Chapter 2

Review of literature

This review of literature will be considered under three sub-headings: 1) concepts and theories of thinking skills, 2) learner-centered teaching approaches, and 3) related studies on thinking skills.

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1. Concepts and Theories of Thinking Skills

1.1 Theories of thinking skills development

Thinking skills are processes in our brains starting from a recognition of things or information through the eyes and ears and it is sent to the brains to analyze and evaluate. Ministry of Education Thailand (2005) acknowledged that a thinking skill is a functional process of the human brain that uses cognitive experience and stimuli to analyze, compare, synthesize and evaluate systematically and logically to reach proper solutions to problems or a new creative invention.

There are more theories which further explain how the human brain can process. Guilford (1976) and Torrance (1977) described three dimensions of human brain abilities, namely: contents (information or aspects are used as tools to build human thinking), operations (processes that a man uses in acquiring and understanding, remembering, analyzing, and evaluating knowledge), and products (consists of units, classes, relations, systems, transformations and implications).

Another theory comes from the revision of Bloom's taxonomy (1956) where he redefined the interactive cognitive process dimension as starting from concrete knowledge to abstract knowledge - factual, conceptual, procedural and metacognitive in comparison to knowledge dimension which represents a continuum of cognitive complexity from lower order thinking skills to higher order thinking skills, and classified into six categories: remembering, understanding, applying, analyzing, evaluating and creating.

Likewise, Guilford (1976) and Torrance (1977) demonstrated that thinking skills contain cognitive process which includes: 1) understanding knowledge, 2) remembering, 3) analyzing, 4) evaluating knowledge, 5) transforming, and 6) implicating. In comparison, Bloom's taxonomy (1956) added another category, creating, to the cognitive process in knowledge dimension.

In addition, Sternberg and Clinkenbeard (1995) presented a triarchic theory of human intelligence, a combination of three sub-theories on contextual, experiential and componential. The contextual sub-theory (practical) deals with intelligence abilities in adaptation, selection and shaping while experiential sub-theory (creative) involves abilities related to novelty and automatic processing. On the other hand, componential sub-theory (analytical) is about intelligence abilities that are related with thinking processes, namely, meta-components, performance components, and knowledge-acquisition components.

From the above, a relationship can be seen between Sternberg and Bloom's taxonomy concerning higher order thinking skills with Sternberg and Clinkenbeard's (1995) practical thinking, creative thinking and analytical thinking, and Bloom's taxonomy (1956): 1) remember, 2) understand, 3) apply, 4) analyze, 5) evaluate, and 6) create. For that reason, this study chose and combined these-higher order thinking skills which are considered essential and fit to the requirements of Thailand's National Education Act B.E. 2542 (1999) and under which this training course hopes to focus on the development of higher thinking skills of students.

1.2 Definitions and classifications of thinking skills

In this classification, the higher order thinking skills from Sternberg and Clinkenbeard (1995) and Bloom's taxonomy (1956) were combined into three main higher thinking skills, which are 1) analytical thinking, 2) creative thinking and 3) practical thinking, in relation to the requirements of the National Educational Act B.E. 2542 (1999), upon which this study is focused on.

1.2.1 Definitions of analytical thinking

The first thinking skill that this study will define is analytical thinking. Analytical thinking is a thinking process that leads the students to use their abilities in analyzing, synthesizing and evaluating. People with analytical thinking skills know how to criticize facts and inferences, make plans, and solve problems.

Analytical thinking may also refer to thinking abilities in criticizing events or problems, comparing solutions, and defining information (Sternberg et al. 1996). In addition, Sternberg (2002) explained that analytical thinking skills are higher-order processes used in planning, monitoring and evaluating performance of a task. In psychology, analytical or critical thinking is an area of study that involves thinking reflectively and productively, and later evaluating the evidence. Dewey (1909) called it reflective thinking and defined it as active, persistent, and careful consideration by giving reasons and implications of a belief or knowledge.

Moreover, Ennis (1996) stated that analytical thinking or critical thinking is a thinking process that develops students to have reasonable reflective thinking that is focused on decision-making.

Scriven and Paul (1987) identified that critical thinking is the process of actively and skillfully conceptualizing, applying, analyzing, synthesizing and evaluating information gathered from observation, experience, reflection, reasoning or communication.

Facione (2009) meanwhile defined critical thinking as a mental ability with attitude or habit.

Halpern et al. (1996) explained the meaning of critical thinking skills as the use of cognitive skills or strategies that increase the probability of a desired outcome.

Rudd (2002) gave details of critical thinking as reasoned, purposive, and reflective thinking used to make decisions, solve problems, and master concepts.

Browne and Keeley (2000) defined critical thinking as a process that begins with an argument and progresses toward evaluation. The process is activated by three interrelated activities: asking key questions designed to identify and assess what is being said, answering those questions by focusing on their impact on stated inferences, and displaying the desire to deploy critical questions.

Kizlik (2010) stated that analytical thinking is a core thinking skill for clarifying information.

On the other hand, Walter (2003) defined analytical thinking as the ability to think abstractly and process information effectively, having high critical and analytical thinking. Analytical thinking emphasizes effectiveness in information processing and is characterized by high-test scores and high I.Q. scores.

In conclusion, analytical thinking is a thinking process that practices students to learn how to criticize facts and inferences, make plans, and solve problems, covering

analytical thinking sub-skills of analyzing, synthesizing and evaluating.

1.2.2 Classifications of analytical thinking

This study focuses on three important sub-skills of analytical thinking skills, namely: 1) analysis that practices the students to discriminate between facts and inferences, 2) synthesis that practices students to learn to combine different things, and 3) evaluating that practices students to evaluate and select the best solution.

Bloom (1956) classified higher order thinking skills of critical thinking into three levels: analysis, synthesis, and evaluation. The three thinking skills are essential for students because all these skills are concentrated on the top three levels of Bloom's Taxonomy theory.

Ennis (1996) divided critical thinking sub-skills into 12 skills, as follows: 1) identifying questions from problems, 2) analyzing and making judgment, 3) creating challenging questions and giving clear solutions, 4) considering trusted sources, 5) investigating and making decisions from observation, 6) applying and deciding solutions, 7) implying and deciding from implication, 8) selecting value aspects, 9) defining and selecting definitions, 10) identifying hypothesis, 11) selecting and using, and 12) interacting with others.

Furthermore, Paul (1996) stated that critical thinking is thinking with reasons consisting of setting goals, identifying questions, explaining clear information, defining empirical data, thinking rationally, identifying hypothesis, and defining implication and consequences.

Facione (1990) gave details of critical thinking sub skills as analysis, evaluation, inference, explanation, and self-regulation, and defined category as decoding significance, clarifying meaning, examining ideas, identifying arguments, analyzing arguments, assessing claims, assessing arguments, querying evidence, conjecturing alternatives, drawing conclusions, stating results, justifying procedures, presenting arguments, self-examination, and self-correction.

Meanwhile, Beyer (1987) proposed the following as critical thinking skills: distinguishing between verifiable facts and value claims, distinguishing relevant from irrelevant information, claims, and reasons, determining factual accuracy of a statement, determining credibility of a source, identifying ambiguous claims or arguments, identifying unstated assumptions, detecting bias, identifying logical fallacies, recognizing logical inconsistencies in a line of reasoning, and determining the strength of an argument or claim.

Halpern et al. (1996) identified a range of issues relevant to the issue of critical thinking, such as memory or its acquisition, retention, and retrieval of knowledge, relationship between thought and language, reasoning or drawing deductively valid conclusions, analyzing arguments, thinking as hypothesis testing, likelihood and uncertainty which means understanding probabilities, decision making, development of problem-solving skills, and creative thinking.

There are different sub-skills, therefore, in analytical thinking, and this study will focus on three sub-skills in accordance with Bloom's taxonomy theory and in relation to the National Education Act B. E. 2542 (1999), consisting of analysis, synthesis, and evaluation skills.

1.2.3 Definitions of creative thinking

The second important thinking skill in this study is creative thinking that allows students to practice in generating their own ideas with activities which they are interested in. There are more definitions of creative thinking skill in the following studies.

Torrance (1966) gave meaning to creative thinking as a process of feeling that is quick with problems, missing aspects or disconnected aspects, and then creating ideas to examine hypothesis, and distribute to others as a way of building new things.

Sternberg (1997) stated that creative thinking is man's ability to generate an invention, discovery, and other creative endeavors.

Church (1999) defined creative thinking skills that form the ability to find new ways or solutions to solve problems or to create something new that can be applied in daily life.

De Bono (1992) described creative thinking as a combination of vertical thinking (using the process of logic and the traditional-historical method) and lateral thinking (which involves disrupting an apparent sequence and arriving at the solution from another angle); the complements from both are the essential elements of creative thinking.

Young (1985) illustrated that creativity is the skill of bringing something new and valuable. Creative people will break old patterns and do more in finding alternatives. Although different from common patterns, they join new solutions with their ideas. Also creative people break laws to restore them. They make hard decisions about what needs to include and what needs to eliminate. Creative people aim toward newness.

Cottrel (2007) stated that creative thinking skills are as much about attitude and self-confidence as about talent. Creativity is often less ordered, structured and predictable.

Facione (2001) identified that creative or innovative thinking is the kind of thinking that leads to new insights, novel approaches, fresh perspectives, and whole new ways of understanding and conceiving things. The products of creative thought include things like music, poetry, dance, dramatic literature, inventions, and technical innovations.

Harris (1998) gave a simple definition of creativity as the ability to imagine or invent something new. Creativity is not the ability to create out of nothing but the ability to generate new ideas by combining, changing or reapplying existing ideas. Creativity is also an attitude which means the ability to accept change and newness, a willingness to play with ideas and possibilities, a flexibility of outlook, habit of enjoying the good while looking for ways to improve it.

Creative thinking skill is a type of skill whereby students can practice to generate their own ideas with activities, as a process of feeling that is quick with problems, missing aspects or disconnected aspects, and then creating ideas to examine a hypothesis and distribute to others as a way of building new things (Torrance, 1966).

1.2.4 Classifications of creative thinking

Creative thinking in this study is classified into four sub-skills, namely: 1) fluency or practice of generating many ideas, 2) flexibility or a practice of generating different ideas, 3) originality or a practice of generating unique ideas, and 4) elaboration or a practice in extending ideas by giving more details (Guilford, 1976 and Torrance, 1977).

Guilford (1976) and Torrance (1977) presented four skills of creative thinking, namely: fluency or the production of ideas, flexibility or the production of different ideas, originality or the production of unusual ideas, and elaboration or persistency on introducing details to products.

Sternberg (2002) defined creative thinking skills as thinking abilities which allow students to know how to create, design, invent, imagine, and suppose their knowledge in their own ways.

Cramond (2004) defined sub-skills of creative thinking as: fluency, originality, abstractness of titles, elaboration, resistance to Premature Closure, and creative strengths: emotional expressiveness, storytelling articulateness, movement or action, synthesis of figures, expressiveness of title, unusual or internal visualization, humor, richness or colorfulness of imagery, boundary breaking, and fantasy.

Harris (1998) explained characteristics of a creative person as someone who seeks problems, enjoys challenge, is curious and optimistic, is able to suspend judgment, is comfortable with imagination, sees problems as opportunities or interesting and emotionally acceptable.

It can be concluded that creative thinking skills based on Guilford (1976) and Torrance (1977) are sufficient for students to practice in the classroom.

In this study, the sub-skills of creative thinking consist of fluency, flexibility, originality and elaboration. Students will be trained to think creatively and to apply their creative thinking through the learner-centered learning activities.

1.2.5 Definitions of practical thinking

The last main thinking skill of this study is the practical thinking skill which is a thinking skill that practices students to apply and adapt their background knowledge and thinking abilities into their real life. Sternberg (2000) gave the clearest definition of practical thinking, which is what most people call common sense. It is the ability to adapt to, shape, and select everyday environments. It is through this adaptation, shaping, and selection that the components of intelligence as employed at various levels of experience become actualized in the real world. Practical ability involves implementing ideas; it is the ability involved when intelligence is applied to real world context.

Perkins (1984) presented one important aspect to develop students' higher order thinking that is needed to involve visual thinking skills (i.e., original, powerful, fundamental), which is the practical thinking.

Walter (2003) described practical thinking as intelligence that covers the ability to adapt, to change environmental conditions and to shape the environment, to maximize one's strengths and compensate for one's weaknesses. People who have practical thinking skills are quick to recognize what factors influence success on various tasks and are adept at both adapting to and shaping their environment so that

they can accomplish various goals.

Practical thinking skills are the skills that practice students to apply and adapt their background knowledge and thinking abilities into their real life, which is through application and adaptation skills.

1.2.6 Classifications of practical thinking

The practical thinking skills were chosen in this study in order to practice students to be able to apply and adjust their knowledge into situations.

Bloom (1956) said that there are three domains of educational activities, namely: cognitive domain (knowledge), affective domain (attitude), and psychomotor domain (skills). On the other hand, there are two skills of domains which are related to practical thinking skill. The first one is in cognitive domain, referred to as application skill. This is a type of skill that uses a concept in a new situation or uncompleted use of an abstraction. The second one is in psychomotor domain, referred to as adaptation skill. Bloom claimed that it is a skill existing in a person which can modify movement patterns to fit requirements.

Neisser et al. (1996), Sternberg (1997), and Wagner and Sternberg (1986) have identified several characteristics distinguishing academic problems from practical ones which tend to be (a) formulated by others, (b) well-defined, (c) complete in the information they provide, (d) characterized by having only one correct answer, (e) characterized by having only one method of obtaining the correct answer, (f) disembodied from ordinary experience, and (g) of little or no intrinsic interest.

Sternberg (2002) defined sub-skills of practical thinking that require one to know how to use, how to apply, how to implement, how to employ and how to contextualize. Part of teaching practical thinking to students is to adopt certain attitudes in their intellectual work which may include (a) combating the tendency to procrastinate, (b) organizing oneself to get work done, (c) figuring out how one learns best, (d) avoiding the tendency to use self-pity as an excuse for working hard, and (e) avoiding blaming others for one's own failings.

Meanwhile, Walter (2003) defined qualities of practical thinking skills as how to use, apply, inform, and contextualize implement feasible.

The practical thinking skills in this study are classified into two sub-skills: 1) application or how to use knowledge in situations, and 2) adaptation or how to adjust knowledge in situations.

2. Learner-Centered Teaching Approaches

This study will prepare students to acquire abilities of higher thinking skills (analytical, creative and practical thinking skills) through a learner-centered training course that allows students to have more opportunities to use and practice their higher thinking skills in class. The learner-centered training course in this study oversees students to become autonomous learners. This teaching methodology is chosen because it allows students to use their thinking skills and their intelligence. The learner-centered training course will also lead students to use their thinking skills in reflecting their ideas and thoughts through learning activities as follows: 1) Inquiry-based learning, 2) K-W-L, 3) Hands-on learning, 4) Multiple intelligence, 5) Cooperative learning, and 6) Project work. Moreover, through practical thinking

skills derived from the learner-centered training course, the learning activities will also support students to develop their intelligence. Students will learn to notice, think, analyze and evaluate or solve problems in their own ways, thus preparing students to become successful people in the future.

The learning-centered concept is supported by a study that was done in the early 1990s by the American Psychological Association (APA). The APA issued and identified 12 learner-centered principles but in 1997, the APA revised this report and instead, identified 14 learner-centered psychological principles. These 14 principles were sub-divided into the following four groups: 1) Cognitive and Metacognitive Factors, 2) Motivational and Affective Factors, 3) Developmental and Social Factors, and 4) Individual Differences. The first principle under the Cognitive and Metacognitive factor in the APA (1997) deals with the nature of the learning process, stating that "successful learners are active, goal-directed, self-regulating, and assume personal responsibility for contributing to their own learning" (APA, 1997).

For this reason, the learner-centered training course was designed based on developing students' thinking skills since the principles of this course focus on constructionism and constructivism, applied from participation and cooperation of learning by doing. Prior to the build up of these principles, the students are required to have analytical thinking, then creative thinking and practical thinking. Papert (1980) stated that the theory of constructionism involves two processes: first, learners learn to construct new knowledge by themselves by translating from their experiences; and second, a powerful one when the learning process gives meanings to the learners through self-participation or learning by doing.

Moreover, this learner-centered training course will focus on enabling students to use their thinking skills as much as they can. All of the activities in the learner-centered training course allow the students to share their thoughts and opinions, and exert their own responsibility with their learning. The teaching methodologies in this study are chosen to give students as much opportunities for them to have student-centered learning.

To put, therefore, an emphasis on the learners in a foreign language learning process with thinking skills development, is the greatest possible importance for some teaching approaches.

Learning activities in this study support students to use their thinking skills by giving them opportunities to analyze, synthesize, evaluate, generate lots of ideas, expand different ideas, create their new ideas, apply their knowledge and adapt to real situations. There are six teaching techniques which were applied in this study: 1) Inquiry – based learning, 2) K-W-L, 3) Hands-on learning, 4) Multiple intelligence, 5) Cooperative learning, and 6) Project work.

2.1 Inquiry-based learning

Inquiry-based learning was developed from the constructivism theory with focus on how students learn, as proposed by the education philosopher, Dewey (1909). Asking questions is the heart of inquiry-based learning. The teacher's roles are to guide the students in finding the answers by themselves and encourage them to ask new questions on and on (Marino Institute, 2009). The constructivism theory believes that an individual gains knowledge by constructing reality through experiences. A more traditional approach would view learning as acquiring facts and skills through memorization, drill, and practice.

Inquiry-based learning introduces the students to learn to solve problems, with students needing to use their analytical thinking to analyze problems, then compare and contrast solutions to solve the problems, and at the end, evaluate the solutions (Fisher, 2003). Moreover, inquiry-based learning also gives students the chance to practice their creative and practical thinking by being flexible and working well in projects that range from being extensive to the bounded, from the research-oriented to the creative, from the laboratory to the Internet (Youthlearn, 2001).

Inquiry-based teaching method centers on students since students themselves create and approach with questions from their own ideas or thoughts, which they will then convert and apply with information into useful situations. It means that students themselves, therefore, need to analyze problems by creating questions and later evaluating the solutions which they may consider useful on different situations. Inquiry-based learning mainly involves the learner and leading him to understand. Inquiry here implies possessing skills and attitude to allow one to ask questions about new resolutions and issues while gaining new information (Exline, 2004).

2.2 K-W-L

K-W-L is a teaching method that makes students use their background knowledge with the lesson learned in their classroom. Ogle (1986) developed a strategy for helping students access important background information before reading nonfiction stories. Prior to reading the stories, students started reflecting on their knowledge about a topic, brainstorming a list of ideas, then creating lists of things which they want to learn concerning the topic. In the last step, students read the material and shared what they have learned.

The K-W-L learning that significantly fosters the development of thinking skills, strongly promotes students to be active learners. In addition, using K-W-L as a classroom setting can facilitate and increase quality of interaction among teacher, students and subject. This increased interaction will foster better understanding of the material and use of critical thinking such as eventual analysis and evaluation by the students.

K-W-L learning leads students to be active thinkers by giving them specific things to look for and reflect on what they learned (Ogle, 1987). Flavell, (1979) also stated that in K-W-L learning, students allow metacognition that involves and controls cognitive processes to engage thinking ability development, self-awareness, and self-regulation. Moreover, from a study of Bonwell and Elison (1991), it is stated that K-W-L promotes active learning through reading, writing, discussing and problem solving. The result shows that active K-W-L learning strategies lead students to engage in higher-order thinking such as analysis, synthesis and evaluation which are necessary in higher levels of thinking.

2.3 Hands-on learning

Hands-on learning started with Committee of Ten of National Education Association (1893). The Committee of Ten concurred on the importance of direct experience, stating that "the study of natural history in both elementary and high schools should be done by direct observational study with the specimens in the hands of each pupil, and in below high school level, no textbook should be used" (National

Education Association, 1893). Dewey (1909) emphasized the same ideas about learning through activity and child-centered instruction, which was also advocated, at the same time, by Rillero and Huary (1994). "The term hands-on learning is so widely used that it is hard to believe that it is something of newcomer. The idea of learning by doing is an ancient one in the arts and crafts, and it becomes a mark of good teaching in science and math" (Rutherford, 1993).

Hands-on learning supports students to become learner-centered and students need to participate in every step of their learning process. A hands-on learning teaching approach requires students to become active participants instead of being passive learners (Rillero and Haury, 1994).

Furthermore, hands-on learning involves students to develop their thinking ability in analytical or critical thinking as well as in practical thinking. Students have to make a plan, study the process of it, and be able to apply what they have learned. Hands-on learning is not just a fashion because it enables students to become critical thinkers, to enable them to apply not only what they have learned but more importantly, the process of learning, to various life situations (Rillero and Haury, 1994). Hands-on learning allows students to have experience in learning by doing. Understanding vocational education is similar to the thought that if someone wants to learn to repair an automobile, there is a need for an automobile to repair. If someone wants to teach how to cook, he has to have a kitchen at first (Brodie, 2000). Hands-on learning involves the child in a total learning experience that enhances the child's ability to think critically. Besides helping the students to remember the material better and be able to transfer the experience easily to other learning situations, it also revolves students who are either not as talented or have not shown interest in school to become interested in their learning (Rillero and Haury, 1994).

2.4 Multiple intelligence

The concept of multiple intelligence was first formulated by Howard Gardner in 1983. Gardner (1983) claimed the theory catalogues the different styles of learning that students bring to the classroom. Using multiple intelligence in the class, will provide opportunities for authentic learning based on students' needs, interests and talents. Students can use all of their imagination to create their performances. Moreover, students can explore and invent new things based on their interests. Students would also be able to learn to apply and use their thinking skills to solve problems with their own methods in addition to making them become more active and involved in the lessons. Gardner (1983) also stated that in the classroom, if multiple intelligence is used, students will be able to demonstrate and share their strengths. Building strengths gives a student the motivation to be a specialist. This can in turn lead to increased self-esteem.

In this theory, Gardner (1983) proposed eight different kinds of intelligence to account for a broader range of human potential in children and adults, and consist of : 1) Linguistic intelligence ("word smart"), 2) Logical-mathematical intelligence ("number/reasoning smart"), 3) Spatial intelligence ("picture smart"), 4) Bodily-Kinesthetic intelligence ("body smart"), 5) Musical intelligence ("music smart"), 6) Interpersonal intelligence ("people smart"), 7) Intrapersonal intelligence ("self smart"), and 8) Naturalist intelligence ("nature smart").

In a multiple intelligence classroom, students can explore their learning with

their own style. Students do not have to worry about the structure of learning and teaching. The contents are not always based on books as they can be applied from other resources such as songs, pictures, paintings and others. In this way, students will have more chances to use their thinking skills in the classroom. Students can share their ideas and can identify different ways of learning by themselves to see which one is good for them. Learners do not have to learn by only following the same way as each person has his or her own specialization. For example, some students can remember better when they listen through songs or music, or some students can understand things by using pictures aids, while some students can acquire language better when they do some actions while they are learning vocabulary. Students learn in ways that are identifiably distinctive (Lane, 1991).

Multiple intelligence classroom supports students to become learner-centered. Students act upon important roles in the class to show their talents or their interests and present them to the class. Wilson (1998) mentioned some benefits of using multiple intelligence to assist the teaching work. This teaching method helps teachers to explain and promote interpersonal and cultural levels. It often validates teachers' insightful and intuitive assessments of students' natural talents and offers them, justifications and assistance in creating related personalized educational accommodations and experiences. And it provides teachers, parents and students with a more extensive and free conceptualization of giftedness.

2.5 Cooperative learning

Cooperative learning started in education to solve problems and to help students-students have interactions to each other. Johnson et al. (1998) gave a definition of cooperative learning as follows, "Cooperative learning is the instructional use of small groups in which students work together to maximize their own and each other's learning".

Cooperative learning is a methodology that promotes students to practice their thinking skills. Students will come in groups and they will have opportunities to discuss and share their thoughts to their peers. Webb (1989) stated that groups of primary school students learned better when they asked for assistance from group mates and received explanations when their requests for assistance were ignored. Moreover, students learned to apply their background knowledge to explain and share what they understand in the group. When students are in groups, they became aware of what their peers do not understand because the material is new to them as well. Students themselves will be able to explain material in ways that their peers can understand better because of their similar background knowledge.

Cooperative learning is a successful teaching strategy in small teams, in combined students with different levels of ability and with a variety of learning activities to improve students' understanding of a subject. Each member in a team is responsible not only for learning what is taught but also helping teammates to learn. Students work through the assignment until all group members successfully understand and complete it (Kagan 1994).

Cooperative learning will lead students to develop higher level thinking skill, increase student retention, build self esteem in students, enhance student satisfaction with a learning experience, promote a positive attitude toward the subject matter, develop oral communication skills, develop social interaction skills, use a team approach to problem solving while maintaining individual accountability, encourage

student responsibility for learning, explore alternate problem solutions in a safe environment, stimulate critical thinking and help students clarify ideas through discussion and debate, and enhance self management skills (Penitz, 2000).

Moreover, cooperative learning practices students to use skills of independence in learning which lead them to become learner-centered. There are some cooperative learning principles which enable students to have independence in studying in class (Jacobs and McCafferty, 2006). The first principle is positive goal interdependence. When students are in groups, they have to set a goal, and they have to plan how they can achieve their goal. The second principle is positive reward interdependence when students will try to help their group to become the winner. Kagan et. al. (1995) recommended a number of alternatives for group grading as a means of motivating students to study hard and to help others. Lastly, the third principle is positive role interdependence with each group member having a role to play in helping the group achieve its goal.

2.6 Project work learning

Project work learning is a teaching methodology which allows students to have free style in studying any topic that they are interested in. Project work or is called project-based learning, has deep roots in education. It was first discussed as an educational approach to K-12 education in an article "The Project Method" by Kilpatrick (1918), who believed that using literacy in meaningful contexts provided a means for building background knowledge and for achieving personal growth (Wrigley, 1998).

Project work learning is an activity, where students can experience with their learning by interacting with real situations. Students are promoted to become learner-centered from participating in project work learning classroom. Students need to plan, think of a process, until they can explain the results by themselves. From a study of Meganathan, (2011), a project work promotes nature of language learning in students, which is aimed at making learners use the language for real life purposes. Students need to use language(s) for communicative purpose only; learners need to use language to function in professional, academic and social settings.

Moreover, project work learning also promotes students' thinking skills. Students need to apply their thinking skills in analyzing project instruction, making plan, finding solutions and how the knowledge can be adapted with real life. Stoller(1995) studied how project work promotes students' involvement with language and content learning. Through applying the project work with content-based classroom, students were required to have learning participations, higher level thinking skills and learning responsibility while teachers constructed instructions of inquiry learning, cooperative learning, students' collaboration, and students' problem-solving. The results found that project work learning provides active learning and collaboration environment classroom. Teachers needed to provide variety of instructional classrooms with occasional projects, and it was proven that it could become a successful learning environment when the project-work learning is based on adaptation and creativity.

2.7 Portfolio assessment

The concept of portfolio was adopted from portfolios of fine arts which are used to display illustrative samples of an artist's work. Jongsma (1989) stated that the purpose of the artist's portfolio is to demonstrate the depth and breadth of the work as well as the artist's interests and abilities.

A portfolio is used in English learning to present students' language progression, how they acquire their new knowledge from learning language and the way they learn how to apply English language in their lives. Moya and O'Malley (1994) stated that a portfolio used for educational assessment must offer more than being a showcase for student products; it must be the product of a complete assessment procedure that has been systematically planned, implemented, and evaluated.

Portfolio assessment is one activity where students can practice and involve in reflecting their own learning from their work. From a study of Barret(2005), learning and technology were explored on electronic portfolios which were digital containers and designed to support a variety of teaching processes and assessment purposes. Types and characteristics of this electronic portfolio have three broad purposes, namely: to process, to showcase and to assess. The process of portfolio can be defined as a collection of student's work that tells the story of a student's effort, progress, and achievement in one or more areas (Arter and Spandel, 1992; MacIsaac and Jackson, 1994). This study reported about the advantages of portfolios which involve students in their learning, allow students to increase their ability to self-evaluate, make choices and reflect themselves.

In this study, portfolio is chosen to study the progress of students' language learning and their thinking skills. Students need to collect all their work and present them in their own portfolios which would be evaluated by instructors using rubric design constructed to evaluate their progression in thinking skills.

3. Related Studies on Thinking Skills

3.1 Thinking skills obstacles

It can be concluded that thinking skills in students can be developed through thinking skills practice, and thinking skills activities involvement. But in learning English by Thai students, students may find some factors which may block their English learning in class and which can further block their thinking skills development. These factors consist of obstacles which affect students learning the English language and concurrently developing their thinking skills, and these include 1) students' attitude and motivation in learning English, 2) students' goal setting for learning, and 3) difficulties in English teaching and learning.

3.1.1 Students' attitudes and motivation in learning English

Students' attitude in learning a language is one of the factors that can support the students to become efficient students. A research topic on 'A ten-year chronicle of student attitudes toward foreign language in the elementary school', was studied by Heining-Boynton and Haitema (2007) over a 10-year period aiming to investigate the

students' attitudes toward early foreign language learning. This two-study research was considered unique because of the long time frame during which students were followed. A large set of data was collected at the elementary school level from surveys of children in Foreign Language classes in the Elementary School (FLES) 2 school systems in North Carolina, USA.

Results of the study of a heterogeneous group of elementary school pupils indicated that female pupils were more interested in foreign language study than the males. This study had two topic foci, namely: the general willingness to learn and accept the teacher as a facilitator of new knowledge and use foreign language as input to the pupils' knowledge base, and their usage of acquiring knowledge as output. From the surveys, it could be identified that mean scores for willingness to learn foreign language were higher, which means that pupils had a desire and were open to something new (Heining-Boynton and Haitema, 2007).

The second study by Tanthanis (2009) examined relationships and comparison among language learning strategies, language learning motivation, and English language proficiency in 1st year university students. The researcher used English test scores to divide the participants into two groups: those with scores of higher than 30% and those with scores lower than 30%. The research instrument used in this study was an evaluation form that was applied to explore strategic inventory for language learning (SILL) of Oxford (1990). Results of the study found that the group of highest score students used more of strategies consisting of memorizing learning, cognitive, compensation, metacognitive, and social strategies than the group of lowest score students. Through comparison, it was found that the group of students with highest scores had higher motivation in learning English than the group of students with lowest scores. When the relationship among learning strategies, learning motivations, and English learning proficiency were studied, it was found that all of three aspects were related positively. The study concluded that the group of students with lowest score used strategies in learning English at an average level because they did not give high attention and did not understand how to use learning strategies in learning English which affected them because they did not acknowledge the benefits of learning strategies. On the other hand, this study found that the group of students who used highest metacognitive strategies to help them learn English language became successful in learning the language and becoming self-directed learners. The results of this study was also related to other studies conducted in England, Palestine and China, which showed that university students use metacognitive strategies to study language while focusing less on memorizing.

3.1.2 Students' goal setting for learning

Srijanyachon (2006), in her research topic entitled, 'An analysis of goal setting for learning and obstacles to improve English language learning based on the perception of Bangkok University students taking the general English course'. This study was aimed to investigate goal setting for learning and obstacles to improve English language learning using research instruments comprised of a set of questionnaires including a form of five-rating scale and open-ended questions. The research found that there was a positive relationship between English background knowledge and goal setting for learning but a negative relationship between English background and obstacles consisting of gender, faculty, educational background, and

English learning experiences and goal setting. It was reported that students had moderate level in goal setting for learning especially the male students who were studying in Economics, Engineering and Arts as indicated by their low scores in English subjects which affected their goal setting in learning English language.

3.1.3 Difficulties in English teaching and learning

Wiriyachitra (2001) conducted a research on 'English language teaching and learning in Thailand in this decade', with focus on the role of English language and the problems of language teaching in Thailand. It was found that teachers had many obstacles, such as heavy teaching loads, too many students in a class (45-60), insufficient English language skills and native speaker's cultural knowledge, inadequately equipped classrooms and educational technology, and university entrance examinations which demanded tutorial teaching and learning style. For learners, the research showed that they could speak fluently but most of them think that fluency in English language is too challenging for them to achieve because of many reasons: an interference from the mother tongue (Thai) such as in pronunciation, syntax, and idiomatic usage, lack of opportunity to use the language in their daily lives, unchallenging English lessons, being passive learners, being too shy to speak English with classmates, and lack of responsibility for their own learning. It was suggested by the research that there is a need to change three parts. The first part is the English teaching and learning in school which greatly involves curriculum and teacher development. Teachers will have to write their own course materials with the contents that are related to real life situations and have to be recommended for related training every two years. The second part is English language teaching and learning in universities where there is a need to have only one set of English scores in considering students who enter the university. The university can make use of these scores to place students in different levels but for students who choose to enroll in English Program, there is a need for them to take the compulsory language course. In addition every student needs to take a National English Proficiency Test before leaving university. The last part is to provide more Self-Access Centers and IT in schools and universities to facilitate learner independence.

3.2 Thinking skills teaching approaches and assessment

3.2.1 Inquiry-based learning

Gluck (2007) focused on an inquiry-learning to instruct students in learning grammar with an aim to find a teaching methodology that could better teach students in grammar. The methodology of this study employs the X-Word grammar that emphasizes the discovery of sentence structure and patterns in written English. The students have to categorize words into word classes grouped by their function with each of the different functions fitting into basic sectors in the English sentence, namely: subject and verb, and clauses. Students need to identify and observe these different structures through grammar discovery. The X-Word grammar is an inquiry-based approach in teaching grammar that provides the vocabulary and framework to integrate inquiry learning into grammar lessons. During the time the instruction was applied, students tried to remove words from the context and put them in a list with

many questions asked. Moreover, this study found that inquiry-based grammar instruction is a foundation that could lead students to move beyond rule memorization but could maybe discover patterns and discuss grammar in context by themselves.

3.2.2 K-W-L learning

The research of Ammre and Natoor (2006) investigated the impact of activating previous knowledge by using K-W-L learning and the closure strategies on the reading comprehension of a sample of 60 grade four pupils. Half of the sample were boys and all pupils had grades which showed their difficulty in learning. Participants were selected randomly and were divided into two groups: an experimental group of 30 pupils who were taught reading texts using K-W-L learning and closure strategies to activate their previous knowledge; and, a control group of another 30 pupils who were taught in the traditional method. Results of this study have proved the effectiveness of K-W-L learning, thus improving reading comprehension.

3.2.3 Hands-on learning

There was a study from Lizardi (2005) that studied about hands-on learning activities. The results of this study recommended that teachers should use different styles of teaching methodology to meet English language learners' needs. The more variety of learning modalities resulted to more benefits that students gain from learning the language. Lizardi shared that teaching took place when students were taught to present a book of Mice and Men by John Steinbeck. Students planned to present events that occured in the book through pictures, characters, and situations, while one student narrated their interpretations. Students had to learn and practice six acting scenes which took less than a minute each. From this study, students should be encouraged to be creative and to think outside the box while learning to know that there is more than one way to get their message across. Teachers do not direct students in every step. The teachers, therefore, should provide the students with rubrics on how their project will be graded. After the students were graded, it was found that students were able to become active learners and gained expertise on the subject as they meet their learning goals. This teaching methodology builds on social interaction and allows students to have an opportunity to provide input as they learn new things and language skills as well.

From a research of Mulalic et al. (2009) on the topic of 'Perceptual learning styles of ESL students, it was found that most of the students with any kind of learning styles preferred to learn by doing from exercises and drills in the class. The students strongly agreed that they learned better when they did things in the class and that they also learned better when they participated in related activities. This study contained a discussion that students needed to have awareness of their learning styles which could encourage them to realize the importance of learning styles in their learning.

3.2.4 Multiple intelligence

In a study on 'The research of using multiple intelligence theory in the fourth grade English class at the elementary school', Hsieh (2004) implemented different

kinds of multiple intelligence activities in each unit. The study consisted of three research instruments, namely: multiple intelligence appraisal, English learning achievement assessment, and learning English questionnaires. It was found that students' multiple intelligence increased as well as their learning achievement. In this research, it was also found that students could experience and absorb more happily the process of learning all kinds of intelligence which could lead the students to develop their Bodily-Kinesthetic intelligence, interpersonal intelligence, and intrapersonal intelligence. In this study, the students' abilities in dialogues were developed thus helping to attract the students to learn while helping them develop their self-reflection and self-development as well.

Gaines and Lehmann (2002) described a Multiple Intelligence-Based project that aimed at improving learners' reading comprehension ability. They conducted a study where they investigated fourth grade students in a major metropolitan city. In this study, the socioeconomic status of the students was taken into account. The objective of this research was to recognize the students' deficiency in reading comprehension. The results found that the use of multiple intelligence strategies could improve students' reading comprehension ability while enhancing their academic performance too.

Mbuva (2003) focused on the implementation of the multiple intelligence theory in the 21st century teaching and learning environment by suggesting that the multiple intelligence theory is an effective teaching and learning tool at all levels. By examining various types of intelligences, a definition of multiple intelligence was derived at where historical developments of multiple intelligence were discussed. In this study, the application of multiple intelligence into the classroom social environment, was further deliberated. It was concluded that "traditional ways of understanding pedagogy and static methods of teaching, are giving way to the new classroom examination and application of the multiple intelligence". It was also noted that teachers should take into account the cognition, language, and culture of every student.

3.2.5 Cooperative learning

Wang (2006), on his study about 'The effects of jigsaw cooperative learning on motivation to learn English at Chung-Hwa Institute of Technology, Taiwan (China)', used 77 students from two classes of Business Administration majors with an aim to determine the differential effects (i.e., achievement in learning English, motivational orientation and intensity, and attitude concerning English language and culture) on students between traditional Chinese teaching method and the Jigsaw cooperative learning method. Questionnaires and tests were run at the beginning and end of the semester. Results indicated that students who were learning with cooperative learning approach had higher final course grades and made more integrative statements on the measure of orientation of learning English than students who learned English with traditional Chinese methods. Students who experienced using cooperative strategies had more positive attitude about learning English and about the learning mechanism they experienced than they did with the traditional Chinese learning strategies besides having greater desire to communicate with English speakers.

3.2.6 Project work

A project work is a learning experience that has a goal to provide students an opportunity to study, choose, and synthesize knowledge from various areas of learning, thus enabling them to create and apply it to real life situations. From the research of Meganathan (2011), a project work was studied to promote the nature of language learning in students with an aim to making learners use the language for real life purposes. Students need to use language(s) for communicative purpose only while learners need to use language to function in professional, academic and social settings. As a requirement of this study, the students need to have higher order thinking skills using tasks, activities, and assignments as tools to help them observe the form and meaning of language(s) by applying it in real life activities.

3.2.7 Portfolio assessment

Puhl (1997) studied a topic on "Develop, Not Judge: Continuous Assessment in the ESL Classroom", that demonstrated a concept that continuous assessment can hold rich potential for teachers because it affirms high-order creative and critical thinking skills and also because it embraces not only cognitive outcomes but also affective and behavioral outcomes. The key of this study was to explore in ESL writing, observe key strategies of self-assessment and peer-assessment, and the role of portfolios in continuous assessment. Students' assignment was to produce four short stories on topic of their own choice. When the students brought their first draft, they had to fill out a self-assessment sheet, then in 2nd draft, they exchanged stories and filled out peer-assessment. Then they rewrote and turned in the final draft. At the end, they were able to choose the best story to be published in a class book. They also were able to submit their portfolios which included the type of story of their choice and a one-page reflection of why they selected that story. From their collection of portfolios and the reflections on their work, the students could see their own growth and later stated that "I have grown more in touch with personal fears and thoughts, and was more able to access my inner feelings".