therefore, National Education Act of B.E. 2542 (1999) reformed Thai education. This act helped the educational system to be placed in the appropriate form, leading students to be full of knowledge and self-reliance. Finally, Thailand will be a society of wisdom and the nation will be carried to stability and contend with international standards.

2) Training is the process of personal development which consists of many mutually related activities. Training should be done continuously in order to gain deep knowledge and obtain high benefits and efficiency for both personnel and the organization. The important activities are divided into steps as follows: (1) Training needs (2) Training curriculum (3) Training process (4) Evaluation and follow-up

As previously stated, training is the method used to increase and improve knowledge, skills, and attitudes for personnel. Although it is a useful tool, a suitable situation, place, timing, and people should be analyzed and prepared properly, such as considering who is attending and when it is held. This challenge is important because

teachers must understand the necessity of training. Training is a management method used to develop the quality of approach, even though the expense is very high. Accordingly, the decision of organizing trainees should be contemplated cautiously, considering training needs. As a choice to not participate in training, there should be alternative options, sometimes, because the training is not always able to settle issues of personnel. They might have other issues such as job blocking and high cost. There should be another option to take the place of the training. Finding training needs is the main method to determine the purpose of the training effectively.

Training needs, To operate trainings, staff should first finalize the training needs, generally it is called TN, which refers to the condition where obstacles or problems need to be solved by providing training courses so that the goal can be accomplished.

Supranee Srichattramuk (2001:34) mentions that to determine training needs, the organization must seek out situations or problems within the organization which can be solved by having training courses so that the organization can accomplish its objectives.

Lynton (1970:77-78) mentions that training needs includes problems, obstacles, and limitations that might be solved through training arrangements. Problems, obstacles, and limitations that cannot be solved by training courses cannot be called training needs and might require different methods.

3) Coaching and Mentoring: The government imposed the policies of society of good quality of life by developing the competency of teachers and educational personnel as moral, ethical, good teachers. In the fiscal year of 2013, the Office of Basic Education provided a developing project regarding competency strength as a part of teaching in schools with a variety in size and nature. The Coaching and Mentoring programs had been used concordantly with the needs of Primary Educational Service Area, Secondary Educational Service Area. The project cooperated with educational institutions in order to develop personnel by using "on the job training." The program stresses developing the mind and spirit of teaching. To develop students to have ability in literacy, numeracy, and reasoning, as well as learning to question, learning to search, learning to construct, learning to communicate, and learning to serve is part of the process of the Basic Education Core Curriculum 2008's guideline for the 21st century. As stated, this projected

was coordinated between the Office of Basic Education and the Institution of Education using the Coaching and mentoring module.

Coaches are responsible for training people who attend the training. Bosses or people in a higher position than trainees are possible trainers. By using this method, it emphasizes the development of individual performance and potential. Coaching might be formal or informal communication, which has no gab and it is a good ice breaker activity. It establishes a good relationship with each other. However, to have good coaching, there should be readiness on the part of the trainee as well as the coach.

Mentoring (mentor) is for people who have skills in an organization, or those who are well-recognized, who have high potential, giving some suggestions to new-comers or others in a lower position (mentee). Mentoring helps the development of those who are very new obtain more potential and capabilities that will lead to the success of the organization. Mentees are possibly new-comers or people who are outstanding in the organization. Mentors would encourage and cheer up mentees and also support them to have growth opportunities in their career path.

4) Supervision. Academics give many definitions of supervision, including educational supervision or instructional supervision, in which they have the same target, which is quality of education. The important educational quality indicator is the quality of students or the effectiveness of students' learning. Thai academics have given the meaning of educational supervision as follows.

Saroch Bausri (1997) explains that educational supervision is to monitor, suggest, and support administration and academics to be effective. Educational supervision is not concerned about command but is truly a suggestion and recommendation.

Sangad Uttranan (1987) defines it as the process of teacher and educational personnel coordination in attempts to accomplish high-level studying in students.

Preyaporn Wonganutraroch (2005) determines it as the educational management process of giving assistance and suggestions in cooperation with teachers and educational personnel in order to develop the method of teaching and to improve student value to qualify for educational aims.

Chanchai Ajinsamajan (2002) summarizes that supervision is a dynamic creation of support provided by giving advice and recommendations in a friendly

way to teachers and students so that they can improve themselves and also improve learning conditions needed in order to obtain the needed education.

Ovliva (1989) who is an overseas educational academic defines supervision as the help of a teacher especially in order to develop studying. Important terms defining practical behaviors of supervision are help and service.

Acheson and Gall (1992) gave the meaning of supervision as cooperation more than indication. It is a democracy not a dictatorship. It emphasizes the teacher more than the supervisor.

In conclusion, according to Thai and overseas academics, the emphasis of supervision is the coordinating process used to improve and develop an area that supports rather than commands. This process will focus on quality assurance and learning management systems to reach goals effectively.

Thus, one can compare the statements mentioned above in order to find similar processes, for example;

Supervision is the process of learning system improvement.

Supervision is the process of unleashing human potential.

Supervision is the process of building leadership.

Supervision is the process of communication.

Supervision is the process of curriculum development.

The 5 processes above express the "coordination" between supervisor and receiver under democracy. Importantly, the basic purpose of this coordination is to build leadership in which all related persons in education are able to practice and balance the profession with problem-solving skills, both individually and as a team. It is not inappropriately a "command" or an "act." Direction and purpose is necessary for the process of supervision, for which the Primary Educational Service committee (1991:34) specifies definite objectives as follows:

To help teachers develop themselves

To improve teacher personality and behavior

To support teacher knowledge and potential in studying activities

To monitor and control while the teacher practices continuously

To promote teacher creativity and teamwork

Sangad Uttranan (1987:12) defined the purpose of supervision in schools in 4 points: (1) Human development (2) Workflow development (3) Coordination (4) Encouragement. These purposes of supervision are associated with purpose of development supervision. According to Glickman, Gordon, and Ross-Gordon's theory, supervisors of this type of supervision have to believe that teachers are able to reach the highest power, be supported and be advised correctly based on individual potential. Instructional supervision is the process of coordinating teachers to improve effectiveness of the learning system used in the classroom. Wacharee Laorean (2007:129) says development supervision has 2 factors: (1) To help teachers develop themselves and their careers consistently (2) To build a quality of school which is similar to Glickman, Gordon, and Ross-Gordon, (2004:464). They say 5 factors are necessary for a school's achievement, which consist of Direct Assistance, Group Development, Professional Development, Curriculum Development, and Action Research.

In conclusion, development supervision aims to help teachers to improve and develop themselves in their professions constantly and effectively. Instructional supervision should not only have evaluation, but also support, suggestion, and monitoring. This will help teachers develop themselves like in the pre-service student teaching practicum experience, which might possibly obtain favors from university supervisors and associated teachers to help them develop their self-learning effectively.

5) Empowered Development Approach**.** The word "empower" is rooted in two terms, which are "em" and "power." "Em" or "en" is a prefix, which means "to take place," and when these two words are combined, it means the building of power. To empower, therefore, is to make people believe and realize that they have potential and to help them be able to unleash power creatively through thinking power, intelligent power, and body power. This empowerment can be used to help themselves or their organization. The organization of empowerment that the author referenced is to develop the quality of teachers defined in 3Hs, which are the Heart, the Head, and the Hand. The 3Hs are relative and shown linked in figure VI (Monniphachutibut: 2010)

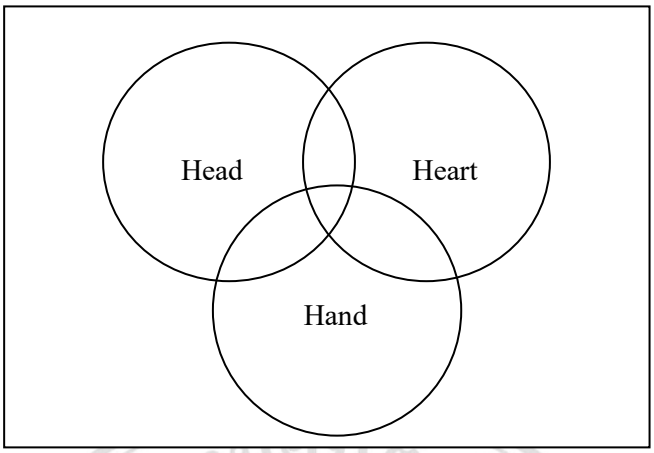


Figure 2.4 The relativity of 3Hs

From figure 2.4, the process of the 3Hs in order to empower teachers is explained as follows.

First topic: To help teachers to have the courage (Heart) to use love to get to the destination.

Second topic: To help teachers to have understanding (Head) to have knowledge of analysis and to link to other perspectives.

Third topic: To practice (Hand) by rehearsing, discipline building, checking, and creative development.

Empowered development consists of many methods.

To empower teachers to have head, heart, and hand, following the previously stated model, might not be successful. It must contain various methods. The popular methods that are used successfully can be divided into 4 items.

(1) Training

Training is an activity that trainees should attend first to prepare and perceive how its importance in terms of development. It emphasizes a target and role of trainees and coaches, and knowledge for development.

(2) Mentoring

Mentoring relies on the people who consult individual trainees and small groups. They will follow up with and monitor trainees in order to reach their goal. The mentor will help trainees analyze and reflect on the reality of their thoughts or actions through creative ways, such as mobile phones or face-to-face.

(3) Coaching

Coaching is a parallel process to mentoring. It means to coach and to help the trainees consolidate their understanding and knowledge throughout the training time in order to reach their goals.

(4) Supervision

Supervision is the activity which helps trainees by caring and consulting. The target is set by providing a learning exchange seminar in order to raise new thoughts and creative applications during and after development training.

Development with the Empowered Method should first begin with Heart, Head, and then to practice – Hand. During the training, supervision might involve many activities to help trainers consult in order to reach the target. As the learning exchange seminar for building new thought and creative adaptation during and after the development training might not work, empowerment of head and heart is the important key to perform by using mentoring and coaching simultaneously on a group or individual level. During the training, there should be a period of time for self-assessment to help students understand their knowledge. In the meantime, the trainers should give more details and knowledge using technical skills, called supervision. Supervision is the process of head and heart development. The coaches will use this way of training. Before the training ends, the trainees will gain head and heart empowerment again. The development will end with the supervision of a learning exchange seminar and presentation. This process will bring pride and sustainable understanding.

6) Professional Learning Community: PLC

This process is a famous method of Teacher Development in the USA. The characteristic feature of this process is a group typically composed of 6-15 persons, but not over 20 persons. It is a volunteer practice. Frequency of the training is very high. The trainees will learn and practice with each other. The objective of this training is to have repetition of and reflection on practice. They respond to changes and all persons are equal. This process is teamwork, so there is no need to have a demand. This reflection process is the method to learn and study true knowledge in the way of Action Research. To have a PCL, 1) All coaches and mentors from schools will go study to understand context and demand. They must have base data about those in the PCL and how many groups there are as well as who has the potential to suggest and consult or who has the potential to

persuade others to join or who knows what their strength is. 2) Survey and observation is necessary in order to be familiar with and to introduce educational persons, coaches, and mentors. 3) Group learning is a PCL. It is possible to help find some opening to improve. Defining the objective and procedures and collecting study cases for analysis using assessment tools or preparing the exchange knowledge stage. 4) Always exchange knowledge, coach in order to achieve the goal. Then, coaches and mentors finally discuss at the end what is needed for the pattern of process.

In summary, PLC is the process of a group of people who help each other work and develop. It has a high frequency of meetings and continuity. There is a protocol or agreement to coordinate, for example, how many times to hold training per month. Each meeting, they should reflect on the successes of thought and commitments and what will be next. So, PLC requires high frequency and continuity. The process of teacher development is to take teachers and make them good, strong, and passionate, improving the quality of teaching by knowing and understanding their weaknesses and strengths by emphasizing teachers as the center of development, targeting and letting teachers find knowledge in practice on their own. A PLC (Wijan Panich, 2012) is the continuous process in which teachers and students work together in questioning and operational research in order to achieve goals. It is believed that effective development depends on the depth of the teacher and academic's operations.

A PLC is a complex process containing lots of elements. It is necessary to view it from many definitions. However, the key definitions are as follows.

Learning emphasis

A culture in collaboration of learning for all parties

Questioning for good operation and current situation

Practice emphasis

Continuity of development

Results emphasize students

Wijan Panich (2012) defines a PLC as the collaboration of teachers in schools or an educational area in order to exchange knowledge and study management for students to gain the skills necessary in order to live in the 21th century. School Administrators, School Committees, the Executive Education Area, and the Executive Education of the Nation should attend and support PLCs to set the system of knowledge

exchange continuously. PLC works systematically. There must be participation in a variety of roles and the goal is to improve the effectiveness of student learning.

Using the PLC method will benefit both the students and the teachers, helping them to learn deeply and widely and to link to each other. Especially, PLCs will reveal individual potential. It will help both to estimate the true situation in schools and educational areas. The principle of changing from A to B will be easier if it is clear to see where B is and how A is. A PLC is collaboration on the "Journey of Life" which the members dedicate their lives to create new generations of society and to invent new ways of learning in order to achieve 21st Century Skills. A PLC is the creative education of the 21st century differing from education of the 19th and 20th centuries. Its purpose is to create a better life caused by teachers' success and people associated with PLCs. PLCs are the practice path helping people gain learning skills in the 21st century, to become learning people.

Teacher development comes from learning people and PLC members' collaboration with interactive learning through action. The happy life is a path you must practice.

PLCs will change the school atmosphere; PLCs give schools an equal voice. Also, the worthwhile benefit is that it gives "invaluable and shining commitment." Everyone will help to improve and balance the learning quality of students in order to lead them to have learning skills in the 21st century. It is an endless cycle when members think of new inventory, assume, and experiment to find results to discuss and exchange. Members believe in themselves and each others, and this will slowly touch the purpose using the principles of "continuous development."

As part of a lot of teachers' responsibility, this method, PLCs, is not made to burden teachers; carefulness with dignity and pride is important, and we can say that the purpose of PLC is to increase dignity and pride. To target PLCs, 2 questions are needed. 1) What do we need students to obtain? 2) How do we know students gain? The principle is for students to have essential learning targeted standards which are not only about earning a degree.

The journey of a PLC is what teachers think, interpret, and understand as the result and turn it into learning improvements on an endless cycle, which is the continuous path of student improvement. However, PLCs in schools take time to

develop; the developments, thus, of learning communities through collaboration of associated teachers, interns, and university supervisors is the beginning of PLCs in the future.

2.6 Concept of Model Development

1) Meaning of Model

Academics give the definition both differently and similarly. They summarize the meaning of model as follows.

A model is a simulator of phenomena used to explain the relationship of elements. (Good, 1973; Stoner and Wankle, 1986; Nadler, 1980; Mescon and Khedouri, 1985; Smith and Others, 1971); Choawarat Temeeyakul, 2010)

Sirichai Kanjanawasee (2009) defines the form or model as 1) Descriptive Model as presentation using the description identifying concepts or variables and the explanation of phenomena by using the description of relations between concepts or variables. 2) Model Picture as presentation using pictures or symbols identifying concepts or variables, drawing the relationship between concepts or variables. 3) Mathematical Model as the presentation using symbols to identify concepts or variables and using math functions to link the relationship between concepts or principles.

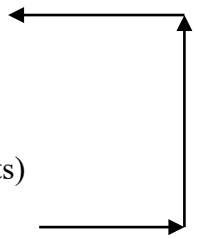
Researchers explain the meaning of model as the conceptual process of researchers using theories and facts to develop the capacity of teachers associated with learning management in the 21st century.

2) The Development Model Process

The essentials of the development model should have a supported theory when developed. Before using the model, there should be a theory and quality inspection in the organization of terms of the actual situation, arranging the result, then, improving the development model. The main purpose is for users to use the model with the main principle. It will bring the best result; additionally, the model can be applied in other situations (Joyce and Weil, 1986).

Rattana Baoson (2009) explains the method of development model consists of 5 important steps as follows 1) Synthesis, analysis, and survey of problems or demands 2) Designing, building, and innovation evaluation (product) 3) Taking the innovation or products to test 4) Assessing and improving innovation (products) 5) Dissemination of innovation (products) which linked the relationship of 5 steps as follows.

1) Synthesis, analysis and survey
2) Designing, building, and evaluation
3) Taking the innovation or products to test
4) Assessing and improving innovation (products)
5) Dissemination of innovation (products)



From above, the research and development starts from synthesis, analysis, and survey of problems or demands as well as the needs of concerned persons to understand the problems, obstacles, and what needs to improve or develop. Information is gained through analysis and synthesis of previous, practical, printed documentation or may be made by surveying those involved with the operation about exploration, development, or performance to resolve problems. According to the 1st step, it is considered Documentary Research or Synthesis Research and Survey Research.

When looking at the result from 1st step, the result (problems or demands) is used to design and build innovations. There is an evaluation to check the consistency of the innovation components before using it with the target. The result of the evaluation will also be used to analyze and improve the 3rd step.

The 3rd step: When taking the innovation or products to testing, this innovation will be tested with the target setting which the experiment will based on. Experimental Research – there is an experimental design to choose the target and observe the result.

The 4th step: When completing innovation conclusion, it is an innovation usage evaluation to get the whole picture in order to get a result to improve and develop completely. Evaluation of the innovation will be done with Project Evaluation or Evaluation Research.

The final step is to disseminate innovation products with the overall evaluation and final improvements which act in business (commercial) or apply to the public. The following method is concerned with public relations, product registration, or intellectual property. This process is separate from the research because it is about public relations; however, there is a data collection about the innovation for development and improvement for the next research.

The model has been widely used in research and development as the System Approach Model of Educational R&D designed by Dick, W., Carey, L., & Carey, JO. (2005) as following the figure 2.5

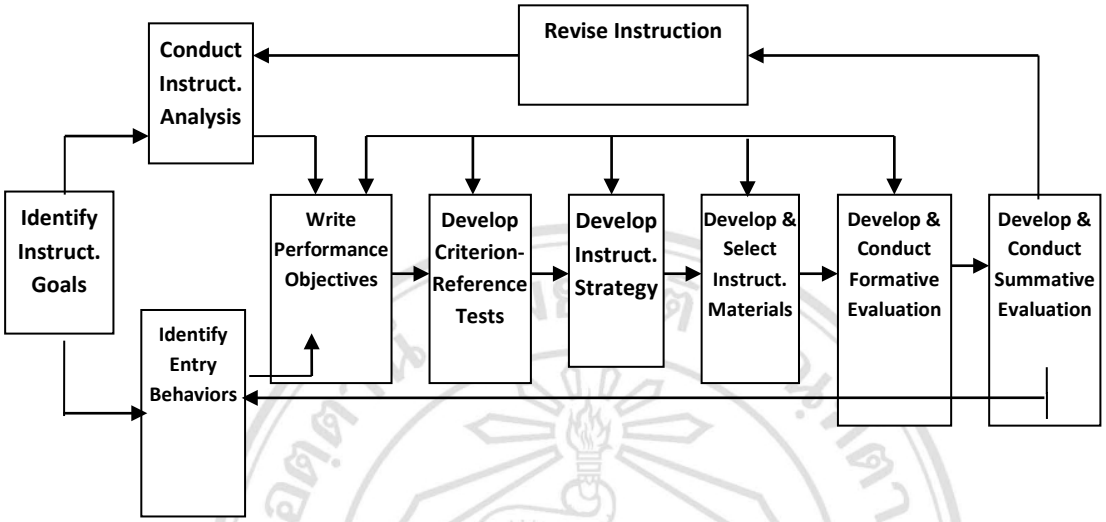


Figure 2.5 System Approach Model of Educational R&D

Figure 2.5: The process of the Dick and Carey Design Model is explained as follows.

Identify Instructional Goals - Describe what the learners are expected to perform at the end of the instruction. Instructional goals are normally broad statements of what you are trying to accomplish. They should describe what the learners should perform, not what you are going to do.

Conduct Instructional Analysis - Identify the exact performance gap between the present performance and the desired performance. This explains what the learners need to learn in order to perform well. Next, identify the steps the learner must be able to perform in order to accomplish the tasks that lead to the desired performance.

Identify Entry Behaviors - Identify the general characteristics of the learners, including skills, experience, motivation levels, and basic demographics; which relate to the skills and topics that will be taught. The information should have enough detail to allow you to identify the correct starting point of the instruction so that they do not waste time reviewing material they already know and does not omit content they need to know. The goal is to start the learning process at a level they already understand so you can scaffold the instruction by providing a structure that they can build upon.

Step 1: Write Performance Objectives - Performance Objectives consist of a description of the task or skills to be learned, the standards or criteria, and the conditions under which the task must be performed.

Step 2: Develop Assessment Instruments - Tests and evaluations are created that will: 1) ensure the learners meet the necessary prerequisites for performing the new skills, 2) identify the learner's progress in meeting the performance objectives during the learning process, and 3) evaluate the learning process itself to ensure it is structurally sound.

Step 3: Develop Instructional Strategy - Create a blueprint of the learning activities that will transfer, develop, and reinforce the skills and knowledge formulated in the performance objectives. Sequence the items in the blueprint in the order that will provide the best learning environment.

Step 4: Develop and Select Instructional Materials - Using the blueprint created in the previous step, fully develop the instructional content and activities. To save time, reuse existing materials whenever possible.

Step 5: Design and Conduct Formative Evaluation - Use iterative design methods, such as prototypes, small field group trials, and/or interviews with prospective learners so that you can collect data to identify areas in the instructional material that need improvement before releasing the instruction for actual use.

Step 6: Design and Conduct Summative Evaluation - Judge the worthiness of the entire program with the focus being on the outcome: Did it work as intended? Continue the evaluation after each class or training activity to determine if it can be approved.

Step 7: Revise Instruction - Use the data from the two types of evaluations to examine the validity of the instructional material and revise as needed.

Step 8: Design and assess during the use of the innovation or model in order to improve and develop a model to be effective. Assessment process should include three steps which are 1) test a model by using it with individual users, such as 1 assessor and 1 user, 2) test a model within a small group from 6-8 people, and 3) test a model in the classroom.

This study explains how teacher development using principles, encouragement, creativity, knowledge, additional skills completion, collaboration, and

reflective development, focusing on mentor teachers as applied to PLCs as well as Coaching and Mentoring, allow mentor teachers to be able to provide mathematics learning in the 21st century effectively.

2.3 Research related to Human Resource Development, Teacher Development, Mathematics Teacher Development, and Mathematics Learning Provision Focusing on Students' Learning.

Siriporn Tipkong and Channon Jantra (2004) – To produce quality teachers, it is not only about good, provided education for interns, but more importantly, it is about teaching skills, responsibility, knowledge, relationships, and effective application. Teaching practice as an intern is very important and necessary. The pre-service teacher will use theories to practice as field experience. Therefore, the internship is the laboratory for a teacher because the experiences from student-teaching will be useful in the future. Furthermore, student-teachers will be cared for in terms of following up, goal achievement, and supervision by the acceptable supervising teachers who hand in problem-solving, suggestions, and improvements to help them be a true teacher via the field work experience of student-teaching (Sudoanpen Kongkajan and faculty, 2007).

Kanita Chaowatthanakul (2010) compared the current supervision of teaching with instructional supervision coupled with research and suggestions, and the research found that there is some fulfillment from field work experience of student-teachers in the subject of mathematics to have the appearance as teacher and researcher with the development factors as follows.

1) Follow up – the process, guidelines, and consulting plan should have clear procedures.

2) Evaluation – there are uninterrupted evaluations of research and evaluations of student-teaching experience.

3) The quality of teaching and research tools in the classroom – using the tools to consult, suggest in supervision to increase potential in teaching and research.

Jareerut Suwan (2003) employed development model and teacher development research of Thinopatwittaya School and Uttaradit Rajabhat University Demonstration School for collaboration of teacher professional development found that Uttaradit Rajabhat University Demonstration School needs to develop their school according to teacher

professional development standards and were a ready source of the pre-service student-teaching practicum experience, especially the associate teacher development to manage studying as student-focused and teaching-integrated. The researcher monitors, follows up, and evaluates because it is important to confirm the productivity quality. The stated process will be a sustainable development. In addition, teacher development will contribute a great deal to teacher learning management. It is a quality development to improve graduates of the institution.

Siriporn Tipking and Channon Jantra (2004), while studying roles and characteristics of the supervising teachers in Education in Teaching Mathematics of Faculty of Education, Kasetsart University, found that 1) The role of associated teachers in the fields of teaching mathematics as a majority were meeting face-to-face, and observation and recording student-teachers was a very important role, 2) Supervising teachers in Education in Teaching Mathematics should be caring, encouraging role-models, trainers, skill-builders and moral-trainers, developing their own characteristics and professions, having faith in the teaching profession, as good members of the organization, creative support for teachers and the community, and conservationists of Thai wisdom development and Thai culture.

Karunpol Wiwathamongkol (2010) researched helping patterns for associated teachers to lead paradigms of local curriculum with class management found to lead the paradigm of local curriculum to class management is a changing the roles of learning management which associated teachers give a suggestion and consultancy to the student teachers in learning management, sharing, being a good model and leadership. The research emphasizes the process more than productivity under the form of CPPME. The principles of CPPME are to monitor and share suggestions from associated teachers to student-teachers in order to manage learning according to local curriculum, which steps are as follows 1) Contextual studying 2) Preparation 3) Planning 4) Mentoring 5) Evaluating. The model is driven by each step using PAR (Preparing, Action, and Refection). Associated teachers and student-teachers develop the stages of monitoring. Associated teachers should be trained and should realize how important helping and following up with student-teachers is. The result of the effective model found it was very successful in helping and monitoring the student-teachers. The paradigm of local curriculum was influenced by the supervising teachers and the pre-service teachers. It caused them to be able to analyze the learning

standards, index and write a learning period and learning plan for management, and be able to manage the learning as high as 0.05 following the statistics.

In addition, the result from research on the field work experience of student-teachers from Office of the National Education (Department of Teacher Education, 1989:14-18) reveals the biggest problem of field work experience of student-teachers highlights a theory. This research suggests there should be more practice. Considering all of teacher's institutions, problems affected by quality of productivity are concluded as follows:

1) The instructors of teaching theory have no direct experience with what they teach.

2) Some instructors of teaching theory are not university supervisors. When instructors of teaching theory are different from people who are university supervisors, it makes student-teachers confused about what they have been taught and what was practiced. Therefore, providing the same people to teach courses, to be in the field to support the activity for supervision and internship of student-teachers and to be university supervisors will allow student-teachers to take the useful things from field experiences to the classroom.

3) The behavior of instructors is more in theory than in practice. The learning is from both experience and books, so some instructors do not have the practical experience.

4) Teaching behavior relies on scenarios more than real situations because it is easier and more widely available, for example, let the student be a student-teacher and suppose the others are students. To perform this way is not workable when compared with the real situations.

5) In the past, training in school practicum took place at the end of semester, which undermines confidence. When student-teachers puncture, it caused them think it is a burdensome task, which affected their ability to have a good attitude towards the teaching profession.

6) School is the best experience field for student-teachers. If they prepare well and are ready to be real teachers, it benefits the school, the quality of teacher, and national education. Thus, it is important to realize that the task of producing teachers is not only the responsibility of teaching institutions, but also for all concerned departments.

According to related research, it can be summarized that, regarding the context of schools during the internship of training teachers, advisors who were responsible for

internships and mentor teachers participated in meetings and were informed about the visions of student assessment based on documents received from the teaching internship center. Mentor teachers always gave advice regarding teaching management and personal behavior as a teacher depending on various fields. Most mentor teachers did not understand the roles of mentor teachers regarding following up and supervision. Furthermore, they have many tasks assigned by the schools that they have to complete, so they actually helped students only when students came to ask for help. It can be seen that most mentor teachers still neglect to give advice and to consult; the cause for which might be because there are no clear guidelines, approaches, or appropriate models to follow effectively.

Porntipa Lasak, Somchai Worakitkasemsakul, Chatchai MuangPatom (2011) have conducted a research on the topic of learning mathematics using the problem-based learning approach of Polya for Mattayomsuksa 2 in which the research aimed to study and compare problem-solving skills regarding mathematics. They also compared mathematics performances of Mattayomsuksa 2 students who studied math using the problem-based learning approach and Polya's problem-solving method before and after studying. The sample group included 43 students from Mattayomsuksa 2 of Nong Khai Vittayakhom School, Nong Khai province, in which random-sampling was used. The tools used in this study included a mathematics learning provision plan, a mathematics performance test, and a mathematics problem-solving skills measurement form. Data analysis employed standard deviation paired with a T-test, for which the results are as follows. 1) Mathematics problem-solving skills of the students who participated in activities using problem-based learning approach and Polya's problem solving method was at the percentage is 76.40, and the skills have improved statically significant after implementing the activities at a level of .01. 2) Mathematical achievement of the students who participated in learning activities using problem-based learning and Polya's problem-solving method was higher than before participation, statistically significant at a level of .01.

Research framework of a model of developing mentor teachers' competency to enhance mathematics learning provisions in the 21 century