

RESEARCH BRIEF

# Enhancing Thai High School Student Critical Thinking Capability: A New Learning Management Model

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Preparing students to be able to think critically is a goal of many professionals in higher education, which is also a quality sought by most employers of university graduates (Sulaiman, Rahman, & Dzulkiffi, 2008). Under Thailand 4.0, critical thinking skills are stated to be a key pillar in the goal for a new, knowledge-based economy (Jones & Pimdee, 2017). Unfortunately, a recent evaluation of logical thinking and analytical skills of 6,235 students by the Thailand Research Fund (TRF) determined that only 2.09% could pass the test (Rujivanarom, 2016).

Plato, nearly 2,500 years ago in his discussions of logic, indicated that critical thinking is the tool that helps individuals find the answer or solution to a person's confusion and problems (Thayer-Bacon, 1998). Socrates, Plato's teacher, emphasized discussion and critical thinking with knowledge residing in the mind of the individual, rather than the "teacher" transmitting knowledge to the student (Ornstein & Levine, 2006).

In a contemporary sense, the evidence of the importance of critical thinking skills for employment came from the survey data from the National Association of Colleges and Employers (NACE, 2016) which indicated that critical thinking/problem-solving skills were ranked first among the 144 employers surveyed (Table 1). This is also consistent with research

from Bassham, Irwin, Nardone, and Wallace (2013), which indicated that college education is for the development of critical thinking skills, which in turn leads to higher-order thinking. This is also consistent with Costa and Kallick's (2014) study, which stated that critical thinking skills are consistently included in all lists of dispositional essentials for college and career readiness.

**Table 1**  
*Employers Rate Career Readiness Competencies in Terms of Essential Need*

Competency	Essential Need Rating 2016
Critical Thinking/Problem Solving	4.7
Professionalism/Work Ethic	4.7
Teamwork/Collaboration	4.6
Oral/Written Communications	4.4
Information Technology Application	3.9
Leadership	3.9
Career Management	3.6

*Note.* Weighted average. Based on a 5-point scale where 1 = not essential; 2 = not very essential; 3 = somewhat essential; 4 = essential; 5 = absolutely essential.

*Source:* Job Outlook 2016 Spring Update (NACE, 2016).

Many scholars and studies have also discussed the importance of critical thinking skills in the context of 21st century education and workforces (Barrington, Casner-Lotto, & Wright, 2006; Geertsen, 2003; Jacobs, 2010). Reeve (2016) also pointed out the importance of 21<sup>st</sup> century and critical thinking skills needed by Thai students in technical and vocational education and training (TVET). While the World Bank (2014) identified problem-solving and critical thinking as job-related skill gaps in Vietnam.

Directives from the Council of the European Union and European Commission (2015) also stated that there needs to be relevant and high-quality knowledge, skills, and competencies developed throughout lifelong learning, which focuses on learning outcomes for employability, innovation, active citizenship, and well-being.

In an OECD/UNESCO (2016) review of Thai education policy, it was stated that information and communication technologies (ICT) can support innovative teaching practices and the creation of learning environments intended to develop students' competencies for success in the 21st century, such as problem-solving and critical thinking. Therefore, from the above overview on the importance of critical thinking skills, we sought out to conceptualize a learning management model of the factors important for the enhancement of critical thinking skills of Thai high school students.

The recognition of the importance of critical thinking abilities dates back over 2,500 years to Socrates and Plato (Ornstein & Levine, 2006), with numerous recent scholars having discussed the importance of critical thinking in education (Ausubel, Novak, & Hanesian, 1976; Dewey, 1910, 1916; Novak, 2011; Piaget, 1970; Sternberg, 1997; Thayer-Bacon, 2000). Added to this volume of work, many contemporary studies have discussed the importance of critical thinking in a 21<sup>st</sup> Century workforce and in a knowledge-based economy (Council of the European Union & European Commission, 2015; Jones & Paitoon, 2017; NACE, 2016; OECD/UNESCO, 2016; Reeve, 2016). Under the Thailand 4.0 initiative, critical thinking and innovation are key pillars for future growth, prosperity, and a better quality of life. Therefore, we undertook a study to develop a new learning management model to

help guide educators in the development and evaluating of Thai high school student critical thinking.

## Literature Review

Educators today continue to incorporate constructionist-based strategies that were originally developed by Piaget (1970), which deals with the idea that learners construct mental models to understand the world around them. Ausubel et al.'s (1976) assimilation theory of meaningful learning and constructivist epistemology was once condensed to a simple idea, in that if educational psychology was reduced to just one principle (Novak, 2011), the most important single factor influencing learning is what the learner already knows. Know this and teach him accordingly. Ausubel et al.'s (1976) theory also included five elements, consisting of teacher, learner, subject matter, context, and evaluation, each of which must be integrated constructively to effect high levels of meaningful learning. Novak (2011) also stated that meaningful learning underlies the constructive integration of thinking, feeling, and acting, leading to empowerment for commitment and responsibility.

Constructionism, however, advocates student-centered, discovery learning where students use the information they already know to acquire more knowledge. Furthermore, constructivism, as a paradigm or worldview, posits that learning is an active, constructive process, which has been embraced globally by scholars such as Vygotsky (1896–1943), Dewey (1859–1952), and Bruner (1915–2016).

Sternberg (1997) conceptualized the Triarchic Theory of Intelligence in 1991, and stated that intelligence consists of three levels. These levels are (1) analytical, which is a representation of analytical thinking and is usually realized by high scores in examinations; (2) experimental (creative) intelligence, which is usually characterized by creativity and is related to the patterns a person learns from life experiences; and (3) contextual (practical) intelligence, which is the capacity that enables a person to engage in the “game of life” in the best way possible. Furthermore, Sternberg's (1997) theory called for the integration of intelligence and creativity and viewed

intelligence as to how an individual performed in the everyday world (successful intelligence).

According to Novak (2011), scholars are learning more about the important role that social exchange plays in learning. Vygotsky's (1930; 1978) early ideas on the importance of language and dialogue between learners are now seen as valuable for planning the context for education. Vygotsky's idea of the zone of proximal development (ZOD) also recognized that children's learning is limited primarily by the ideas they have mastered at a given point in time, and development beyond this zone requires careful coaching and scaffolding of learning.

Dewey (1859–1952) in 1916 suggested that the idea of the separation of body and mind is untenable, which today is supported by countless studies in which the term *bodymind* is discussed as a single idea (Thayer-Bacon, 2000). Dewey (1910) also discussed critical thinking in terms of reflective thinking, which is an uneasiness in accepting the status quo and that critical thinking is both an emotional and intellectual component. Students must, therefore, be taught to examine, poke, question, and reflect on what they have learned. Skepticism, questioning, and reflection are essential. Dewey also stated that schools should have an intimate relationship with the community it serves.

Bruner was heavily influenced by Vygotsky, from which the concept of scaffolding emerged from a larger social constructivist theory. Vygotsky's zone of proximal development (ZOD) theory subsequently became the template for Bruner's model. In the simplest of terms, teachers act as guides, helping students focus on acquiring the skill or knowledge that is required. The simplistic elegance of Bruner's theory means that scaffolding can be applied across all sectors, for all ages, and for all topics of learning (Bruner, 1961, 1976; Wood, Bruner, & Ross, 1976).

Ornstein and Levine (2006) emphasized the growing role of technology in education and how students should use it to foster critical thinking skills. They focused on the importance of "core topics," but accept that the definition of core can be ambiguous.

From the research and theory, critical thinking was therefore determined to consist of these five key elements: (1) identification, (2) clarification,

(3) facts establishment, (4) logic evaluation, and (5) final evaluation. Using these five critical thinking elements, the *PUCSC model* was developed which consisted of five steps:

Step 1: P – Preparation for learning management.

Step 2: U – Understanding and practice.

Step 3: C – Cooperative solution.

Step 4: S – Sharing new knowledge.

Step 5: C – Creation of new knowledge.

## Methods

### *Sampling and Data Collection*

The population for the study consisted of 500 Bangkok secondary high school Mathayom Suksa 5 students (Juniors/11<sup>th</sup> grade) enrolled in the second-semester of the 2016 academic year at the Protpittayapayat School in Bangkok. The sample used cluster random sampling to select 69 students from the population's total of 12 classrooms (500 students) as the study's sample group, which were subsequently divided into two sub-groups of 35 experimental students (17 boys and 18 girls) and 34 traditional learning students (16 boys and 18 girls).

### *The Focus Group*

Prior to the implementation of the study, a focus group of nine experts was convened in August 2016 to assist with the development of the exploratory learning model. From it, the group examined the quality of the learning management model that reinforces student critical thinking ability, which confirmed that the learning management model had an appropriate learning process. After the model's appropriateness was determined, a "try-out" of the preliminary PUCSC Model was undertaken with 10 seniors/12<sup>th</sup> graders. From the results of the 16-week try-out conducted by the primary researcher, the findings were revised according to the student's suggestions and used for the fine tuning of the final PUCSC Model used with the Protpittayapayat School students.

### *Normal Learning Management*

Using traditional classroom learning management techniques, normal classrooms are taught using a teacher's manual which uses three levels of learning activities. They include step-by-step, organization, and summarization.

### *Critical Thinking Test*

For the study, the Watson-Glaser critical thinking appraisal (CTA) test was used. The test consisted of a 30-item test with five options and included inferences, recognition of assumptions, deductions, interpretation, and evaluation of arguments. Each situation was related to the critical thinking model's ability and that of the primary researcher, which included problem definition, targeting of thinking, identifying, and assumptions. The item-objective congruence from this phase was 1.00, and the overall confidence value was 0.81.

### *Academic Achievement Test*

The Thai test of academic achievement in social studies (SO 32102) at the upper secondary level was also used for student evaluation purposes. The characteristics of the quiz are optional, which has five options for 30 items, measured by six steps of intellectual learning which is patterned after Bloom et al.'s new taxonomy in which nouns are changed to verbs, including remembering, understanding, applying, analyzing, evaluating, and creating. Difficulty index ranged between 0.35–0.80, discriminative power ranged between 0.30–0.80, and reliability was found to be 0.86.

### *Student Satisfaction Questionnaire*

A questionnaire was used to collect student satisfaction data that used a 5-level agreement scale, having a total of 20 items. The reliability of the questionnaire was determined to ensure that the responses collected through the instrument were reliable and consistent. The reliability value of 0.90 was calculated by using Cronbach's alpha (Cronbach, 1951) to ensure whether there was internal consistency within the items.

### *Data Collection*

Data collection was divided into two groups. Their details are as follows:

Group 1 – The experimental group consisted of 35 Bangkok Juniors/11<sup>th</sup> graders who were enrolled in the second semester of the 2016 academic year. Their evaluation period was for 16 weeks, 2 hours each week, for a total of 32 hours. There was both a pre-course test and post-course test administered to evaluate each student's critical thinking skills. Furthermore, each student was administered a 20-item questionnaire concerning their overall impressions of the class and its learning management model process.

Group 2 – The control group consisted of 34 Bangkok Juniors/11<sup>th</sup> graders. Their evaluation period was also for 16 weeks, 2 hours each week, for a total of 32 hours. There was both a pre-course test and post-course test administered to evaluate each student's critical thinking skills. Furthermore, each student was administered a 20-item questionnaire concerning their overall impressions of the class and its learning management model process.

### *Data Analysis*

The one-way multivariate analysis of variance (one-way MANOVA) was used to determine whether there were any differences between the control and experimental groups on more than one continuous dependent variable. Furthermore, ways of comparison of the critical thinking ability and learning achievement of the experimental group who used the conceptualized PUCSC learning management model, and the control group, which used traditional methods, used  $\bar{x}$ . Student satisfaction of both the experimental model and the control group traditional methods was undertaken by use of average  $\bar{x}$  and standard deviation.

Descriptive statistics ( $\bar{x}$  and standard deviation) were used to evaluate the quality of the experimental model. Content analysis was used to synthesize the learning management models that enhanced critical thinking ability of Thai high school students. A 5-level agreement scale was used to interpret the responses by calculating  $\bar{x}$  and the standard deviation. The interpretation criteria that was used was 1.00–1.49 (least appropriate), 1.50–2.49 (somewhat appropriate),



2.50–3.49 (moderately appropriate), 3.50–4.49 (very suitable), and 4.50–5.00 (most appropriate).

**Results**

Each element of the PUCSC learning management model consisted of principles and concepts drawn from theory related to guidelines, activities, aims, and evaluation of student critical thinking capabilities. Based on the experts’ assessment, it was found that the conceptualized PUCSC learning management model’s overall fit was at the highest level (mean  $\bar{x}$  = 4.84 and standard deviation  $\sigma$  = 0.26). Content validity was also evaluated by using item-objective congruence which was deemed to be highly reliable as the score was 0.92.

The study also tested the baseline variance agreement with Box’s M test (Table 2), which is used to determine whether two or more covariance matrices are equal (Tabachnick & Fidell, 2001). It was found that the variance of all the groups was not significantly different (0.05). Additionally, the preliminary agreement of the correlation coefficient

was tested, which was then followed by Bartlett’s test for homogeneity of variance which is derived from Box’s test (Snedecor & Cochran, 1989). Results indicated that the initial agreement of the relationship of the dependent variables, followed by Bartlett’s test statistic, found that the average value relationship of critical thinking ability to achievement at the end of the course to be statistically significant (0.05), and when compared to the control group, it was found that the experimental learning management model achieved higher results in both critical thinking (17.62) and post-learning achievement (19.26).

Results from the tests showed that the common variance of all the groups was not different, which was statistically significant at 0.05 level. Furthermore, the average value of critical thinking ability to the average achievement after the testing ended showed the relationship was statistically significant (0.05). As a result, I compared the results in Table 3 and determined that after the post-test, data showed the average of critical thinking ability and post-learning achievement were higher than before the study.

The results of the study also revealed that the post-

**Table 2**  
*Average Comparison of Critical Thinking Ability and Achievement After Class Classified by Learning Model or Learning Style*

Dependent Variable	Independent Variable (Learning Model/Style)	Students (n)	Mean	$\sigma$	F	Sig.	Comparison
Critical thinking ability	Experimental group	34	17.62	3.28			Experimental > Control
	Control group	34	14.21	2.87			
					20.80*	.000	
Achievement	Experimental group	35	19.26	3.64			Experimental > Control
	Control group	35	18.83	3.24			

Note. Box’s M Test: F = .275, Sig = .844; Bartlett’s Test:  $X^2$  = 25.387, \*Sig = .000.

**Table 3**  
*Comparison of Critical Thinking Ability and Achievement Classified by Test Category*

Dependent Variable	Independent Variable	Students (n)	Mean	$\sigma$	F	Sig.	Comparison
Critical thinking ability	Pre-test	34	17.62	3.28			Experimental > Control
	Post-test	34	14.38	2.73			
					20.51*	.000	
Achievement	Pre-test	35	19.26	3.64			Experimental > Control
	Post-test	35	12.83	2.62			

Notes. Box’s M Test: F = 2.399, Sig = .066; Bartlett’s Test:  $X^2$  = 23.358, \*Sig = .000.

test scores were significantly higher than the pre-test after use of the PUCSC learning management model (Table 3). The experimental group student results concerning the satisfaction analysis on the PUCSC learning management model are shown in Table 4, which indicate a very high overall rate.

**Table 4**  
*Experimental Student Group Satisfaction of the PUCSC Learning Management Model*

Side	$\bar{x}$	$\sigma$	Satisfaction Level	Rank
Content	4.56	0.12	Most	1
Learning management activities	4.47	0.07	Much	3
Learning management media	4.50	0.18	Most	2
Benefits and satisfaction	4.47	0.07	Much	3
Measurement and evaluation	4.47	0.07	Much	3
Total	4.49	0.10	Much	-

## Discussion

Habits of mind such as analysis, interpretation, precision and accuracy, problem-solving, and reasoning can be as or more important than content knowledge in determining success in university courses (Conley, 2008). Furthermore, the 21<sup>st</sup>-century citizens must be active critical thinkers if they are to compare evidence, evaluate competing claims, and make sensible decisions (National Education Association, 2011). Therefore, we developed and evaluated the PUCSC model to help educators develop and enhance Thai high school students' critical thinking skills. The model's validity and strength were confirmed in large part by the following discussion.

Results showed that critical thinking ability and learning achievement within the experimental group had a higher critical thinking ability than the control group, at the 0.01 level. Step 1's preparation for learning management (P) is validated by research from Thaiposri and Wannapiroon (2015), which indicated that in use of social media and ICT in teaching critical

thinking skills, preparation was highly important. Learning management systems (LMS) are also recognized now as powerful tools in the preparation of critical thinking skills education (Wichadee, 2014), with LMS platforms becoming widely popular in tertiary education (Schroeder, Minocha, & Schneider, 2010).

Step 2 consisted of understanding and practice (U). Halpern (1993) confirmed this by stating that critical thinking improvement can be obtained with appropriate instruction, while McPeck (1981) found that critical thinking can be taught through drills, exercises, and problem solving. Bruner (1976) also stated that the outcome of cognitive development is thinking, and the purpose of education is to facilitate a child's thinking and problem-solving skills.

Step 3 consisted of cooperative solutions (C). In support of this, Vijayaratnam (2009) concluded that adopting critical thinking tasks centered on cooperative learning strategies helps improve social relationships among team members. Johnson and Johnson (1994) also confirmed this as students who have opportunities to work collaboratively on real world tasks learn faster and more efficiently, and have greater retention and feel more positive.

Today, social media and ICT are playing important roles in student development in 21<sup>st</sup> century learning (Thaiposri & Wannapiroon, 2015), with students using social networking to communicate and collaborate with each other during learning activities.

Step 4 revolves around the idea of sharing new knowledge (S), which in a 21<sup>st</sup>-century classroom is now easier due to technology and can become powerful tools in classroom learning management and the development of student critical thinking (Leesa-nguansuk, 2015; Phuapan, Viriyavejakul, & Pimdee, 2016).

Step 5 is the creation of new knowledge (C), which Sternberg et al. (2000) indicated means encouraging students to apply, use, put into practice, implement, employ, and render practical what they know. Such teaching must relate to the practical needs of the students and their community, not just to what would be practical for other individuals (Jho, Hong, & Song, 2016). Heick (2014) also stated that the essential attribute of intelligent human beings is not only having information but also knowing how to act on it.

Therefore, the PUCSC critical thinking learning management model has a strong foundation in theoretical concepts and practical studies, wherein the post-test results showed that the students which used the experimental model achieved significantly higher scores than students who were taught critical thinking skills via traditional classroom methods. Self-realization, thinking, and practice through group learning, continuous learning, and organized learning activities in the classroom are all elements that enhance critical thinking skills. Instructors must additionally create an interesting learning environment, allowing students to continuously practice critical thinking skills, which results in more confident learning.

Part 2 consisted of the comparison of the  $\bar{x}$  concerning critical thinking abilities and academic achievement. From the results, it was found that the experimental group had a better ability to think critically, with their learning achievement after class higher than before. This may be because we provided the opportunity for the learner to learn, to think for themselves, and to work through a group.

Part 3 entailed the analysis of the experimental group's students' satisfaction concerning their use of the PUCSC model as a learning management tool for the development of critical thinking skills. The results showed that the students' satisfaction with the experimental model, was considered at a high level (4.49). When considering each aspect of the content, the researcher/instructor with prepared materials and media used in the learning management model was found to have the highest level of satisfaction on learning activities.

This is consistent with ongoing evaluation of digital tools for Thai students under the 47 school Samsung Smart Learning Centre initiative. Under the project, children receive technological tools and guidance from their "mentoring teachers" in surveying their community's problems and exploring possible solutions, which strengthens skills in creative thinking, analytical thinking, communications, and coordination.

## Conclusion

Ng (2001) argued that in Asia, creative and critical thinking is culturally limited as Asians place a great

emphasis on obedience and conforming to group expectations, together with the avoidance of losing face as a result of appearing different. Praparpun (2012), however, in a discussion about Thailand's path to 21st century social, political, and economic development, felt that the Thai youth must learn skills in critical thinking, collaborative problem solving, and the effective use of internet technologies, both in communication and in searching for vital information. Blocking this, however, was the Thai education system's rote learning process. Without it changing, nothing else would change.

It seems therefore that technology is the enabler and the teachers should serve as mentors in using it and the outcomes from it. Also, community involvement is of paramount importance with real-world challenges and solutions offered to a young, inquiring mind. Transformation must come quickly if the Thailand 4.0 agenda and goals are to ever be met, at least for the domestically educated, digitally enabled, critical thinking, 21<sup>st</sup>-century workforce.

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