

## Development of Analytical Thinking Skills Among Thai University Students

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### ABSTRACT

This study aimed to examine the analytical thinking skills development through learning management plans. Research and development design coupled with case study method was employed to Thai Basic Education University students from a public university in Khon Kaen province, Thailand. There were two groups of samples consisted of 45 teacher educators and 1,575 Basic Education university students. The quantitative finding indicated that teacher educators' analytical thinking score was 36.54 out of the full score as 45, higher than defined criterion of 70 percent while focus group interviews showed positive feedback including analytical thinking knowledge and practices in handling learning management.

**Key Words:** Analytical thinking, university students, learning management plans

### INTRODUCTION

Analytical thinking skills are critical in today advanced technology work place, particularly in the teaching profession. This is because analytical thinking skills help teachers or teacher trainees to gather information, articulate, visualize and solve complex problems in the rapid information age of changing trend world. Hence it becomes a necessity for every country to develop its future human resource to be able to think analytically, critically, know how to solve problems, acquire creative and initiative thinking skills, know how to acquire knowledge from multiple sources, learn and construct bodies of knowledge by themselves, adapt themselves in time for the ever-changing situations and be prepared to confront the challenge of the world. University students are expected to develop analytical thinking mind and they must not only understand what they read but also pick it up apart, question it, evaluate it and assess it. Analytical thinking involves questioning and reflecting upon ideas. University students must look deeper into what they are learning and think about its relation to the bigger picture. They must be able to present their critique and a structured, clear, and well-reasoned and supported way (UCL Transition Program, n.d.).

It is essential to develop teachers' analytical thinking skills so that they are able to integrate analytical thinking skills in their learning management. Even teachers have gone through comprehensive training, there will be many times where teachers will put on the spot to think analytically and the right or wrong answer could make a difference with regard to their upward mobility within the schools. To what extent teachers are able to incorporate training of analytical thinking skills, thinking process, management, and situation confrontation in their learning management so that students learn from real experiences is still questionable (Pamphilon, 2000). In order to develop analytical thinking skills among the learners in current rapid changes, the world is extremely vital because learners have to be prepared by teachers to face it. As a result, Basic Education pre-service teachers have to be appropriately equipped to practice the integration of analytical thinking skills in their learning management as they are going to become Basic Education teachers in the future. Pre-service teacher trainees or Basic Education university students have to be trained accordingly so that they will be responsible for developing their students with strong analytical thinking skills to live in the 21<sup>st</sup> Century (Jones, 1997; Wasee, 1999; Pamphilon, 2000; Makanong, 2001; Paziotopoulos & Kroll, 2004).

Thailand Basic Education Core Curriculum (2008) stipulated the significant competencies of students which mainly cover thinking competency especially analytical thinking, synthetic thinking, creative thinking, which will lead to the construction of bodies of knowledge or information, or to appropriate decision for themselves and the society (Ministry of Education, 2008). The importance analytical thinking skill-oriented instruction has been highlighted in National Education Act of 1999 and the amendment versions 2002 and 2010 (Ministry of Education, 2015) whereby teachers are required to incorporate analytical thinking process, situation confrontation practices, and application of knowledge in prevention and solution of problems in students' learning process. As a consequence, the capability of teachers to instill thinking skill in their teaching processes is extremely vital in order to fulfill the Thailand educational goal. Although some research studies had been carried out on students' analytical thinking for the past decades, findings revealed that Thai students' analytical

thinking still failed to optimally be developed and seemed to reach only at certain limitation (Office of Education Standard, Ministry of Education, 2006). The evaluation of students' analytical thinking competence indicated that the achievement level requires improvement and is not satisfied (Nonglak, Suwimon, & Uayporn, 2004; Office of National Education Standards and Quality Assessment (ONESQA), 2007).

### **ANALYTICAL THINKING THEORY (BLOOM, 1956)**

Researcher utilizes Benjamin Bloom and his associates' discussions about analytical thinking as the theoretical foundation of this study. Their taxonomy for information processing skills (Bloom, 1956) is one of most widely cited sources for educational practitioners when it comes to teaching and assessing higher order thinking skills like analytical thinking skills. Bloom's taxonomy is hierarchical, with 'comprehension' at the bottom and 'evaluation' at the top. The three highest levels (analysis, synthesis, and evaluation) are frequently said to represent analytical thinking (Kennedy, Fisher, & Ennis, 1991).

The benefit of this Bloom's educational approach is that it is based on years of classroom experience and observations of student learning (Sternberg, 1986). However, some have noted that the educational approach is limited in its vagueness. Concepts within the taxonomy lack the clarity necessary to guide instruction and assessment in a useful way (Ennis, 1985; Sternberg, 1986). Furthermore, the frameworks developed in education have not been tested as vigorously as those developed within philosophy or psychology (Sternberg, 1986). On this line of reasoning, researcher considers analytical thinking abilities according to past researchers of analytical thinking typically agree on the specific abilities encompassed by the definition, which includes:

- Analyzing argument, claims, or evidence (Ennis, 1985; Facione, 1990; Halpern, 1998; Paul, 1992).
- Making inferences using inductive or deductive reasoning (Ennis, 1985; Facione, 1990; Paul, 1992; Willingham, 2007).
- Judging or evaluating (Case, 2005; Ennis, 1985; Facione, 1990; Lipman, 1988; Tindal & Nolet, 1995), and
- Making decisions or solving problems (Ennis, 1985; Halpern, 1998; Willingham, 2007).

Other abilities or behaviors identified as relevant to analytical thinking include asking and answering questions for clarification (Ennis, 1985); defining terms (Ennis, 1985); identifying assumptions (Ennis, 1985; Paul, 1992); interpreting and explaining (Facione, 1990); reasoning verbally, especially in relation to concepts of likelihood and uncertainty (Halpern, 1998); predicting (Tindal & Nolet, 1995), and seeing both sides of an issue (Willingham, 2007). According to Bloom, Engelhart, Furst, Hill, and Krathwohl (1979), the analysis is the major component of analytical thinking skills in this study. Therefore analytical thinking skills have to be operationally defined into three types of analytical thinking namely analysis of elements, analysis of relationships, and analysis of organizational principles. At the first level, Basic Education university students are trained to break down the material into its constituent parts. This is followed by identification and classification process of the elements of the original material. At the second level, Basic Education university students are required to make explicit reports on the relationships among the elements, thus to determine their connections and interactions. The final level involves recognition of the organizational principles, the arrangement and structure, which hold together the learning process as a whole.

### ***Analysis of elements***

Most of the learning management may be conceived as composed of a large number of elements. Some of these elements are explicitly stated or contained in the learning processes hence these elements can be recognized and classified easily and relatively. However, there are also high possibilities that learners have difficulty in recognizing the elements which are taught and identified by teachers. Learners may be unable to recognize the conclusions drawn by their teachers due to the analysis of elements are not explicitly stated by teachers. There are still many other elements during the learning management which are not clearly communicated, labeled or identified by the teachers that may cause the students cannot do their thinking appropriately. On top of that, many of these elements may be of paramount importance in determining the nature of learning management until the stage that learners cannot detect and have difficulty in fully comprehending or evaluating the whole learning. Thus there are some unstated assumptions being made by teachers which can only infer from an analysis of a series of statements within learning materials. It is also the value to the learner if he or she can detect the nature and function of particular statements including statements of fact, statements of value, and statements of content in the learning management.

The following are the analytical thinking skills related to an analysis of elements which should be considered to integrate into learning objectives.

- Ability to recognize unstated assumptions.
- Skill in distinguishing facts from hypotheses.

- Ability to distinguish factual from normative statements.
- Skill in identifying motives and in discriminating between mechanisms of behavior with reference to individuals and groups.
- Ability to distinguish a conclusion from statements which support it.

### ***Analysis of relationships***

Having identified the different elements within a learning management, learner still has to have the ability to determine some of the major relationships among the various parts of the learning process. Learners may need to determine the relationship of the hypotheses to the evidence and in turn the relationship between the conclusions and the hypotheses as well as the evidence. This type of analysis includes the relationship between different kinds of evidence presented. In addition, analysis of relationships can be quite difficult when the essential parts of learning are contradicted between each other, which in turn hinder learners to expand, develop, or support their learning progress. Most of this type of analysis may deal with the consistency of part to part, or element to element or the relevance of elements or parts to the central idea.

The following are the analytical thinking skills related to an analysis of relationships which should be considered to integrate into learning objectives.

- Skills in comprehending the interrelationships among the ideas in a passage.
- Ability to recognize what particulars are relevant to the validation of a judgment.
- Ability to recognize which facts or assumptions are essential to the main learning or to the argument in support of the learning.
- Ability to check the consistency of hypotheses with given information and assumption.
- Ability to distinguish cause-and-effect relationships from other sequential relationships.
- Ability to analyze the relations of statements in an argument, to distinguish relevant from irrelevant statements.
- Ability to detect logical fallacies in arguments.
- Ability to recognize the causal relations and the importance details from historical account.

### ***Analysis of organizational principles***

The most complex and difficult level of analytical thinking is analyzing the structure and organization of the learning process. It is rarely teachers will explicitly point out the organizational principles they have used frequently they may not be aware of the principles they have utilized. Thus their purpose, point of view, attitude or general conception of the learning process may be discerned in their teaching and learners may be unable to fully comprehend or evaluate the learning until they have determined them. Similarly, some teachers select some form, pattern or structure to organize their arguments, evidence or other elements. This type of analyzes underlying organizational qualities to assist in the comprehension as well as evaluation of the entire learning process. Frequently it is impossible to make an evaluation until the analytical thinking process has been done.

The following are the analytical thinking skills related to an analysis of organizational principles which should be considered to integrate into learning objectives.

- Ability to analyze, in a particular work of art, the relation of the materials and means of production to the 'elements' and to the 'organization'.
- Ability to recognize form and pattern in literacy or artistic works as a means of understanding their meaning.
- Ability to infer the teacher's purpose, the point of view or traits of thought and feeling as exhibited in his or her teaching.
- Ability to infer the teacher's concept of science, philosophy, history, or his or her art as exemplified in his or her practice.
- Ability to see the techniques used in persuasive materials, such as advertising, propaganda, etc.
- Ability to recognize the point of view or bias of a teacher in a historical account.

## **LITERATURE REVIEWS**

Researcher explores the teaching ability of analytical thinking, as well as the instructional implications of the empirical literature on analytical thinking skills. Specific instructional recommendations for fostering the development of analytical thinking will be summarized as follows:

### *The teaching ability of analytical thinking*

Many researchers argued that analytical thinking skills and abilities can be taught. For example, Halpern (1998) offers evidence of two instructional programs aimed at improving the analytical thinking skills and abilities of college students. In one of Halpern's study, students who were taught general problem-solving skills improved on Piagetian-inspired measures of cognitive development. In the other study, Halpern found that college students instructed in a specific type of problem-solving strategy produced mental mathematics representations that were more like those of experts than of novices. Kennedy et al. (1991) concluded that instructional interventions on students' analytical thinking skills have generally shown positive results. In a meta-analysis of 117 empirical studies examining the impact of instructional interventions, in general, have a positive impact, with a mean effect size of 0.34. However, the distribution of effect sizes was highly homogeneous, with effect sizes varying dramatically by type of intervention and sample characteristics. For example, effect sizes for students in K-12 settings were higher than those observed among undergraduates.

### ***Specific instructional strategies***

A number of past researchers have recommended using particular instructional strategies to encourage the development of analytical thinking skills and abilities namely explicit instruction, collaborative or cooperative learning, modeling and constructivist techniques. For instance, many researchers have noted that analytical thinking skills and abilities are unlikely to develop in the absence of explicit instruction (Abrami et al., 2008; Case, 2005; Facione, 1990; Halpern, 1998; Paul, 1992). Facione pointed out that this explicit instruction should also attend to the dispositional or affective component of analytical thinking. Proponents of collaborative or cooperative learning include Thayer-Bacon (2000), who emphasizes the importance of students' relationships with others in developing analytical thinking skills. Bailin, Case, Coombs, and Daniels (1999) argued that analytical thinking involves the ability to respond constructively to others during group discussion, which implies interacting in pro-social ways by encouraging and respecting the contributions of others. Similarly, Heyman (2008) indicated that social experiences can shape students' reasoning about the credibility of claims. On top of that, Abrami et al. (2008) found a small but positive and significant effect of collaborative learning approaches on analytical thinking.

Besides, teachers are urged to use constructivist learning methods, characterized as more student-centered than teacher-centered (Bonk & Smith, 1998; Paul, 1992). Constructivist instruction is less structured than traditional instruction, amplifying students' roles in their own learning and de-emphasizing the role of the teacher. Educators should model analytical thinking in their own instruction by making their reasoning visible to students.

### **RESEARCH AIMS**

The major aim of this study was to investigate the analytical thinking skills in learning management for Basic Education students. Researchers seek to investigate: (i) Developmental process of integration of analytical thinking skills by Basic Education teacher educators while managing learning process through training; (ii) Teacher educators' achievement in integrating analytical thinking skills in learning management after training by evaluating their learning management plans; (iii) Basic Education university students' analytical thinking skills and satisfaction level after receiving intervention, and (iv) teacher educators' feedback after implementation of learning management plans.

### **METHOD**

Researchers utilized Research and Development design to develop analytical thinking of Thai Basic Education university students from a public university located in Khon Kaen province, Thailand. Researcher aimed to develop pre-service teachers' competency to emphasize analytical thinking in their learning management. Case study research design was utilized. Case study research intensively investigates a small set of cases, focusing on many details within each case and context. In short, it examines both details within each case's internal features as well as the surrounding situations. Case study enables researchers to link the micro level that is undergraduate program pre-service university students to the macro level, or large-scale structures and processes (Vaughan, 1992). The logic of the case study is to demonstrate a causal argument about how general social forces shape and produce results in particular setting (Walton, 1992).

The research and development procedure was used as a guideline for the study and conducted in two phases. The first phase was to develop educators' learning management through training. Researchers worked with the sample group to identify problems and to find effective ways of solving them. Several meetings were organized in order to make the objectives of the project clear to the participants who are teacher educators and to discuss a training workshop which emphasizes on analytical thinking learning management. This is followed by evaluation of the results of the development.

The following was the research procedure: (i) Researchers held a meeting with research working group to explain the objectives for integrating analytical thinking skills in learning management, the training procedures, evaluating procedures, training schedule and value, and the roles as well as duties of research working group; (ii) Researchers invited four experts in the areas of development of analytical thinking skills and learning management to conduct a comprehensive training workshop; (iii) Subsequently researchers held several meetings with the four experts for common understanding of the use of the learning management model to develop analytical thinking (Sitthipon Art-in, 2011) and the planning of the training; (iv) A total of 45 teacher educators were volunteering to participate in training. These teacher educators were trained to develop learning management from October 20 to 21, 2014 at the Faculty of Education, a public university in Khon Khen city, Thailand; (v) The training activities emphasized three main competencies namely the basic knowledge of analytical thinking, training analytical thinking process, and learning management model to develop analytical thinking; (vi) By the end of the training, evaluation was carried to measure the outcomes of the training; (vii) Teacher educators' analytical thinking skills were tested and their learning management plans with analytical thinking skills integration were evaluated by the end of the training, and (viii) teacher educators were assigned to construct two analytical thinking learning management plans for their teaching within duration of four weeks and submitted their plans for evaluation.

The second phase of this study was to construct learning management plans, implementing learning management, and measure feedback from Basic Education university students and teacher educators. The following steps had been taken: (i) Researchers and the 45 trained teacher educators attended a workshop from January 18 to 19, 2014 at Faculty of Education, a public university at Khon Kaen city, Thailand; (ii) This workshop mainly aimed to plan and draft the learning management plans with integration of analytical thinking skills based on the learning model; (iii) The Learning Management Model emphasizing analytical thinking (Sitthipon Art-in, 2011) has six steps namely orientation, presentation of learning task, practice of analytical thinking individually or small group, presentation and discussion of ideas, and conclusion; (iv) A total of 12 learning management plans had been developed and would be implemented for 12 hours per one class for each cohort for a period as one semester; (v) Teacher educators who applied the 12 learning management plans were responsible for developing analytical thinking skills of their Basic Education university students in their respective classes; (vi) By the end of the 12 hours learning management processes, the Basic Education university students were tested on their analytical thinking skills; (vii) The test results of Basic Education university students were analyzed and interpreted by comparing with the defined criterion as 70 percent, and (viii) researchers interviewed teacher educators to collect their feedback after implementing learning management plans.

The target group in this study consisted of two groups of samples. The first target group consisted of 45 teacher educators from undergraduate programs in Khon Kaen city, Northeast of Thailand utilizing purposive sampling technique. All the 45 teacher educators agreed to participate in designing learning management plans that emphasizing analytical thinking skills. The second target group comprised of 1,575 Basic Education university students from nine undergraduate programs. This group of students has to attend the 12 hours learning management process for the first semester of 2014.

The instruments utilized in this study were learning management plans, evaluation tools, and interview protocol for teacher educators. There are two types of evaluation tools. The first type of evaluation tool is a 45 four-choice items test used to evaluate teacher educators' analytical thinking skills after the training. It had been tested for content validity with the Index-Objective Congruence (IOC) as within 0.80 to 1.00, item difficulty level as within 0.24 to 0.72, item discrimination factor as 0.35 to 0.86, and reliability value as 0.86. The second type of evaluation tool is a 16 five-scale rating items used to evaluate analytical thinking of the Basic Education University students.

## RESULTS

Results of this study are presented in accordance with the research aims that are indicated above. The initial finding is the result of analytical thinking test of teacher educators and evaluation of learning management plans after training. This is followed by the Basic Education university students' achievement test on analytical thinking skills according to defined criteria. Finally, results of feedback from teacher educators after implementing learning management. Results were organized according to quantitative and qualitative methods.

### *Quantitative results*

The result indicates that teacher educators' analytical thinking score was 36.54 out of the full score as 45 (standard deviation = 3.68) after training. This shows that teacher educators' analytical thinking skills were higher than the defined criterion of 70 percent. Besides, the result of evaluation of their learning management

plans which emphasized analytical thinking skill after training was at ‘good’ and ‘very good’ quality level. As indicated in Table 1, a total of 34 and 11 teacher educators are able to construct the ‘very good’ and ‘good’ quality learning management plans respectively after training. On the other hand, the average score in analytical thinking skills for the overall Basic Education University students after the intervention was 78.19 percent which was higher than the defined criterion of 70 percent. The percentage for the nine programs ranged from 76.95 to 79.51.

**Table 1.** Evaluation on teacher educators after training

Quality level of learning management plan	Frequency	Percentage
Very good	34	75.56
Good	11	24.44
Mean score of analytical thinking test ( $\bar{x}$ ) = 36.54		
Standard deviation ( $SD$ ) = 3.68		

Additionally, the result indicates that Basic Education university students were satisfied with the learning management with integration of analytical thinking skills. The result of evaluation on their satisfaction level after the intervention was found to be encouraging, mean score ranged from 4.59 to 4.63. As a result, Basic Education university students’ achievement was higher than the defined criterion thus they were satisfied with the learning management.

### **Qualitative results**

The qualitative findings were found to support the quantitative findings above. From the focus group interview with teacher educators, researchers found that the training has been successfully assisted teacher educators to acquire better understanding and knowledge, be able to practice self-analytical thinking, be able to write learning management plans, and confidence to handle effective learning management. These points were explicitly pointed out by teacher educator 1 to teacher educator 11 (T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, and T11).

*“I acquire knowledge...a clear understanding of analytical thinking.”* (T2)

*“The analysis of elements, analysis of relationships, and analysis of organization principles including learning management model is very useful to emphasize analytical thinking.”* (T4)

*“I will use the learning management to develop analytical thinking of my students.”* (T1)

*“I now able to practice the process of self-analytical thinking.”* (T3)

*“As a result, I can practice a higher analytical thinking to my students.”* (T8)

*“And I will apply learning activities to develop my students’ analytical thinking”* (T5)

*“I have the practice to write learning management lesson plans that emphasize analytical thinking.”* (T6)

*“I always discuss with my friends and speakers of the training, I find myself good at writing learning management plans now.”* (T7)

*“Training makes me possible to write effective learning management plans”* (T9)

*“I am now very confident that I can handle learning management that emphasizing analytical thinking to develop analytical thinking of students effectively.”* (T10)

*“I will apply the knowledge gained from the training to learning management to develop analytical thinking of students.”* (T11)

### **DISCUSSION**

Findings of this study show that teacher educators’ analytical thinking achievement was improved after the training. This finding corresponds to Khaemmanee (2003), Baldwin (1984), National Council of Social Studies NCSS (1989) ideas. According to Khaemmanee, individual thinking process could be developed. On the other hand, statement from Baldwin and National Council of Social Studies indicated that there were three important activities namely provision of basic knowledge in analytical thinking, analytical thinking process, and provision of knowledge on the designed patterns of procedures for learning management that emphasizes analytical thinking are able to train them to think and understand the thinking process. Results from this study revealed that teacher educators acquired knowledge and clear understanding related to analytical thinking after the training. They found themselves are able to practice thinking analytically, exchange knowledge, share ideas with other teacher educators, and enable to know and understand the patterns or procedures of learning management model after the training. These teacher educators also had the chance to practice designing learning management plans that involve analytical thinking. They presented the plans and discussed their opinions and shared with others who criticized the plans. This is why those teacher educators had been trained to design quality learning management plans.

In addition, findings also indicated that teacher educators’ attitudes toward the training are positive. The majority

of them reflected that they obtained knowledge and understood analytical thinking process clearly. They are able to practice thinking analytically and their analytical thinking competency becomes higher than before. They also acquired knowledge and understanding related to the model of learning management that emphasizes analytical thinking and had a chance to practice designing the learning management plans that involve analytical thinking. They agreed to apply their knowledge obtained from the training to improve their students' analytical thinking skills. On this line of reasoning, the learning management plans enable students to practice thinking in order to find answers. The learning management plans consisted of situations, contents, stories, articles, events or interesting phenomena since the heart of process-based learning is the use of questions to encourage students to think. Therefore, the students became eager to know and search for the answers. All the students participated in the activities had practiced thinking both individually and as a small group. They practiced analyzing the importance, relationships, and principles and that was where students acquired thinking skills and shared their opinions together. Group discussion and learning in the group also promoted the atmosphere to encourage students' thinking. This implies an effect on the students' development of thinking process (Pollack, 1987; Takington, 1989).

Furthermore, presentation and discussion activities were found to assist in developing students' thinking process. The relationship between teacher educators and students as well as among the students enable students to extend the boundaries of their thinking at a wider and more complicated scale (Gall & Gall in Dillon, 1984), resulting in the students to achieve the higher level of analytical thinking. This finding is correlated to the work of Sitthipon Art-in (2012, 2014). Finally, the results were derived from the fact that learning management with integration of analytical thinking activities is learner-centered. Students are able to do the activities and construct their own knowledge to practice thinking analytically according to the given situations, stories or events. Students learned the content of the course and at the same time practiced analytical thinking.

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