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Instructional model development to enhance critical thinking and critical thinking teaching ability of trainee students at regional teaching training center in Takeo province, Cambodia

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ABSTRACT

The main purposes of this research are to develop, implement, and evaluate an instructional model based on the cognitive approach to enhance critical thinking among trainee students and to develop their abilities in teaching critical thinking to learners. The model was designed utilizing 4 main components of research and development processes and implemented with 15 trainee students whose majors were English and Khmer at the Regional Teacher Training Center. The received data was analyzed using scoring rubrics, descriptive statistics, the Wilcoxon test, and content analysis. The results revealed that there were 6 main components of the developed instructional model: principle, objective, learning content, learning instruction, learning materials, and evaluation. The developed instructional model was at the highest level of applicability ($\overline{X} = 4.21$, SD = 0.23). Critical thinking learning instruction was designed into 8 steps consisting of: triggering activity, identifying problem, investigating related data, discussing findings, evaluating findings, creating solutions, presenting solutions, and reflecting learning outcome. Trainee students' post critical thinking was much higher than pre-critical thinking implementation, while their abilities in teaching critical thinking were at the exemplary level ($\overline{X} = 20.62$, SD = 0.28). Trainee students' perceptions toward learning critical thinking and teaching instruction were at the highest level ($\overline{X} = 4.28$, SD = 0.19).

Introduction

Rebuilding the teacher training system in Cambodia still presents some challenges, especially the lack of comprehensive training system, teachers to fulfill the current needs, guidance from the concerned authorities, and limitations regarding the quality of teacher training and the training curriculum and program. Furthermore, the policies of training improvement which are under development need to be immediately enhanced (UNESCO, 2010–2013, p. 25). Concerning this matter, the institutions should train trainee students to be a competent human resource by nurturing them to have high capacity, knowledge, skills, morality, inventive and creative ideas, enterprise spirits, and in particular critical thinking skills (MoEYS, 2011).

The research "Exploration of Critical Thinking of Trainee Students at Regional Teacher Training Center in Takeo Province, Cambodia" conducted by Vong and Keawurai (2014) reported that trainee students' critical thinking abilities were generally at a low level ($\overline{X} = 1.88$). This

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finding reflected that trainee students' critical thinking abilities needed to be immediately strengthened. Fisher (2011, p. 1) stated that enhancing students' abilities for critical thinking is considered as an important goal of education. The goal of education for critical thinking is to develop students drawing on sound thinking, reasons, and good judgment in searching for clarity and authenticity (Marzano et al., 1988).

Literature Review

Critical thinking is considered as one of the compulsory skills needing improvement in the 21st century (Trilling & Fadel, 2009, p. 7), and considered as a skill that can be enhanced in a person's life (Ornstein & Hunkins, 2004, pp. 119–120). In daily life, critical thinking is utilized to create sharp decision making, to form an opinion based on reasons, to surmount individualistic discernment and predisposition, and to indicate persuading motives in sustaining conclusions regarding what should be done and accepted as true (Bassham, Irwin, Nardone, & Wallace, 2011, p. 1).

Stupinsky, Renaud, Daniels, Haynes, and Perry (2008) conducted research on critical thinking dispositions and perceived academic control and achievement of pre-service teachers. Their findings revealed that college students who had high academic achievement were strongly committed to think critically. In an investigation of the discernment of critical thinking, Alazzi (2008) agreed with the recognition of critical thinking in the junior high school environment and inferred that more exploration on how critical thinking is taught, learned, and judged is required to explicate. McMahon (2009) clarified that any student who was completely involved in strengthening critical thinking performed through teaching or digital methods as a doorway to acquire critical thinking, appeared to obtain a profound comprehension of aspect and implementation. However, learning based on memorization inevitably interrupts the enhancement of critical thinking (Chapman, 2001).

Critical thinking can be taught and learned (Halpern, 1993). Students will improve their critical thinking when teachers use appropriate instructional methods and curriculum materials (Gadzella & Masten, 1998; Halpern, 1993; McMillan, 1987), active learning strategies (Kim, 2009), and student-to-student and student-to-instructor interactions (Cooper, 1995; Howe & Warren, 1989). In addition, critical thinking is considered as the aim of instruction in which the students learn to apply cognitive skills such as hypothesizing, designing, performing, and analyzing a series of investigations (Dell'Olio & Donk, 2007, p. 33; Gomez, 2002; Wiles & Bondi, 1989). The cognitive approach emphasizes the importance of mental processes in learning which occurs through the surrounding environment with an active role for learners' perceptions, thoughts, beliefs, attitudes, and values in constructions, acquisitions, retrieval, or forgetting (Schunk, 2008, pp. 17–18). Furthermore, cognitive processing expresses the way that students learn or concerns the development of their thinking abilities such as analysis, inference, induction, and evaluation are identified as key elements of critical thinking (Adler, 2000).

The cognitive approach covers certain theories including constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive information processing theory, and adult learning theory in which the key principles form the basic root in fostering learners to use critical thinking in order to construct new knowledge themselves. Constructivist learning theory is extensively related to students constructing new knowledge based on their past experiences (Bruner, 1960), cognitive development theory focuses on learning constructed through stages of development (Dewey, 1916; Piaget, 1963), social-cognitive theory is learning that occurs through social interaction (Meichenbaum, 1977), cognitive information-processing theory is concerned with students learning through analyzing the information (Broadbent, 1958), and adult learning theory is related to individual needs and freedom (Knowles, 1984).

It is clear that critical thinking is really important for classroom, workplace, and especially for daily life (Ornstein, Pajak, & Ornstein, 2011, p. 89), but teaching and evaluation of critical thinking in the current collegiate environment and curricula are insufficient (Gupta, 2005). Due to its necessity, this research will investigated how the cognitive approach consisting of constructivist learning theory, cognitive development theory, social-cognitive theory, cognitive information processing theory, and adult learning theory is used to develop an instructional model to enhance critical thinking and the critical thinking teaching ability of trainee students at the Regional Teacher Training Center (RTTC) in Takeo province, Cambodia.

Research Objectives

The main purposes of this research were:

1. To develop an instructional model based on the cognitive approach to enhance critical thinking among trainee students and to develop their abilities in teaching critical thinking to learners.
2. To implement the developed instructional model to enhance critical thinking among trainee students and to develop their abilities in teaching critical thinking to learners.
3. To evaluate the developed instructional model to enhance critical thinking among trainee students and to develop their abilities in teaching critical thinking to learners.

Research Method

Design of Instructional Model Development

The research was conducted using three main steps as follows:

Step I: The development and validation of the instructional model consisted of three sub-steps as follows:

1. Critical analysis of related theories was done to draft an instructional model. The deductive method was used to investigate and gather the best findings

from the related theories and concepts whereas the inductive method was employed to check the quality of instructional model development.

2. A validity check was conducted based on the main elements of the developed instructional model and evaluated by academic advisers/professionals/experts using a rating scale of 1–5 (with 1 as the lowest and 5 as the highest scale).
3. A reliability check was done by conducting a pilot study with 15 trainee students (A1 Class), year I, majoring in English and Khmer.

Step II: The implementation of the developed instructional model was composed of five sub-steps as follows:

1. The developed instructional model was implemented with 15 year-I trainee students (B1 Class), majoring in English and Khmer. The implementation consisted of 20 sessions with two hours per session and was divided into five modules: (1) critical thinking, (2) critical thinking evaluation, (3) teaching critical thinking, (4) critical thinking teaching plan, and (5) practice teaching a critical thinking lesson.
2. Pre-and post-testing were conducted using the five main elements of critical thinking appraisal developed by Watson-Glaser (1980) (inferences, recognition of assumptions, deductions, interpretation, and evaluation of arguments) in order to evaluate the learning outcome of the trainee students by comparing the results from before and after critical thinking implementation.
3. The evaluation of the trainee students' critical thinking teaching ability was done based on the scoring rubric developed by the researcher using the scoring weights developed by Greenstein (2012).
4. Classroom observation recording of the trainee students' critical thinking activities was evaluated using scoring rubrics developed by Nitko (2004).
5. The trainee students carried out individual reflection. Each trainee student was informed earlier and asked to reflect on teaching and learning critical thinking instructions using the developed instructional model.

Step III: The evaluation of the developed instructional model covered two main sub-steps as follows:

1. The evaluation of trainee students' perceptions about learning critical thinking and teaching instructions was conducted using a questionnaire. Each question was developed using the content extracted from teaching and learning critical thinking instruction and checked by academic advisers/professionals/experts. Any question which was not matched was revised or reworded.
2. The evaluation of trainee students' overall perceptions about instructional implementation was conducted using a structured interview. The questions used for the structured interview were developed based on the content of teaching and learning critical thinking instruction and checked by academic advisers/professionals/experts.

Research Participants

The instructional model was implemented with 15 trainee students (B1 Class) who were trained in semester II, year I for the 2015 academic year.

Research Instruments

The research instruments consisted of: evaluation form of the instructional model and instructional handbook, training instructional document, instructional handbook, pre-and post-tests, classroom observation form, practice teaching critical thinking observation form, individual reflection form, perception questionnaire, and the structured interview.

Data Analysis

Different scoring rubrics using a rating scale of 0–3 (0 = novice, 1 = basic, 2 = proficient and 3 = exemplary) were used to assess classroom activities based on classroom observation and teaching practice. The Wilcoxon test was used to compare the results between pre-and post-testing, while descriptive statistics (mean and standard deviation) were used to evaluate the quality of the instructional model, instructional handbook, and trainee students' perceptions. Content analysis was used to identify learning activities retrieved from individual reflection and the structured interview.

Results and Discussion

Effect of the Developed Instructional Model

The developed instructional model consisted of six components: principle, learning objective, learning content, learning instruction, learning material, and evaluation of effectiveness. Furthermore, the learning instruction had eight steps: triggering activity, identifying the problem, investigating related data, discussing findings, evaluating the findings, creating solutions, presenting solutions, and reflecting on solutions (Figure 1).

The results of the evaluation revealed that the components of the instructional model, in general, were at the high level of applicability ($\overline{X} = 4.21$, SD = 0.23). This reflected that all the components were consistent with the potential criteria of the instructional development and the incumbent needs of trainee students and educational goals. Similarly, this finding was in line with some previous research. Research on “Learning Management Model for Learner Development with regard to Ethics, Intellect, and Learning” conducted by Kaewurai (2011) found that the developed model was good, and suitable for learning process reform focusing on learners. In addition, research on “Development of a Professional Activity Model on Readiness Preparation to Enhance Student Teachers' Desirable Characteristics for an Industrial Education Program in Agricultural Education” conducted by Junlek, Keawurai, Nopparak, and Shinatrakool (2014) indicated that the validity of the developed model (including principle,

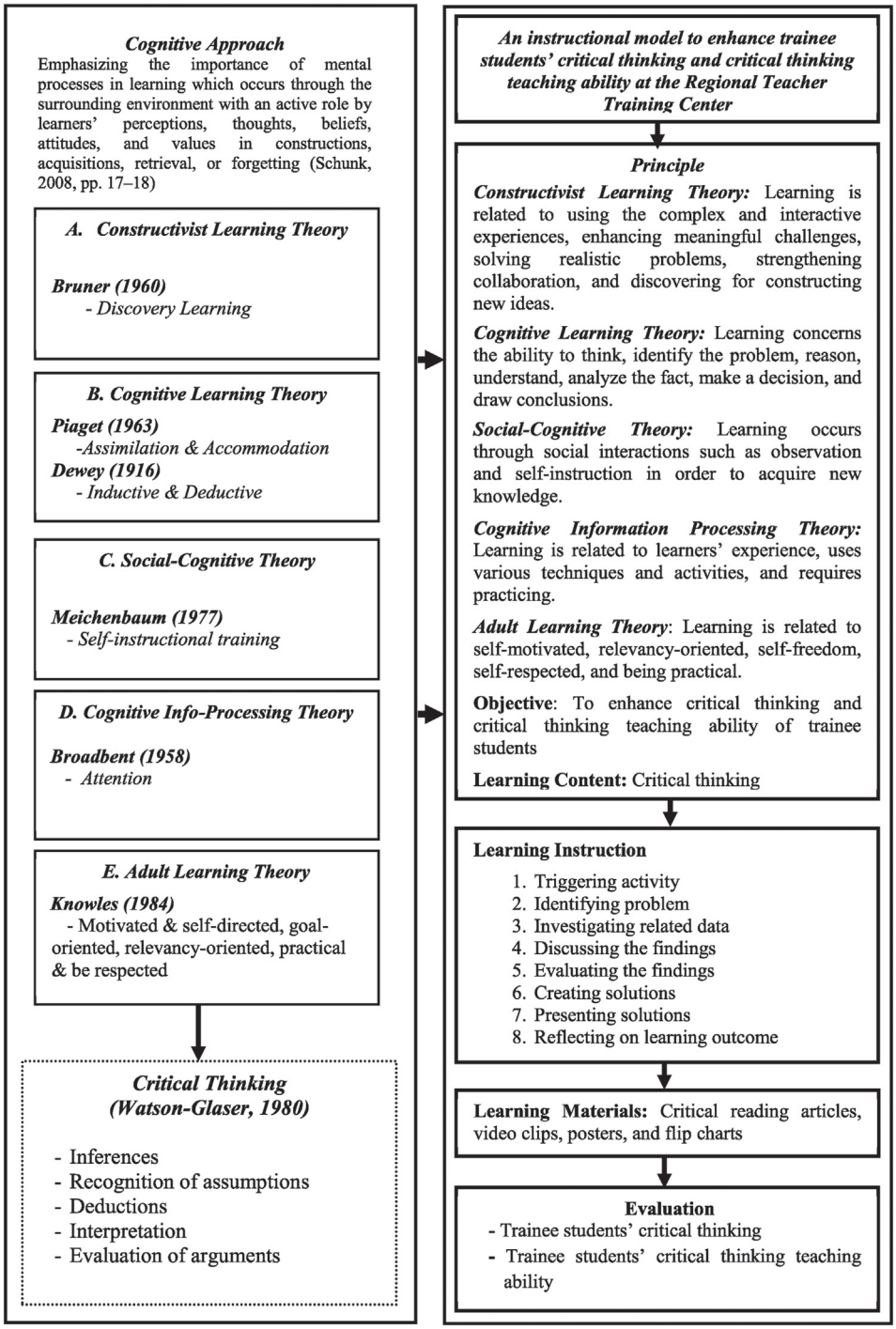

Figure 1 Instructional model to enhance trainee student critical thinking and critical thinking teaching ability

objectives, structure and content, activity arrangement, and evaluation) was at high levels of possibility and applicability.

Moreover, testing by application was also conducted, and the findings indicated that the learning content, learning activities, learning materials, and timeframe were at the highly satisfied level and were considered as key factors in fostering trainee students' critical thinking and enhancement of their abilities in teaching critical thinking to learners. In particular, these components motivated the trainee students to use their own experiences and to construct new knowledge themselves. Supportively, Gadzella and Masten (1998) in their studies identified numerous approaches showing promise to better promote

critical thinking in the classroom. Halpern (1993) claimed that "better critical thinking can be improved with appropriate instruction", and from this, it could be assumed that if teachers use appropriate instructional methods and curriculum materials, students will improve their critical thinking skills (McMillan, 1987).

Critical Thinking and Teaching Critical Thinking

Critical thinking is indispensable for today's life, where individuals daily face unlimited amounts of information, complex problems, and rapid technological and social changes. The increased emphasis of implementation of an instructional model development based on the cognitive approach to enhance trainee students' critical thinking and critical thinking teaching ability requires the active involvement of trainee students in their learning processes, not only enabling them to work together but also providing them with opportunities to choose learning activities and to evaluate their own performance. Trainee students in learning teams take responsibility for particular partitions of the tasks and share what they learn with their groups in a way that group members will comprehend. In particular, trainee students construct new knowledge using their own experiences.

1. Critical thinking

The results of analysis indicated there was a huge gain in trainee students' critical thinking between pre-and post-testing (Table 1). This reflected that the critical thinking of trainee students could be improved when appropriate instruction was used. Of course, an instructional model development based on the cognitive approach to enhance trainee students' critical thinking and critical thinking teaching ability concerns motivating trainee students to create their own meanings through personal experiences using group work and authentic learning environment, suitable learning instructions, and sufficient materials. The same result was reflected in the research "Exploring Undergraduate Students' Active Learning for Enhancing Their Critical Thinking and Learning in a Large Class" conducted by Kim (2009), where active learning strategies were found to be useful in enhancing students' critical thinking as well as engaging their critical thinking process.

2. Critical thinking teaching ability

The results of teaching critical thinking indicated that trainee students' critical thinking teaching ability was generally at the exemplary level ($\overline{X}$ = 20.62, SD = 0.28).

Table 1
Comparison between pre and post critical thinking implementation

		N	Mean rank	Sum of ranks	Z	*p*
Post−Pre	Negative ranks	0	0.00	0.00	3.410*	0.001
	Positive ranks	15	8.00	120.00		
	Ties	0				
	Total	15				

There are some challenges that place trainee students' critical thinking teaching ability at the exemplary level, and especially lesson plans and teaching activities.

The lesson plans included clear topics which concerned problems of current situations and students' experiences. The purposes of all lesson plans were clear and fostered learners' critical thinking. The content concerned critical analysis of a real-life problem, and the learning materials included critical articles, posters, reports. Also, learning instruction engaged in small-group discussion, collaborative activities, debate, and simulation, among others. Moreover, learning instruction involved approaches to teaching critical thinking including Bloom's cognitive domain, the project-based approach, and the problem-based approach, and especially the assessment of learning outcome engaged students in developing new knowledge. Similar ideas were also proposed by some scholars. Halpern (1993) claimed that "better critical thinking can be improved with an appropriate instruction", and critical thinking can be taught through drills, exercises, or problem solving (McPeck, 1981).

Teaching activities encouraged learners' curiosity and participation to establish learning issues. The activities involved learners in identifying problems through using critical articles and portfolios, among others. Also, these activities engaged learners in authentic learning environment through data collection and verification hypothesis and motivated them to work in groups, to share ideas, and to discuss the findings. Moreover, these activities led learners to analyze, evaluate, and use alternative sources of information collected on the problem, and especially encouraged them to construct new knowledge through presenting possible solutions and options for solving the problem based on their own experience. The same findings were revealed by some scholars. For example, critical thinking is related to applying cognitive skills such as hypothesizing, designing, performing, and analyzing a series of investigation, identifying problems, incorporating underlying assumptions, using relevant data sources, incorporating varying perspectives into the analysis of the problem at hand, generating viable alternatives, and comprehending the consequences of the suggested solutions (Dell'Olio & Donk, 2007).

3. Critical thinking learning activity

Trainee students' learning participation in all critical thinking learning activities was generally at the proficient level ($\overline{X}$ = 22.81, SD = 4.17). There are several reasons that lead to this proficiency level.

Interactions among trainee students: By emphasizing the collaborative and cooperative nature of tasks, trainee students shared responsibility for learning with each other, discussed divergent understandings, and shaped the direction of the class. Some particular scenarios which were considered that encouraged interactions between students and students included jigsaw activities, think-pair share, theme discussion, open-ended questions, in-class debates, or controversial issues. Likewise, the notion of cognitive coaching (Collins, Brown, & Holum, 1991) can be used in a

variety of ways to facilitate critical thinking. The role of the social environment can play an important role in the growth of critical thinking. In a safe social environment, the interaction with peers can promote critical thinking and its growth. However, a more lecture-focused or well-organized material environment will minimize student–-student interactions and also stagnate their critical thinking (Collins et al., 1991).

Interactions between trainee students and trainer: Effective interaction between the teacher and the trainee students is essential for promoting learning success. The interactions were characterized by providing trainee students with frequent and engaging learning activities, motivating and supporting them to think of meaningful challenges, facilitating language barriers, and recognizing their needs for a sense of autonomy and an active role in learning. These ideas were also reflected in some previous research. Cooper (1995), in his research on cooperative learning and critical thinking, found that student-to-student and student-to-instructor interactions were consistent with improvement in the ability to think critically.

4. Learning critical thinking and teaching participation

Trainee students were asked to reflect on learning and teaching instruction. Their reflections indicated that the content used to teach critical thinking was very clear and easy to understand. Trainee students understood the meaning, the main components, and the barriers to and the benefits of critical thinking. This revealed that critical thinking is very important for daily life, and especially it is a common expectation in the workplace.

Trainee students also learned that strategies were very useful if the approach was project-based, case-based, inquiry-based, cooperative or problem-based. These approaches are full of components that motivate and involve learners in learning and constructing new knowledge using their own experiences. Noticeably, trainee students applied their own practices using some of these approaches while learning, reflecting the effective learning outcomes. Similarly, Chapman (2001) stated that learning based on memorization rather than active participation inevitably interrupts the enhancement of critical thinking and is also less effective for long term knowledge retention, transfer of knowledge to new situations, higher order thinking, attitude, and motivation for further learning.

Trainee students expressed that they worked in small groups, shared ideas, looked for different data and information, and analyzed, evaluated, and synthesized the data which in return, led them to create very useful lesson plans to teach critical thinking. Supportively, involvement in problem-solving, cooperative learning, simulations, debates, and critical reporting sessions enhances students' critical thinking (Howe & Warren, 1989).

Trainee students discovered that they were very happy with the classroom environment involving working together on real-life based content, sharing ideas with each other, using their own experiences, making their own decisions, doing presentations, using reflection, and especially practice teaching sessions. With reference to this matter, critical thinking can be taught and learned (Halpern, 1993). Paul (1988) construed critical thinking as the ability to reach sound conclusions based on observations and information.

Evaluation of Instructional Implementation

Evaluation of the implementation of the developed instructional model monitors the progress toward the achievement of the desired goal. A questionnaire composed of five main sections with a total of 40 items was used to evaluate trainee students' perceptions about learning and teaching instruction. Trainee students were asked to rate their personal perceptions using a Likert rating scale of 1–5 ranged from strongly disagree to strongly agree.

1. Perceptions about learning and teaching instruction

As indicated in the research results, trainee students' perceptions about general course instruction, group work activities, interpersonal/team skills, critical thinking skills, and critical thinking teaching were extensively investigated. Overall, trainee students' perceptions were at the highest level ($\overline{X} = 4.28$, SD = 0.19).

There are some critical factors leading to the highest perceptions. Trainee students were exposed to diverse teaching methods and activities through ambiguity and multiple interpretations and perspectives of a situation and problem to stimulate growth and promote critical thinking. Through practice, trainee students had experiences in exploring opinions, engaging in discussion with an open mind, handling conflict, negotiating agreement, accepting compromises, and analyzing and synthesizing information to make sound decisions and conclusions. The explanations were consistent with the concepts of critical thinking illustrated by Gomez (2002).

The result was also consistent with the approach stated Halpern (1998) who suggested that practice is important to the development of thinking skills. The integration of this instruction into specific subject matter allows greater opportunity for the transfer of learning and development due to greater opportunities for practice in thinking through diverse situations and problems. Relatively, Bonwell and Eison (1991) expressed that when using active learning, students are engaged in more activities than just listening. They are involved in dialogue, debate, writing, and problem-solving, as well as higher-order thinking, such as analysis, synthesis, and evaluation.

2. Overall view on instructional implementation

Awareness of the effectiveness of the developed instruction may prove to be of significant value to trainers, educators, administrators, and particularly practitioners. After implementation, an interview was conducted with seven trainee students to share ideas about learning and teaching instruction. The results were as follows:

The training course to enhance critical thinking was very useful. This course provided a lot of new ideas and experiences, especially on how to improve critical thinking.

Trainee students shared ideas, discussed the subject matter, made their own decisions, did a variety of presentations, and reflected on their own thoughts about learning outcomes. Costa and Kallick (2009) expressed that working together in small groups, sharing ideas, showing each other respect, and especially contents related to the learners' background are crucial to enhance critical thinking. In addition, trainee students were involved in the processes of making inferences, drawing logical conclusions, and evaluating relevant sources of information to reach possible conclusions (King, 1995).

Working in small groups helped the trainee students to develop a host of skills including sharing ideas, being sensitive to each other's feelings, respecting each other's opinions, and especially helping make decisions to reach sound conclusions. Small-group activities also presented a positive environment which contributed to student learning and retention. Moreover, small-group work reinforced trainee students' critical thinking and critical thinking teaching abilities that are relevant to both group and individual work, including the ability to break complex tasks into parts and steps, refine understanding through discussion and explanation, challenge assumptions, develop stronger communication skills, and give and receive feedback on performance. This small-group work was reflected in the student-focused approach in which students are involved in problem-solving, cooperative learning, simulations, debates, and critical reporting sessions (Howe & Warren, 1989), and are encouraged to develop their own strategies for critical thinking (Kurfiss, 1988).

Conclusion

Appropriate instruction was extremely successful in fostering trainee students' critical thinking and developing their abilities in teaching critical thinking. To infuse trainee students with critical thinking skills and critical thinking teaching ability is to think of them not as receivers of information, but as users of information. Any learning instruction or environment that actively engages trainee students in the investigation of information and the application of knowledge will promote their critical thinking skills and enhance their abilities in teaching critical thinking. These descriptions and illustrations are congruent with those on critical thinking expressed by Geertsen (2003). In using critical thinking and critical thinking teaching, one learns to make critical judging, examine some claim or assertion, listen to or to collect evidence in support of the claim, determine the strength of the arguments derived from the evidence, assess the underlying assumptions and possible biases supporting the claim, and to arrive at a judgment and course of action where appropriate.

Policy Implication for Educator

The results showed that the implementation of the developed instructional model reflected positive consequences in promoting trainee students' critical thinking and developing their abilities in teaching critical thinking. Concerning this matter, educators are recommended to initiate training to facilitate instruction on how to utilize critical thinking skills and critical thinking teaching methods. Moreover, critical thinking should be collaboratively defined and incorporated into program accreditation standards and guidelines so that trainee students might benefit from understanding how critical thinking and critical thinking teaching apply to the their career goals.

Implications for Further Research

This study illustrates the enhancement of trainee students' critical thinking and critical thinking teaching ability using the developed instructional model based on the cognitive approach. More evidence is needed to demonstrate the needs to strengthen trainee students' critical thinking and critical thinking teaching ability. Thus, further study should be conducted to investigate some other potential methods used to cultivate critical thinking and critical thinking teaching ability. Furthermore, continued research is needed in the area of the development of curriculum to nurture critical thinking and the teaching of critical thinking.

Conflict of interest

There is no conflict of interest.

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